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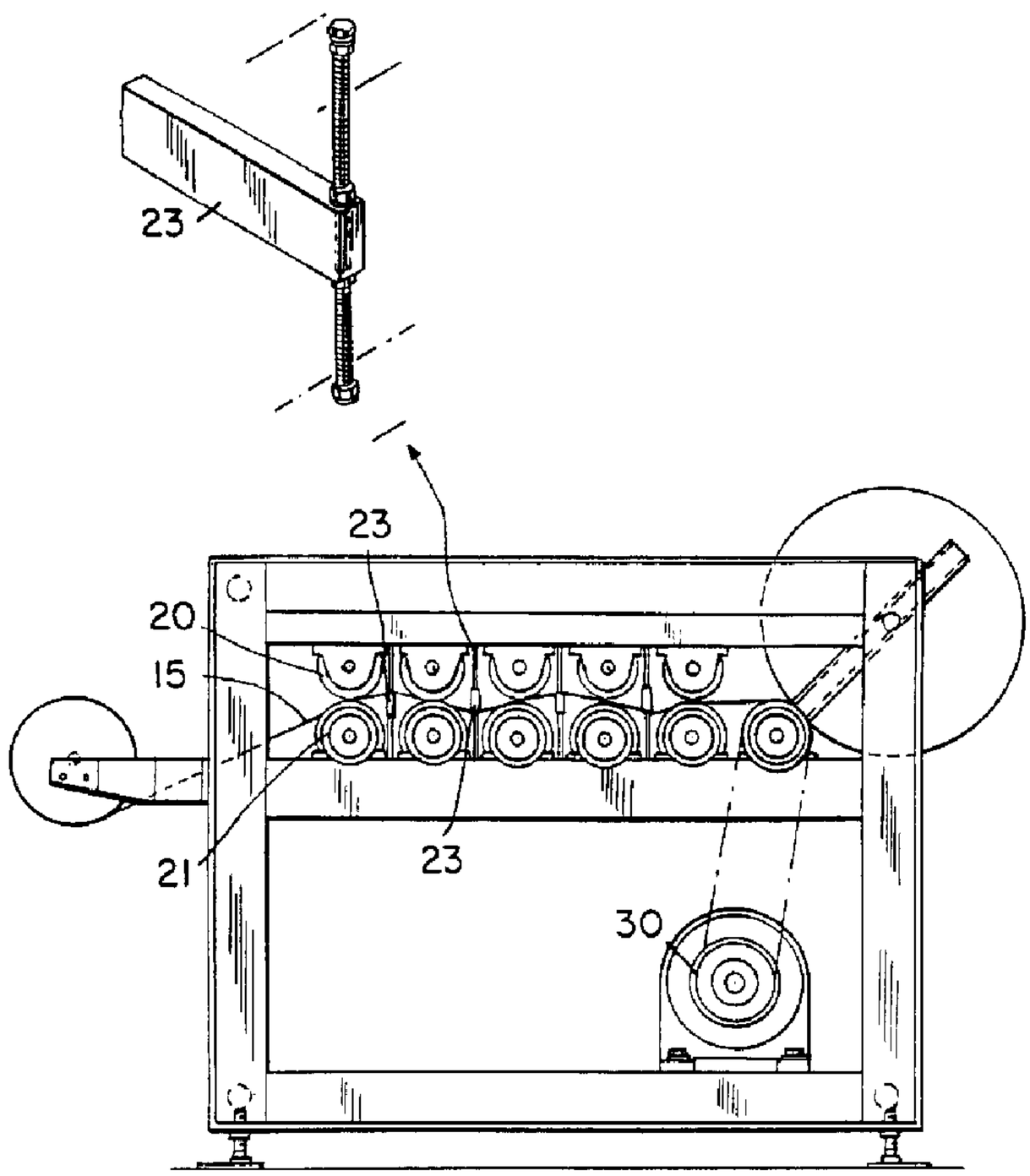
(54) Titre : APPAREIL ET PROCEDE PERMETTANT D'ADOUCIR UNE BANDE DE STRUCTURE
(54) Title: APPARATUS AND METHOD FOR SOFTENING A FABRIC WEB MATERIAL



(57) Abrégé/Abstract:
An apparatus for imparting soft hand to a non-woven, paper, paper with synthetic fibers and/or additives, printed knit fabrics and the like in web form, by mechanically introducing localized tensions on diverse preselected situses of the web. The web (15) is

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(57) Abrégé(suite)/Abstract(continued):
preferably advanced in continuous rubbing engagement with one or more contact members that can be pairs of nip rollers (20, 21) and/or breaker bars (23). Nip roller pairs (20, 21) include one irregularly surfaced roller deformably engaging into a soft roller (12) with the web passing therebetween. Breaker bars (23) can have straight, serrated or curvilinear edges and the web can be passed over or under the breaker bars. Various combinations of nip roller pairs and breaker bars are provided for and preferably a variable drive can be employed.

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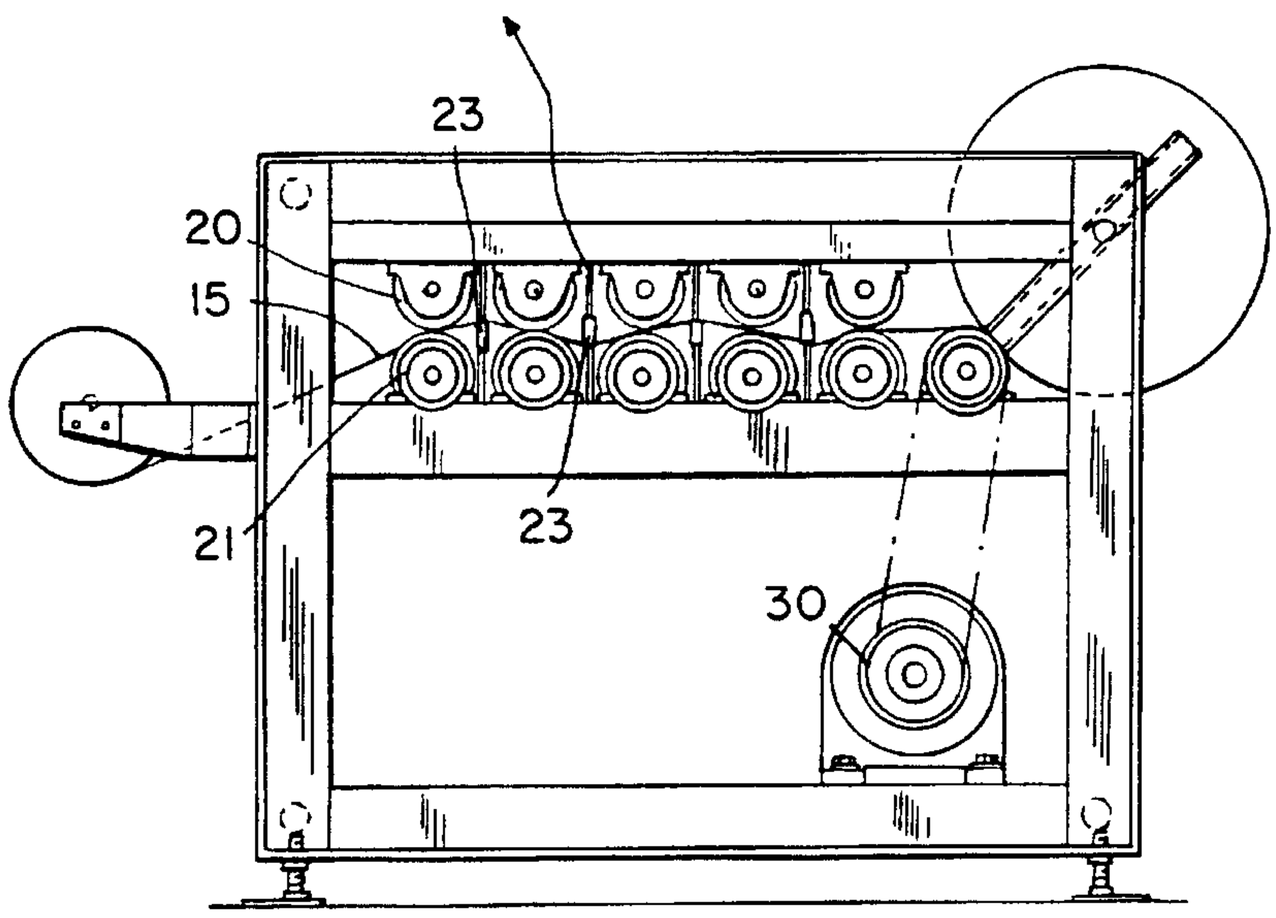

(57) Abstract: An apparatus for imparting soft hand to a non-woven, paper, paper with synthetic fibers and/or additives, printed knit fabrics and the like in web form, by mechanically introducing localized tensions on diverse preselected situses of the web. The web (15) is preferably advanced in continuous rubbing engagement with one or more contact members that can be pairs of nip rollers (20, 21) and/or breaker bars (23). Nip roller pairs (20, 21) include one irregularly surfaced roller deformably engaging into a soft roller (12) with the web passing therebetween. Breaker bars (23) can have straight, serrated or curvilinear edges and the web can be passed over or under the breaker bars. Various combinations of nip roller pairs and breaker bars are provided for and preferably a variable drive can be employed.

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APPARATUS AND METHOD FOR SOFTENING A FABRIC WEB MATERIAL

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus for softening a web material by exerting local tensions at predetermined situses on the web.

Certain types of fabric web materials such as non-wovens, paper, paper with synthetic fibers and/or additives, printed knits and the like generally have a harsh hand or feel. Manufacturers and finishers of these fabrics have tried to soften the fabrics and improve their drape by applying chemical treatments, compacting and sometimes washing the web following same by relaxed drying. Chemical treatment is expensive and requires application apparatus plus drying equipment. Compacting increases weight of a fabric web material and also its cost. Washing and drying fabric webs also are expensive.

Printed woven fabrics have been, and still are, softened by applying longitudinal tension while at the same time passing the material in contact with several rollers that have a button head knobbed surface. This procedure causes application of localized tensions on the material as the knobs protrude into and stretch the fabric

breaking its printed pigment surface thereby to end up with a softer fabric. A machine of this type is referred to in the art as a "Button Breaker." While a Button Breaker works reasonably well on woven fabrics, it distorts other materials such as non-wovens, paper, paper with synthetic fibers and/or additives, and knits to a degree that substantially damages them. Usually imposing longitudinal tension on a knitted fabric stretches the fabric and curls or rolls its edges making the fabric undesirable for use.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an apparatus which functions to impart a soft feel or hand to a fabric web material which feel or hand is very desirable.

Another object of the present invention is to provide an apparatus for achieving soft and desirable hand in an inexpensive and efficient manner.

Another object of the present invention is to soften fabric webs, especially non-wovens, paper, paper with synthetic fibers and/or additives, and printed knits, without applying excessive longitudinal tension thereto.

Another object of the present invention is to provide an inexpensive mechanical apparatus for softening various fabric web materials, especially non-wovens, paper, paper with synthetic fibers and/or additives, and printed knits, without substantially changing weight, shape or size of the fabric web and achieving at the same time a soft feel or hand to the fabric web.

Another object of the present invention is to offer a versatile selection among equipment arrangements and techniques for application to particular needs of various of the fabric webs to be softened.

Generally speaking, an apparatus according to the present invention comprises a means for allowing movement of the fabric web material through the apparatus and while the fabric web is so moving the apparatus imparts localized tension thereto in various predetermined locations distributed over the fabric web.

The foregoing and other objects and advantages of the present invention will appear more clearly hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

Other important objects and advantages of the present invention will be apparent from the following detailed description taken in connection with accompanying drawings wherein like numerals refer to like parts throughout and wherein:

Fig. 1 is a side elevational view of an apparatus according to the present invention for acting on a fabric material to soften same;

Fig. 2 is a schematic prospective view of another embodiment of the apparatus;

Fig. 3 is a simplified and broken away view of a knobbed roller co-acting with a soft rubber-covered roller;

Fig. 4 is a side elevational view showing another embodiment of the apparatus which likewise permits one to achieve objectives of the present invention;

Fig. 5 is an isolated, enlarged, broken isometric view of a breaker bar from Fig. 1 with a straight edge;

Fig. 6 shows breaker bars with buttons 23A, curvilinear edge 23B and serrations 23C;

Fig. 7 is a side elevational view showing another embodiment of the present invention with a sprayer box for applying moisture, steam and/or a cooling substance to the web; and

Fig. 8 is a detailed view of a grooved version of an irregularly shaped roller which can be used instead of, or in addition to, a knobbed roller.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to the drawings, various embodiments for achieving the soft and desirable hand are shown. In Fig. 2, an arrangement is shown comprising a plurality of rollers having a relatively hard knobbed roller **10** which presses into a rubber or similar roller **12**. Knobs **10a** of the button roller **10** press into a soft roller **12** and stretch the web locally at various preselected situses without applying substantial longitudinal tension to a fabric web **15** being processed and soft hand of the fabric web results. Likewise in Fig. 8, ridges **10b** press into soft roller **12**.

Another form of the apparatus is shown in Figs. 1, 5 and 6 wherein the fabric web **15** passes through upper and lower rolls **20, 21** and over a breaker bar **23**, seen more clearly in Fig. 5. That arrangement also imparts localized tension to a web. The fabric may be arranged by adjusting the breaker bar **23** as shown in Fig. 4 so that the web runs through a pair of rollers **40** then over the top of one bar **23** and then under

the bottom of another bar **23** as is similarly shown in Fig. 1. Also as shown in Fig. 6, edges of the breaker bar **23** can be straight **23**, buttoned **23A**, serrated **23C**, curvilinear **23B** or combinations thereof. A variable speed drive **30** is arranged to turn a preselected roller, as shown, which moves the web through one or more pairs of rollers **20, 21** and over or under a desired number of breaker bars **23**.

Various arrangements of locating the web between the breaker bars **23** may be used, as shown in Figs. 1 and 4, in order to achieve desirable web softening results. Such disposition is shown particularly in Fig. 4, for example, wherein the web material passes through a pair of rollers **40** then continuously over a breaker bar **35** then under a succeeding breaker bar at **36**, through another pair of rollers **41** and so on. As will be understood, it may not be necessary to run the web both between nip rollers and also over and/or under a breaker bar. A non-woven web sometimes softens considerably by just passing the material continuously over and under one or more of the breaker bars **23**, in which case the nip rollers would merely control overall web tension. In circumstances, depicted in Figs. 3 and 8, where relatively hard knobs **10a** or ridges **10b** are provided, the rubber roller **12** yields locally to pressing by the knobs **10a** or ridges **10b**. The rubber roller **12** normally has an approximate durometer hardness of about **15**.

As seen in Fig. 8, the irregularly surfaced relatively hard roller will usually be metal. Grooves are shown to form the irregular surface. The grooves typically have a wave length of one-half inch (1/2") whereby each ridge is one quarter of an inch (1/4") in width on its neighboring troughs are each one quarter of an inch (1/4"). Other sizes have also been used in varying nip arrangements. Where plural pairs of nip rollers are used, for example, a first nip typically would be one fourth of an inch (1/4"), a second nip

three sixteenths of an inch (3/16") and a third nip one eighth of an inch (1/8") to treat the fabric web more evenly over its width. Many other groove shapes and configurations can also be employed within the teaching of this invention.

In Fig. 7 an injection box **42** is shown with nozzles **43** for application of moisture, heat and/or coolant to the web so as to assist in softening the web **15**.

Having described the present invention in detail, it is obvious that one skilled in the art will be able to make variations and modifications to same without departing from a disclosed scope of the invention. Accordingly, the scope of the present invention can be seen further from claims which follow.

I CLAIM:

1. An apparatus for imparting soft hand to a web of a fabric material, the apparatus comprising:

a pair of nip rollers through which the web is passed;

the pair of nip rollers including one irregular surfaced roller having protrusions thereon and a paired relatively soft roller organized to yield locally under pressure of the protrusions thereinto.

2. The apparatus of as claimed in claim 1, with means for introducing moisture to the web.

3. The apparatus as claimed in claim 1, with means for heating the web.

4. The apparatus as claimed in claim 1, with means for cooling the web.

5. The apparatus as claimed in claim 1, with a plurality of the pairs of nip rollers.

6. The apparatus as claimed in claim 5, with a variable speed drive arranged to turn a preselected one of the nip rollers.

7. The apparatus as claimed in claim 1, wherein the protrusions are arranged on the irregularly surfaced roller in a decorative pattern that repeats on the web.

8. The apparatus as claimed in claim 1, wherein the protrusions are knobs provided with an arcuate surface.

9. The apparatus as claimed in claim 1, wherein the protrusions are irregular in shape.

10. The apparatus as claimed in claim 1, wherein the protrusions are ridges.

11. The apparatus of claim 10, wherein the ridges are arranged longitudinally relative to a general path of travel of the web.

12. An apparatus for imparting soft hand to a web of a fabric material having a first side and an opposite second side, the apparatus comprising:

a first physical contact member and a second physical contact member;

means for advancing the web with the first side in continuous rubbing engagement with the first physical contact member and with the second side in continuous rubbing engagement with the second physical contact member;

whereby localized tension is developed in the fabric.

13. The apparatus of claim 12, wherein each of the physical contact members comprises a breaker bar having an edge over which the web of the fabric is passed in continuous rubbing engagement.

14. The apparatus as claimed in claim 12, wherein the means for advancing the web passes the first side of the web in continuous rubbing engagement with the first physical contact member before passing the second side of the web in continuous rubbing engagement with the second physical contact member.

15. The apparatus as claimed in claim 14, wherein at least one of the physical contact members is stationary.

16. The apparatus as claimed in claim 15, wherein both of the physical contact members are stationary.

17. The apparatus as claimed in claim 16, with each of the physical contact members including a straight edge to provide the continuous rubbing engagement with its associated side of the web.

18. The apparatus as claimed in claim 17, with:

each of the physical contact members comprising a breaker bar spaced from the other breaker bar along a general path of travel of the web;

the straight edge of one of the breaker bars arranged in a first direction normal to said general path of travel of the web and the straight edge of the other of the breaker bar arranged in a second direction opposite to said first direction and also normal to said general path of travel of the web.

19. The apparatus as claimed in claim 16, with:

each of the physical contact members including a serrated edge to provide the continuous rubbing engagement with its associated side of the web;

each of the physical contact members comprising a breaker bar arranged along a general path of travel of the web and each of the breaker bars spaced from the other breaker bar along said general path of travel of the web;

the serrated edge of one of the breaker bars arranged in a first direction normal to said general path of travel of the web and the serrated edge of the other of the breaker bars arranged in a second direction opposite to said first direction and also normal to said general path of travel of the web.

20. The apparatus as claimed in claim 16, with:

each of the contact members including a curvilinear edge to provide the continuous rubbing engagement with its associated side of the web;

each of the contact members comprising a breaker bar arranged along a general path of travel of the web and each breaker bar spaced from the other of the breaker bars along the general path of travel of the web,

the curvilinear edge of one of the breaker bars arranged in a first direction normal to said general path of travel of the web and the curvilinear edge of the other one of the break bars arranged in a second direction opposite to said first direction and also normal to said general path of travel of the web.

21. The apparatus as claimed in claim 12, wherein:

one of the physical contact means comprises at least one pair of nip rollers,

a first breaker bar having a first straight edge and a second breaker bar having a second straight edge,

means for passing the web of the fabric through the pair of nip rollers in continuous contact therewith and in series past the breaker bars over one and under the other of the breaker bars in continuous rubbing contact with the straight edge of each of the breaker bars.

22. An apparatus for imparting soft hand to a web of fabric material, selected from a group consisting of printed knits, non-wovens, paper and paper with synthetic fibers and/or additives, the apparatus comprising:

a pair of nip rollers through which the web of the fabric is passed, the pair of nip rollers including one irregularly surfaced roller having protrusions thereon and a paired relatively soft roller organized to yield locally under pressure of the protrusions thereinto.

23. The apparatus of claim 22, with a plurality of the pairs of nip rollers.

24. The apparatus of claim 22, with means for introducing moisture to the web.

25. The apparatus of claim 22, with means for heating the web.

26. The apparatus of claim 22, with means for cooling the web.

27. The apparatus of claim 23, with a variable speed drive arranged to turn a preselected one of the nip rollers.

28. The apparatus of claim 22, wherein the protrusions are arranged on the irregularly surfaced roller in a decorative pattern that repeats on the web.

29. The apparatus of claim 22, wherein the protrusions are knobs provided with an arcuate surface.

30. The apparatus of claim 22, wherein the knobs are irregular in shape.

31. The apparatus of claim 22, wherein the protrusions are ridges.

32. The apparatus of claim 22, wherein the ridges are arranged longitudinally relative to a general path of travel of the web.

33. An apparatus for imparting soft hand web of a fabric material, selected from a group consisting of non-wovens, paper, paper with synthetic fibers and printed knits, the fabric material having a first side and an opposite second side, the apparatus comprising:

a first physical contact member and a second physical contact member,

means for advancing the web with the first side in continuous rubbing engagement with the first physical contact member and with the second side in continuous rubbing engagement with the second physical contact member,

whereby localized tension is developed in the fabric.

34. The apparatus of claim 33, and means for introducing moisture to the web.

35. The apparatus of claim 33, and means for introducing heat to the web.

36. The apparatus of claim 33, and means for cooling the web.

37. The apparatus of claim 33, wherein the physical contact member comprises a breaker bar having an edge over which the web of the fabric is passed in rubbing engagement.

38. The apparatus as claimed in claim 33, wherein the means for advancing the web further passes the first side of the web in continuous rubbing engagement with the first physical contact member before then passing the second side of the web in continuous rubbing engagement with the second physical contact member.

39. The apparatus as claimed in claim 38, wherein at least one of the physical contact members is stationary.

40. The apparatus as claimed in claim 39, wherein both of the physical contact members are stationary.

41. The apparatus as claimed in claim 40, with each of the physical contact members including a straight edge in the continuous rubbing engagement with its associated side of the web.

42. The apparatus as claimed in claim 41 with:

each of the physical contact members comprising a breaker bar spaced from the other breaker bar along a general path of travel of the web;

the straight edge of one of the breaker bars arranged in a first direction normal to said general path of travel of the web and the straight edge of the other of the breaker bars arranged in a second direction opposite to said first direction and also normal to said general path of travel of the web.

43. The apparatus as claimed in claim 40 with:

each of the physical contact members including a serrated edge in the continuous rubbing engagement with its associated side of the web;

the serrated edge of one of the breaker bars arranged in a first direction normal to said general path of travel of the web and the serrated edge of the other of the breaker bars arranged in a second direction opposite to said first direction and also normal to said general path of travel of the web.

44. The apparatus as claimed in claim 37 with:

each of the physical contact members including a curvilinear edge in the continuous rubbing engagement with its associated side of the web;

the curvilinear edge of one of the breaker bars arranged in a first direction normal to said general path of travel of the web and the curvilinear edge of the other of the breaker bars arranged in a second direction opposite to said first direction and also normal to said general path of travel of the web.

45. The apparatus as claimed in claim 33, wherein:

one of the physical contact members comprises at least one pair of nip rollers,

the others of the physical contact means comprise a first breaker bar having a first straight edge and a second breaker bar having a second straight edge,

means for passing the web of the fabric through the pair of nip rollers in continuous contact therewith and in series past the breaker bars over the first straight edge and under the second straight edge of the breaker bars in continuous rubbing contact with both of the straight edges.

46. A method for imparting soft hand to a web of material, the method comprising steps of:

passing the web through a pair of nip rollers which include one irregularly surfaced roller having protrusions thereon and a paired relatively soft roller organized to yield locally under pressure of the protrusions thereinto;

whereby localized tension is developed in the web.

47. The method of claim 46, and introducing moisture to the web.

48. The method of claim 46, and introducing heat to the web.

49. The method of claim 46, and cooling the web.

50. The method as claimed in claim 46, and passing the web through a plurality of pairs of the nip rollers.

51. The method as claimed in claim 46, and providing a variable speed drive arranged to turn a preselected one of the rollers.

52. The method as claimed in claim 46, and organizing the protrusions on the irregularly surfaced in a pattern to impart to the web a decorative design that repeats thereon.

53. The method as claimed in claim 46, and providing knobs with arcuate surfaces as the protrusions.

54. The method as claimed in claim 46, and providing irregular shapes to the protrusions.

55. The method as claimed in claim 46, and providing ridges as the protrusions.

56. The method as claimed in claim 55 and arranging the ridges longitudinally relative to a general path of travel of the web.

57. A method for imparting soft hand to a web of a fabric material having a first side and an opposite second side, the method comprising steps of:

providing a first physical contact member and a second physical contact member;

advancing the web with the first side in continuous rubbing engagement with the first physical contact member and with the second side in continuous rubbing engagement with the second physical contact member;

whereby localized tension is developed in the web.

58. The method of claim 57, and introducing moisture to the web.

59. The method of claim 57, and introducing heat to the web.

60. The method of claim 57, and cooling the web.

61. The method as claimed in claim 57, and arranging the first side of the web to pass in continuous rubbing engagement with the first physical contact member before the second side of the web passes in continuous rubbing engagement with the second physical contact member.

62. The method as claimed in claim 57, and arranging at least one of the physical contact members to be stationary.

63. The method as claimed in claim 57, and arranging both of the physical contact members to be stationary.

64. The method as claimed in claim 63 and providing each of the physical contact members with a straight edge in the continuous rubbing engagement with its associated side of the web.

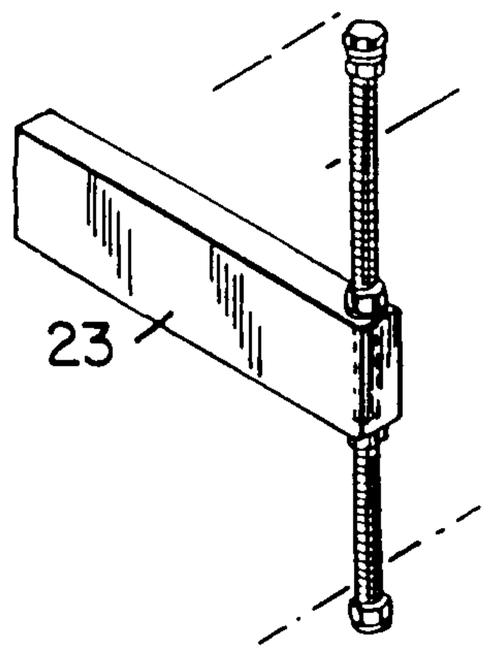
65. The method as claimed in claim 64 and:

providing a breaker bar at each of the physical contact members, spacing the breaker bars from each other along a general path of travel of the web;

arranging the edge of one of the breaker bars in a first direction normal to said general path of travel of the web and the edge of the other breaker bar in a second direction opposite to said first direction and also normal to said general path of travel of the web.

* * * * *

FIG. 5



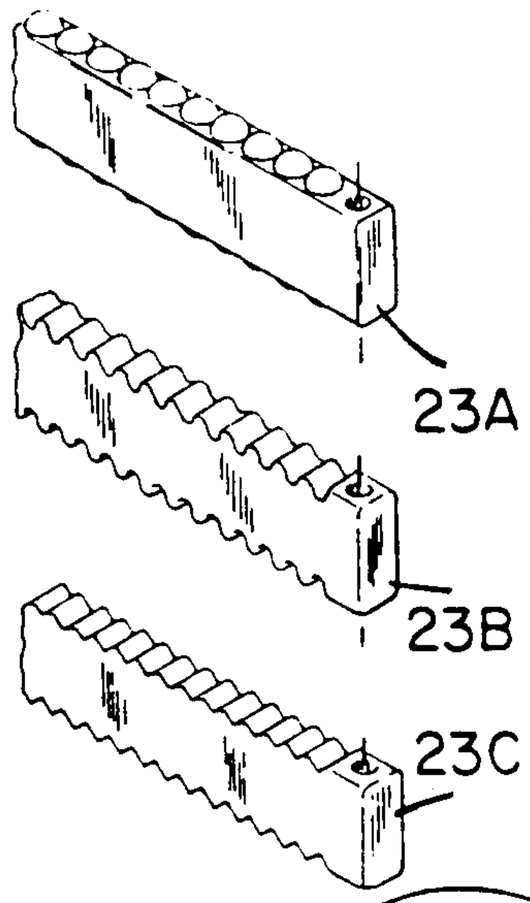


FIG. 6

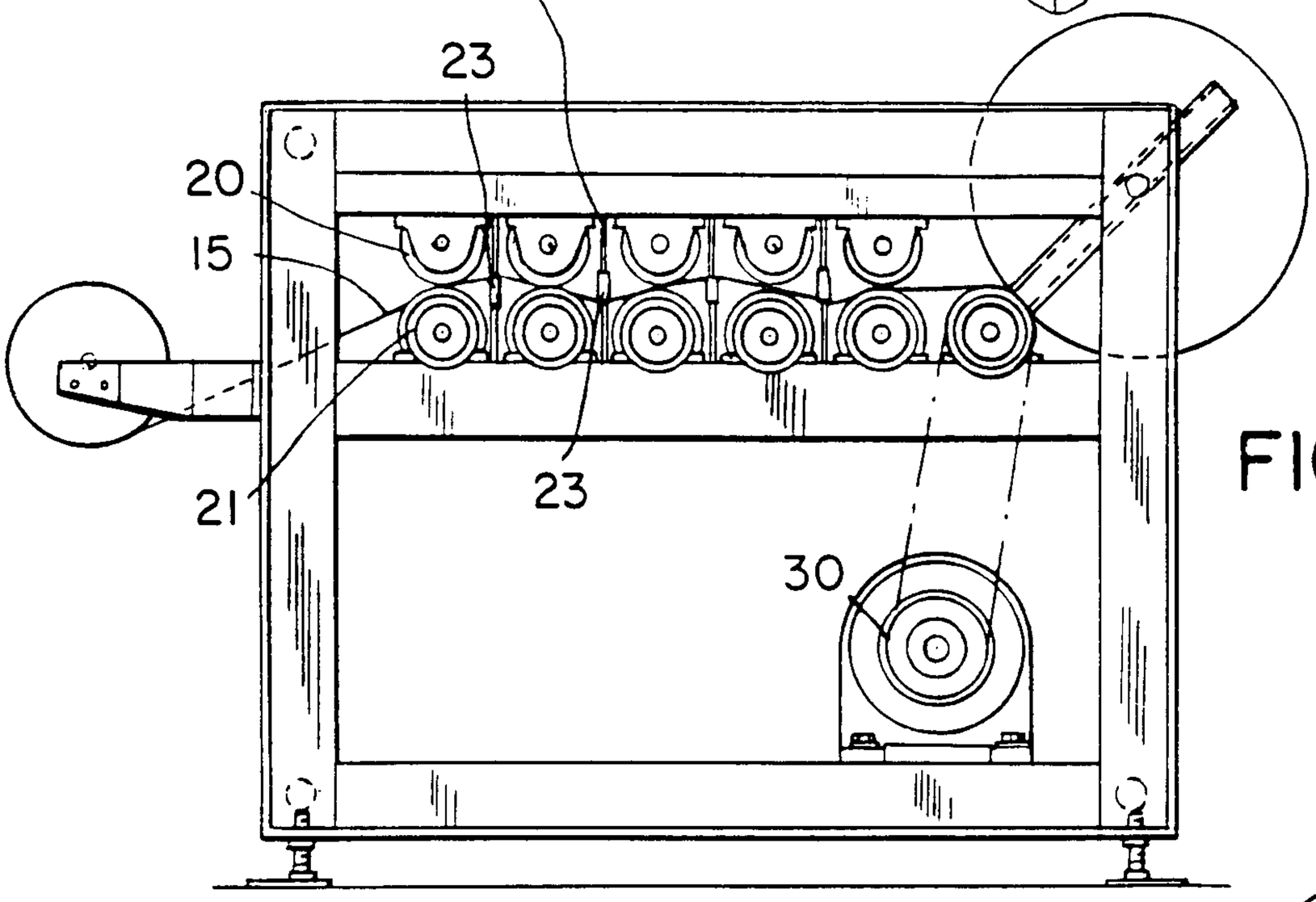


FIG. 1

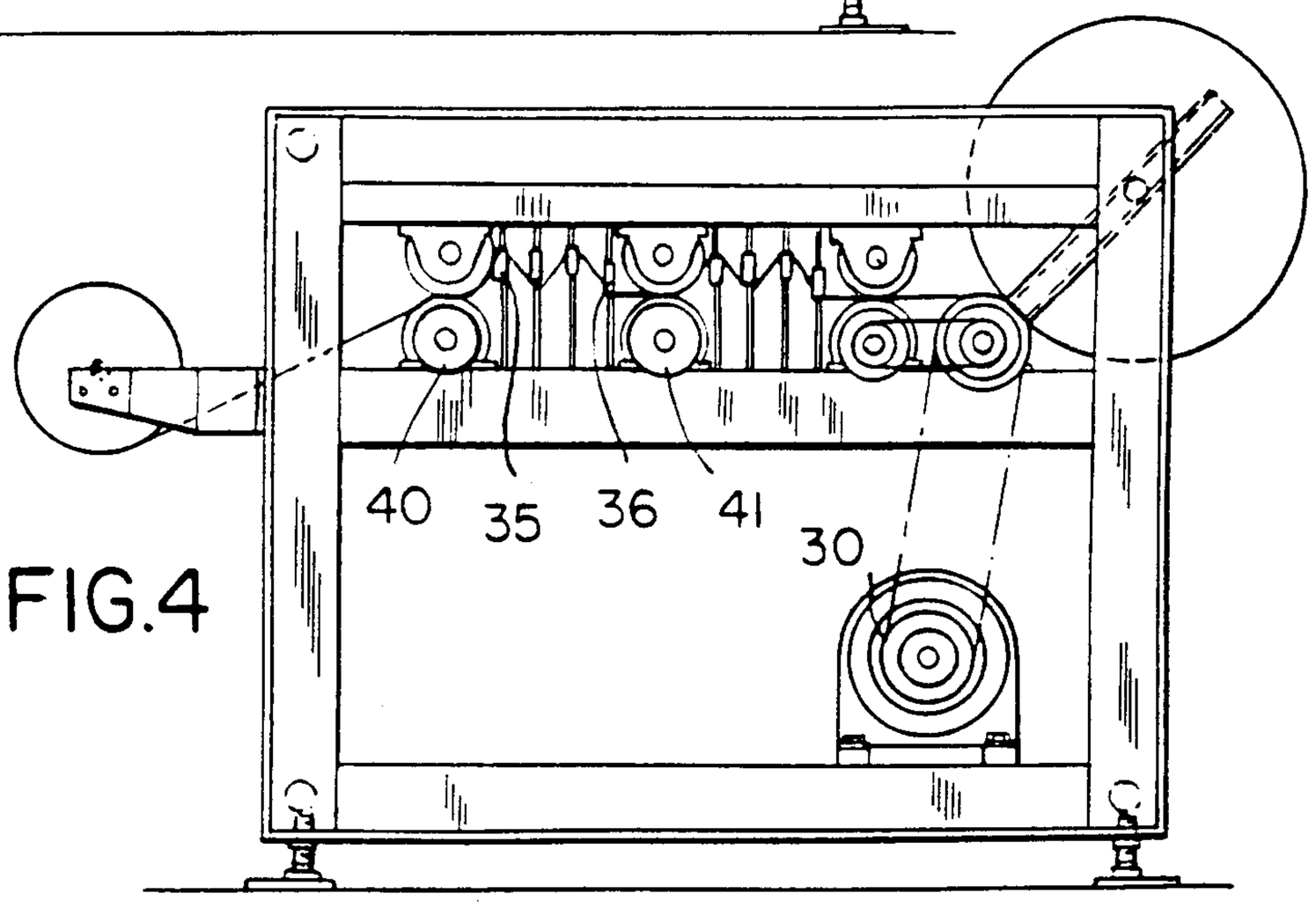


FIG. 4

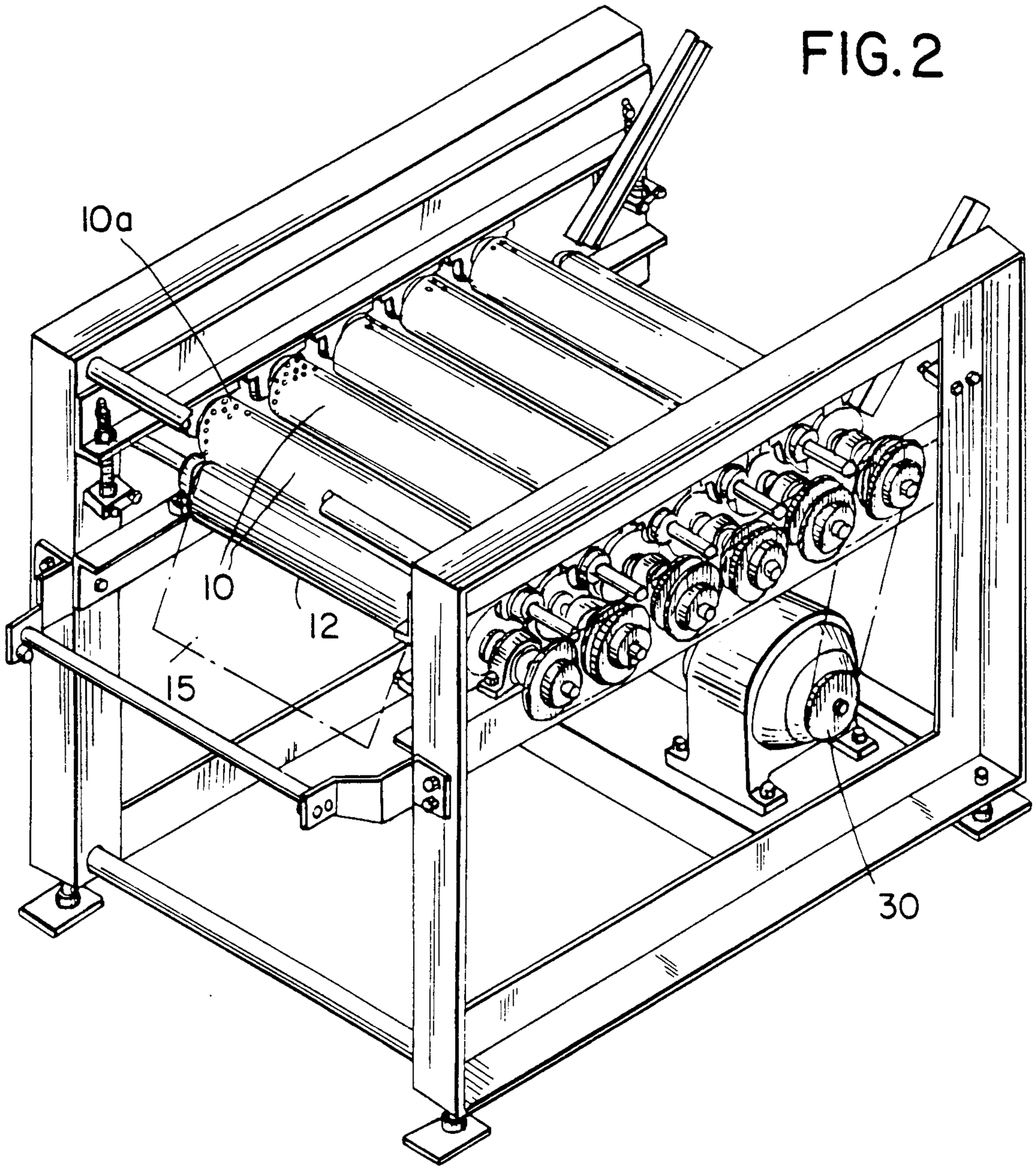


FIG. 2

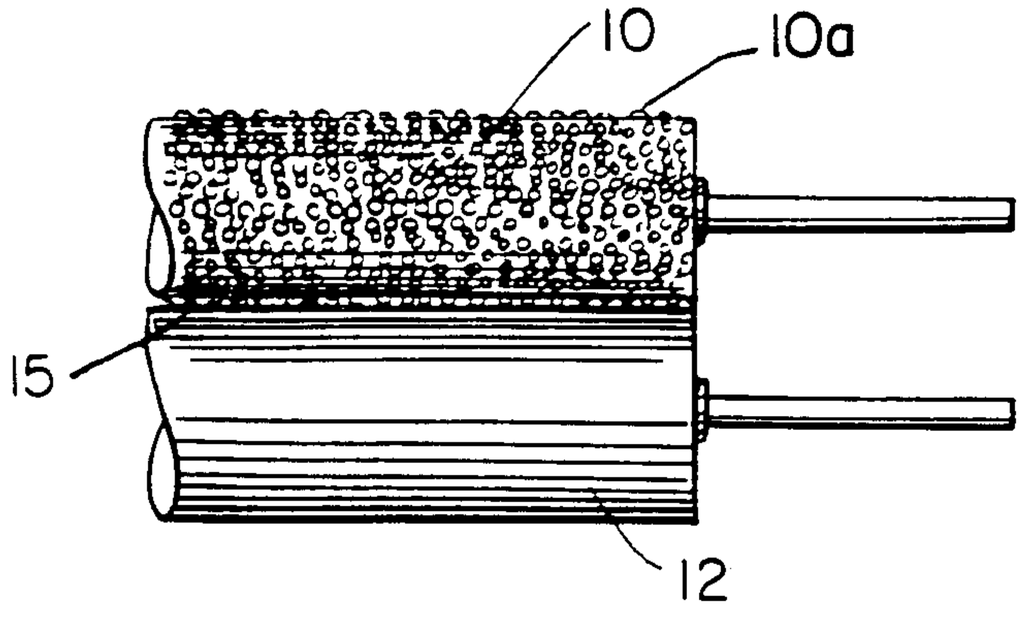


FIG. 3

FIG.7B

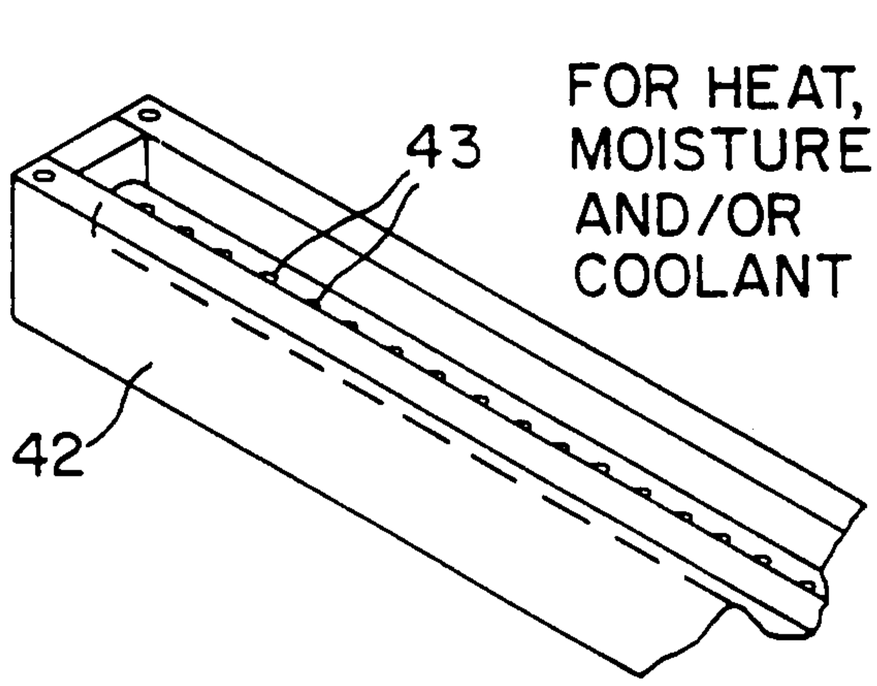

43
FOR HEAT, MOISTURE AND/OR COOLANT
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FIG.7A

SEE FIG. 7B
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FIG. 8B

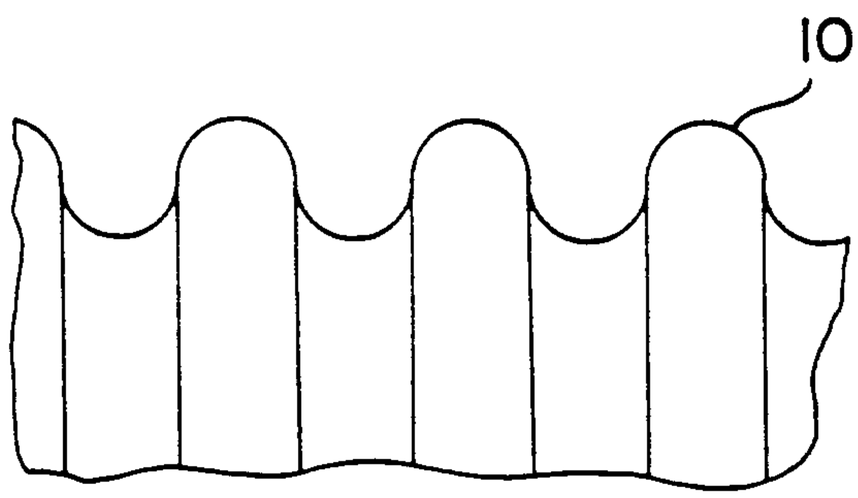
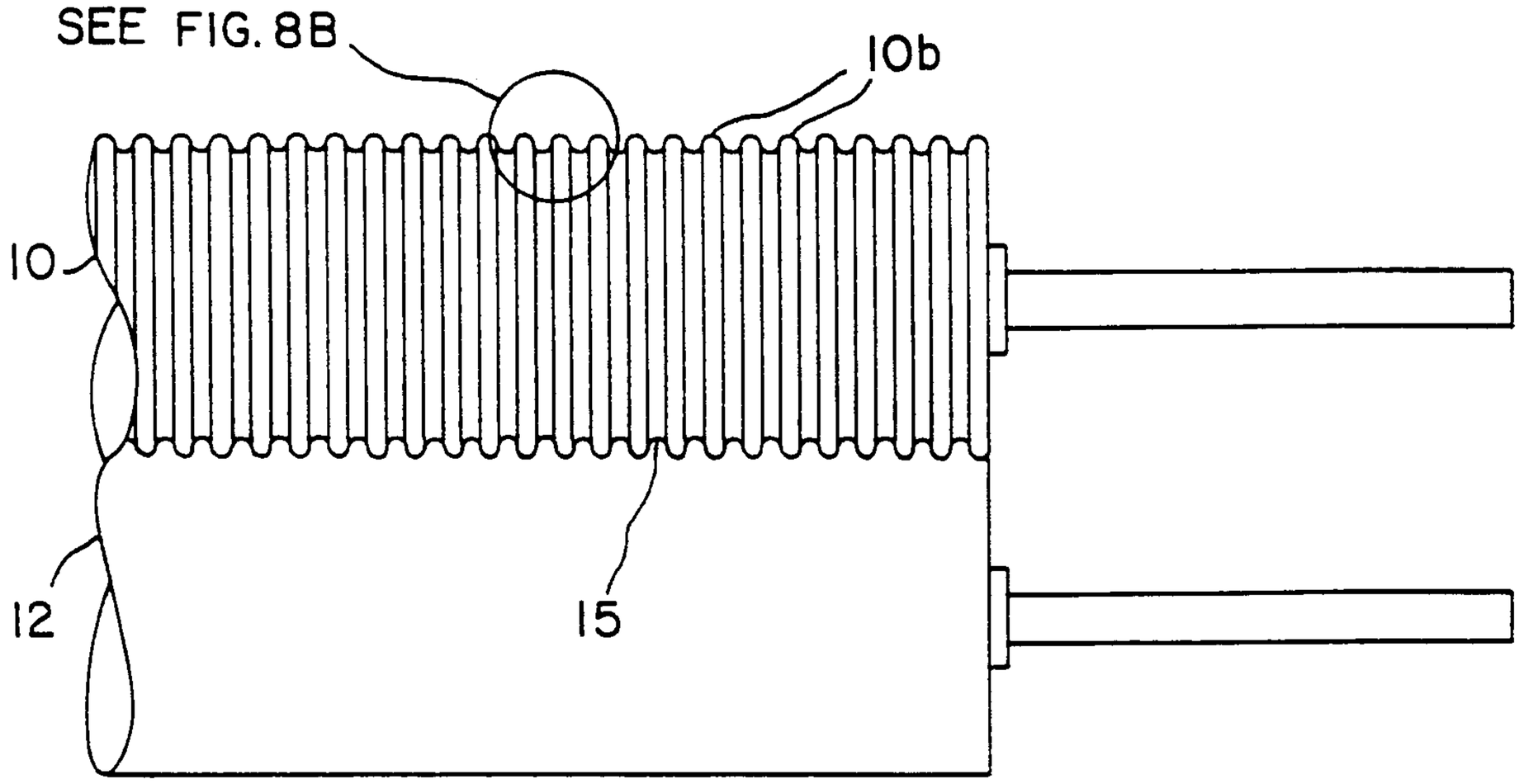
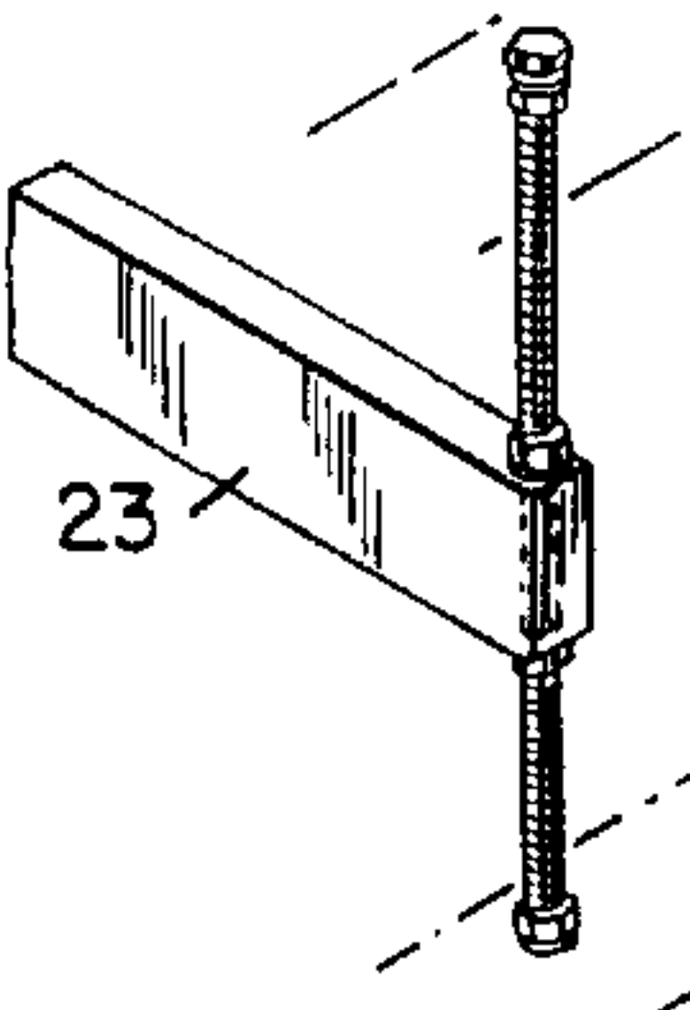


FIG. 8A

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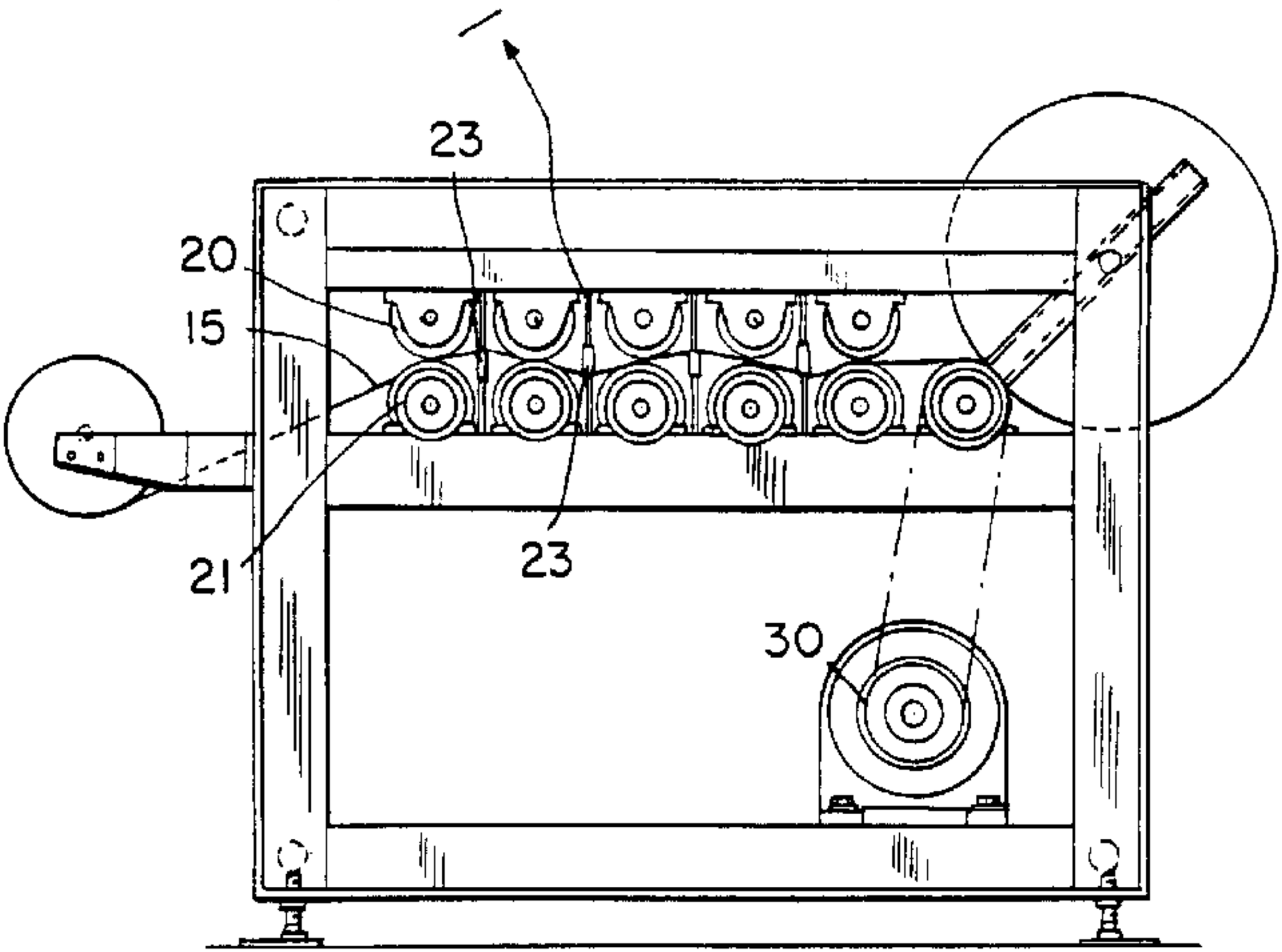
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