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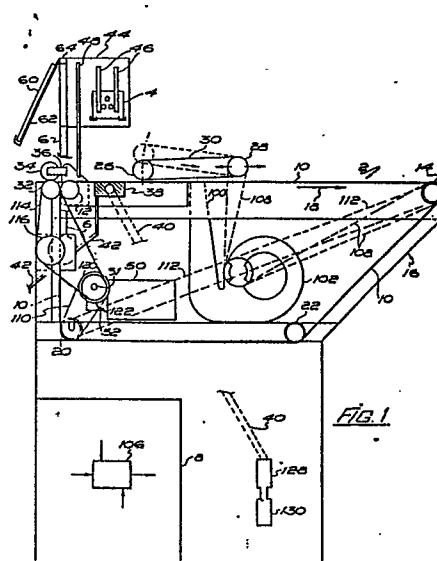
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54 **Knitted fabric separating machine.**

57 The invention relates to machines for the separation of knitted fabrics into discrete portions by the effective removal of threads linking the portions, the machines comprising infra-red radiation tubes of which the output is controlled in accordance with the rate of progress of the fabrics through the machine.



Description

Knitted fabric separating machines

The invention relates to machines for the separation of knitted fabrics into discrete portions by the effective removal of threads linking the portions.

Hitherto it has been known to produce a plurality of garments, such as socks, or of garment parts, such as collars, in a continuous knitting operation in which steam-soluble or steam-degradable yarns are introduced to link each garment or garment part to the next, and subsequently to treat the knitted goods with steam at atmospheric pressure so as to dissolve or at least soften the linking yarns and thus separate the individual garments or parts. However, it is desirable in some circumstances to treat the knitted goods, before separation, with dyes or other aqueous liquors at or even above 100 degrees C but such treatment would soften or dissolve the link threads hitherto conventionally used and result in premature separation. In order to retain the linkage between individual portions throughout such treatment so that they can be handled as a single elongate unit, it is necessary to employ a link thread which is resistant to such treatments, and the object of the invention is to provide a machine for separating portions of knitted fabric linked by such resistant link threads whilst avoiding damage to the fabric portions.

According to the invention there is provided apparatus for separating knitted fabric comprising fabric portions linked by link threads, said apparatus comprising means for conveying the said fabric from an input station towards an output station, infra-red radiation means positioned so as, when connected to a source of electric power, to irradiate the fabric intermediate the stations, and means for controlling the output of the radiation means.

The apparatus may further comprise means for treating the fabric intermediate the stations with steam.

The control means may control the output of the radiation means in accordance with one or both of the rate of conveyance of the fabric intermediate the stations and the nature of the fabric.

The apparatus may also provide means for distancing the fabric portions from one another after the separation thereof.

Embodiments of the invention will now be described by way of example and with reference to the accompanying drawings of which :-

Fig. 1 is a partially schematic side elevation on a fabric separating machine,

Fig. 2 is a front elevation of the machine of Fig. 1,

Fig. 3 is a plan view of the heating unit of the Fig. 1 machine,

Fig. 4 is a side view of the heating unit, and

Fig. 5 is an end view of the heating unit.

As shown in the figures the apparatus comprises essentially a free-standing cabinet 2, an infra-red heating unit 4 mounted transversely above the cabinet at the front end thereof by means of supports 6, and a control console 8.

The upper part of the cabinet 2 projects rearwardly of the lower part, and the upper surface of the cabinet is defined by a portion of a continuous and permeable belt 10 extending between transverse roller 12 towards the front of the machine and a further transverse roller 14 towards the rear of the rearward extension 16 of the cabinet. The remainder of the path of the belt 10 is defined by transverse rollers 20, and 22.

An electric motor 50 coupled to a tachogenerator 104 and to a speed reduction gear 52 having an output shaft 51 is located within the cabinet 2. In an embodiment not shown the tachogenerator is replaced by an encoder or other device capable of producing an electrical output proportional to the motor speed. Drive belt 110 is driven by a first pulley 120 on shaft 51, and this in turn drives a pulley which is fast to one end of the rollers 20. A further belt 112 similarly drives roller 14 at the same speed as roller 20 and in the same direction so that the upper reach of belt 10 travels in the direction of arrow 18. The belts driving the rollers 14 and 20, and those driving other rollers as will be described below, are generally accommodated in housings 15 to each side of the upper portion of cabinet 2. The other rollers supporting belt 10 are idlers.

Transverse rollers 26 and 28 are mounted in bearings above the level of the upper reach of belt 10, intermediate rollers 12 and 14. A permeable conveyor belt 30 is arranged tautly about the roller 26, 28, and roller 28 is driven from roller 14 via drive belt 108 which passes over pulleys fast to the rollers and two loose pulleys 124. This drive ensures that the lower reach of belt 30 moves in the same direction and at the same surface speed as belt 10.

The bearings of roller 26 are adjustably mounted so that the roller may be raised in an arcuate path of which the centre is the axis of roller 28. Moreover, the bearings of both rollers are so adjustable (and the belt 108 is sufficiently extensible) that the unit comprising roller 26 and 28 and the belt 30 can be moved a short distance bodily towards roller 12 or roller 14 if required.

Two nip rollers 32, 34 are mounted forwardly of the cabinet, parallel to roller 12 and with their nip at about the level of the upper reach of belt 10. The bearings of upper roller 34, which is freely rotatable, are carried at the end of arms 36 which can be raised or lowered to provide an open or a tight nip between the rollers as required.

Roller 32 is rotated by a V-belt 114 driven by a spring-loaded variable-pitch V-belt pulley 122 on the shaft 51 of speed-reduction gear 52, the pulley ensuring that the roller 32 rotates at a surface speed proportional to but less than that of belt 10. By adjusting the position of a compensating pulley 116 between positions shown in full and in dotted lines in Fig 1, the belt 114 is caused to run at a different effective diameter of pulley 122 and so the speed differential between the roller 32 and the belt 10 can be varied as required and as will be explained below.

A steam chamber 38 having a perforated lid, a steam inlet pipe 40 and a condensate outlet 42 is located below the upper reach of belt 10 intermediate rollers 12 and 26. The inlet pipe 40 is connected externally of the cabinet 2 to a pressure reducing valve 128 and a water-separator 130 (shown schematically), which in turn are for connection to a source of steam at pressure in the region of 2 atmospheres.

An air duct 100, connected to an electric blower 102, is arranged within the cabinet 2 rearwardly of the steam chamber and terminates below the upper reach of belt 10 where it passes under belt 30. The blower is connected to a source of electric power so that ambient air is forced through the belts 10 and 30 and any permeable material which lies between the belts.

The heating unit 4 is supported over the cabinet by a structure comprising end plates 44, each supported by an upright 6 which in turn is secured to a side of the cabinet 2. Each end plate is provided with two vertical slots 46, and the unit 4 is attached to the respective plates by bolts passing through the slots. The unit is intended to be arranged parallel to the belt 10 and, by fixing the bolts in the slots at different heights, at variable distance therefrom.

The heating unit 4 comprises two elongate parallel channel members 66 supporting, at their ends, housings 68, 70, and terminating in end plates 72. Each of the end plates 72 has a horizontal slot 74 through which the bolts pass which have been described in relation to the vertical slots 46. The slot 74 is longer than the spacing of the slots 46 and allows adjustment of the location of the heating unit forwardly or rearwardly of the underlying cabinet 2.

Each of the housings 68,70 encloses sockets 72 for the reception of the ends of two twin short-wave infra-red heating tubes 78,80, ceramic terminal blocks 74, 76 and an electric fan 79. Blocks 74 serve to connect the heating tubes to mains via a controller to be described below, whilst blocks 76 are for connecting the fans 79 to mains through a switch. The fans serve to draw air downwardly into the housings through openings 90 in the lids 92 for the cooling of the sockets and terminal blocks. The openings 90 are protected by guards 94.

The heating tubes are arranged parallel to one another and are surmounted by a reflector 82 which is in the form of an elongate aluminium extrusion having three lengthwise rows of holes 83 for ventilation purposes. In another embodiment, not shown, the reflector 82 is of formed sheet metal. The reflector is secured at its ends to the respective terminal housings 68, 70. The housings also provide support for the ends of a cylindrical conduit 85 which is mounted above the reflector and which carries electrical cables from one housing to the other. Housing 68 is provided with an entry socket 86 for input power cables and each housing has an earthing or grounding stud 88.

In use of the apparatus, considerable heat is generated by the heating unit, and to safeguard against injury to operatives, a vertical safety screen 48 of expanded metal is fixed between the end plates 44 and a tinted, transparent screen 60 of

toughened glass is removably supported in front of screen 48 by inclined arms 62 which in turn are tiltably supported by beam 64 which extends between the supports 6 at their upper ends.

The control console 8, which stands at the side of cabinet 2 and is shown schematically, contains a triac 106 of which the input is provided by mains electricity and of which the output is connected to the heating tubes 78,80. The triac is operatively connected to the tachogenerator 104 so that the output potential of the triac fed to the heating tubes is directly related to the speed of the motor 50 and thus to the surface speed of the belts 10 and 30, which typically ranges between 0 and 8 m/min. The output of the triac can also be manually varied by means of a potentiometer to adjust the heat of the tubes to suit the fabric being handled.

When the apparatus is in use, a length of knitted fabric comprising a lengthwise series of fabric portions linked together with a link-thread degradable by heat, is fed into the light nip between rollers 32 and 34 from the front of the cabinet so that the fabric emerging rearwardly of the rollers is carried on the upper reach of belt 10 towards the belt 30. By means of the differential pulleys mentioned above, the surface speed of the roller 32 is set at up to 20% less than the surface speed of the belts 10, 30 so that all portions of the fabric which are firmly linked to the portion held, for the time being, in the nip between rollers 32 and 34 lag behind the faster-moving belt 10, which thus slips forwardly of and below the fabric.

The height of the roller 26 and thus the depth of the entry between the belts 10 and 30 is adjusted in accordance with the nature, and in particular of the thickness, of the fabric, in order that the belt 30 bears so lightly on the fabric as not to exert longitudinal tension on fabric thus held in the nip.

In use of the apparatus, the motor 50 is switched on to initiate the motion of the rollers and belts, and the fabric to be separated is fed between rollers 32 and 34. On switching of mains power to the triac 106, a speed-related potential is fed to the tubes 78, 80, so that they generate heat in direct relation to the rate of the fabric advancement through the nip between rollers 32 and 34 and over belt 10 in the direction of arrow 18.

If required, the steam box 38 is also operated by connecting it to the steam source referred to above and adjusting the pressure transmitted thereto to about 0.5 atmospheres. Steam passes out of the box through the perforations therein, penetrates the belt 10, and thus reaches the fabric. The blower 102 is also switched on so that the steam is discharged from the fabric by a current of air as it passes under roller 30.

The radiant heat generated by unit 4 and falling on the fabric, is intended on the one hand to degrade the material of the link threads so much that it loses its coherence, and on the other hand to cause no damage to the fabric portions. This objective is primarily attained by the control of the output of the tubes in accordance with the speed of the fabric so that fabric remaining under the tubes for a longer period receives heat energy at a lower rate, whilst more intense heat is fed to fabrics passing more

quickly through the apparatus. Further adjustments are also provided, however, by the possibility of raising or lowering of the heating unit by means of the slots 46, and by the use of the potentiometer which adds a constant bias to the speed-related potential fed to the tubes in order to allow for differences in sensitivity of the link threads and of the fabrics to thermal degradation.

The tubes respond very quickly to the electrical input, so that any slowing of the movement of the fabric results in a rapid reduction of radiant heat received by the fabric, and unwanted damage is thereby avoided. As an additional safeguard, conventional devices may be added to detect a breakage of any of the drive belts 108, 110 112 and 114, and consequently to isolate the tubes. Again, a radiation pyrometer may be mounted above the belt 30 to measure radiation from the heated fabric and to operate a switch to break the electrical connection to the tubes in the event of the temperature of the fabric becoming excessive.

The thermal degradation of the link thread material under the influence of radiant energy from the heating unit 4 and of any steam applied from the steam box, results in the link threads becoming effectively severed. As a result, a fabric portion downstream of the nip between rollers 32 and 34 becomes detached from the fabric being held, for the time being, in the nip, so that it is no longer held back by the speed of roller 32 but tends to advance, upon and at the faster rate of belt 10, and this tendency is reinforced as the detached portion enters under belt 30. Thus, as successive fabric portions are separated from the fabric in sequence, they are advanced on the belt 10, spaced apart longitudinally, towards roller 14 for further handling. Conveniently, the spacing may be 1-2 cm, and this can be varied by adjusting the lag of the feed roller 32 relative to belt 10.

Claims

1. Apparatus for separating knitted fabric comprising fabric portions linked by link threads, said apparatus comprising conveying means for conveying the said fabric from an input station towards an output station, infrared radiation means connectable to a source of electric power, located so as to irradiate the fabric intermediate the stations when so connected, and means for controlling the output of the radiation means.

2. Apparatus according to Claim 1 including steaming means located between the stations for treating the fabric with steam.

3. Apparatus according to Claim 1 or Claim 2 wherein the control means controls the output of the radiation means in accordance with one of the rate of conveyance of the fabric intermediate the stations and the nature of the fabric.

4. Apparatus according to Claim 1 or Claim 2 wherein the control means controls the output

of the radiation means in accordance with both of the rate of conveyance of the fabric intermediate the stations and the nature of the fabric.

5. Apparatus according to any one of the preceding Claims further including means for distancing the fabric portions from one another on the conveying means after the separation of the said portions.

6. Apparatus for separating knitted fabric comprising fabric portions linked by link threads, substantially as described with reference to Figures 1 and 2 or 3 to 5 of the drawings.

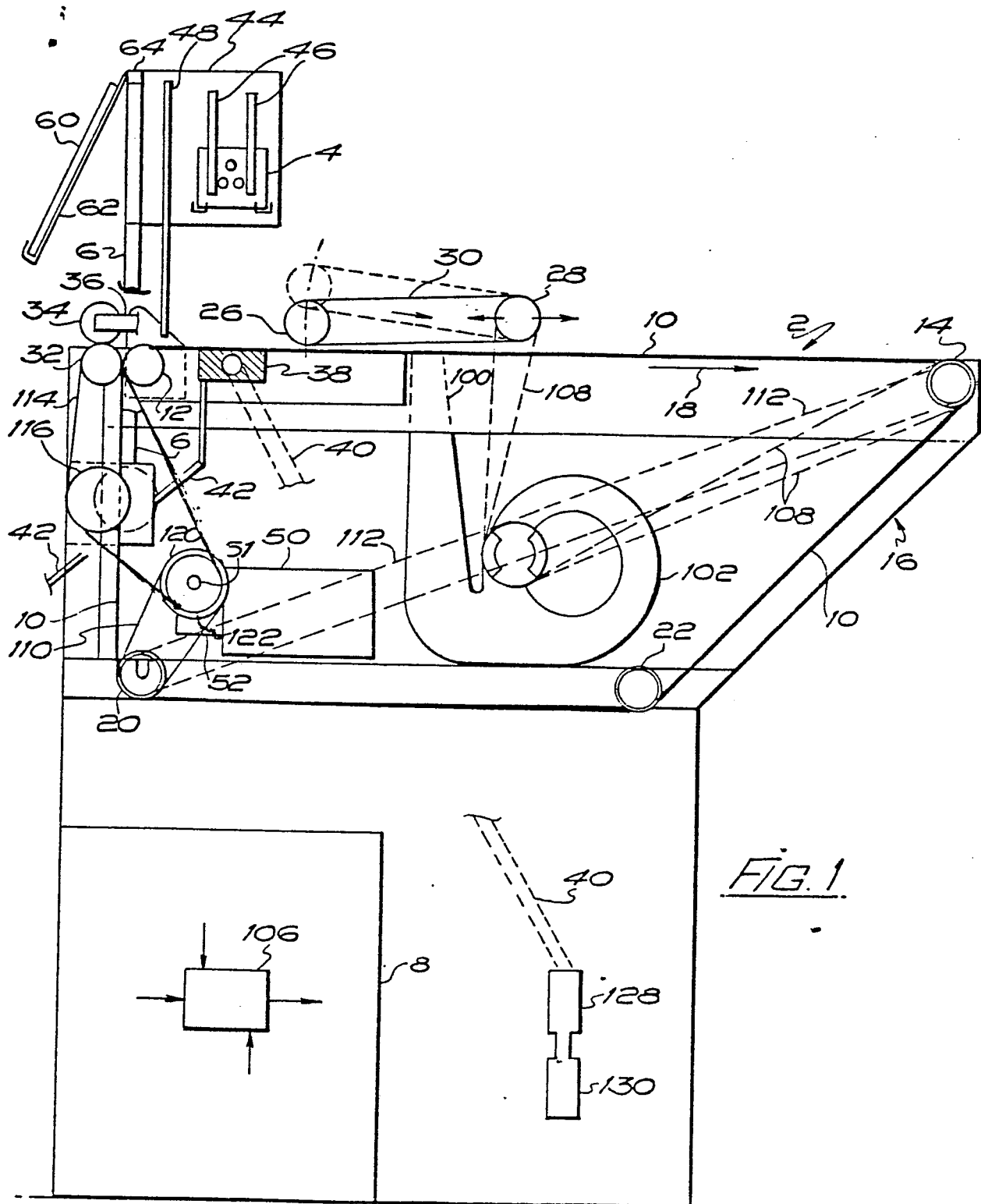
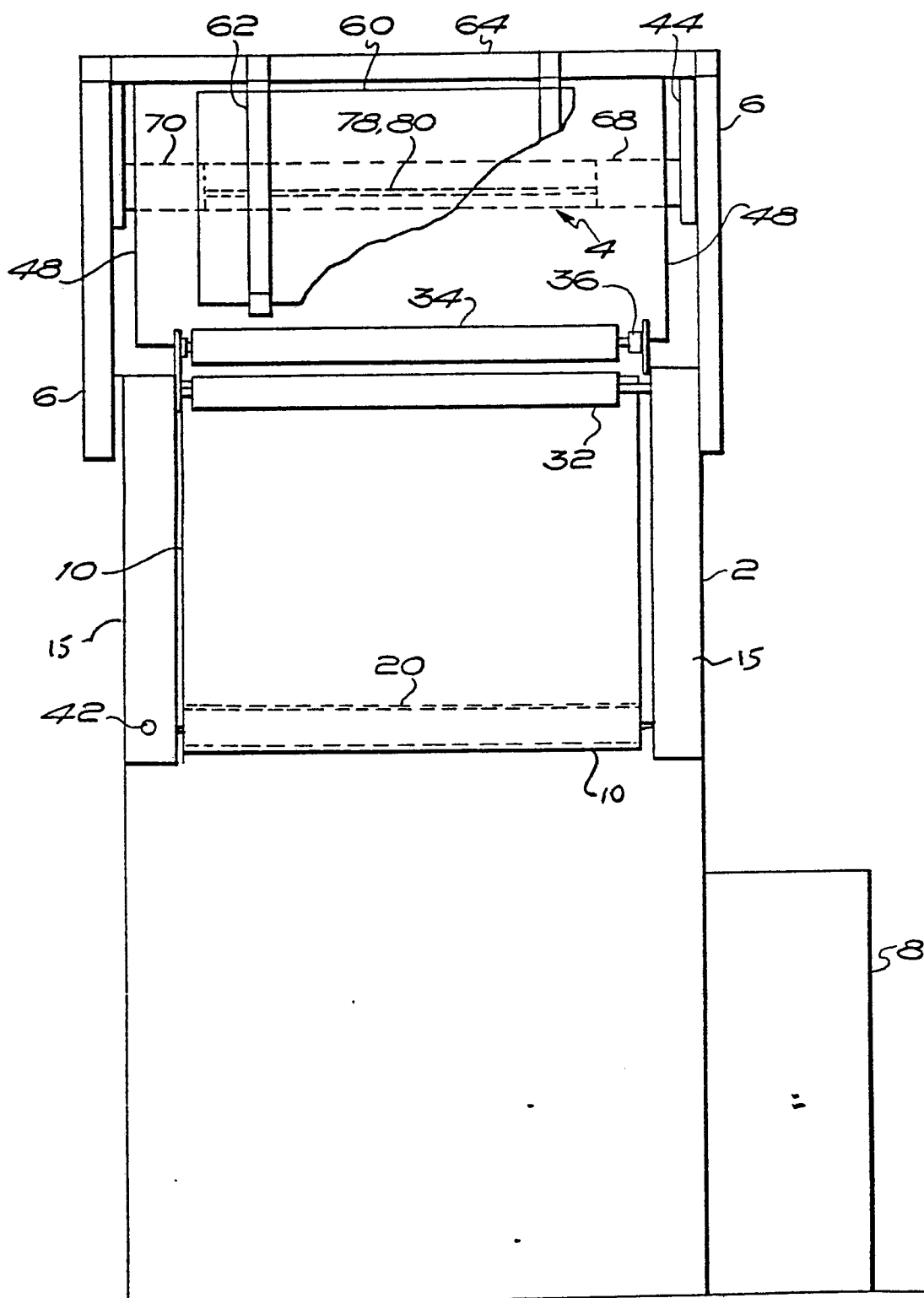
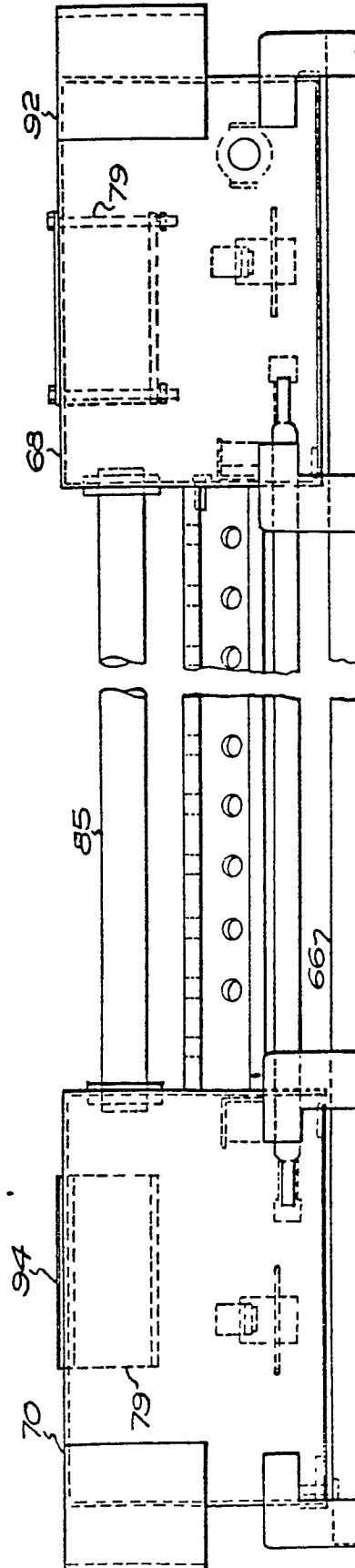
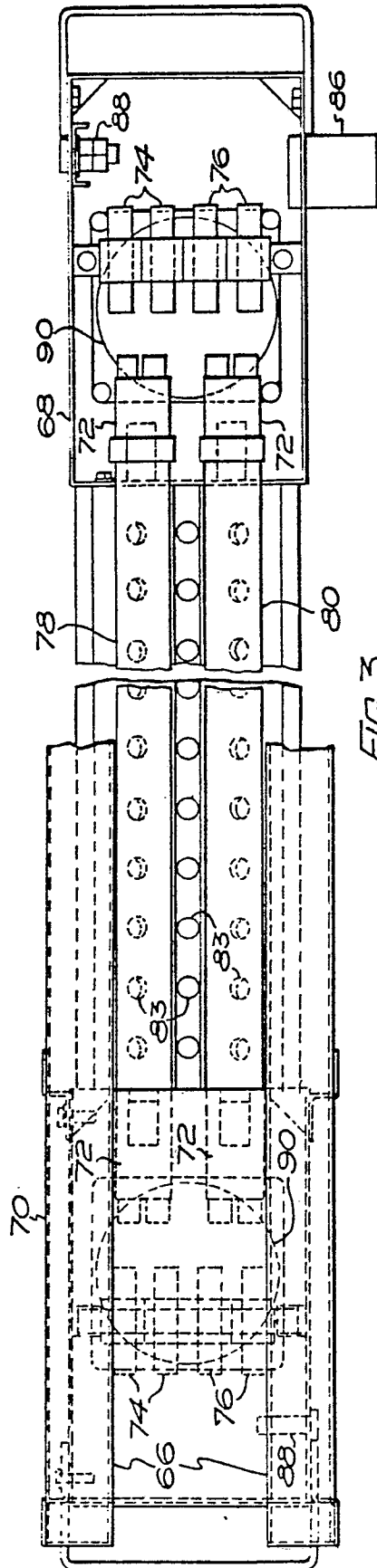
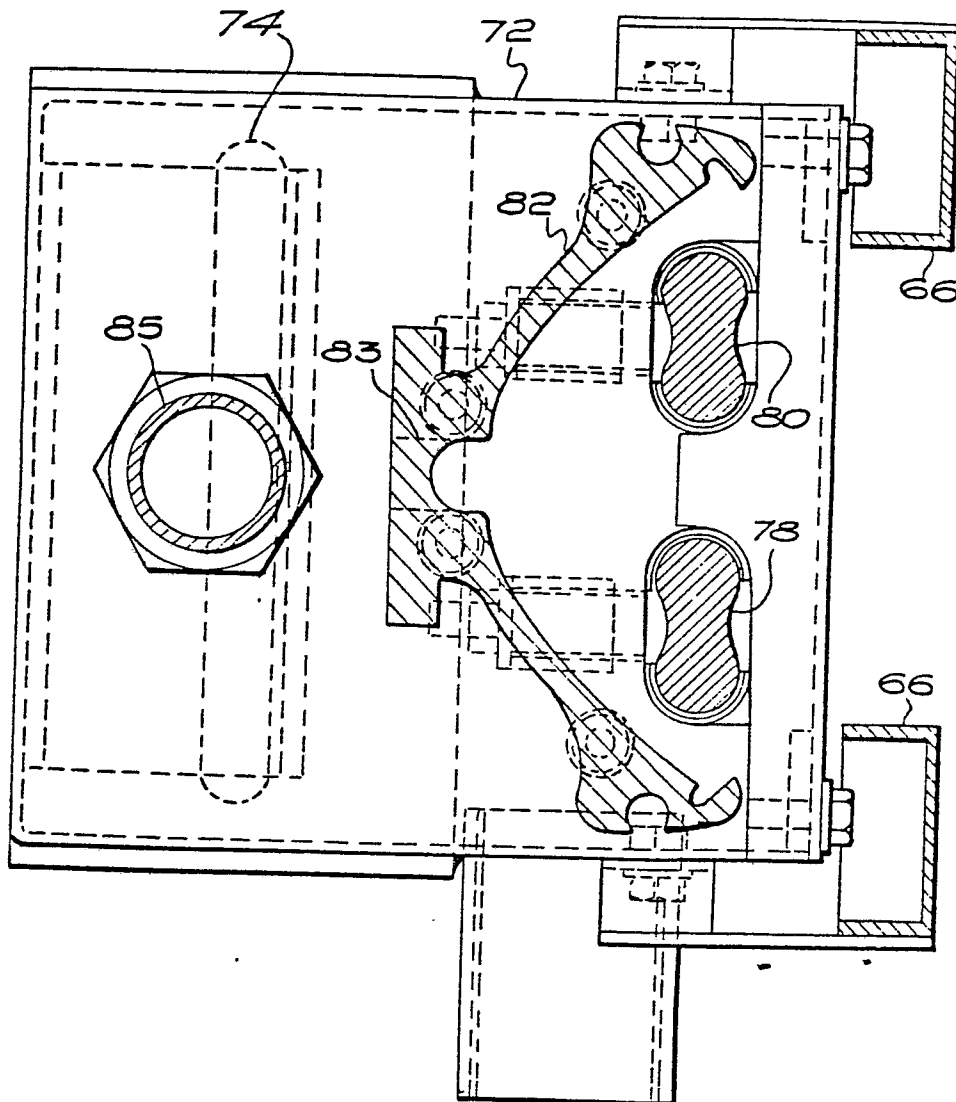


FIG. 1

FIG. 2



FIG. 5