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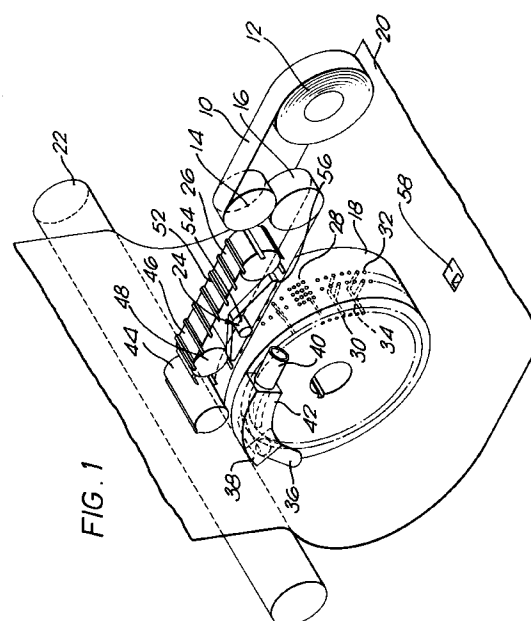
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(54) **Methods and apparatus for web handling and apparatus for heating spaced areas of a moving object.**

(57) A method and apparatus for heating separating and accelerating portions of a moving web of plastics film by leading a moving web (10) over the surface of a rotating web support member (18), which has a surface speed higher than the speed of the moving web such that the web slips on said member, periodically cutting lengths of web material from said web on said support member using a cutter (44), capturing said cut lengths on said support member by attraction of said cut lengths to the surface of said support member by vacuum applied through ports (28) via sliding valve manifolds (38, 42) and transporting said cut lengths thereon at the surface speed of the support member to be heat sealed to a second web (20) of paperboard to form pull tabs for use in opening cartons made therefrom.



The present invention relates to methods and apparatus for handling moving webs and in a second aspect relates to apparatus for heating spaced areas of a moving object which may be a web.

When lengths are cut from a moving web of material, they are usually transported for further processing initially at a speed which is the same as that at which the web moves. A need has now arisen for lengths cut from a web to be accelerated rapidly to a higher speed of movement for further processing.

Accordingly, according to a first aspect the present invention provides a method for separating and accelerating portions of a moving web comprising leading a moving web over the surface of a rotating web support member, which member has a surface speed higher than the speed of the moving web such that the web slips on said member, periodically cutting lengths of web material from said web on said support member, capturing said cut lengths on said support member by attraction of said cut lengths to the surface of said support member and transporting said cut lengths thereon at the surface speed of the support member.

The invention in its preferred embodiments is particularly applicable to handling cut lengths of web material which are insufficiently stiff or too small to be handled by more conventional means such as pairs of opposed rollers or conveyor belts. Thus the invention has particular applicability to the handling of cut lengths of thin plastics film, especially lengths of 10 cm or less, e.g. 3 cm or less (measured on the web length direction).

In a first preferred practice according to the invention, the end portion of the web is first cut off and then the resulting cut length is accelerated to the speed of the web support member.

Preferably, the cut lengths are attracted to the support member by negative pressure (suction) applied at the surface of the support member beneath said cut lengths through one or more cut length attracting openings in said surface. However, alternative methods of attracting the cut lengths to the support member may be employed such as electrostatic attraction or the choice of materials for the surface of the web support member and the moving web which naturally tend to cling to one another.

The web is preferably attracted to the support member upstream of a cutting station at which it is cut into lengths. The attraction of the web to the support member may be of the same nature as the attraction of the cut lengths to the support member but is preferably less intense. Once again therefore, the web may be attracted to the support member by negative pressure applied at the surface of the support member beneath said web through web attracting openings in said surface.

Preferably, the attraction of the cut lengths to the surface of said support member is commenced or is

increased in synchrony with the cutting of said cut lengths from the web and this thereby made sufficiently strong as to prevent slipping of the cut lengths on the surface. The support member preferably comprises a roller having a radially outward facing web support surface over which said web is led, which surface has at least one cut length attracting opening therein communicating with a source of negative pressure e.g. communicating through means defining a gas-flow path with a corresponding opening or openings on a second surface portion of said roller which is rotated so as to bring said corresponding opening or openings into constant or periodic connection with the negative pressure source.

The corresponding opening or openings may be brought into connection with the negative pressure source periodically in synchrony with said at least one cut length attracting opening passing through a cutting station at which said web is cut into said cut lengths, whereby the attraction of said cut lengths to the surface of the support member is commenced or is increased in synchrony with the cutting of said cut lengths from the web to capture each said cut length on said support member. The cut length is preferably held in a non-slipping manner on the support surface.

The corresponding opening or openings may be brought out of connection with said negative pressure source to release each said cut length before the at least one opening attracting a cut length is brought round by rotation of the support member once more to underlie the web.

Thus, the web may be advanced over the rotating roller at a speed which is less than the surface speed of the roller so that the roller slips beneath the web and vacuum openings on the surface of the roller may be actuated as a cutting means cuts across the web to separate cut lengths repeatedly from the web. The cut lengths are then attracted by the vacuum to the surface of the roller and rapidly (preferably essentially instantaneously) accelerated to roller speed whilst being held thereon. They may then be subjected to any desired form of further processing.

Preferably, the web slipping on the roller is also attracted to the roller, but not so intensively as to prevent the desired slipping action.

Preferably therefore the support surface has, for attracting said web, a succession of web attracting openings circumferentially spaced, each communicating with a source of negative pressure, e.g. communicating through a said means defining a gas-flow path with a said corresponding opening or openings on said second surface portion of said roller, each said corresponding opening being in communication with said negative pressure source at least when the respective web attracting opening is beneath said web. Thus there may be openings on said support surface which comprise both said succession of web attracting openings and at least one cut length attract-

ing opening.

The cut length attracting opening or openings may be communicated periodically with a first said source of negative pressure and the web attracting openings may be communicated with a second source of negative pressure. The suction applied through said at least one cut length attracting opening may be more intense than the suction applied through said web attracting openings. This may be achieved by suitable choice of the intensity of action of the first and second sources of negative pressure or a common source of negative pressure may be employed for the cut length attracting opening or openings and for the web attracting openings and the required difference in intensity of action can be obtained through a suitable choice for the size and spacing of the openings or the flow paths by which they communicate with the source of negative pressure.

An alternative preferred practice according to the invention is to accelerate the end portion of the web immediately before it is cut off.

One type of further handling for the cut lengths which may be envisaged is the temporary or permanent application of the cut lengths to spaced locations on a second moving web or a stream of objects such as lengths cut from a second web. For this purpose, a second moving web or lengths cut therefrom may be led over a portion of the surface of the rotating web support member, suitably at a speed substantially equal to that of the surface of the web support member, said portion being downstream from the cutting of said cut lengths, and said cut lengths may be carried on said web support member to lie between the web support member and said second web or web lengths. The difference between the speed of the first moving web and the higher speed of the second moving web or web lengths will cause the cut lengths to be applied at spaced locations on the second web or on respective lengths cut from said second web.

Preferably, the attraction of the cut lengths to the support member is reduced or ended whilst the cut lengths are positioned between the support member and the second web or lengths thereof overlying the support member.

The cut lengths may be adhered to the second web or lengths thereof at said spaced locations. For this purpose, the cut lengths or the web from which they are cut or said spaced locations on said second web may be heated to a heat sealing temperature before contacting said second web with said cut lengths. To achieve this, the web from which said cut lengths are cut or said second web or lengths thereof may be passed adjacent to source of heat to raise at least portions thereof to a heat sealing temperature.

Generally, it will be desirable that the areas which are heated are spaced from other heated areas along the direction of the moving first or second web material by areas which are relatively unheated. In partic-

ular, if the first web (from the which the lengths are to be cut) is heated, it will generally be desirable to avoid heating zones in which cuts are to be made as there will otherwise be a risk that the heated web will stick to the cutter used. If the second web material is to be heated, (i.e. the continuous web or cut lengths thereof to which the cut lengths of the first web are to be applied) it will be undesirable to heat areas other than those which are to receive the cut lengths as this is likely to have a permanent visible effect upon the web surface.

To this end, at least one shield member is preferably interposed between said heat source and said web to be heated so as to prevent portions of said web to be heated being raised to heat sealing temperature.

Preferably, said at least one shield member is moved in synchrony with and in the same direction with said web to be heated so as to shield a respective area of the web from said heat source whilst allowing areas bordering on said shielded area in the direction of web extension to be heated. A plurality of said shield members spaced from one another in the direction of the extension of the web to be heated may be moved in synchrony with the web to be heated in said web extension direction.

Preferably therefore said shield member or members are moved along an endless path, at least a portion of which lies between said heat source and said web to be heated. The shield members may take the form of fingers protruding from a flexible endless carrier.

The heat source may be a hot gas blower or a radiant heater.

Means may be provided for cooling the support member, e.g. by passing a coolant liquid through channels in it, by passing cool air over it or by contacting it with a further chilled roller upstream of its point of contact with the first web. Suitably, the chilled roller is a pressure roller used to press the second web against the support member.

Means may also be provided for cooling the cutting member of the cutter used to separate the cut lengths from the web. Such cooling may reduce any tendency for the heated web to stick to the cutter member, even if the heat shield described above is not used.

An alternative option to the use of heating to adhere the cut lengths to the second web is to apply adhesive to said cut lengths, the web from which they are cut or said spaced locations of the second web. The adhesive may be a molten hot melt adhesive. This may be applied at spaced locations on the first web, for instance by a process of printing. Other methods of applying hot melt adhesive may be used if they are suitable for the required speed of operation. Once again, it will be desirable to apply the adhesive at spaced locations avoiding areas in which

cuts are to be made.

The application of adhesive or the heating to a heat sealing temperature described above is preferably carried out on the first web rather than the second web because of the lower speed of advancement of the first web. Particularly in high speed operations, it may be impracticable to carry out these operations on the faster moving second web.

The second web may be a web of carton forming material such as paperboard or cardboard, typically laminated with other materials such as plastics films and/or metal foils. Typically, such carton forming webs have a heat sealable plastics layer on each surface, typically of polyethylene.

The first web is preferably of plastics film, preferably being composed of or having a surface layer of compatible heat-sealable plastics material. The film may be a laminated film and in particular may have a first layer of relatively tough heat-resistant material and a surface layer of readily heat-sealable plastics material such as polyethylene, polyethylene/vinyl acetate blends or microcrystalline wax. The relatively tough layer may for instance be of polyester, nylon or regenerated cellulose.

The method described above may therefore be employed to apply spaced cut lengths of plastics film on to a web from which carton blanks will be cut. The cut lengths of plastics film may serve as sealing tapes over lines of weakness or apertures in the carton forming material or as tabs to be grasped by a user of finished carton. For this latter purpose, the cut lengths may be adhered to the second web over only part of their surface, leaving the remainder of the cut length free.

According to a second aspect of the invention, there is provided a method of heating areas of a moving object which are spaced from one another in the direction of movement of the object whilst intervening areas are not heated or are less intensively heated, which method comprises applying heat to said object from a heat source spaced from said object, interposing between said object and heat source at least one shield member, and moving said shield member in the direction of movement of said objection in substantial synchrony therewith. The application of such a method to the securing of cut lengths of a first web to a second higher speed web at spaced locations has been described above.

For use in a method in accordance with the first aspect of the invention, there is provided apparatus for separating and accelerating portions of a moving web comprising a rotating support member, means for supplying a said web at a web supply speed to lie over a portion of the surface of the web support member, means for rotating said web support member at a surface speed higher than the speed of the moving web such that the web slips on said member, means for periodically cutting lengths of web material from

said web on said support member, and means for capturing said cut lengths on said support member by attraction of said cut lengths to the surface of said support member and thereby accelerating said cut lengths to the surface speed of the support member.

Said means for capturing said cut lengths may comprise a source of negative pressure and means for applying said negative pressure at the surface of the support member beneath said cut lengths through one or more cut length attracting openings in said surface. There may also be means for attracting said web to said support member upstream of said means for cutting said web into lengths and said means for attracting said web to said support member may comprise a source of negative pressure and means for applying said negative pressure at the surface of the support member beneath said web through web attracting openings in said surface.

The means for capturing said cut lengths by attraction of said cut lengths to the surface of the said support member may be adapted to commence its action or increase the intensity of its action in synchrony with the cutting of said cut lengths from the web and thereby to make the attraction sufficiently strong as to prevent slipping of said cut lengths on said surface.

The support member may comprise a roller having a radially outward facing web support surface over which said web is led, which surface has at least one cut length attracting opening therein, a corresponding opening or openings on a second surface portion of said roller, means defining a gas-flow path communicating between said at least one cut length attracting opening and said corresponding opening or openings, and means defining a flow path providing a constant or periodic connection between said corresponding opening or openings and a said negative pressure source.

Said means defining a flow path between said corresponding opening or openings and said negative pressure source may comprise at least one slide valve having a respective gas-flow port connected to a respective said negative pressure source sliding over a second surface portion of said roller and making periodic connections with said corresponding opening or with at least a respective set of said corresponding openings.

A said corresponding opening or a set of corresponding openings may be so positioned in said second surface portion of said roller as to be rotated into connection with a said gas-flow port periodically in synchrony with said at least one cut length attracting opening passing said means for cutting lengths of web material, whereby the attraction of said cut lengths to the surface of the support member is commenced or is increased in synchrony with the cutting of said cut lengths from the web to capture each said cut length on said support member.

The position of said corresponding opening or

openings on said second surface portion of said roller may be such that said corresponding opening or openings is or are rotated out of connection with gas-flow port to release each said cut length before the cut length is brought round by the rotation of the support member once more to underlie the web.

The support surface may have, for attracting said web, a succession of web attracting openings circumferentially spaced, each communicating through means defining a gas-flow path with a said corresponding opening or openings on said second surface portion of said roller, each said corresponding opening being in communication with a negative pressure source at least when the respective web attracting opening is beneath said web. Said openings on said support surface may comprise both said succession of web attracting openings and at least one cut length attracting opening.

The apparatus may comprise a first source of negative pressure and a second source of negative pressure and the cut length attracting opening or openings may be communicated periodically with said first source of negative pressure and the web attracting openings may be communicated with said second source of negative pressure.

The arrangement may be such that the suction applied through said at least one cut length attracting opening is more intense than the suction applied through said web attracting openings.

Means may be provided for leading a second moving web over a portion of the surface of the rotating web support member at a speed substantially equal to that of the surface of the web support member, said portion being downstream from the means for cutting said cut lengths, and said cut lengths being carried on said web support member to lie between said web support member and said second web.

The apparatus may further comprise means for heating said cut lengths or the web from which they are cut or said spaced locations of the second web to a heat sealing temperature before contacting said second web with said cut lengths.

Said means for heating may comprise a source of heat disposed adjacent said web from which said lengths are cut or said second web and operating so as to raise at least portions thereof to a heat sealing temperature.

The apparatus may further comprise at least one shield member interposed between said heat source and said web to be heated so as prevent portions of said web to be heated being raised to a heat sealing temperature.

Said at least one shield member may be mounted to be movable and means may be provided for moving said shield member in synchrony with and in the same direction with said web to be heated so as to shield a respective area of said web from said heat source whilst allowing areas bordering upon shielded

area in the direction of web extension to be heated.

The apparatus may comprise a plurality of said shield members spaced from one another in the direction of extension of the web to be heated, which shield members are mounted for movement, and said means for moving said shield members may operate to move said plurality of shield members in synchrony with the web to be heated in said web extension direction, suitably about an endless path, at least a portion of which lies between said heat source and said web to be heated.

Alternatively or additionally, means may be provided for applying an adhesive to said cut lengths, the web from which they are cut or said spaced locations of the second web, e.g. a hot melt adhesive.

According to the second aspect of the invention there is further provided apparatus for heating areas of a moving object which are spaced from one another in a direction of movement of the object whilst intervening areas are not heated or are less intensively heated, which apparatus comprises a heat source spaced from said object for applying heat to said object, at least one shield member interposed between said object and said heat source, and means for moving said at least one shield member in the direction of movement of said object in substantial synchrony therewith.

Such apparatus may further comprise means for cutting said object arranged to act after said heating to make cuts in said intervening areas.

The apparatus may further comprise means for moving the said object over a path in spaced relation to said heat source and in substantial synchrony with said at least one shield member.

The invention will be illustrated and further described with reference to the preferred embodiments illustrated in the accompanying drawings in which:-

Figure 1 is a perspective view of a first embodiment of apparatus according to the first and second aspects of invention;

Figure 2 is a schematic side view of a second embodiment of apparatus according to the first aspect of the invention;

Figure 3 is an elevation of a further apparatus according to the invention;

Figure 4 is a plan view of the apparatus of Figure 3;

Figure 5 is a longitudinal cross-section on the line A-A of Figure 6 of the knife assembly of the apparatus of Figure 3;

Figure 6 is a transverse cross-section of the line B-B of Figure 5.

Figure 7 is a perspective view of an alternative form of cutting station from that used in the apparatus of Figures 2 to 6;

Figure 8 is an elevation view of the face of the knife of Figure 7 with part of the web support member shown in section; and

Figure 9 is an enlarged sectional view of the line IX-IX of Figure 8.

Figure 1 illustrates apparatus for separating tabs of plastics film from a continuous web, accelerating the tabs to the speed of advancement of a faster moving second web of carton forming material and securing the tabs on the carton forming material by heat sealing.

A first web 10 of tab forming plastics film is supplied from a reel 12 and passes over and between a pair of driven metering rolls 14, 16 and hence over the surface of a rotating web support member constituted by a vacuum roller 18. A second web 20 of carton forming paperboard is mounted on a supply (not shown) and led between roller 20 and a cooperating pressure roller 22, which may be cooled by means (not shown) such as means for circulating a cooling fluid therethrough.

The speed of rotation of vacuum roller 18 substantially exceeds the rate at which the plastics film of the first web is supplied by the metering rollers 14, 16.

Between the metering rollers 14, 16 and the surface of the vacuum roller 18, the first web passes beneath a hot air heater 24 which co-operates with a movable heat shield assembly 26. Vacuum roller 18 is provided with a first set of surface openings constituting cut length attracting openings 28 which are grouped in three small approximately square areas (only one shown) equi-spaced circumferentially on the web supporting surface of the vacuum roller 18 and which communicate via bores in said roller with a set of corresponding openings 30 on a second surface portion of the roller provided on the side face of the roller.

A second set of openings 32 is provided on the support surface of the roller for attracting the web 10. These openings 32 are arranged in a pair of parallel circumferentially extending lines running around the whole periphery of the vacuum roller 18 and pairs of said openings 32 are connected through a common bore in the vacuum roller 18 to a respective corresponding opening 34 on said second surface portion of the roller. The corresponding openings 34 extend in a circle on the side face of the roller concentric with the circle over which the corresponding openings 30 rotate, but of lesser radius.

A first source of negative pressure (not shown) is connected via a high vacuum line 36 to a slide valve manifold 38 positioned against the side face of the vacuum roller 18. A second source of negative pressure (not shown) is connected via a low vacuum line 40 to a second manifold 42 of the same slide valve assembly. The first manifold 38 has a port which lies on the circle of rotation of the corresponding openings 30 for the cut length attracting openings 28 whilst the second manifold 42 has a port which lies on the circle of rotation of the corresponding openings 34 of the web

attracting openings 32.

A cutter for cutting the web 10 periodically is schematically shown at 44.

The movable heat shield assembly 26 comprises in more detail an endless belt 46 mounted to run on an endless path over a driving roller 48 and an idler roller 50 and carrying a spaced succession of heat shielding fingers 52 which project from one edge of the endless belt 46. The projecting portions of the fingers 52 pass in succession beneath the hot air heater 24. Hot heater 24 comprises an inlet duct 54 for hot air from a supply (not shown) and an elongate outlet nozzle directed downwardly towards the web 10 but spaced from the web 10 by an amount sufficient to accommodate the moving fingers of the heat shield assembly 26.

In use, the second web of carton forming material is advanced through the apparatus by rotation of the vacuum roller 18 and the pressure roller 22 at a rate suitable for use in carton making machinery. For instance at a rate sufficient to produce about 800 blank lengths per minute. The first web of plastics film is drawn from the reel 12 by the metering rolls 14, 16 at a speed which may be in the region of 1/10th of that of the second web and hence of the surface speed of the vacuum roller 18. Low intensity suction is applied through the low vacuum line 40 and hence through the succession of openings 32 in the surface of the vacuum roller 18 and the web 10 is attracted to the surface of the roller but permitted to slip thereover. Hot air supplied through the heater 24 raises spaced areas of the web 10 to a heat sealing temperature. The fingers 52 of the heat shield assembly 26 are driven at the same speed as the web 10 beneath the heater 24 so as to protect areas intervening between the spaced heated portions from the action of the hot air heater. The heater also acts only upon part of the width of the web 10.

The cutter 44 is actuated to cut the web 10 in those areas kept cool by the shielding action of the shield assembly 26, one cut being made for each carton blank length fed through the apparatus. Generally, this will involve making a small number (e.g. 3) of cuts per revolution of the vacuum roller 18. The cutter 44 should be designed to avoid a speed differential between its cutting blade and the vacuum roller 18.

As the cutter 44 is to be actuated, the cut length attracting openings 28 on the vacuum roller 18 pass beneath the cutting station at which the cutter is located. The corresponding openings 30 for the cut length attracting openings 28 pass into communication with the suction port of the manifold 38 connected to the high vacuum line 36 and a more intense suction is applied to the cut length than through the web attracting openings 32. The cut length is thereby seized by the surface of the vacuum roller 18 and essentially instantaneously accelerated to the surface speed of the vacuum roller 18 and is then applied to

the second web in the nip between the vacuum roller 18 and the pressure roller 22 to effect the required heat seal. The heat sealed area is shown shaded on a cut length 58 applied as a tab on the second web illustrated in Figure 1, the unshaded area of the tab 58 being free and not adhered to the second web.

The heater 24 and the heat shield assembly 26 together constitute apparatus according to the second aspect of the invention.

A second embodiment of apparatus according to the first aspect of the invention is illustrated in Figure 2. In this variant of the apparatus previously described, the heater 24 and the heat shield assembly 26 are replaced by a hot melt adhesive applicator system. The web 10 is fed through the nip between metering rollers 14', 16' and hot melt adhesive is printed on to the web 10 at spaced locations along the web by the roller 16'. Suitable methods of printing hot melt adhesives are well known to those skilled in the art and need not be described here in detail.

The remaining operation of the apparatus is as described with reference to Figure 1.

Apparatus in accordance with the illustrated embodiments of invention discussed so far may be employed to attach tabs of plastics film at spaced intervals on the surface of a web of carton forming material. It may be employed with little modification to apply longer strips of plastics film, for instance to cover lines of weakness or openings in the carton forming material which may be desired to provide an opening mechanism for a subsequently formed carton. However, the methods and apparatus described herein may be employed in fields other than carton manufacture.

A further apparatus according to the invention, in which the end of the web of film is accelerated before being cut off is shown in Figures 3 to 6.

As shown in Figure 3 a web of plastics film 118 is drawn from a supply by a pair of feed rollers 120, 120' and passed to a web cutting station 122 described in detail hereafter which is located adjacent the web support member 114. Short lengths are cut from the end of the web 118 of plastics film at the cutting station 122 and are carried on the web support member through the zone of operation of a hot air heater 126 and are eventually brought into contact with the paper board web (not shown) at spaced intervals therealong and heat sealed thereto.

Referring to Figure 3, the cutting station 122 comprises a knife assembly 128 carried on a pair of beam members 130. The knife assembly will be described in detail with reference to Figures 5 and 6 below. However, in brief the knife assembly includes an elongate blade mounted to a support and as can be seen in Figure 4, the support extends between and runs transversely with respect to the beam members 130. Each beam member 130 has a pattern of cut-out holes and slots such that the beam member can op-

erate as a stiff spring allowing a degree of deflection along the plane of the blade of the knife.

Each beam member 130 is mounted in a similar manner. In each case at each end of the beam member 130 there is provided a pulley 132 rotatable on a shaft which also carries a rotatable member 136 to be driven by the pulley about the same axis. The beam member 130 is pivotally mounted to the rotatable member 136 about an axis 134 spaced from the axis of rotation of the pulley. The rotatable member 136 is mushroom shaped and the "head" of the mushroom shape provides a counterweight for the motion of the beam member and its attached knife assembly, the beam member 130 being pivotally mounted to the mushroom shaped rotatable member 136 at the end of the "stalk" of the mushroom.

Each of the pulleys 132 is driven for rotation by a belt 138 driven by a motor 140.

The motion executed by the beam member can therefore be seen to be a parallel motion, each point on the beam executing a synchronised circular motion.

The plastics film web is fed via the pair of feed rollers 120, 120' one of which is driven by a belt 142 and passes from the rollers 120, 120' to a further roller 144 constituting a movable web carrier member is provided at the end of a bell crank 146 which is pivotally mounted about a pivot axis 148 and which has a first arm 150 and a second arm 152 extending initially at right angles to one another. The arm 150 is towards its free end curved away from the arm 152 and carries the roller 144 at its end. A curved plate 154 is carried on the arm 150 in such a manner as to provide a guidance slot for the plastics film web between the curved plate 154 and the adjacent part of the arm 150. The roller 144 runs against the curved plate 154 and is driven by belts 156 and 158. The bell crank 146 is biased towards the position shown in the figure by a coil spring 160 attached to the second arm 152. The end of the second arm 152 also carries a cam follower roller 162 which is positioned to interact with a cam 164 provided to rotate with the pulley 132 at the right hand end of the beam member 130.

A cylindrical stop member 166 is provided which limits pivoting movement of the bell crank in a clockwise sense.

The knife assembly 128 as shown in Figures 5 and 6 comprises an elongate blade carrier 168 carried towards each end by beam members 130. An elongate blade 170 is adjustably positioned on the blade carrier 168 by a plurality of bolts 172. Cylindrical end portions of the blade carrier 168 outboard of the attachment to the beam members 130 each carry a rotatable buffer member 174 having a hard cylindrical outer surface and supported for rotation on the knife carrier 168 by axially preloaded roller bearings 176 so as to eliminate radial play between the buffer member 174 and the blade carrier 168. The two cylindrical ro-

tatable buffer members 174 define between them a surface of rotation and the blade member 170 is adjusted to lie just within that surface of rotation.

In cross-section as shown in Figure 6, the blade carrier 168 incorporates an L-shaped bracket extension 178, an arm of which extends down parallel to the line of the blade 170. To the free end area of the bracket 178 is mounted a member for periodically preventing slippage between the plastics film web and the rotatable support member 114. This takes the form of a plate-like member 180 having an end portion which curves round towards the point of application of the blade to form a web pressing member. The web pressing member 180 is mounted adjacent the blade on a pair of leaf springs 182 and its motion upwards parallel to the blade is limited by an elastomeric pad 184.

The web support member 114 has six equiradially spaced anvil areas 186 at each of which a line of bores 188 extend from the interior of the web support member 114 to its surface as a line of vacuum ports. Interiorly, they are connected to a manifold which is in turn connected to a source of vacuum (not shown).

The operation of the apparatus as described above is as follows:-

Plastics film is withdrawn from its web supply by feed rollers 120, 120' and is fed toward the roller 144 from where it is fed on by the rotation of the roller 144 so as to pass on to the surface of the web support member 114 immediately up-stream of the location of the knife blade 170. At this stage the bell crank 146 is held away from the knife blade 170 by the spring 160.

The web support member 114 is continuously rotated, anvil portions 186 thereof passing in succession through the cutting station 122.

In the cutting station 122, rotation of the pulleys 132 carries the knife assembly through a circular motion essentially tangential to the web support member 114. This is synchronised to the motion of the web support member 114 such that the knife blade 170 makes its closest approach to the web support member as an anvil portion 186 thereof passes through the cutting station.

As the knife assembly in its circular motion approaches the web support member 114 a short length of the web of plastics film 118 will have been fed over the surface of the web support member and through the cutting station. It should be appreciated that the rotational speed of the surface of the web support member is substantially greater than the rate of feed of the plastics web 118. As the knife assembly approaches the web support member, the web pressing member 180 contacts the web 118 and presses it against the surface of the web support member. Up to this point, the web support member has been slipping underneath the web 118 but pressure of the web

pressing member holding the web against the web support member 114 prevents the continuation of this slippage and the web 118 at this point now seeks to advance at the rate of motion of the web support member 114. It is temporarily able to do this by drawing the roller 144 at the free end of the bell crank 146 in toward the cutting station 122 against the force of the spring 160 and until the first arm 150 of the bell crank 146 reaches the stop 166. Immediately prior to this occurring, the knife blade 170 is brought into contact with the web through the rotary motion of the knife assembly on its beam 130 and makes a partial thickness cut through the web. The buffer members 174 are brought into contact with the web support member 114 at this point in the operation. They of course come down on to the web support member 114 on either side of the width of the web 118 and do not contact the web itself. The point of the knife blade 170 lies within the circle of rotation defined by the buffer members 174 so that the blade remains spaced by a predetermined extent from the anvil surface 186 of the web support member 114 and therefore cuts partially only through the thickness of the web 118. Generally, the web 118 will be a multilayer plastics film in which there is a relatively strong layer provided to give mechanical strength to the film and at least one heat sealable plastics layer which will be mechanically weak in comparison and which is positioned at the bottom of the web immediately on the surface of the web support member. There may well be further layers. It is arranged that the knife cuts through all or substantially all of the mechanically strong layers but none or only a partial amount of the weaker heat sealing layer. The cut is completed immediately before the arm 150 reaches the stop 166 at which point continued rapid rotation of the web support member 114 snatches the portion of the web 118 held by the web pressing member 180 off the end of the web 118 along the cut line, tearing through the thin remainder of the mechanically weak heat sealing layer not cut by the blade 170.

The blade assembly is driven such that the tip of the blade 170 moves at substantially the same circumferential speed as the surface of the web support member so that there is no slippage between them as the cut is made.

Whilst desirably the buffer members 174 just touch the surface of the web support member, any failure in adjustment of those which protrude them too far in the direction of the web support member surface is of no substantial consequence as the beam 130 carrying the misaligned buffer 174 can deflect to allow both buffer members 174 to come down on to the web support surface. The knife blade 170 is held safely away from the web support surface by its fixed disposition relative to the buffer members 174, so avoiding blunting of the blade by direct contact with the anvil area 186.

The separated end portions of the web 124 are held on the web support surface by the application of vacuum through the bores 188 and are carried under the zone of operation of the heater 126.

A modification of the cutting station shown in the preceding Figures 2 to 6 is illustrated in Figures 7 to 9. In this modified form of cutting station, the plastics film web is cut by a shearing action rather than by pressure of a knife blade against a smoothly curved support surface.

Apart from the matters described below, the apparatus as a whole is as described with reference to the earlier figures.

The apparatus of Figure 7 includes a web support member 118 having a generally cylindrical surface divided into a broad central strip flanked on either side by portions which are shaped as described below. The portions flanking the central strip are symmetrical. That nearer to the viewer in Figure 7 can be seen to comprise a series of recesses 213 all of similar nature. Each recess 213 has a floor 215 concentric with the outer surface of the web support member but recessed radially inwards. An abutment face 217 connects the floor 215 to the outer surface of the web support member. Starting from the web support member and as best seen in Figure 9, the abutment surface 217 is divided into a first portion 218 which slopes downwardly from the web support surface against the direction of rotation of the web support surface and connects to a second portion 219 which forms an undercut by sloping downwardly in the direction of rotation.

Concentric with floor 215, there is a ledge 220 at a higher level inboard from the floor 215. Ledge 220 therefore lies concentric with the surface of the support member but spaced somewhat below it. The abutment 217 lies in each case generally at the point of cut in the cutting operation but an abutment face 223 at the end of ledge 220 defines a datum for the positioning of the knife. The degree of alignment between faces 217 and 223 depends on the extent if any to which the rollers project in front of the knife blade. This may be by a greater (as in Figure 7) or a lesser (as in Figure 9) amount.

The central strip of the web support member has at each cutting location a shearing edge 285 forming a step in the surface connected to the next similar shearing edge 285 by a gradually rising ramp portion of the web support surface. At its outer ends, each shearing edge 285 connects with the imaginary line along which the outer surface of the web support member would meet the abutment face 219 if both were projected to meet.

The knife assembly comprises a pair of support mounts 221, only one of which is shown the other being omitted for clarity. Each support mount 221 is carried on a respective beam member 130 which is mounted generally as shown in Figure 3. It is prefer-

red that the beam members 130 for use in the cutting station illustrated in Figure 7 are not cut away to render them more springy but are relatively rigid.

A knife blade 270 is mounted in a blade carrier 268. Blade carrier 268 has at each end a circular bore through which passes a shaft 271 to which the blade carrier 268 is made fast. Shaft 271 is received at each end in linear bearings 273 through which it is slidable in the support mount 221 within limits imposed by a pair of stop members 275 positioned at each end of the support mount 221. The blade carrier is biased forwardly in the direction of rotation by a coil spring 279 positioned around the shaft 271 in each support mount 221.

The blade carrier 268 as best seen in Figure 8 has at each end a downwardly projecting arm 281 which at its outer end carries a freely rotatable cam follower roller 274 and at its inner end is formed with a shoulder 283 forming a step. The spacing between the steps 283 at each end of the blade carrier matches the spacing between the ledges 220 on opposite ends of the web support member whilst the spacing between the rollers 274 matches the spacings between the recesses 213 of the web support member.

A sprung foot 280 is provided as in the arrangements shown in the embodiment of Figure 2.

In use, the knife assembly including the knife carrier and support mount is carried in a parallel circular motion on the beams 130 in synchrony with the movement of the web support member. The strip of plastics film web is fed over the guide roller 244 as previously described and is trapped upon the surface of the web support member by the sprung foot 280 as the blade assembly moves down towards the web support member. The knife assembly rollers 274 come down on to the surface of the web support member on the sloping faces of the first portions 218 of the abutment face 217, the knife blade being held off the shearing edge 285 on the web support member and the blade and blade carrier 270, 268 being deflected back against the action of the springs 271. As soon as the web support member has rotated far enough to carry the shearing edge 185 into the ideal position, the rollers 274 slip off the slope face 118 of the abutment face 217 and pass on to the undercut second portion 219 of the abutment face 217 allowing the knife blade 270 to be pushed forward by the springs 271 against the shearing edge 285 to make a shearing cut of the plastics web. To guide the knife blade into and through the shearing action when the rollers 274 pass on to the second portion 219 of the abutment face 217, the faces of shoulders 293 are pressed against the rearward facing (in the direction of rotation) faces of the web support member at the ends of the ledges 220. As a guard against blade misadjustment causing the blade to contact the surface of the web support member below and behind (in the direction of rotation) the shearing edge 285, the ledge

220 acts as a stop for the shoulders 283 on the arms 281 of the blade carrier 268.

The severed strip of plastics film 124 is released by the raising sprung foot 280 and carried away on the surface of the web support member 218.

The knife blade 270 can have a self-sharpening action with the shearing edge 285 of the web support member.

Many modifications and variations of the invention as illustrated in the embodiments described in detail above are possible within the scope of the invention.

For instance the invention could be used to apply tabs or sealing strips to precut blanks rather than to a continuous web.

The first web could optionally be extruded on-stream instead of being drawn from a reel of pre-formed polyester tape.

Claims

1. A method for separating and accelerating portions of a moving web comprising leading a moving web (10) over the surface of a rotating web support member (18), which member has a surface speed higher than the speed of the moving web such that the web slips on said member, periodically cutting lengths (58) of web material from said web on said support member, capturing said cut lengths on said support member by attraction of said cut lengths to the surface of said support member and transporting said cut lengths thereon at the surface speed of the support member.
2. A method as claimed in Claim 1, wherein said cut lengths are attracted to said support member by negative pressure applied at the surface of the support member beneath said cut lengths through one or more cut length attracting openings (28) in said surface.
3. A method as claimed in Claim 1 or Claim 2, wherein said support member comprises a roller having a radially outward facing web support surface over which said web is led, which surface has at least one cut length attracting opening therein communicating through means defining a gas flow path with a corresponding opening or openings on a second surface portion of said roller which is rotated so as to bring said corresponding opening or openings into constant or periodic connection with a negative pressure source.
4. A method as claimed in any preceding claim, wherein a second moving web (20) is led over a portion of the surface of the rotating web support member at a speed substantially equal to that of

the surface of the web support member, said portion being downstream from the cutting of said cut lengths (58), and said cut lengths are carried on said web support member to lie between said web support member and said second web and wherein said cut lengths are secured to said second web at spaced locations thereon.

5. A method as claimed in Claim 4, wherein said cut lengths or the web from which they are cut or said spaced locations of said second web, are heated to a heat sealing temperature before contacting said second web with said cut lengths.
6. A method of heating areas of a moving object (10) which are spaced from one another in the direction of movement of the object whilst intervening areas are not heated or are less intensively heated, which method comprises applying heat to said object from a heat source (24) spaced from said object, characterised by interposing between said object and said heat source at least one shield member (52), and moving said shield member in the direction of movement of said object in substantial synchrony therewith.
7. Apparatus for separating and accelerating portions of a moving web (10) comprising a rotating web support member (18), means for supplying a said web at a web supply speed to lie over a portion of the surface of said web support member, means for rotating said web support member at a surface speed higher than the speed of the moving web such that the web slips on said member, means (44) for periodically cutting lengths of web material from said web on said support member, and means (28) for capturing said cut lengths on said web support member by attraction of said cut lengths to the surface of said support member and transporting said cut lengths at the surface speed of the support member.
8. Apparatus as claimed in Claim 7, wherein said means for capturing said cut lengths comprises a source of negative pressure and means for applying said negative pressure at the surface of the support member beneath said cut lengths through one or more cut length attracting openings (28) in said surface.
9. Apparatus as claimed in Claim 8, wherein said support member comprises a roller (18) having a radially outward facing web support surface over which said web is led, which surface has at least one cut length attracting opening therein (28), a corresponding opening or openings (30) on a second surface portion of said roller means defining a gas flow path communicating between

said at least one cut length attracting opening and said corresponding opening or openings and means (38) defining a flow path providing a constant or periodic connection between said corresponding opening or openings and a said negative pressure source.

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10. Apparatus as claimed in Claim 8 or Claim 9, further comprising means for leading a second moving web (20) over a portion of the surface of the rotating web support member (18) at a speed substantially equal to that of the surface of the web support member, said portion being downstream from the means for cutting said cut lengths, and said cut lengths being carried on said web support member to lie between said web support member and said second web.

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11. Apparatus as claimed in Claim 10, further comprising means (24) for heating said cut lengths or the web from which they are cut or said spaced locations of said second web, to a heat sealing temperature before contacting said second web with said cut lengths.

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12. Apparatus as claimed in Claim 11, further comprising at least one shield member (52) interposed between said heat source and said web to be heated so as to prevent portions of said web to be heated being raised to a heat sealing temperature which shield member is mounted to be moveable, means (48) being provided for moving said shield member in synchrony with and in the same direction with said web to be heated so as to shield a respective area of the web from said heat source whilst allowing areas bordering upon said shielded area in the direction of web extension to be heated.

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13. Apparatus for heating areas of a moving object which are spaced from one another in the direction of movement of the object whilst intervening areas are not heated or are less intensively heated, which apparatus comprises a heat source spaced from said object for applying heat to said object, at least one shield member interposed between said object and said heat source, and means for moving said at least one shield member in the direction of movement of said object in substantial synchrony therewith.

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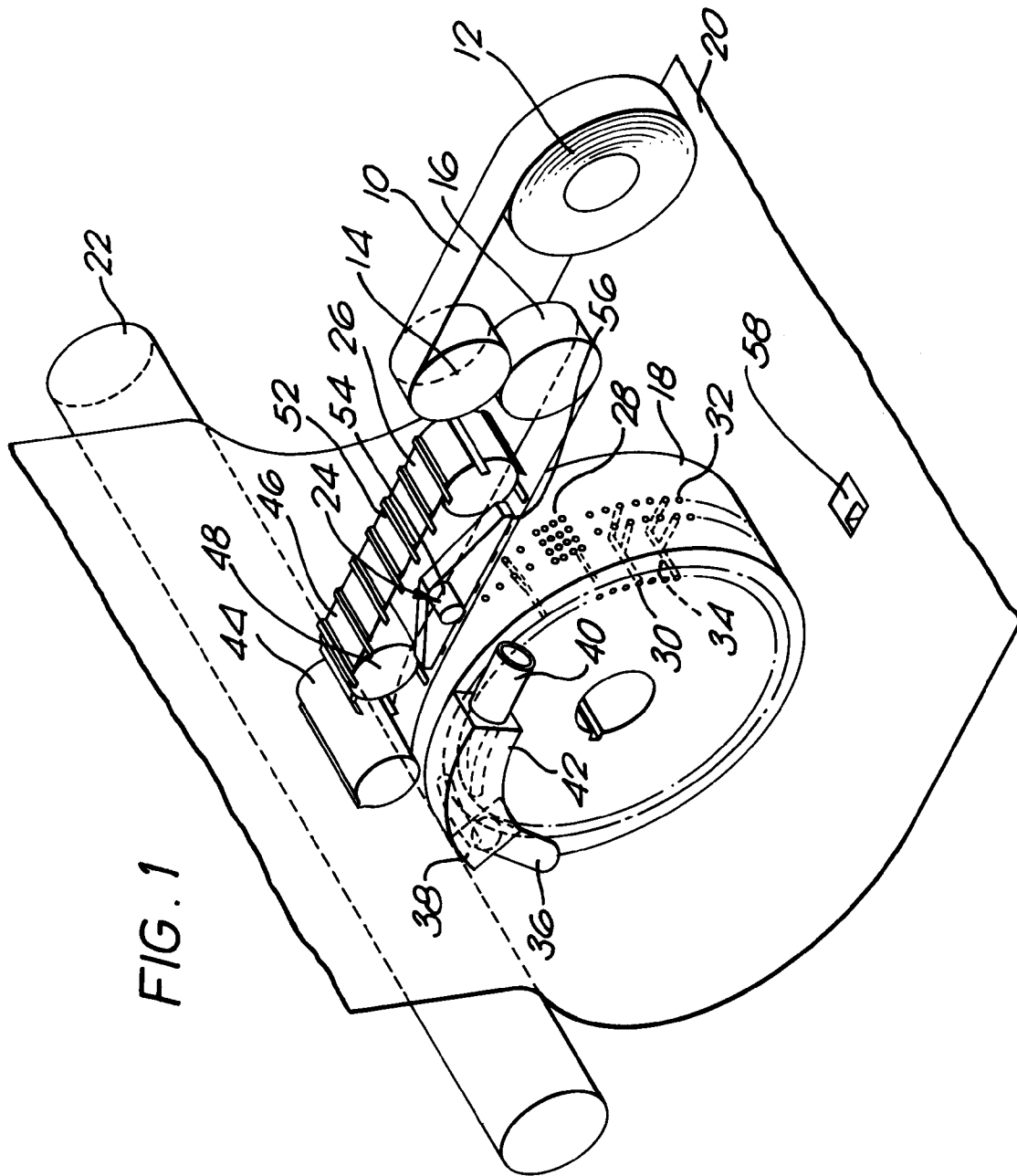


FIG. 2

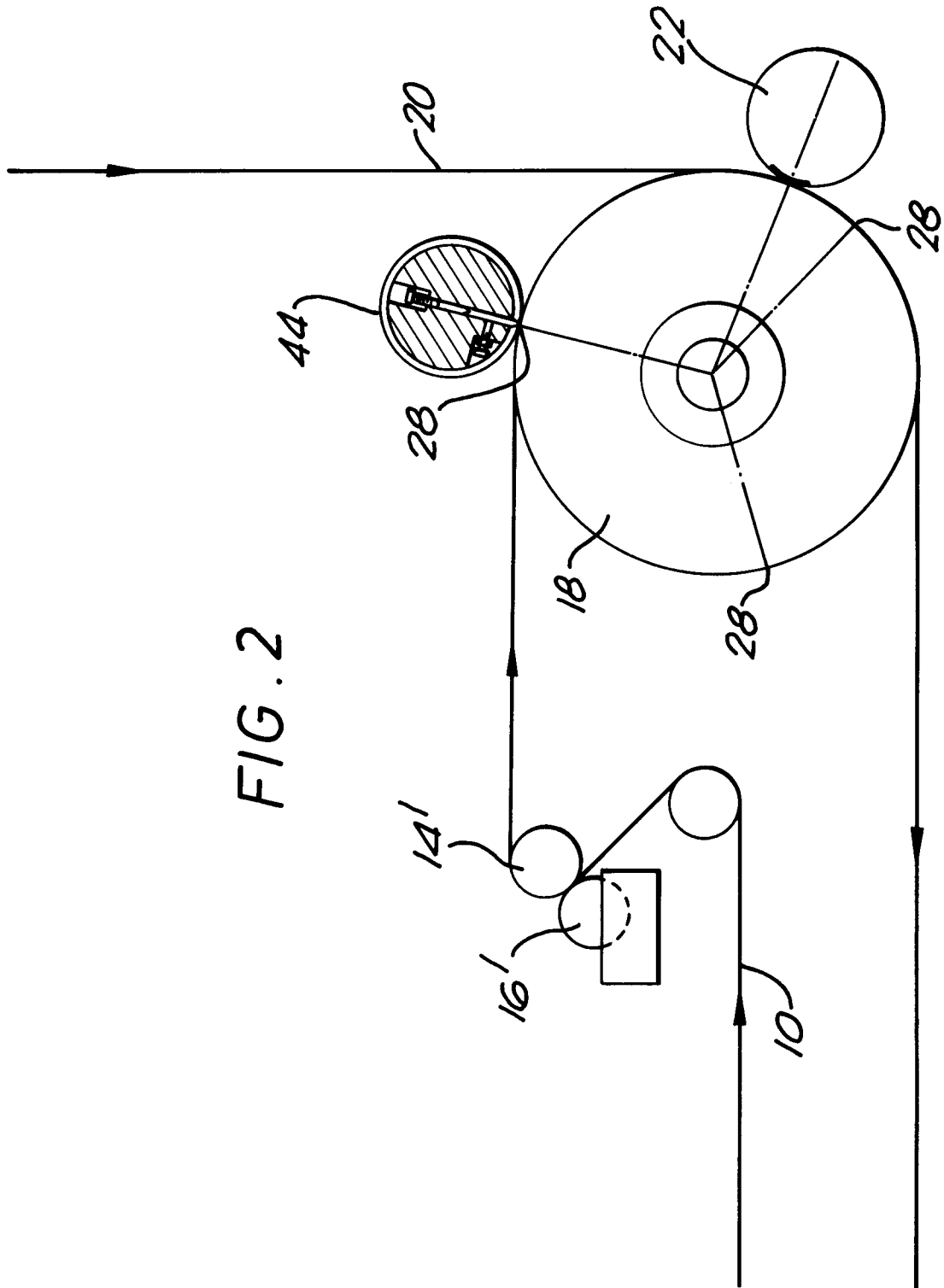
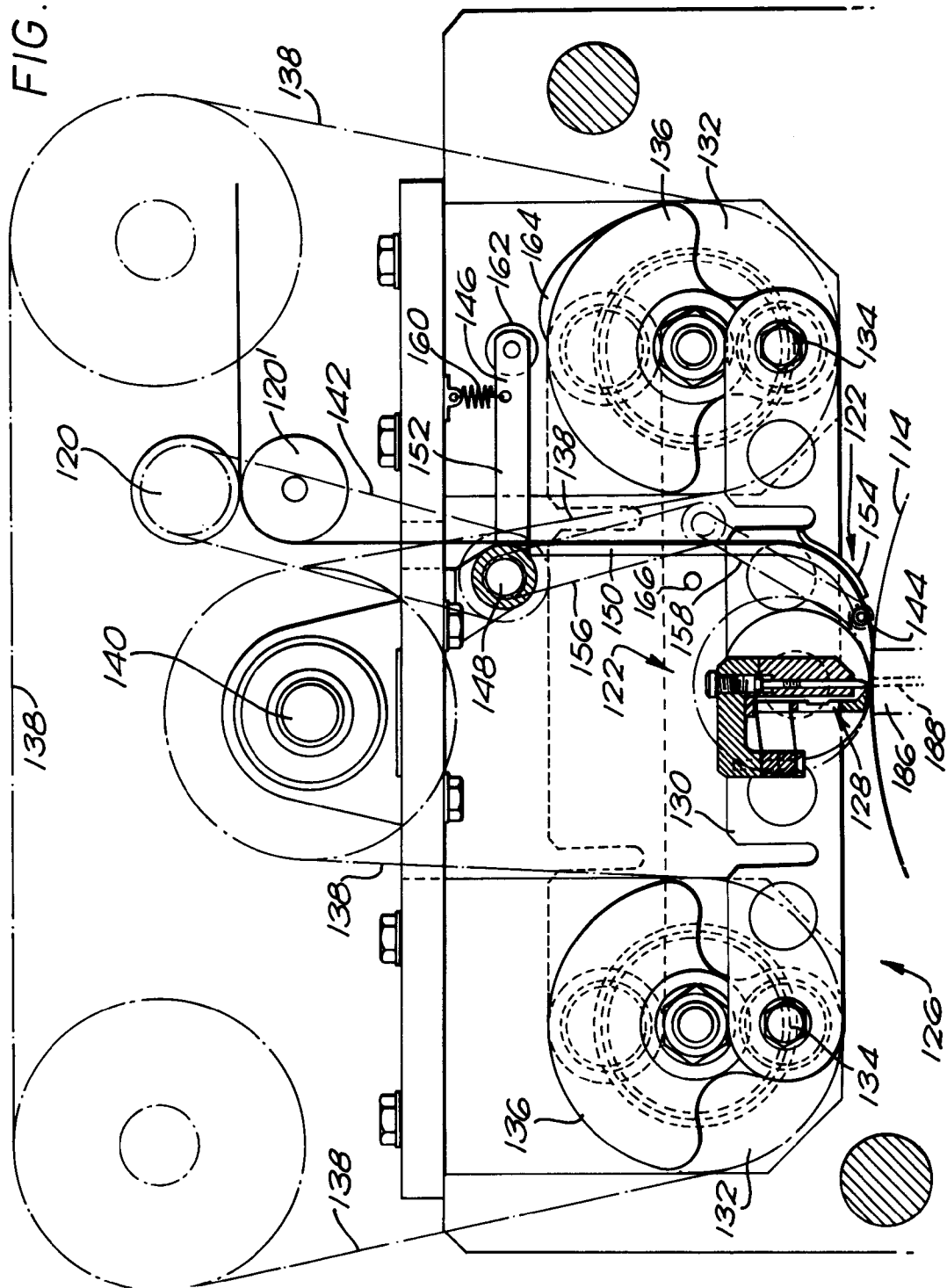
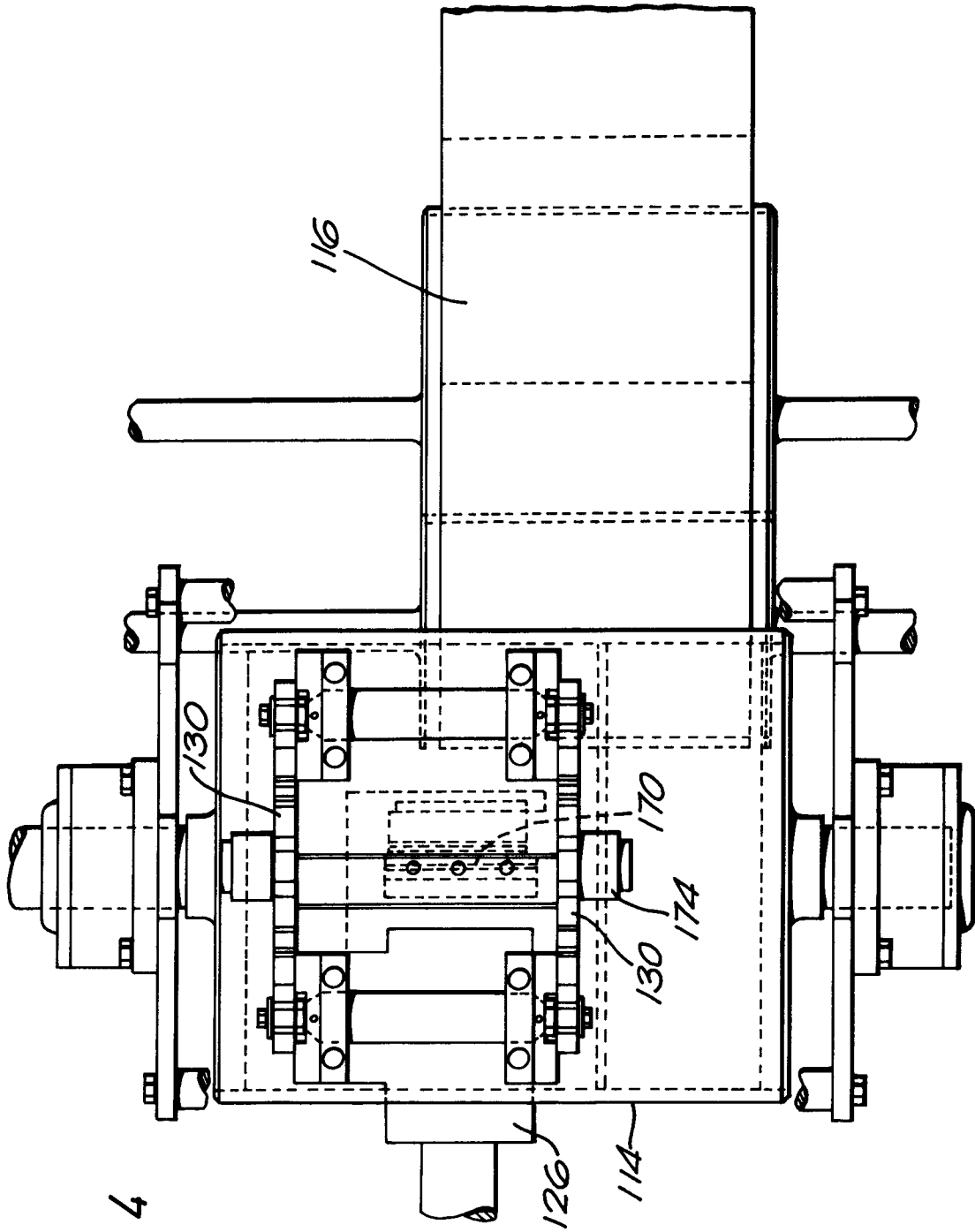
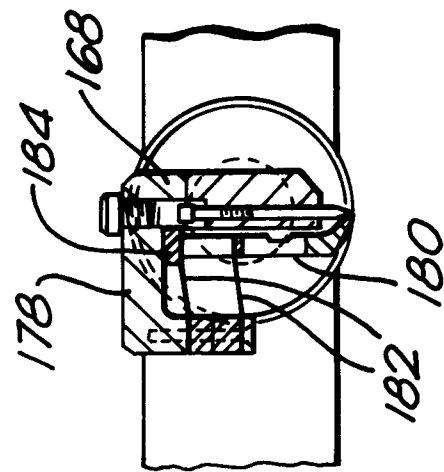
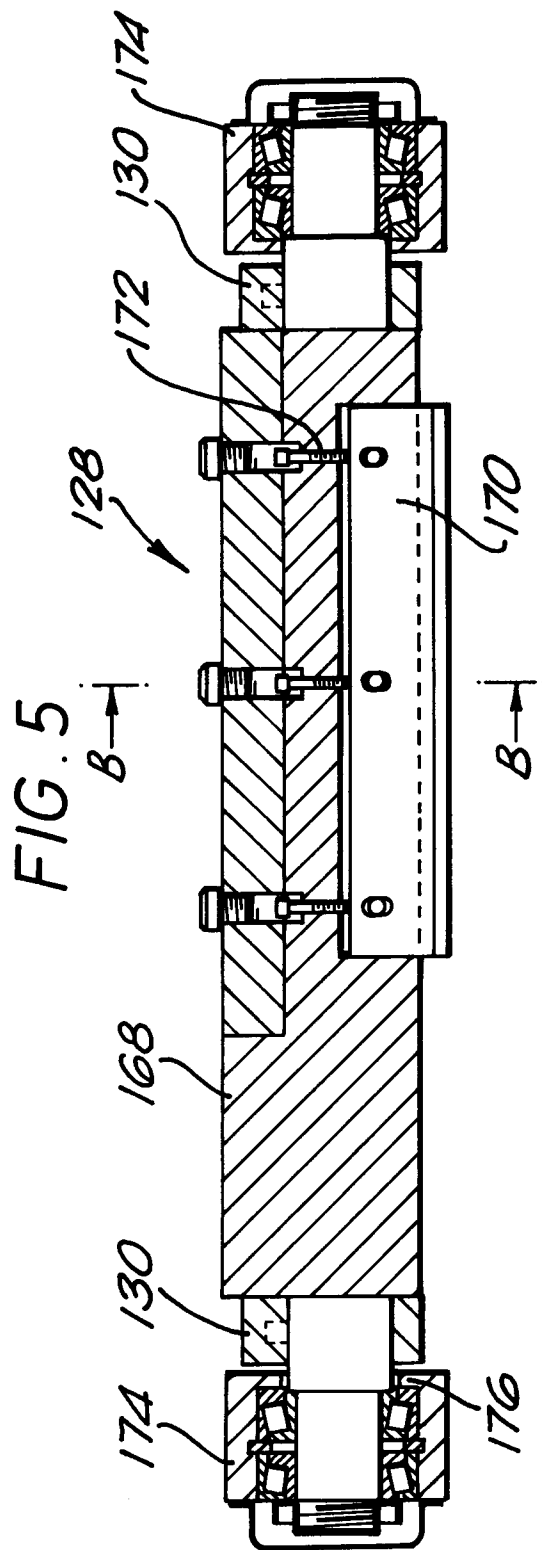


FIG. 3







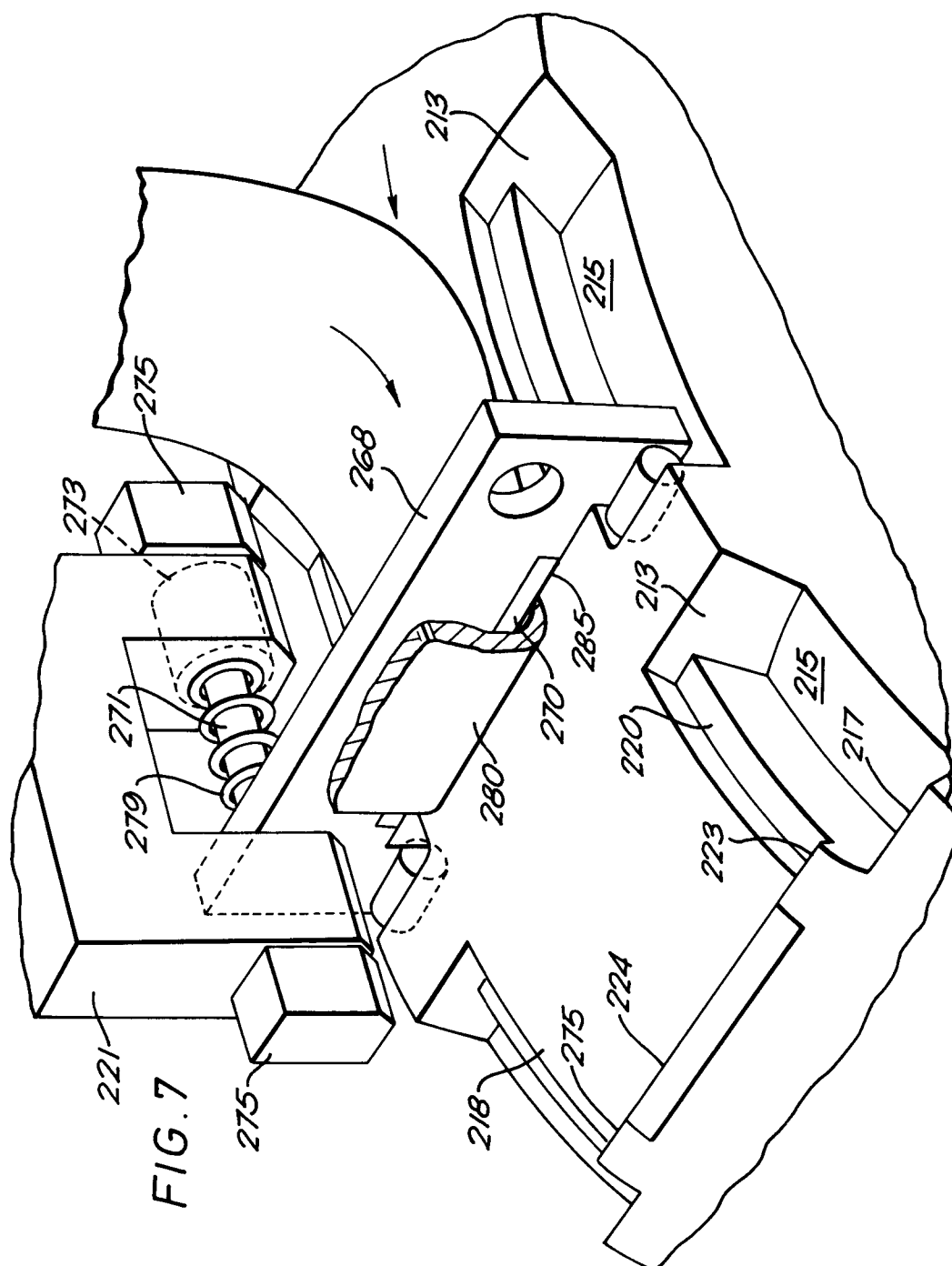


FIG. 8

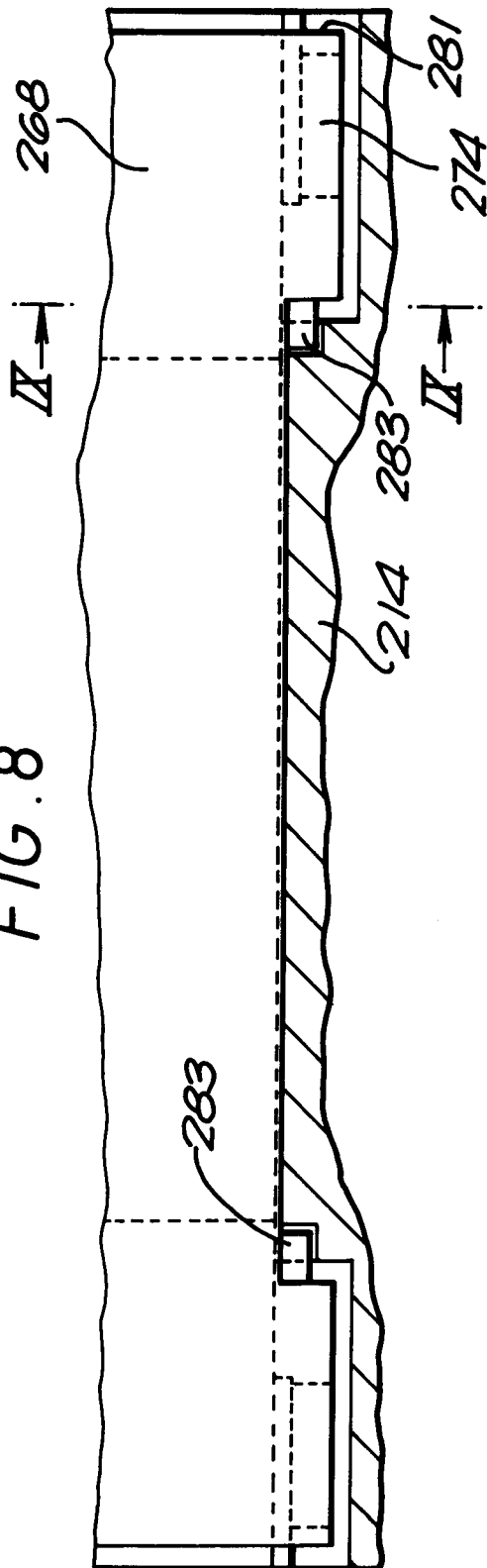


FIG. 9

