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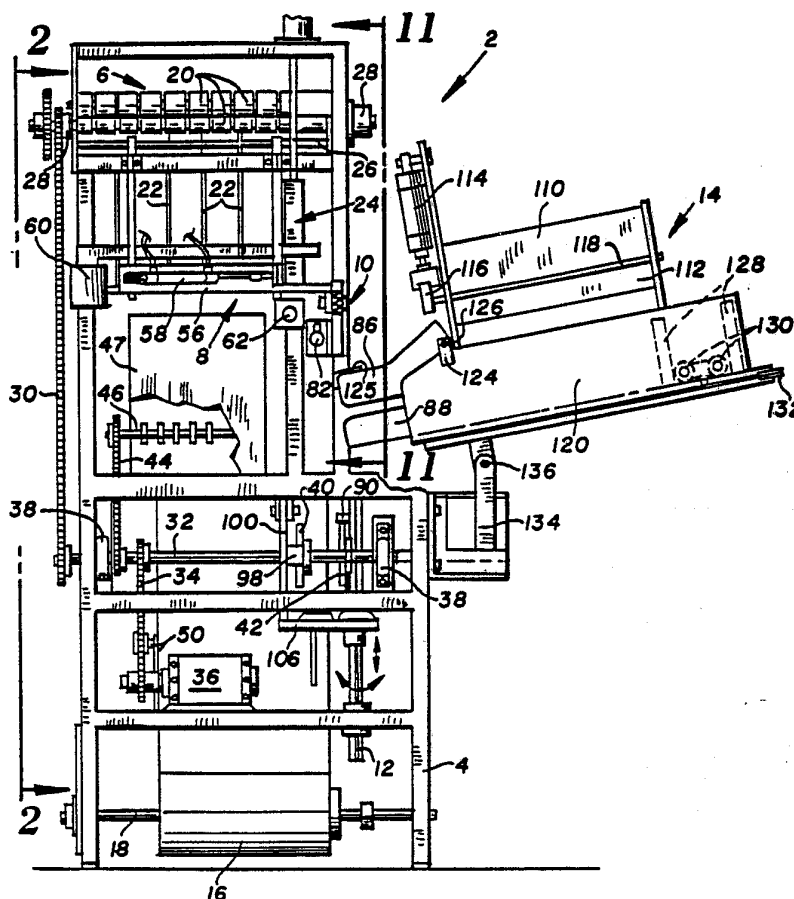
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(54) Title: FILM HANDLING APPARATUS FOR POSITIVE DISPLACEMENT FILLING MACHINE

## (57) Abstract

Apparatus for positioning a folded film relative to a film spreading and clamping assembly (10) and for holding an open end of the film while the film is sealed to form a bag. A cam driven pedestal (12), in turn, aligns the thus prepared bag with a filling assembly (14) where the bag is grasped and rammed full of produce or the like, before being sealed. The film spreading assembly includes an elongate guide bar (226) that engages the sealed leading film edge to aid in moving the film and in setting bag width. An elongate flexure (218), attached at one end to the guide bar, is elastically bent away from the bar to spread the film.



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## FILM HANDLING APPARATUS FOR POSITIVE DISPLACEMENT FILLING MACHINE

### BACKGROUND OF THE INVENTION

The present invention relates to packaging machinery and, in particular, to equipment for forming plastic bags from a continuous, folded web of film and for filling the bags with produce or the like.

The packaging of fresh produce in individual retail sales wrappers is generally accomplished by the hand and is time consuming and costly. With produce shipped in large containers, spoilage and damage often occur due to the weight of the produce, and shifting and jostling during shipment, thus to reduce the saleable quantities and further increase costs.

With the above problems in mind, equipment for packaging various types of produce in plastic bags was developed, as disclosed in patent application Serial No. 609,344, filed May 11, 1984. This equipment receives quantities of produce and meters it by volume into prepared extensible plastic bags that are held adjacent to an expandable snout or nozzle and through which a measured quantity of produce is fed into each bag. Subsequently, the bag is sealed and contracts to form a relatively skin-tight fit with the contained produce, which serves to inhibit damage and spoilage of the packaged product.

Associated with the present bag filling assembly is apparatus for indexably conveying a folded web of film to a web separating assembly, where the open side of the folded web is separated and each side of the film is clamped in an expandable jaw assembly. Thereafter, the film web is simultaneously sealed and severed by a moving hot knife/anvil assembly to form the sides of the bag. Subsequently, the mouth of the bag is expanded, while the bag is moved to receive the snout of the produce feeder. Control and sequencing of the assemblies is provided by a plurality of motor driven timing cams.

In the course of testing the produce packaging equipment, particularly when operated at increased speed, two critical needs were identified in the handling of the web. First, higher speed demanded a more precise movement of the opposed folded sides of the web as they were separated from one another. Secondly, the need arose to more precisely advance the web in order to form bags of more consistent width.

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It therefore is an object of the present invention to separate opposed sides of a folded web of film, maintaining control over film displacement and velocity of displacement.

Another object of this invention is to provide a web separating apparatus that assists in advancing a continuous folded web in order to more accurately and consistently determine the width of bags formed from the web.

#### SUMMARY OF THE INVENTION

To achieve these and other objects, there is provided an improved apparatus for separating the opposed sides of a folded web. The apparatus includes a frame, and a web moving means for supporting a continuous folded web of film for movement along a path relative to the frame. A web separating means spreads the folded sides of the web apart. The separating means includes a substantially rigid first guide member, and a second guide member mounted with respect to the first guide member in a normal position against the first guide member. The separating means also includes a guide supporting means for mounting the first and second guide members with respect to the frame and between the opposed sides of the web, and for reciprocating the guide members along a portion of the path between an upstream position and a downstream position. The separator means further includes an expansion means for moving the second guide member away from the normal position to a web expanding position away from the first guide member when enabled. When it is disabled, the expansion means permits the second guide member to return to the normal position.

Preferably, the first guide member is an elongate bar oriented substantially parallel to the path, and the second guide member is an elongate flexure fastened at one end to one end of the bar. The expansion means can be a pin, mounted with respect to the frame and reciprocable to contact the flexure and move it to the web expanding position. The pin is retractable to permit the flexure to return to its normal position. The pin can be mounted on the opposite side of the bar from the flexure, in which case it contacts the flexure through an opening in the bar.

#### BRIEF DESCRIPTION OF THE DRAWINGS

These and other features and advantages are more readily understood upon consideration of the following detailed description in view of the drawings, in which:

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Figure 1 is a front elevational view of a packaging apparatus constructed in accordance with the present invention;

Figure 2 is a left side elevational view taken along the line 2-2 in Figure 1;

Figure 3 is a left side elevational view taken along lines 3-3 of Figure 2;

Figure 4 is a rear elevational view taken along line 4-4 of Figure 3;

Figure 5 is a top view taken along line 5-5 of Figure 4;

Figure 6 shows a top view of a timing shaft and cam assembly of the packaging apparatus;

Figure 7 is an end elevational view of part of the cam assembly for rotating pedestal mounted clamping members of the packaging apparatus;

Figure 8 is an end elevational view of part of the cam assembly for raising the pedestal mounted clamping members;

Figure 9 is an elevational view of the pedestal and clamping members;

Figure 10 is an elevational view of a spring metal film expanding assembly of the packaging apparatus;

Figures 11a to 11e are elevational views illustrating the operation of the packaging apparatus;

Figure 12 shows a cycle timing diagram relative to the lapsed time and cam dwell for the various bag forming and filling sequences;

Figure 13 is a partial front elevation showing an alternative film expanding assembly constructed in accordance with the present invention;

Figure 14 is a sectional view taken along the line 14 - 14 in Figure 13;

Figure 15 is a perspective view of the alternative film expanding assembly; and

Figures 16 - 18 are schematic views illustrating the operation of the alternative film expanding assembly.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to the drawings, there is shown in Figure 1 the produce packaging equipment 2 of the present invention. Mounted on a frame 4 are major subassemblies including an overhead film delivery

assembly 6, a heat sealing/severing assembly 8, a bag clamping/spreading assembly 10, and a side mounted produce receiving and filling assembly 14.

Clamping/spreading assembly 10 is mounted upon a transfer pedestal 12 which is raised, lowered and rotated at appropriate times during each cycle. Film supply portion 6 is a roll that supplies a web of longitudinally folded plastic film 16. The roll is chucked to a free rotating, bottom mounted shaft 18. Folded film 16 can have a width ranging from 4 to 20 inches and thickness of 0.5 to 3 mills. It may or may not contain printing or other graphics to identify the contained produce and/or package. Film 16 is threaded about a pair of web tensioning rollers 19 (Figure 2). From there it is routed through a row indexably driven draw rollers 20 and over a top roller 17 as the film 16 passes from the back to the front of the present apparatus. Downstream, the film is held away from adjacent equipment by stripping rods 22 and the open end of the film is passed over a spring metal spreader 24, then past heat sealing/severing portion 8 to clamping assembly 10. Also, mounted beneath draw rollers 20 is a static discharge assembly 26 which prevents the buildup of static electricity on film 16.

Film 16 is drawn intermittently from the lower roll supply arbor 18 by an end mounted drive clutch 28, mounted to the ends of the lower row of draw rollers 20. Clutch 28 is driven by a linking chain 30, a timing shaft 32, a transfer chain 34 and a motor 36 coupled thereto. Timing shaft 32 is mounted to frame 4 through a pair of pillow blocks 38 and drives a pair of cams 40 and 42 and a timing chain 44. The timing chain is coupled to a shaft 46 in an enclosure 47 containing a plurality of cam operated electrical switches (not shown). The operation of their respective cams is explained hereinafter.

Depending upon the type of produce to be wrapped, the duration of drive signals to the clutch 28 is set to deliver an appropriate length of film 16 to make a bag of a desired width. Because the bags are made in a horizontally edgewise fashion relative to the direction of film travel, the width of the film 16 determines the length of the bag, while the length of film delivered determines the width of the bag.

Figure 2 shows the film delivery assembly 6 and the associated chain drives to the timing shaft 32 and draw rollers 20. As film 16 rises along the rear of frame 4 it traverses the film tensioner 19 and passes over idler roller 17, before being fed through draw rollers 20. A drive chain tensioner 50 is provided for the drive chain 34, coupled to the frame by a

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spring 52. Also mounted to the front of packaging assembly 2 is a bag tying device 54 which, upon receipt of a filled bag, pinches the bag opening and seals it by wrapping a piece of adhesive tape around it.

From Figure 1, bag sealing/severing assembly 8 is seen to include a pneumatically driven anvil 56 movable towards and away from a wedge-shaped, pneumatically driven heated knife member 140 (Figure 11A), by a pneumatic cylinder 58 pivotally coupled to anvil 56 to cause it to move towards and away from the heating element. A cylinder 141 controls knife 140. Mounted above the heating element is a blower assembly 60 with ports directed and controllably operated to cool film 16 just after each sealing/severing operation. As film 16 passes through and is held away from packaging assembly 2 by stripper bars 22, it passes between the anvil 56 and the hot knife. Once film 16 is advanced the predetermined length, it is transversely sealed and severed. Sealing operation is aided by a pneumatically driven clamp 62 mounted on the right side of anvil 56 that presses the opposite folded sides of film 16 together prior to sealing/severing film 16 with the hot knife.

Pedestal 12 is cam operated by cams 40 and 42, to rise and fall, and rotate, during selected times of each cycle. Mounted to pedestal 12 is the portion of clamping assembly 10 which operates upon the expanded open-end of film 16, as can be seen in Figure 9. The clamping portion of clamping/spreading assembly 10 is orthogonally coupled to the upper end of the pedestal 12 by a coupler 64, a tubular member 66 and a flat plate 68. Attached to plate 68 are a pair of pneumatic linear actuators for operating bag clamping plates 70 and 72. Complimentary presser feet 74 and 76 are mounted opposite to clamping plates 70 and 72. The opposite sides of the folded web of film 16 pass between presser feet 74 and 76 and clamping plates 70 and 72, respectively.

A pneumatic cylinder 80, when enabled, moves clamping plate 72 laterally toward clamping plate 70 to a position established by bolts 77 holding plate 68. Clamping plate 70 is supported by a curved arm 78 spring loaded by a spring 79. When the clamping plates 70 and 72 are together, the sides of the film 16 at the open edge pass freely in the space between the clamping plate 70 and 72 and the associated presser feet 74 and 76. Just prior to the sealing operation, the pneumatic cylinders 82 and 84 are actuated to bring presser feet 74 and 76 against their associated clamping plates 70 and 72 to clamp the sides of film 16 therebetween. At the same

time, a film clamp 62 clamps and immobilizes the upper end of the film 16 before it is sealed and severed by the hot knife. Subsequently, the thus formed bag is opened by the operation of cylinder 80 to cause clamping plate 72 and presser foot 76 to retract and thereby expand the open end of the bag. Thereafter, pedestal 12 is lowered and rotated and the opened bag is inserted onto upper and lower snout portions 86 and 88 of produce filling assembly 14. Assembly 14 is described in greater detail hereinafter.

Clamping/spreading assembly 10 also includes a film spreading portion that includes spring metal spreader 24. Figure 10 shows elongated spring metal member 24 bent in an inverted "V" shape adjacent to the right side stripper bar 22. A bent rod member 25, mounted to frame 4, has a portion between the sides of member 24. Member 24 is mounted to a slidable weldment 27 coupled at its upper end to a pneumatic cylinder 29. Cylinder 29 is mounted to frame 4 to raise and lower spring metal member 24 relative to rod member 25. Member 24 is mounted within the opposed open edges of film 16. When member 24 is lowered to overlie the closed clamping plates 70 and 72, it is spread by rod 25 and guides film 16 over the clamping plates. Thereafter, member 24 is raised and film 16 is sealed and severed to form a bag. Thus, spring metal member 24 acts to expand and guide the film onto the clamping portion of the assembly 10.

Figures 6 - 8 show cam follower linkages used to raise, lower and rotate the pedestal 12. Figure 6 is a top view of timing shaft 32, cams 40 and 42, and their respective cam follower linkage assemblies 87 and 89. Overlying cam 42 is a cam follower 90 mounted on a linking arm 92. Linking arm 92 is pivotally mounted at each of its ends to an overlying support member 94 attached to the frame 4 and an underlying member 96 clamped to pedestal 12. Pedestal 12 is slidably mounted between upper and lower bushings 93 and 95. As cam 42 rotates, cam follower 90 follows its profile to cause linking arm 94 and pedestal 12 and the clamping portion of assembly 10 to rise and fall.

Cam 40 and its associated linkage assembly 87 are transversely mounted from cam 42 along timing shaft 32. From Figure 7 it can be seen that cam follower 98 is disposed on a linking arm 100 pivotally suspended from an overlying arm 102 attached to frame 4. A lower lying linking arm 104 mounts to a transversely extending arm 106 clamped to pedestal shaft 12. Rising from arm 106 is a shaft 107 attached to an upper support arm 109, that also is clamped to the pedestal 12. Thus, as the cam

follower 98 traverses the profile of cam 40, the linking arm 100 moves to the right and left. This movement is translated to rotation of linking arm 106, support arm 109 and pedestal shaft 12, shown by a broken line in Figure 6. The clamping portion of assembly 10 moves toward and away from snout portions 86 and 88 of the produce filling assembly 14.

In explaining the produce receiving and filling assembly 14, reference is made to Figures 1 - 5. In Figure 1, produce filling assembly 14 is comprised of an overlying produce reservoir or hopper 110 made to contain a quantity of produce to be packaged. The bottom of hopper 110 is comprised of a pair of inwardly directed and pivotally mounted flapper plates 112, pneumatically controlled by a pneumatic cylinder 114 and its associated linkage assembly 116 acting upon an axle 118 of each plate. Cylinder 114 controllably causes linking elements 116 to pivot axles 118 and plates 112. In response thereto, produce in hopper 110 drops into a chute 120.

Before the produce is dropped, the forward, pivotally mounted snout portion 86 is engaged by its associated linking assembly including a pneumatic cylinder 122 to pneumatically raise and grasp a bag, previously inserted over relaxed upper and lower snout elements 86 and 88. Snout portion 86 is raised and lowered by a pneumatic cylinder 122 mounted on the backside of chute 120 (Figure 3). A pair of linking arms 124 mounted on opposite sides of snout portion 86 are interconnected by an axle 126 to cylinder 122. Upon actuation of cylinder 122, arms 124 cause snout portion 86 to rise and fall. The raising of snout portion 86 within the open end of a preformed bag causes the clamping thereof, prior to its filling with produce from hopper 110. A lip 125 on the snout portion 86 facilitates holding the bag.

The deposited volume of produce is ejected from chute 120 by a pushing carriage 128, mounted upon a pair of wheels 130 internal to chute 120, and driven by a pulley drive assembly 132 mounted beneath the chute. Pulley drive 132 causes pushing member 128 to move to and fro, much like a shuttle, within chute 120. During its forward movement it ejects the produce into the held bag.

Figure 4 shows the relative mounting of chute 120, drive 132 and hopper 110. Chute 120 is pivotally mounted to frame 4 by a weldment 134 welded at an angle to the frame. The inclination of the chute 12 can be adjusted by loosening or tightening a bolt 136 (Figure 1) that passes through the upper end of weldment 134. Typically, the inclination of the chute

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relative to the floor is set somewhere between  $0^{\circ}$  degrees and  $45^{\circ}$  degrees. The angle of the shoot 120 to the frame 4 also is adjustable, by bolts through the bottom of the weldment 132, within a range of 0 degrees to 45 degrees. These adjustments facilitate transfer of the bag opening over the snout.

Figures 13 - 18 illustrate a second embodiment of a web separator assembly, which may be employed in lieu of spring metal spreader 24. The web separator assembly includes an elongate, substantially rigid guide bar 216 and an elongate guide flexure 218. The upper end of flexure 218 is mounted to the upper end of the guide bar by a support plate 220. Because it is pre-stressed, flexure 218 tends to occupy a normal position against guide bar 216, but can be flexed to a web expanding position relatively remote from the guide bar as is later explained.

The web separating assembly further includes a guide block 222 fastened to the guide bar at a horizontal extension 224 of the bar. Guide block 222 is supported slidably on an elongate guide shaft 226. Upper and lower shaft support brackets 228 and 230 secure guide shaft 226 to a panel 232. The panel in turn is fixedly mounted to frame 4, through structure not illustrated.

Mounted to guide bar 216, through a clevis 236, is a piston rod 238 which reciprocates in a web separating cylinder 240 mounted to panel 232 by a cylinder bracket 242. Operating cylinder 240 causes guide bar 216 and guide flexure 218 to reciprocate between a raised or upstream position when piston rod 238 is retracted, and a lower, downstream position when the rod is fully extended. Guide block 222 is near lower bracket 230 when the piston is fully extended.

As seen in Figure 14, extension 224 of guide bar 216 is secured in guide block 222 by a pair of threaded members, one of which is shown at 244. A pair of pads 246 and 248 similarly are secured on opposite sides of the guide bar extension to provide added stiffness and protect against wear. Guide shaft 226 is contained in a bore 250 through the guide block with a bearing 252 to facilitate the sliding of the block on the shaft. The guide block has a forwardly extended finger 254 to which clevis 236 is attached.

Guide bar 216 and flexure 218 - and most of the structure which supports them - are on opposite sides of panel 232, thus to position the bar and flexure in the path of the web, while preventing guide block 222, shaft 226 or web separating cylinder 240 from interfering with the web. Consequently, an elongate slot 256 is provided in panel 232 to permit

vertical travel of the web separating assembly, particularly pads 246, 248 and extension 224.

The location of the web separating assembly along the web path is depicted in Figure 13. In Figure 15, panel 232 and the other structure supporting the separating assembly are removed to more clearly show the assembly itself. Bar 216 and flexure 218 are supported near the side of the web opposite the fold, between the two opposed folded sides of the web. The guide bar and flexure reciprocate vertically between the upstream position illustrated in broken lines, and the downstream position shown in solid lines.

The web spreading assembly further includes a forwardly extended flexure cylinder 258 fixed with respect to frame 4. An elongate pin 260 reciprocates horizontally in the flexure cylinder. With bar 216 and flexure 218 in the downstream position, flexure cylinder 258 is operated to extend pin 260 through an aperture 262 in the guide bar to contact flexure 218. As it continues to extend, pin 260 bends flexure 218 outwardly away from its normal position to a web expanding position, in which the lower end of the flexure is remote from the guide bar. Since the flexure and guide bar are positioned between the folded opposed sides of the web, such flexure movement forces these sides apart from one another. Flexure 218 is biased toward its normal position and immediately returns to the normal position when pin 260 is retracted.

It is apparent in Figure 15 that pin 260, during its extension, punctures the side of the web located between it and guide bar 216. This does not affect the bagging of produce, in that openings in the bag are desirable to prevent undue accumulation of moisture. Further, as the flexure cylinder and pin are located near the web edge that forms the top of each finished bag, the puncture caused by the pin can readily be avoided by sealing the finished bag at a point inside of it. Alternatively, an electromagnet might be employed to pull flexure 218 away from bar 216 when actuated.

For grasping and then opening each completed bag, there is provided a pair of clamping plates 264 and 266 (Figure 16) similar to clamping plates 70 and 72, except that neither of plates 264 and 266 is spring biased. Also provided are gripping feet 268 and 270, one associated with each of the clamping plates. Shown in Figure 15 is gripping foot 270, which is reciprocated horizontally by a cylinder 272.

Figures 11A to 11F show the sequential operation of packaging apparatus 2. Attention also is directed to the timing diagram of Figure 13 wherein the sequence of various machine operations is shown in a typical cycle time and cam dwell. Figure 11A shows sealing/severing assembly 8, spreader/clamping assembly 10 and pedestal 12. The clamping assembly is shown with clamping plate 72 retracted from clamping plate 70 and with presser feet 74 and 76 retracted from the clamping plates. Anvil 56 is retracted from a hot knife 140, while film clamp 62 is retracted by its air cylinder 142 from a stationary plate 144. The web spreader portion of assembly 10 is raised, with the arms of spring metal member 24 relaxed. Drive clutches 28 are engaged to permit draw rollers 20 to advance the film. Air cylinder 80 then is enabled to bring clamping plate 72 near clamping plate 70 before the film 16 reaches the clamping plates. Just prior thereto, at approximately 40° of dwell, air cylinder 29 is enabled to lower spring metal member 24 to expand the open end of the film 16 and guide the sides of the film web over the closed clamping plates 70 and 72. This condition, shown in Figure 11B, continues until approximately 55° of dwell when spring metal member 24 is raised.

Referring now to Figure 11C, air cylinders 82 and 84 are next enabled to bring presser feet 74 and 76 against associated clamping plates 70 and 72 and thereby clamp the sides of the previously advanced and separated film 16. Air cylinder 142 is thereafter enabled to clamp the upper side of the film web between clamp member 62 and plate 144. At approximately 60° of dwell, air cylinder 58 is enabled to bring anvil 56 and film 16 against hot knife 140 to seal and sever film 16. After the first cycle, the bottom side seal of the next following bag is formed during the first sealing and severing operation and a completed bag is formed after each sealing and severing operation. The sealing operation continues until approximately 80° of dwell, after which anvil 56 is retracted.

Referring now to Figure 11D, at approximately 80° of dwell pedestal 12 is lowered and air cylinder 84 is disabled to retract clamping plate 72 and its associated presser foot 76, to open the mouth of the prepared bag. This condition also is shown in Figure 11E in top view.

At approximately 85° of dwell (Figure 11F), pedestal 12 is rotated to bring the clamped, open mouth of the bag against snout portions 86 and 88 of chute 120. At approximately 95° of dwell, air cylinder 122 is enabled and upper snout portion 86 is opened to clamp the bag to the snout.

At 100° of dwell, clamping plates 70 and 72 are opened, after which filling assembly 14 is enabled to force the produce into the bag.

For each cycle, while a bag is being prepared, the previously prepared bag is being filled. At approximately 5° of dwell, air cylinder 114 is enabled to cause hopper plates 112 to open and dump produce from hopper 110 into chute 120. At approximately 20° of dwell, drive assembly 132 is enabled and pusher member 128 advanced to push produce through chute 120 into the contained bag at the snout. The rest and advanced positions of pusher 128 are shown, with the advanced position in broken lines. At approximately 55° of dwell, pusher or shuttle 128 is returned to its rest position, after which a new quantity of produce is supplied from hopper 110.

The filled bag of produce is then dropped from chute 120 by disabling air cylinder 122 which relaxes snout portion 86. Prior thereto sealer 54 is positioned to receive and support the bag in a central opening thereof while the bag's open end is clamped and sealed with an appropriate tape. Sealer 54 operates asynchronously relative to the bag preparing and filling assemblies, i.e., upon detecting the presence of a filled bag irrespective of when that occurs. After a filled bag is dropped, a new bag is inserted over snout portions 86 and 88 and clamped at 90° of dwell and a new cycle begins. Thus, for each machine cycle of packaging apparatus 2, the film 16 is advanced and a new bag is formed, while a previously formed bag is filled and sealed.

Figures 16 - 18 illustrate the operation of the alternative web separating assembly. In Figure 16, clamping plate 266 is retracted, and each of gripping feet 268 and 270 is retracted from its associated clamping plate. While shown in Figure 16 to aid the description, the clamping plates and gripping feet at this stage actually are pivoted away from the web path, with swing arm 66 in its funnel position. Flexure cylinder 258, with pin 260 retracted, is immediately above or upstream of the clamping plates.

Upstream of the flexure cylinder are a clamping member 274 operated by a pneumatic cylinder 276 and associated with a stationary member 278, and a hot knife 280 and associated movable anvil 282. These are substantially identical in structure and function to their corresponding parts illustrated in Figure 11, in that clamping member 274 fixes the interface for the cutting and sealing operation.

The timing cycle associated with the alternative web separating assembly is essentially similar to that of the first embodiment,

with one difference to be explained below. Figure 16 can be considered equivalent to Figure 11A, in that clamping plate 266, feet 268 and 270, anvil 282 and member 274 all are retracted. Guide bar 216 and flexure 218 are in the upstream position, with the lower end of bar 218 near the bottom or lead edges of the folded sides of web 16. These sides are joined together, having been sealed as previously explained.

At this point bar 216 and flexure 218 begin their descent, preferably at a speed substantially identical to that of the web, so that guide bar 216 contacts the sealed lead edges of the web's sides and pushes against them as it descends, hence to assist rollers 20 in moving the web. One advantage to using the guide bar to move the web is improved control over the width of each bag, as determined by the amount of web advance between successive cutting and sealing operations. Another is better control over the configuration of the web edges just prior to their engagement by the clamping plates and gripping feet, for a more consistent and reliable handling of the bags. Of course, care is taken to ensure that the guide bar descent speed does not exceed the web speed by an amount sufficient to cause undue stretching of the web.

Unlike the ends of spring metal spreader 24, guide bar 216 and guide flexure 218 do not move away from one another as they descend, but are separated by pin 260 after reaching the downstream position. Consequently, clamping plates 264 and 266 and their associated gripping feet 268 and 270 must be clear of the web path of travel until bar 216 and flexure 218 have separated the web. Thus, there is a deviation from the timing cycle shown in Figure 12, in that swing arm 66, which carries the clamping plates and gripping feet, is not rotated from the funnel position to the bag position until pin 260 has moved flexure 218 to the web expanding position.

In the interim between Figures 16 and 17, web and guide bar complete their downward travel, then flexure cylinder 258 extends pin 260 to expand the open end of film 16. The velocity and acceleration of pin 260 can be controlled through cylinder 258, resulting in a more controlled and consistent expanding of the film, and preventing damage to the seal along the web's leading edge. Swing arm 66 then is pivoted clockwise as viewed in Figure 11E to position clamping plates 264 and 266 between guide bar 216 and flexure 218, and thus between the opposite sides of film 16. Such swing arm

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pivot can occur, for example, at 55° dwell, after a cylinder 284 has moved clamping plate 266 proximate clamping plate 264.

With the clamping plates in the web path, the guide bar and flexure are returned to the upstream position, leaving the opposite web sides between clamping plate 264 and gripping foot 268, and between clamping foot 266 and gripping foot 270, respectively. Cylinders 272 and 286 are then enabled to bring their associated gripping feet against their associated clamping plates to secure the web sides. Clamp member 274 and anvil 282 then are brought against stationary member 278 and knife 280, respectively, to cut and seal and thus form a bag with one open end opposite the web fold. Distance  $d$ , from the center of knife 280 to the center of the clamping plates and gripping feet, should be one-half the bag width to ensure even gripping of the bag. Clamping plate 266 then is retracted from clamping plate 264 to stretch the open end of the bag into the configuration shown in Figure 18, for subsequent filling of the bag. Preferably, the retraction speed of plate 266 is controlled to minimize the chances of damage to the bag, particularly at the newly formed seal along the trailing edge. Another key consideration is to minimize the time necessary for stretching open the bag. Consequently, plate 266 is controlled with both factors - speed and seal preservation - in mind.

WHAT IS CLAIMED IS:

## CLAIMS

1. An improved apparatus for separating the opposed sides of a folded web, including:
  - a frame;
  - web moving means for supporting a continuous folded web of film for movement along a path relative to said frame; and
  - web separating means for spreading apart the opposed sides of said web, including a substantially rigid first guide member, a second guide member mounted with respect to said first guide member in a normal position against the first guide member, and guide supporting means for mounting said first and second guide members with respect to said frame and between said opposed sides, and for reciprocating said guide members along a selected portion of the path between an upstream position and a downstream position; and an expansion means for moving said second guide member away from its normal position to a web expanding position relatively remote from the first guide member when enabled, said expansion means when disabled permitting the second guide member to return to the normal position.
2. The apparatus of Claim 1 wherein:
  - said guide members reciprocate parallel to the movement of said web.
3. The apparatus of Claim 1 further including:
  - a means for forming a seal between the leading edge portions of said opposed sides, and wherein said first guide member engages said leading edge portions as it travels from the upstream position to the downstream position at a speed substantially equal to the web speed, thereby to assist said web moving means in moving the web.
4. The apparatus of Claim 3 wherein:
  - said first guide member includes a substantially flat bar elongate in the direction of web travel; and
  - said second guide member includes a flexure elongate in the direction of web travel, one end of said flexure being fastened with respect to one end of said bar.
5. The apparatus of Claim 4 wherein:
  - the upstream end of said flexure is fastened with respect to the upstream end of said bar.

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6. The apparatus of Claim 4 wherein:

said expansion means includes a pin mounted to reciprocate with respect to the frame and extensible to contact said flexure and elastically deflect the flexure to the web expanding position, said pin being retractable to permit said flexure to return to the normal position.

7. The apparatus of Claim 6 wherein:

said pin is mounted on the opposite side of said bar from said flexure, and contacts the flexure through an aperture in the bar.

8. The apparatus of Claim 7 wherein:

said pin is extended to contact said flexure only when said plate and flexure are in the downstream position.

9. The apparatus of Claim 1 wherein:

said expansion means includes a pin mounted to reciprocate with respect to said frame and extensible to contact the second guide member and move it to the web expanding position, said pin being retractable to permit the second guide member to return to the normal position.

10. The apparatus of Claim 1 wherein:

said guide supporting means includes a shaft integral with said frame and parallel to said selected portion of the path, a web separator support carrying said guide members and mounted slidably on said shaft, and a pneumatic cylinder including a reciprocable piston attached to said web separator support.

11. The apparatus of Claim 1 including:

a clamping assembly including a pair of clamping plates and one gripping foot associated with each clamping plate for receiving and clamping one of said opposed sides, and means for mounting said clamping assembly relative to said frame for movement into and out of said path at a location wherein each of said guide members is positioned between one of said clamping plates and its associated gripping foot when said guide members are in the downstream position and the second guide member is in the web extending position.

12. Packaging apparatus for forming and filling an integrally prepared bag comprising:

a frame; a web moving means for moving a folded web along a path relative to said frame; a first means mounted with respect to the frame for severing said folded web of film material and for forming a

seal along a leading edge thereof; bag forming means secured to said frame including clamping means for releasably holding the opposed sides of said folded web;

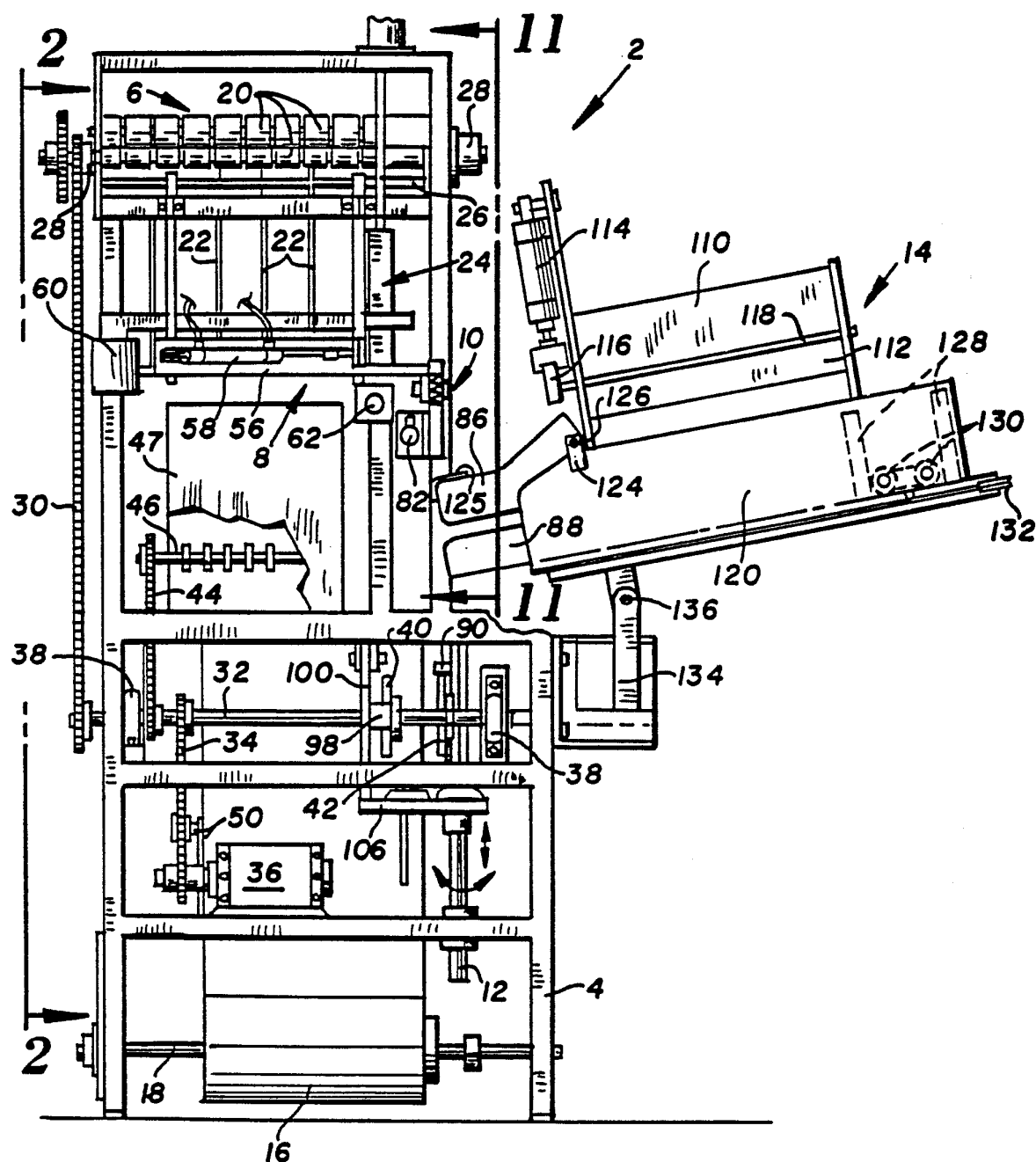
a web separating means for spreading an open side of said web, said separating means including a substantially rigid first guide member, a second guide member mounted with respect to the first guide member in a normal position against the first guide member; means for mounting said guide members with respect to said frame and between said opposed sides, and reciprocating the guide members between an upstream position and a downstream position; and a web expansion means for moving the second guide member away from said normal position to a web expanding position relatively remote from said first guide member thereby to controllably spread the open side of said web, said expanding means when disabled allowing said second guide member to return to the normal position, said first means sealing and severing a predetermined width of said film from said web to form a bag with an open end;

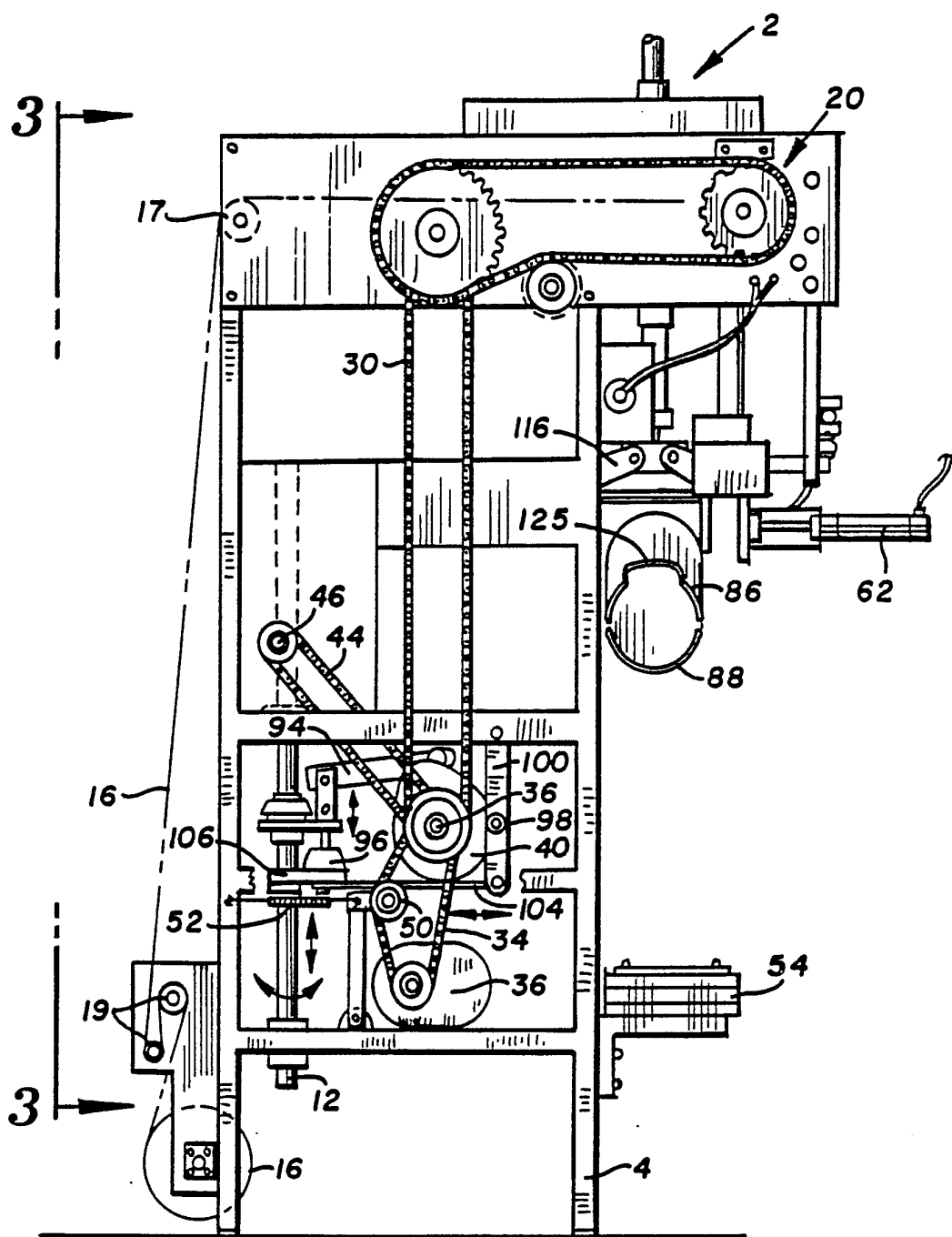
bag filling means for receiving and supporting the formed bag before filling said bag with a measured amount of product; and

control means for synchronously operating said bag forming means relative to said bag filling means.

13. The packaging apparatus of Claim 12 wherein:

said first guide member engages said leading edge, when sealed, as it travels downstream at a speed substantially equal to the web speed, thereby to assist said web moving means in moving the web and in determining said predetermined width of film.

**FIG. 1****SUBSTITUTE SHEET**

**FIG. 2****SUBSTITUTE SHEET**

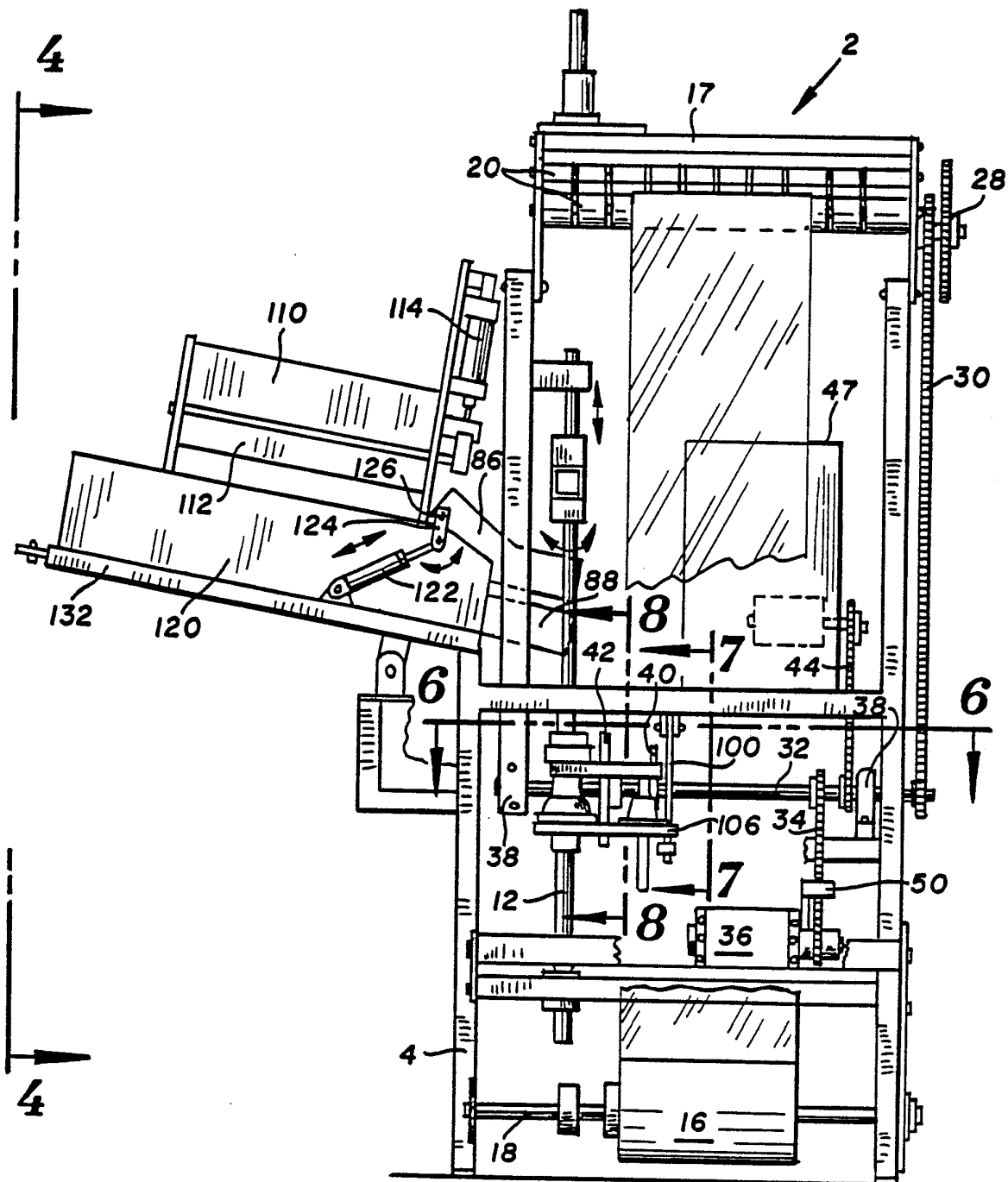


**FIG. 3**

**SUBSTITUTE SHEET**

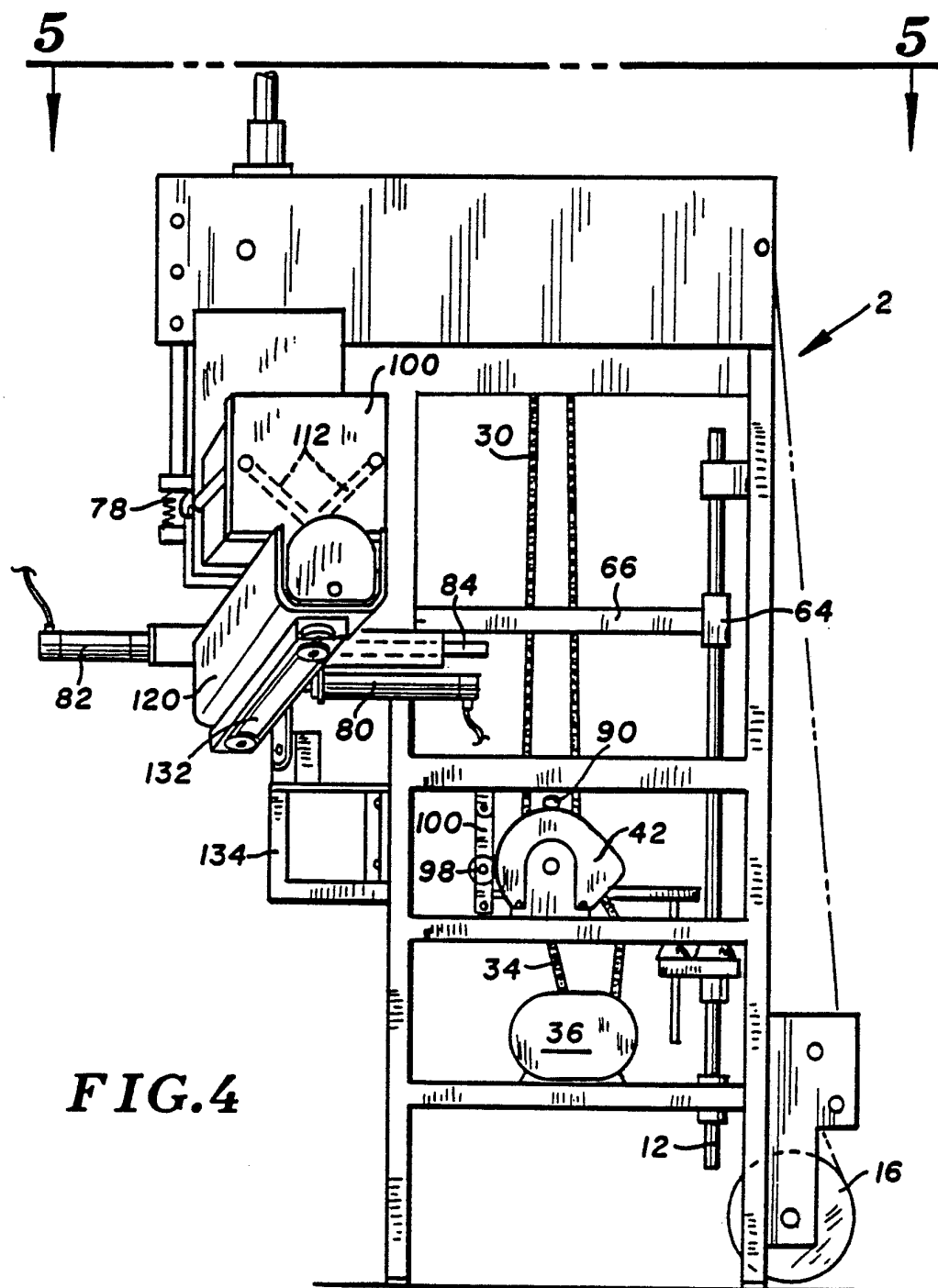
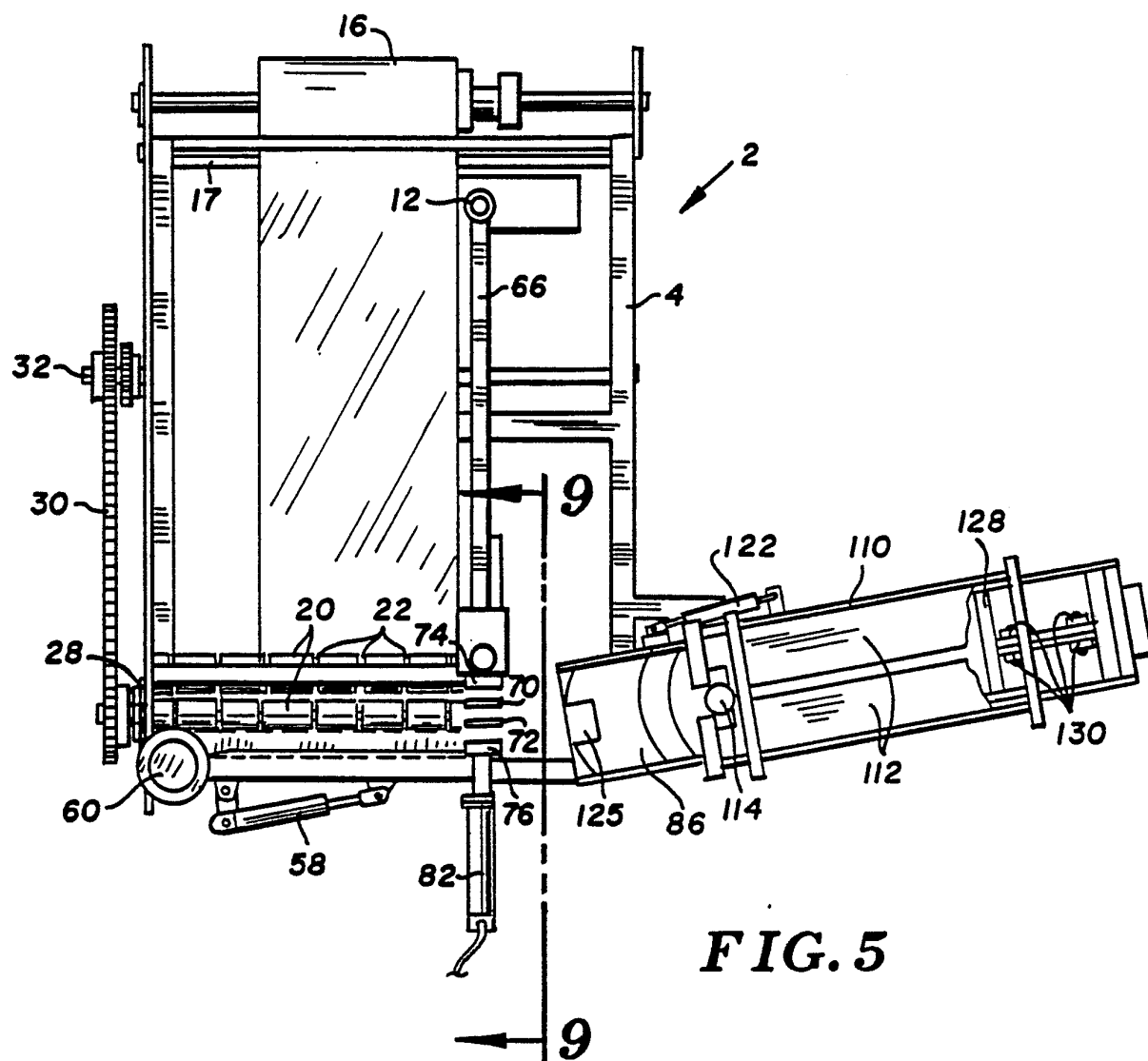


**FIG. 4**



**SUBSTITUTE SHEET**

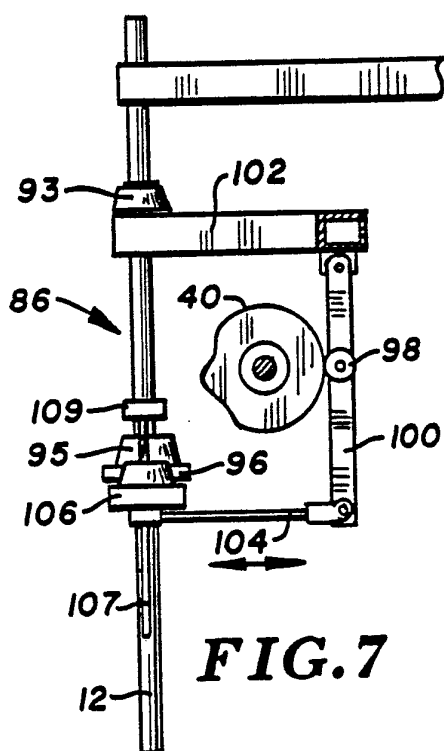


**FIG. 7**

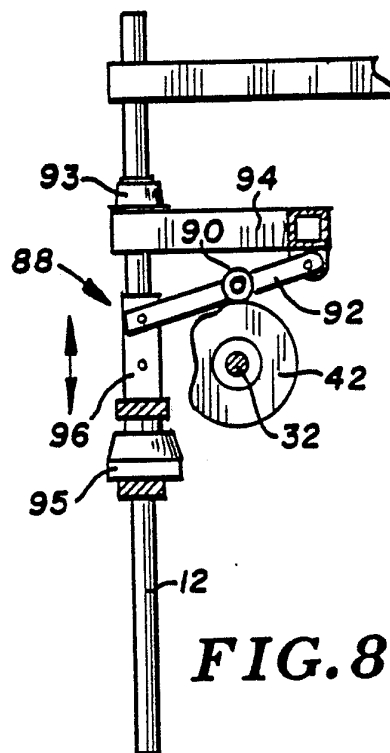


**FIG. 8**

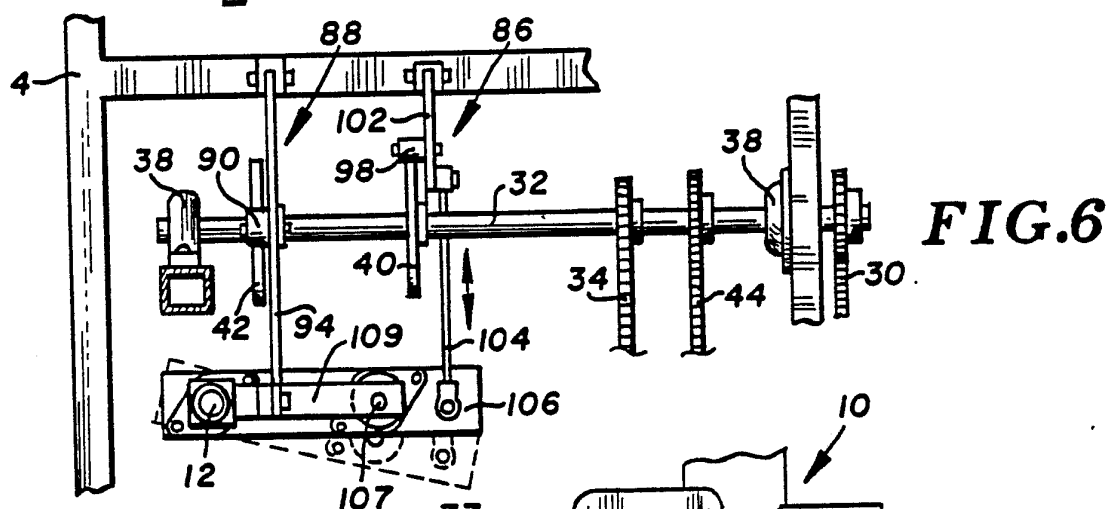


**FIG. 6**

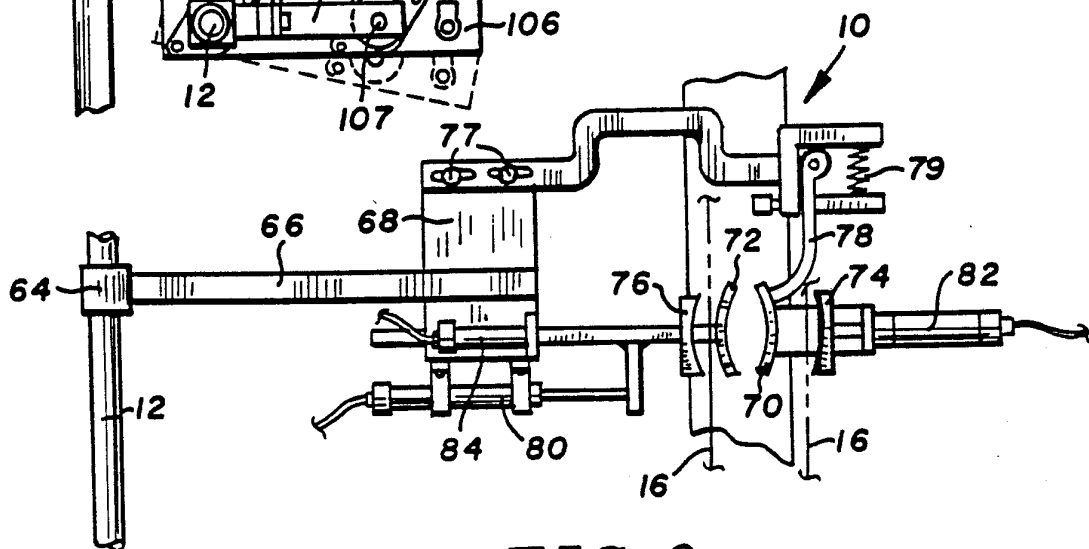


**FIG. 9**

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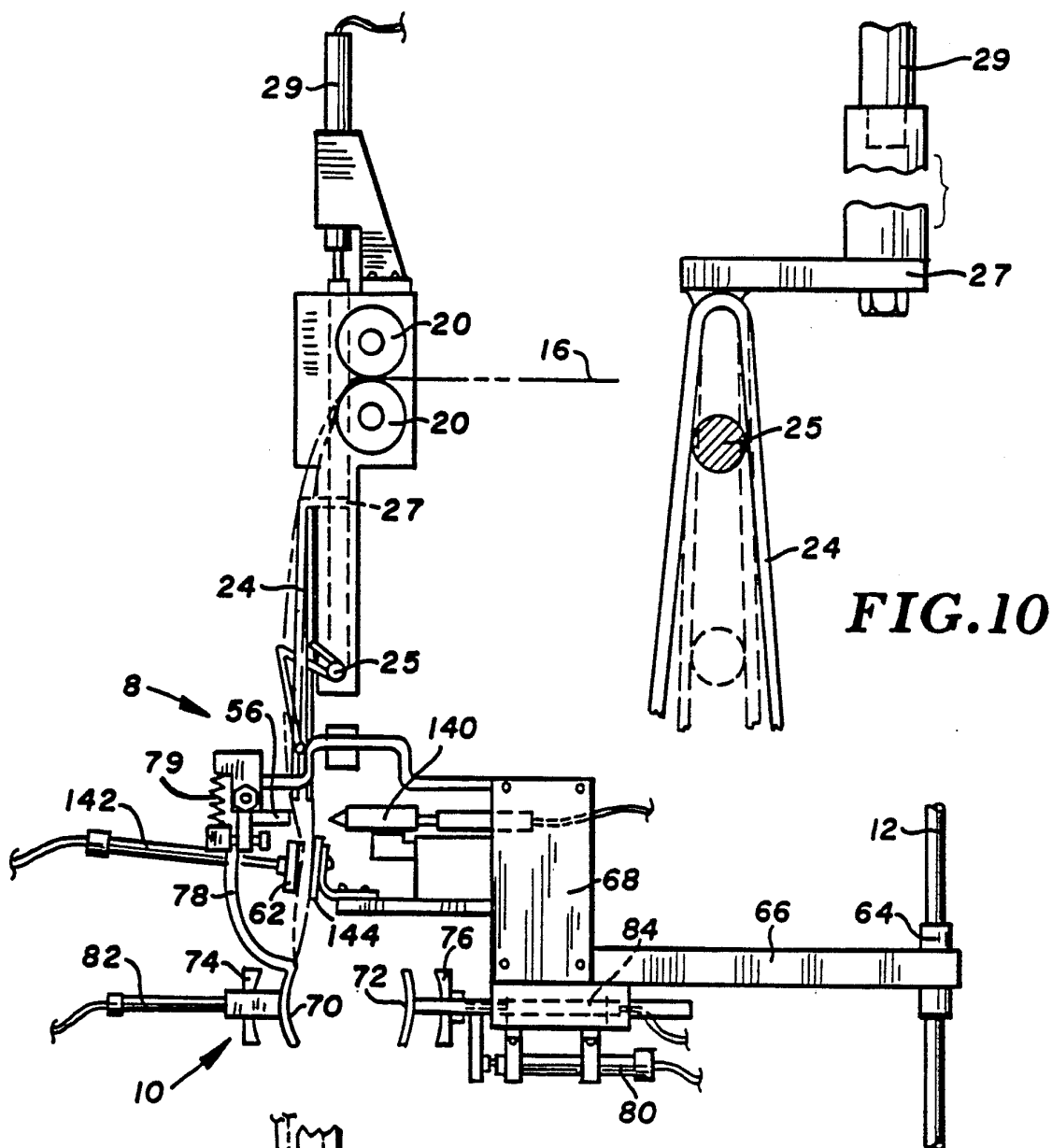


FIG. 11A

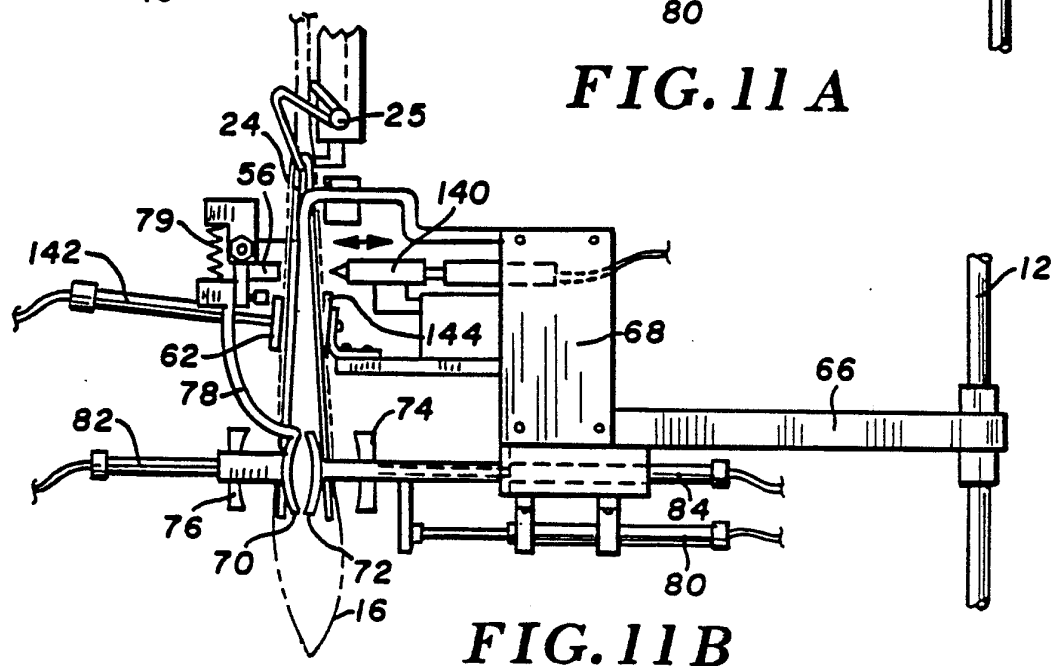
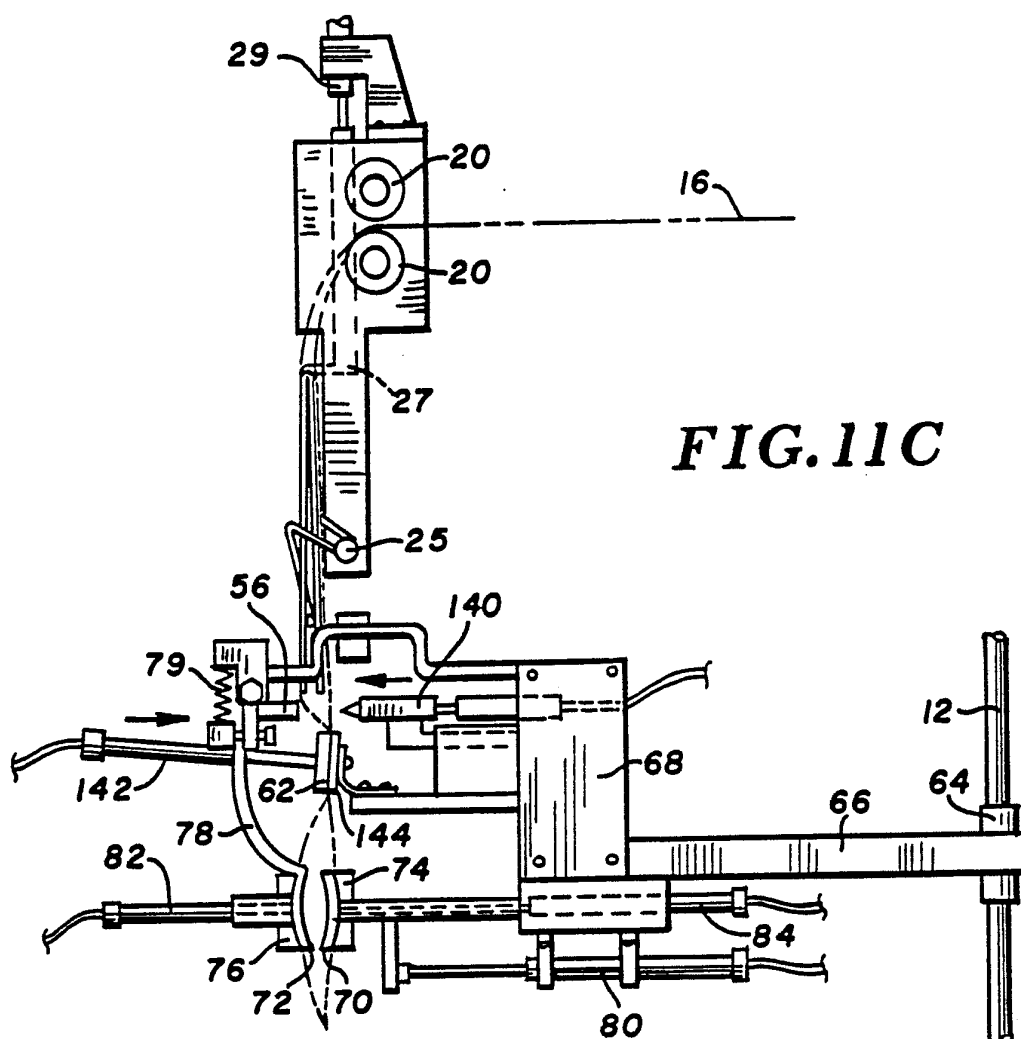
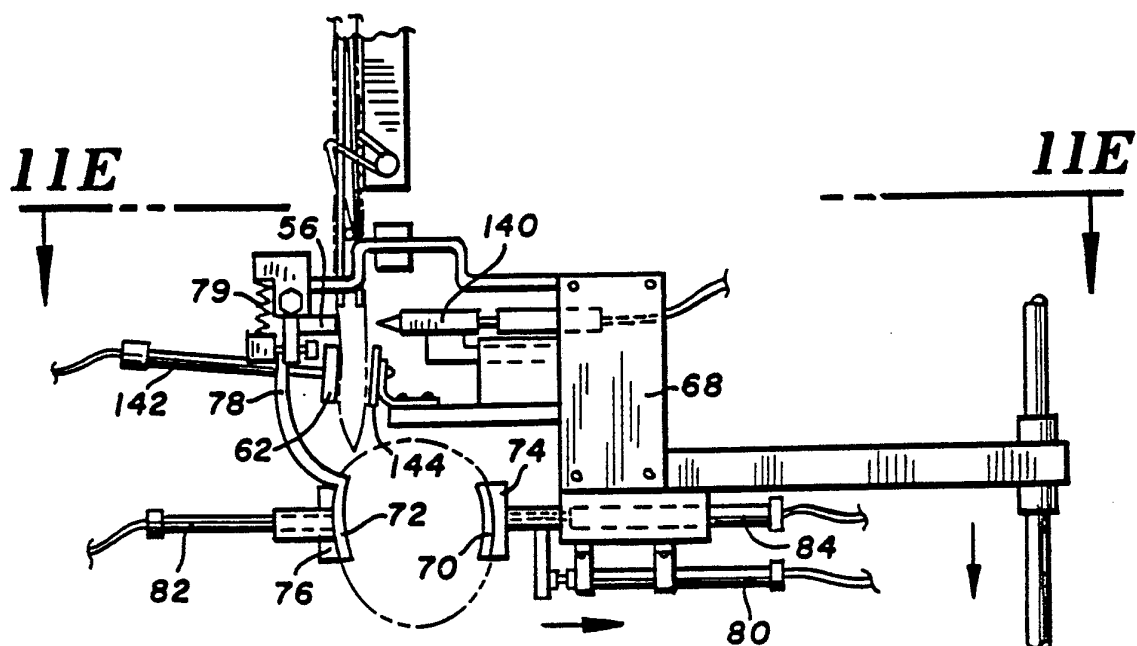


FIG. 11B

**FIG. 11C****FIG. 11D**

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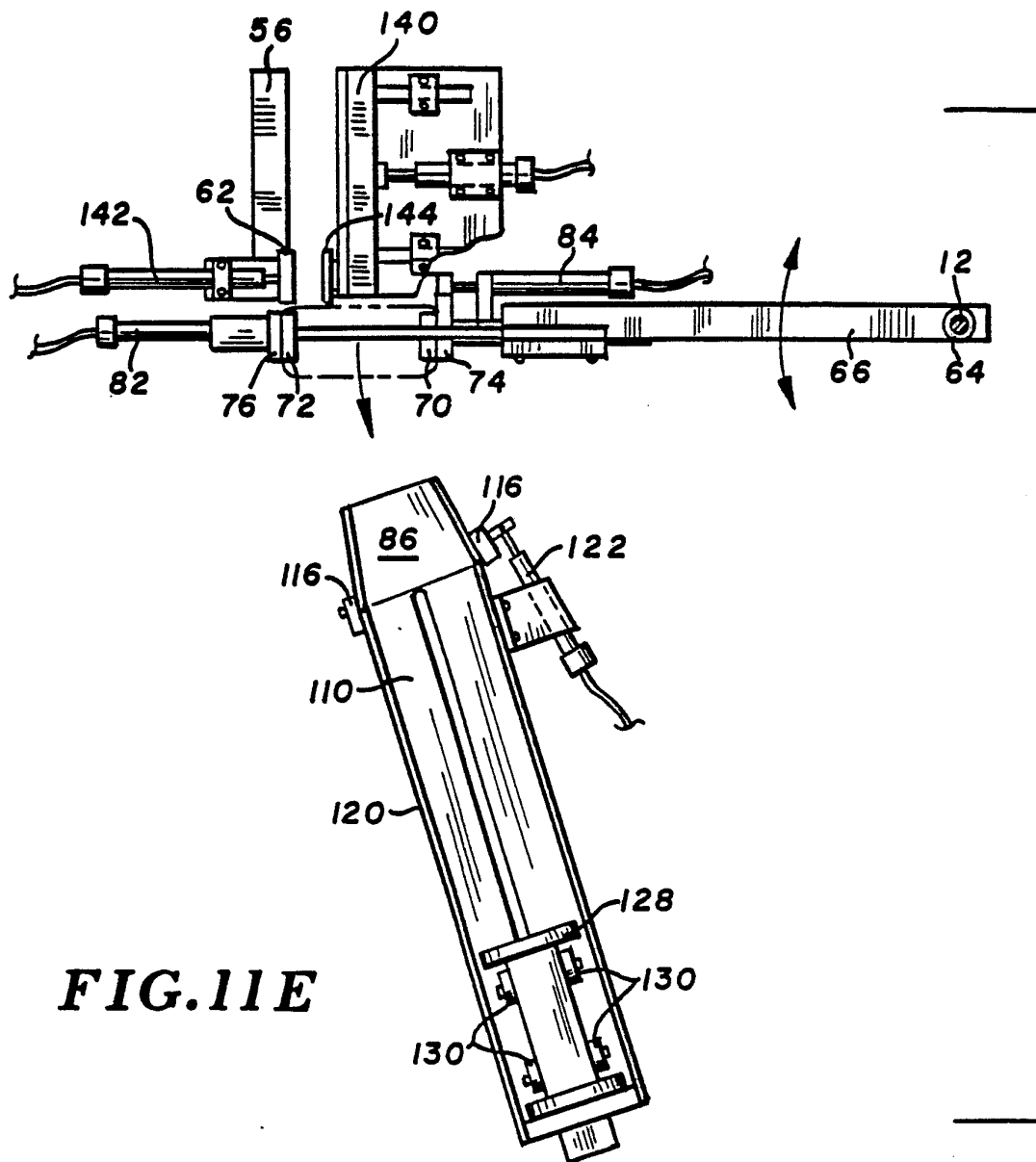


**FIG. 11E**

**SUBSTITUTE SHEET**

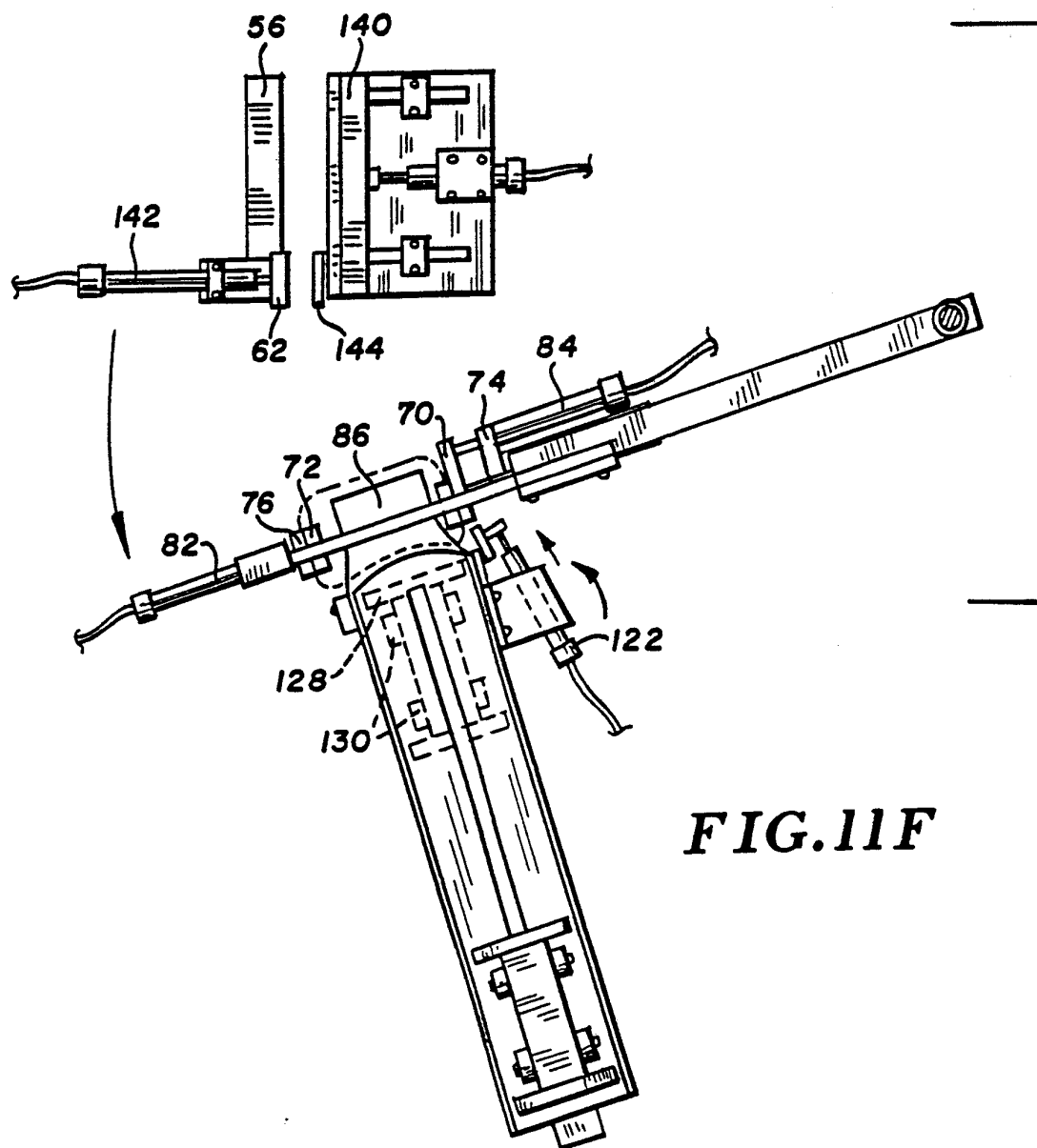


**FIG.11F**

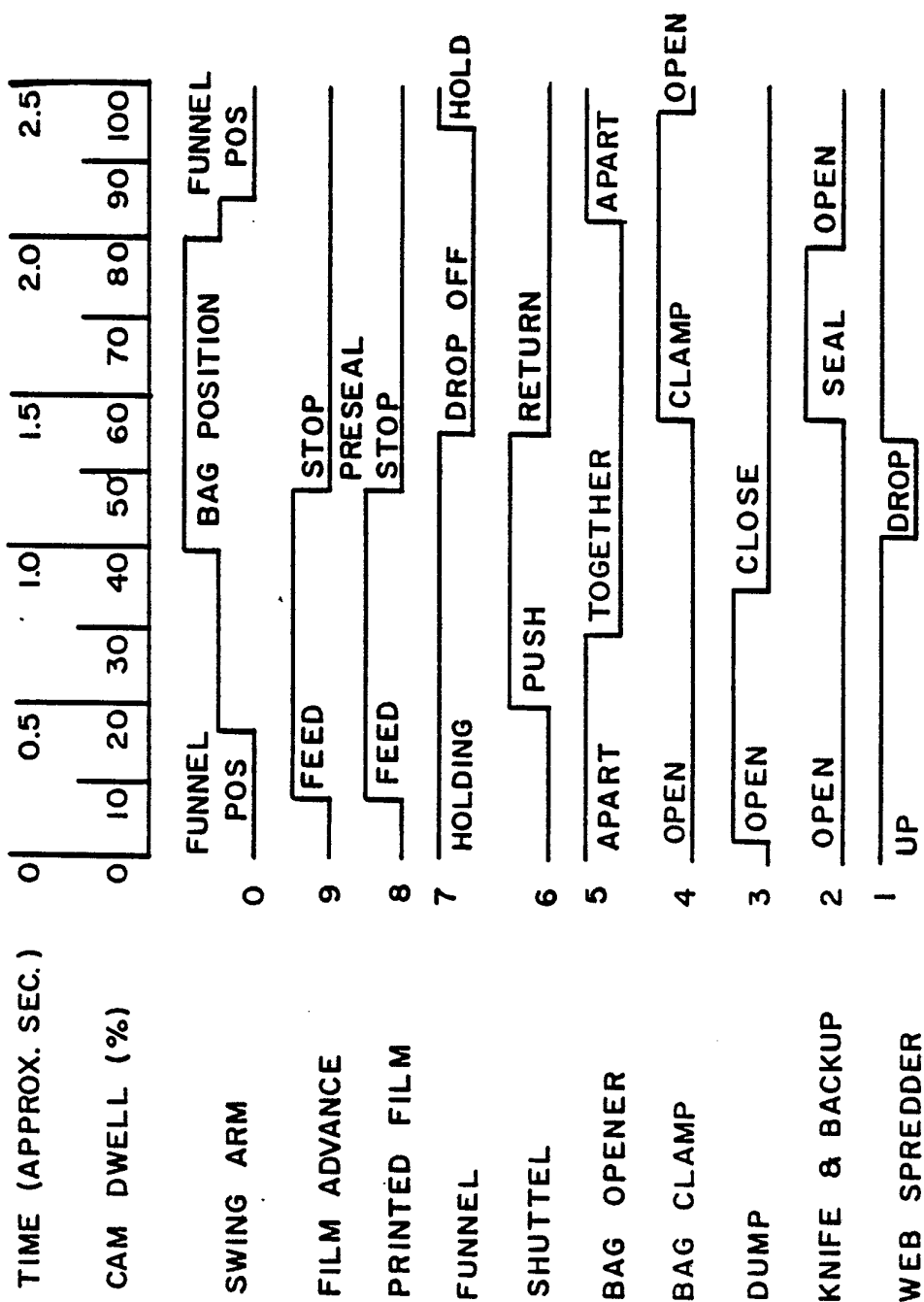


FIG. 12

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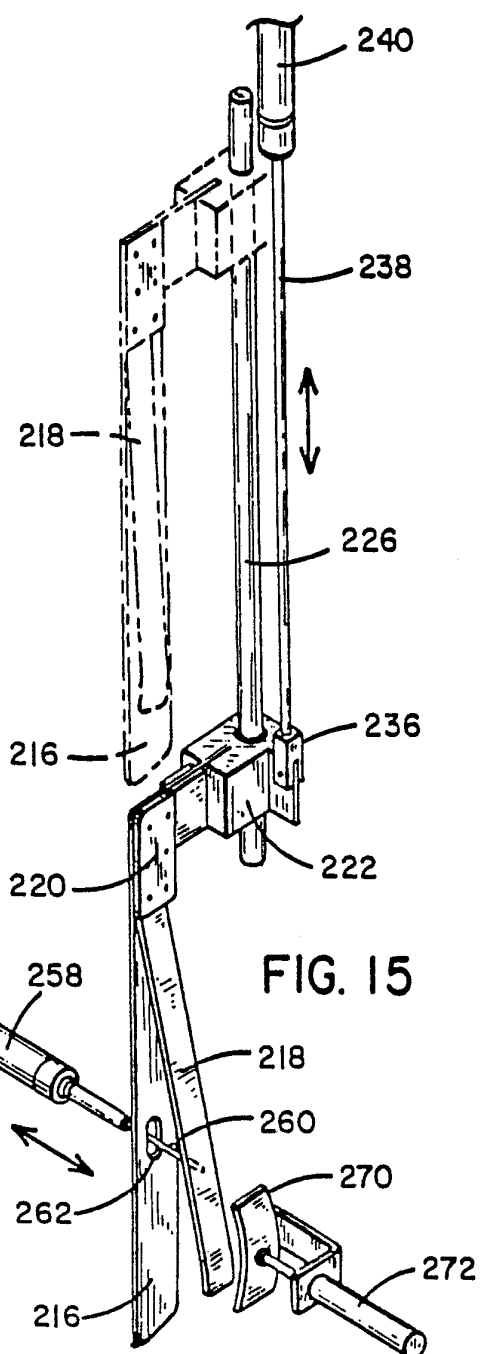


FIG. 14

FIG. 15

**SUBSTITUTE SHEET**

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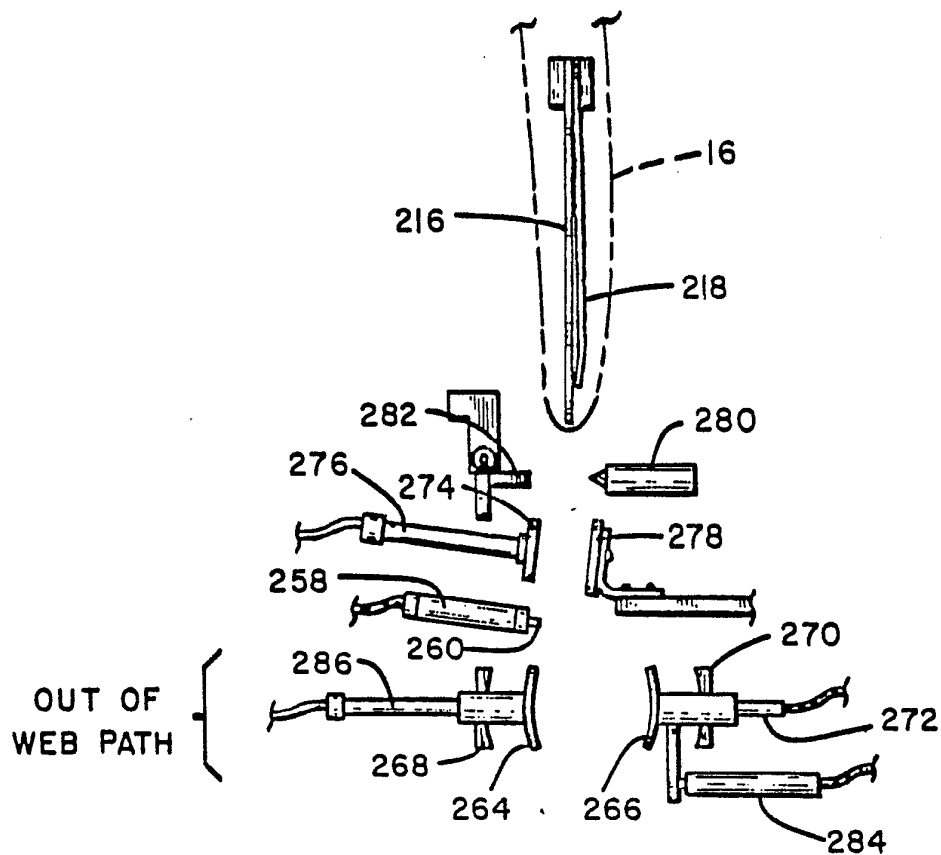


FIG. 16

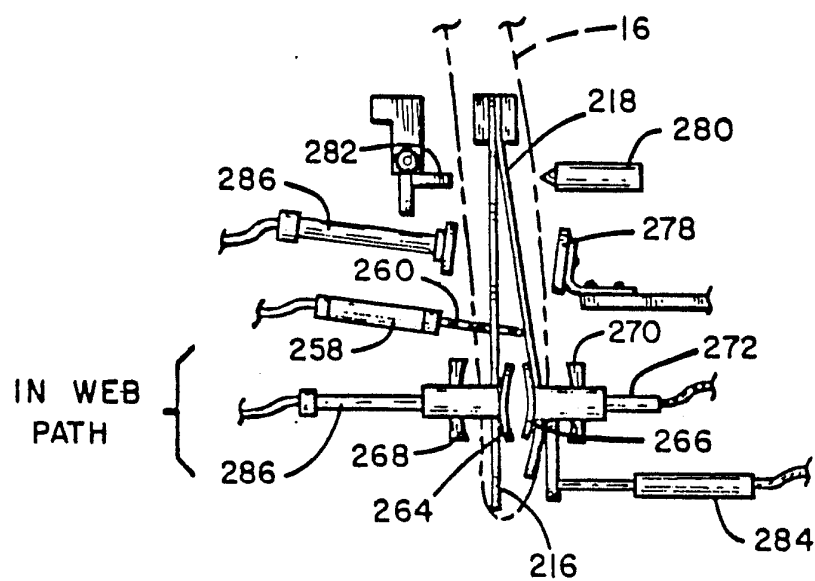


FIG. 17

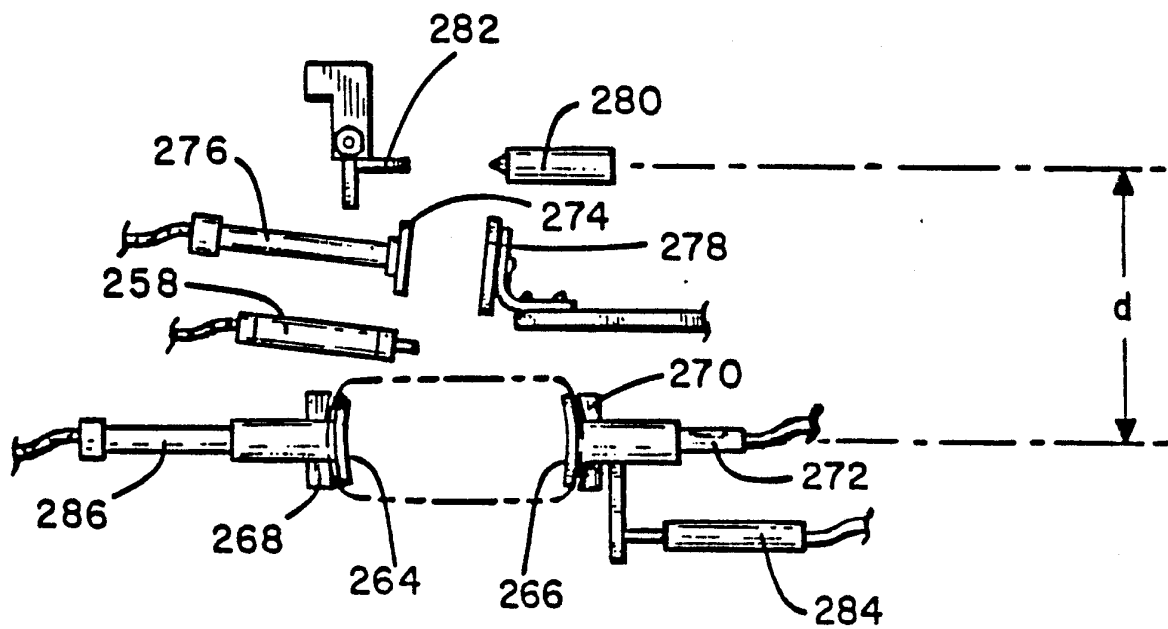


FIG. 18

SUBSTITUTE SHEET

# INTERNATIONAL SEARCH REPORT

International Application No. PCT/US86/01132

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                |                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>8</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                |                                     |
| According to International Patent Classification (IPC) or to both National Classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                |                                     |
| Int. Cl.(4) B65B 43/04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                |                                     |
| US Cl. 53/562                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                |                                     |
| <b>II. FIELDS SEARCHED</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                |                                     |
| Minimum Documentation Searched <sup>4</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                |                                     |
| Classification System                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Classification Symbols                                                                                         |                                     |
| U.S.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 53/258, 259, 261, 384, 550, 551, 558, 562, 564, 567, 568, 570, 573                                             |                                     |
| Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>6</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                |                                     |
| <b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                |                                     |
| Category <sup>*</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup> | Relevant to Claim No. <sup>18</sup> |
| A, E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | US, A, 4,590,741 Published 27 May 1986 (Schjeldahl) See entire document.                                       | 1-14                                |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US, A, 4,514,962 Published 07 May 1985 (Ausnit) See entire document.                                           | 1-14                                |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US, A, 4,169,345 Published 02 October 1979 (Dcuwenga) See entire document.                                     | 1-14                                |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US, A, 3,501,887 Published 24 March 1970 (Umholtz et al.) See entire document.                                 | 1-14                                |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US, A, 3,462,913 Published 26 August 1969 (Bodclay et al.) See entire document.                                | 1-14                                |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US, A, 3,397,505 Published 20 August 1968 (Critchell) See entire document.                                     | 1-14                                |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US, A, 3,295,289 Published 03 January 1967 (Critchell) See entire document.                                    | 1-14                                |
| <p><sup>*</sup> Special categories of cited documents: <sup>15</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p> |                                                                                                                |                                     |
| <b>IV. CERTIFICATION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                |                                     |
| Date of the Actual Completion of the International Search <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Date of Mailing of this International Search Report <sup>1</sup>                                               |                                     |
| 22 July 1986                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 05 AUG 1986                                                                                                    |                                     |
| International Searching Authority <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Signature of Authorized Officer <sup>2</sup>                                                                   |                                     |
| ISA/US                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Donald R. Studebaker                                                                                           |                                     |