

April 10, 1962

H. E. HUMMEL

3,028,833

HOT MELT ADHESIVE APPLICATOR

Filed July 12, 1960

7 Sheets-Sheet 1

FIG. 1

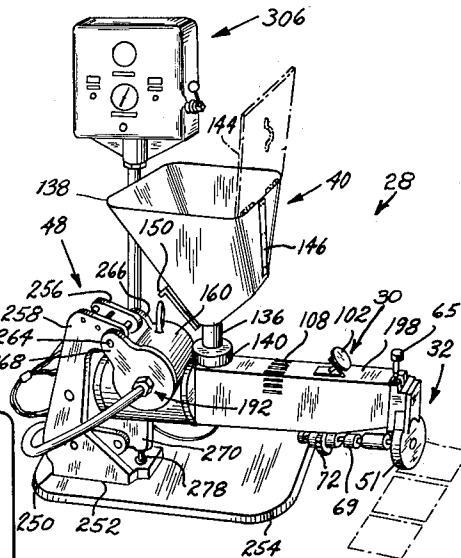
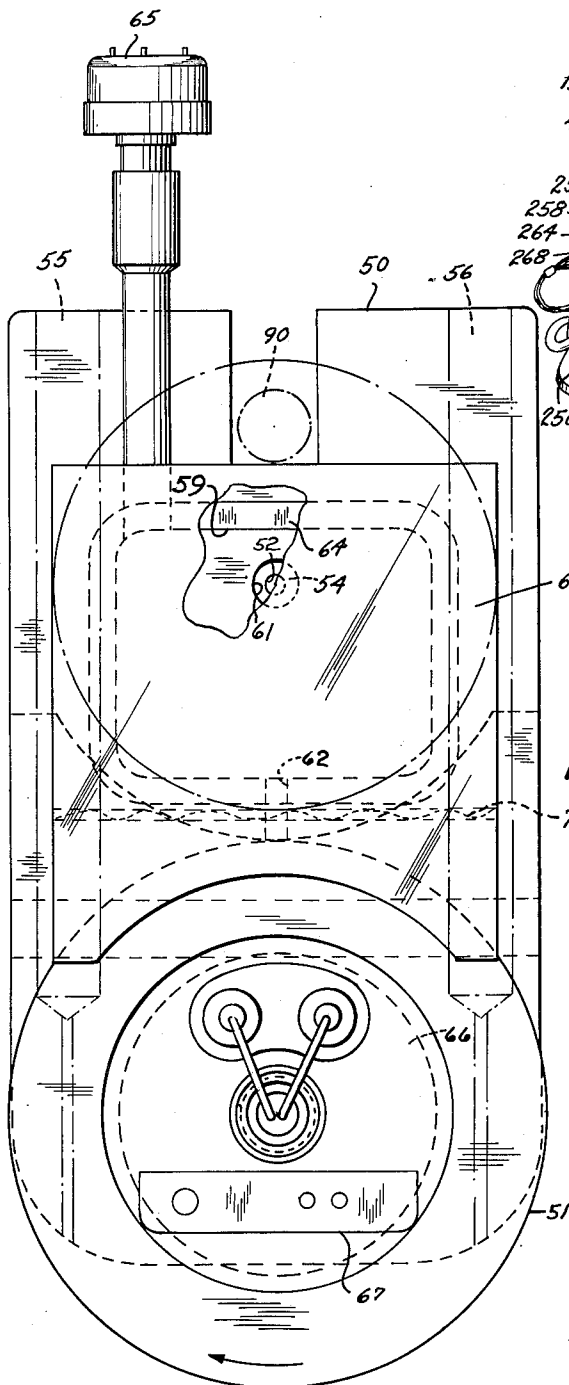


FIG. 13

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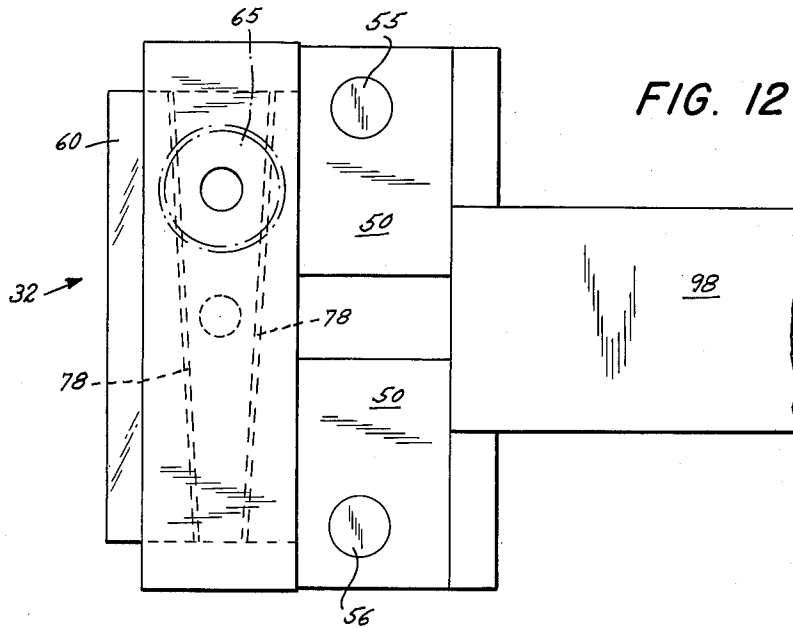


FIG. 12

FIG. 2

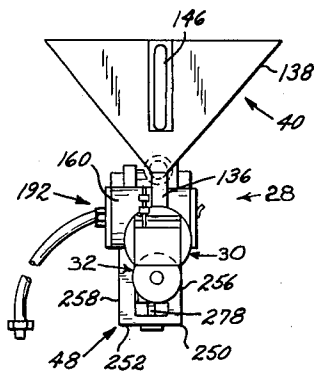
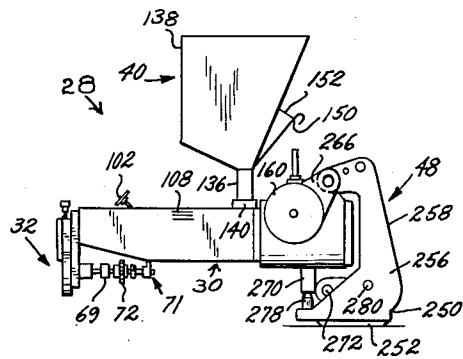


FIG. 3



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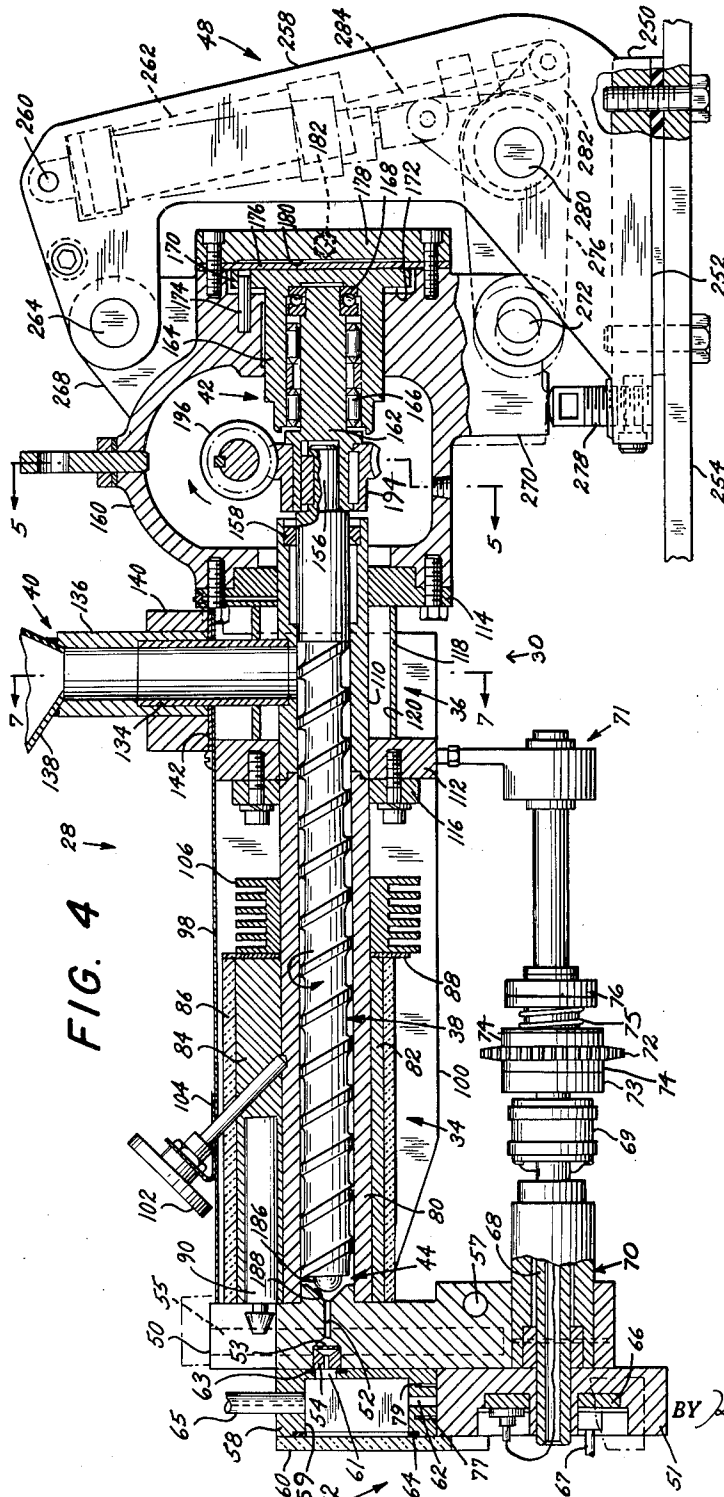
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HOT MELT ADHESIVE APPLICATOR

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7 Sheets-Sheet 3



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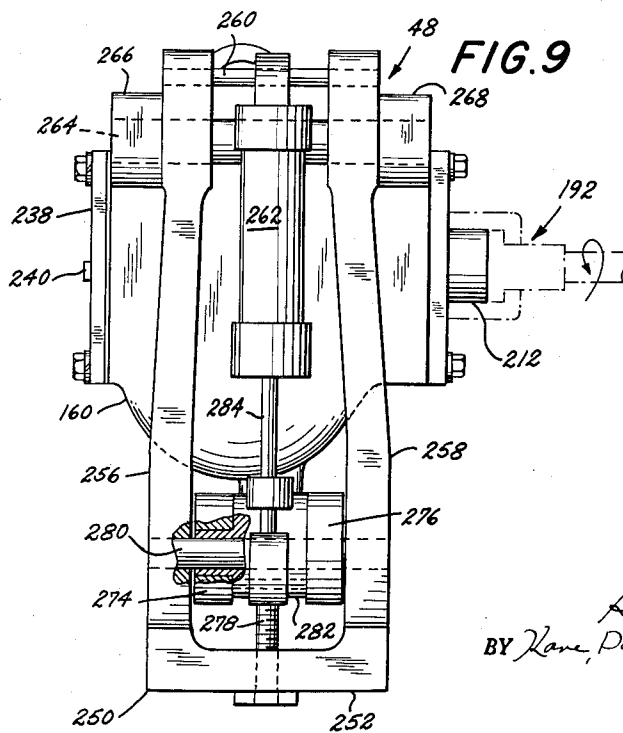
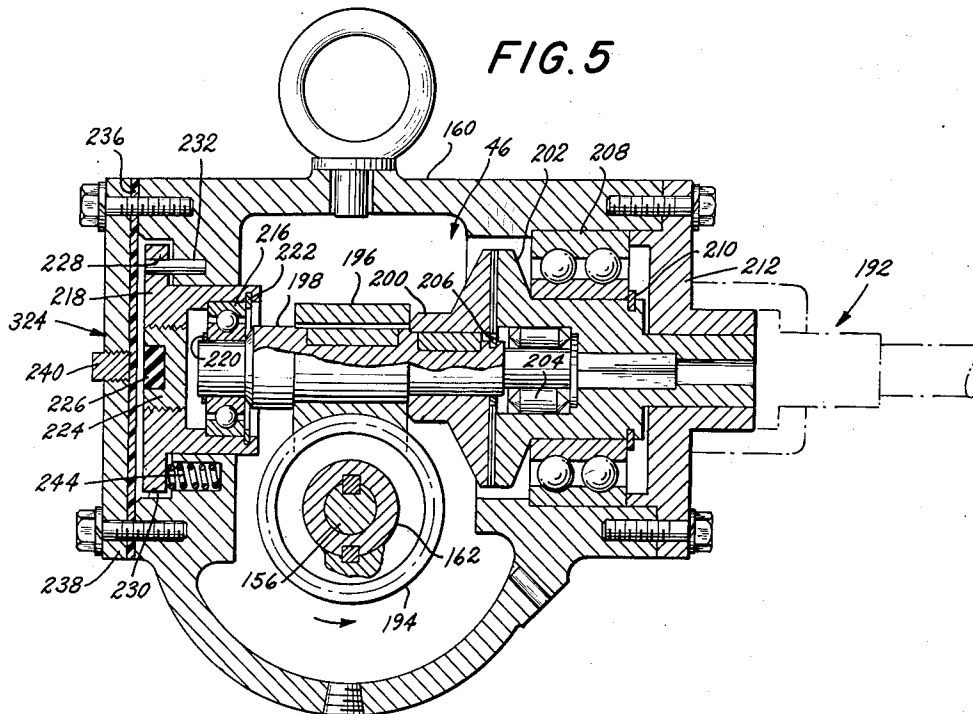
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HOT MELT ADHESIVE APPLICATOR

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HOT MELT ADHESIVE APPLICATOR

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FIG. 6

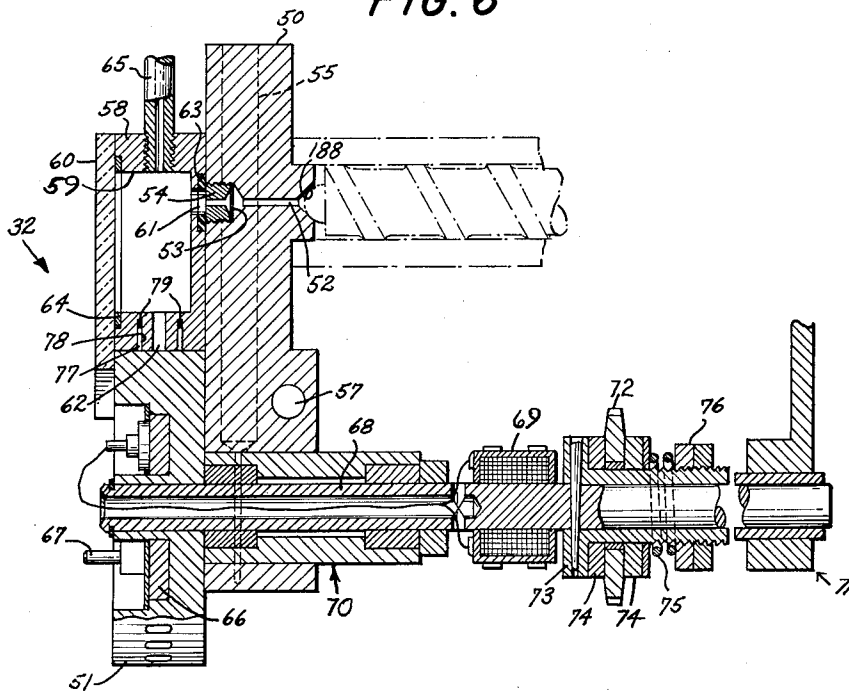
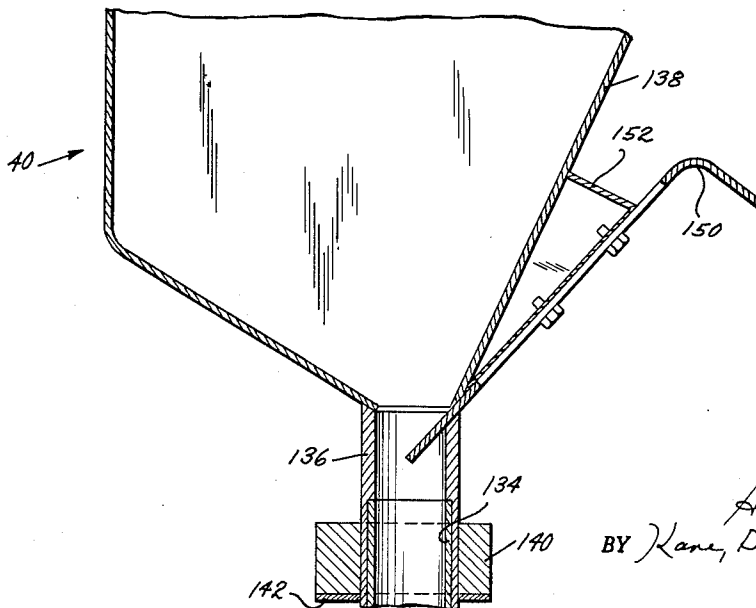


FIG. 8



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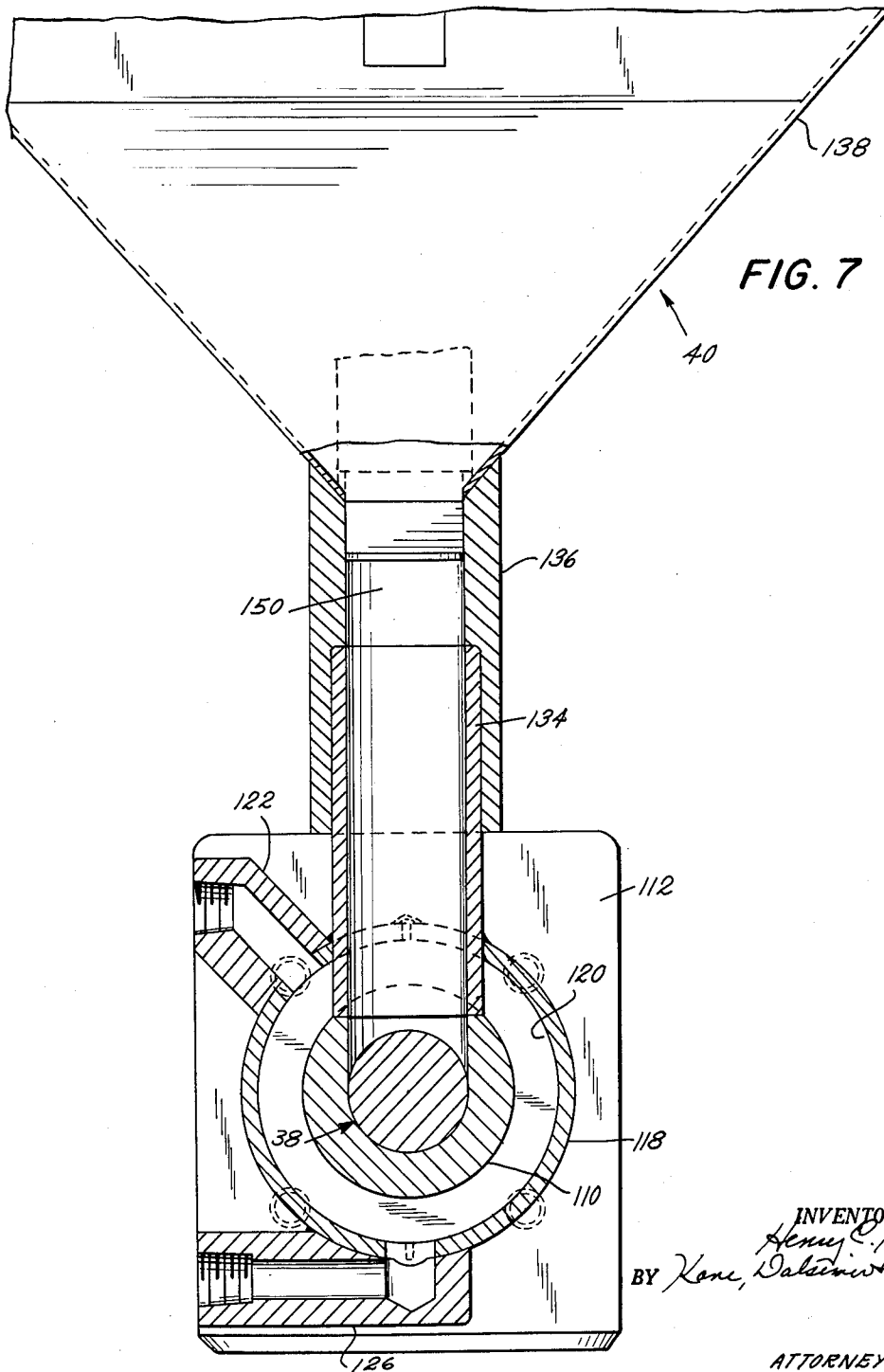
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HOT MELT ADHESIVE APPLICATOR

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Filed July 12, 1960, Ser. No. 42,372

6 Claims. (Cl. 118-7)

This invention relates to a hot melt adhesive applicator and more particularly to an improved hot melt adhesive wheel applicator permitting high speed adhesive application to individual passing objects.

The demand from industry for adhesives and applying devices to give continuous high speed bonds on new, tougher stocks has increased considerably. This is particularly true in paper bag manufacturing where optimum production and exceptionally strong finished bags are essential. For many years these hot melted adhesives have become increasingly important to the packaging industry. These synthetic materials are desirable because of their superior strength and relatively quick set. Foremost among the many advantages of hot melt adhesives are the remarkable fast production speeds that are potentially obtainable with them. This is due largely to the fact that setting time depends only on heat loss, since there are generally no liquid solvents in such adhesives. Up to now, it has been difficult to develop simple, inexpensive and fast, yet reliable machines capable of applying such adhesives.

In such fields as bag manufacturing, the step involving the pasting of the bag bottom demands fast set and high strength of the contemplated hot melt adhesives. Individual bags would ordinarily be passed through the adhesive applicator for purposes of securing their bottoms. In this connection, an interrupted adhesive application would be most economical and practical in view of the rigid requirements for high operating speeds and continuous line control in a closed system found to be extremely desirable for paper bag manufacturing.

Accordingly, the present invention provides an improved wheel applicator for such adhesives. This wheel applicator is suitably patterned depending upon the particular conditions and requirements encountered, and is designed for continuous service while being capable of metering the usable molten material with consistent tolerances that are well within production criteria. A family of hot melt adhesives in granular form are commercially available; and the present invention contemplates the use of low cost granular or pelletized hot melts, including polyethylene.

An important object of the present invention is to provide a hot melt adhesive wheel applicator having means for controlling the feed of molten adhesive to the applicator wheel, thereby eliminating the danger of any deficiency of adhesives on the applicator wheel and obviating the possible detrimental consequences of adhesive build-up between the applicator wheel and the feeding mechanism for the adhesive.

Further objects of this invention include an improved wheel applicator for hot melt adhesives that is easy to mount and use; is rugged and of compact construction; is designed for use in bag bottom pasting where the partially finished bags are fed individually; is capable of taking its drive from a parent machine, thereby rendering the adhesive output a function of the feed of the material to be bonded; and eliminates the need for adhesive pot-clean up, in that, with heaters properly incorporated into the wheel applicator, any adhesive left in the applicator is remelted upon heater energization subsequent to applicator turn-off and adhesive hardening.

It accordance with a somewhat preferred embodiment of this invention, a wheel applicator will include an ad-

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hesive applying wheel mounted for rotation and adapted to apply hot melt adhesive in molten form to the material to be bonded. A cavity communicates with the outer surfaces of the wheel and is adapted to receive molten adhesive fed by an extruder. A pressure switch is tapped into the cavity and is pre-set to respond to a predetermined pressure of the air entrapped therein by the extruder fed adhesive. Under such circumstances, the entrapped air is compressed by the accumulation of molten adhesive in the cavity. The cavity, as well as the wheel, may be exposed to thermostatically controlled heaters for purposes of assuring proper melt characteristics of the adhesive during the operation of the wheel applicator.

Although an extruder is exemplary of a suitable feeding means for the adhesive, if should be understood that the present invention is in no sense limited thereby. With this in mind, the extruder includes a heating barrel assembly having an elongated chamber mounted at one end of the cavity and heated by a thermostatically controlled heater unit which functions to place the adhesive in proper molten condition prior to its discharge into the cavity. Cooling fins and a water jacket are at the other end of the heating chamber for off-setting the undesirable effects that may result from the adhesive being prematurely placed in a molten state. A large capacity hopper serves to load granular or pelletized forms of hot melt adhesives. A screw within the heating chamber carries forward the adhesive discharged from the hopper. This screw possesses an increasing root diameter along its length and consequently cooperates in forcing entrapped air in the heating chamber back out through the hopper.

In addition, the extruder includes a clutch controlled drive means for rotating the screw which is actuated by a fluid actuated mechanism when it is desired to stop and start the feeding operation. A valve is employed at the forward end of the screw for closing the passageway between the cavity and heating chamber upon cessation of the adhesive feed. This valve is similarly actuated by means of a fluid actuated mechanism and has its operation synchronized with the starting and stopping of the rotation of the screw. In this connection, both of the fluid pressure mechanisms are coupled with the pressure switch exposed to the cavity so that, when a predetermined pressure is experienced therein, the switch will cause, through interconnecting means, the screw to stop rotating and the valve to close. On the other hand when the pressure of the entrapped air drops below the present value, the switch will be actuated to thereby open the valve and restart the rotation of the screw to permit further molten adhesive to be fed to the applicator wheel.

A shiftable bracket for mounting the extruder functions to raise and lower the extruder such that the applicator wheel is placed distal and adjacent, respectively, the surface on which the hot melt adhesive is to be applied.

Other objects and advantages will become apparent from the following detailed description which is to be taken in conjunction with the accompanying drawings illustrating the preferred embodiments of the present invention and in which:

FIG. 1 is a perspective view of a wheel applicator, incorporating the teachings of the present invention, in an operating position, during which, it is adapted to apply adhesive to the material illustrated by phantom lines, that is to be bonded, with a hinged hopper cover having a handle, also shown in phantom.

FIG. 2 is a schematic front elevational view of the applicator;

FIG. 3 is a schematic side elevational view of the applicator;

FIG. 4 is a longitudinal sectional view of the applicator, with certain parts broken away and removed, in its op-

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erative position, during which, it is adapted to apply adhesive to the selected surfaces, the inoperative position of the application during which it is elevated, being shown by dot-dash phantom lines;

FIG. 5 is a sectional view taken along the lines 5—5 of FIG. 4 illustrating the fluid actuated clutch control mechanism of the applicator;

FIG. 6 is an enlarged fragmentary sectional view illustrating the valve closed and screw stopped but the applicator otherwise in an operative position at which the wheel is adapted to apply adhesive in accordance with the selected pattern along its circumferentially extending periphery;

FIG. 7 is an enlarged sectional view taken along the lines 7—7 of FIG. 4 illustrating the coupling of the hopper assembly and cooling barrel assembly, as well, as details of the water jacket of the latter assembly;

FIG. 8 is a fragmentary longitudinal sectional view of the hopper assembly showing the details of the hopper shut-off;

FIG. 9 is the rear-elevational view of the shiftable bracket employed for purposes of raising and lowering the applicator, with the bracket being shown in a position, at which, the applicator wheel will be in a lowered adhesive applying position;

FIG. 10 is a schematic view of pneumatic circuitry incorporated in the applicator, at such a time, as the extruder is in an operative position during which it feeds molten adhesive to the applicator wheel;

FIG. 11 is a similar schematic view of the pneumatic circuitry illustrating the relationship of the components when the extruder is inoperative and not permitting further flow of molten adhesive into the cavity;

FIG. 12 is a fragmentary plan view illustrating the orientation of the wheel scrapers and their relationship to the circumferentially extending periphery of the wheel; and

FIG. 13 is an enlarged elevational view of the wheel assembly and its associated cavity with projecting pressure switch as well as other related components.

Referring now to the drawings, wherein a hot melt adhesive wheel applicator 28 is illustrated, it will be observed that an extruder 30 is operatively connected to an applicator wheel assembly 32 which is mounted at one end of a heating barrel assembly 34 of the extruder 30. This heating barrel assembly 34 is coupled with a coaxial cooling barrel assembly 36, both of which are adapted to rotatably receive a screw 38. A hopper assembly 40 is in communication with the interior of the cooling barrel assembly 36, as well as, the heating barrel assembly 34. A fluid actuated mechanism 42 is coupled to the rear end of the screw 38 and is adapted to shift the screw 38 in an axial direction to open and close a valve 44 present at the other or forward end. The screw 38 is connected to a clutch controlled drive mechanism 46 which, upon actuation, is adapted to induce rotation of the screw. The extruder 30, and consequently wheel applicator assembly 32, is adapted to be raised and lowered through the operation of a shiftable bracket 48.

The wheel applicator assembly 32 functions to apply molten adhesive, as for example, along a seam line established for bag bottom pasting, at relatively high speeds. As will be appreciated, the high setting speed of the contemplated hot melt adhesive will, accordingly, produce an immediate bond of the material which is to be bonded, as stated. This may include the bonding of bag bottoms and even the material fed in continuous web form. Under the circumstances, applicator assembly 32 of the disclosed embodiment will include a head 50 and applicator wheel 51.

The head 50 is secured to the forward end of the heating barrel assembly 34 and is formed with an orifice 52 through which molten adhesive is adapted to flow and ultimately be placed on the selected circumferentially extending faces or periphery of the wheel 51 for application

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to the material to be bonded. If desired, a screen 53 may be suitably placed in the orifice 52 and retained with respect to the head 50 by a plug 54. In addition, the head 50 encases a pair of heating elements 55 and 56 disposed in suitably formed bores for such purposes. These heaters 55 and 56 in the head 50 serve to assure the proper elevated temperatures of the hot melt adhesives as they are extruded, and further facilitate the remelting of the adhesive when it has hardened, subsequent to the stopping of the operation of the applicator 38 and turning-off of the heaters of the applicator assembly 32. The head heaters 55 and 56 are regulated by means of a thermostat 57 placed in a suitably formed bore in the head 50.

The head 50 additionally includes a block 58 having a cavity 59 covered by a transparent window 60 which may be formed from tempered glass. A bore 61 interconnects the orifice 52 and cavity 59, whereas bore 62 is adapted to permit drainage of molten adhesive onto the selected circumferentially extending periphery of the wheel 51. Gaskets 63 and 64 may be utilized as shown, to accomplish the usual sealing function, and may be formed from silicone rubber.

The cavity 59 initially contains air which obviously will be pressurized as the molten adhesive is discharged therein when flowing from the orifice 52 and bore 61. The bore 62 is so dimensioned and arranged with respect to the circumferentially extending surfaces of the wheel 51, that the molten adhesive within the cavity 59 will accumulate and build up. Naturally, this accumulation is dependent upon the over-feeding of adhesive by extruder 30. In this connection, a pressure sensitive switch 65 is tapped into the upper part of cavity 59 for purposes of responding to a predetermined pressure of the compressed air in the cavity 59. In passing, an adjustable pressure switch, type C2060, manufactured by The Bristol Company of Waterbury, Connecticut has been found to function satisfactorily. When a certain amount of molten adhesive accumulates within cavity 59 a predetermined air pressure will be reached which will actuate the air pressure switch 65. As will be more fully understood shortly, this switch actuation will cause the valve 44 to close and the clutch control drive mechanism 46 to stop, so that further flow of molten adhesive into the cavity 59 will be prevented. In this connection, the wheel 51 will continue its application of the molten adhesive and, consequently, will cause drainage of the adhesive within the cavity 59 and reduction of the air pressure therein. When this air pressure is reduced below the selected value at which the pressure switch 65 is actuated, the switch will open to cause the valve 44 to open and the clutch controlled drive mechanism 46 to restart, to thereby resume the feeding of the molten adhesive into the cavity 59.

Referring now to the applicator wheel 51, it will be observed that its circumferentially extending periphery is patterned, as determined by the requirements of each installation. In this connection, the pattern may be such as to produce either continuous lines or dots, bars and other shapes of adhesive applications at the desired spacings.

The forward side face of the wheel 51 is formed with a suitably located and concentrically disposed recess which conveniently receives a ring heater 66 for maintaining the wheel at proper elevated temperatures. This heater 66 is regulated by a thermostat 67 projecting from the interposed heater cover, which is suitably secured to the wheel 51, as shown.

The wheel 51 is fixedly mounted on shaft 68, the forward portion of which is suitably bored substantially as illustrated for accommodating the electrical lead extending between the terminals of the heater 66 and a commutator 69 mounted intermediate the ends of this shaft 68. The shaft 68 is rotatably suspended by means of head 50 by an interposed bearing assembly 70. The rear end of shaft 68 is rotatably mounted by an outboard bear-

ing assembly 71 suspended from a flange to be described in connection with the cooling barrel assembly 36.

As should be evident, the rings of commutator 69 may be coupled with suitably disposed brushes (not shown) connected to a suitable source of electrical energy, so that, the ring heater 66 can be actuated and thereby generate the desired degree of heat. Although in some instances, the contemplated rotation of the wheel 51 may be induced by movement of the object on which the adhesive is to be applied, it is preferred that an independent drive be utilized which may also be operatively connected to the parent machine for purposes of obtaining synchronization. In this connection, a drive sprocket 72 may be advantageously coupled to the selected main drive. This sprocket is mounted on a sleeve 73 conveniently keyed to the shaft 68 as shown. The sprocket 72 is interposed between a pair of clutch disks 74 also mounted on the sleeve 73. A spring 75 creates the necessary bias of this clutch arrangement to determine the point at which slippage occurs and is adjustable by means of a nut-and-lock-nut assembly 76 which is threadedly received by the rear end of the sleeve 73.

Thus, it will be clear that the drive sprocket 72 when properly connected is adapted to rotate the shaft 68 and consequently the applicator wheel 51. Under such circumstances, the commutator 69 will be coupled to a source of current to properly heat the wheel 51 by energizing the ring heater 66 controlled by the thermostat 67. Obviously, when an undesirable amount of torque is created, the spring biased clutch disks 74 come into play. As the wheel 51 rotates, its gravure pattern will receive molten adhesive, discharged through bore 62, to be applied to the material to be bonded. Naturally, with such gravure wheels 51, the size, shape and the depth of the gravure cavities determine the amount of adhesive applied. Even though the parts of the applicator assembly 32 will be constructed and arranged to obtain the desired tolerances, a certain amount of molten adhesive will be present on the circumferentially extending periphery of the wheel 51 adjacent the gravure cavities. In order to confine the location of such adhesive and prevent it from flowing to or dripping from the sides of the wheel 51, a scraper means is preferably employed. In this connection, a pair of scraper blades 77 having a bottom contour complementing the periphery of the wheel 51 are arranged in a diverging relationship with respect to one another, as clearly shown in FIG. 12. These blades 77 are disposed in suitably formed slots 78 in block 58 and are spring biased, by means of spring 79 against the circumferentially extending periphery of the wheel 51 so that the adhesive will be confined to the gravure cavities and the neighboring areas.

Reference is now made to the heating barrel assembly 34 which serves to heat the hot melt adhesives driven therethrough by screw 38 to the desired temperature prior to their flow into the orifice 52 and discharge by the applicator wheel 51. In this connection, the heating barrel assembly 34 includes a barrel or chamber 80, the front end of which is connected to the head 50 such that the interior of the chamber is in communication with the orifice 52. A barrel heating unit 82 embraces the chamber 80 and extends over a part of its exterior, substantially as shown. In addition, a thermo-well block 84 is on the outer face of the chamber 80 and exposed to the heating effect of the heating unit 82. An insulating material 86, as for example asbestos, is then wrapped around both the heating unit 82 and block 84. An asbestos washer 88 serves to close the heating unit 82 and block 84 at their rear ends and thereby cooperate with the asbestos packing 86. The heating unit 82 is regulated by a thermo-switch control 90 disposed in a suitably formed hole in the block 84. A bracket 92 on the head 50 cooperates to retain the thermo-switch control 90 properly within the block 84. The setting of the thermo-switch

control 90 may be accomplished by means of a dial as shown.

As illustrated, a guard 98 conveniently surrounds the heating barrel assembly 34. A thermometer 102 is mounted by a bracket 104 which is secured to the upper face of the guard 98 and extends through the heating barrel assembly to the chamber 80 for purposes of cooperating with the thermo-switch control 90 in assuring the proper temperature characteristics within the forward part of the chamber 80. A system of cooling fins 106 forming part of a cooling means to be described in detail shortly, surrounds the barrel 80 proximate the heating unit 82 and the block 84, with the asbestos washer 88 interposed therebetween.

It will be recalled, that the granular or pelletized hot melt adhesive contained within the hopper assembly 40 is fed through the chamber 80 and exposed to the heat dissipated by the heating unit 82, by the action of the screw 38. Under the circumstances, it is desirable to minimize and even prevent the transition of the hot melt adhesive employed into its molten form from occurring at too early a stage in the feeding process, and more particularly, at a location substantially before the zones of the barrel 80 embraced by the heating unit 82. It should be clear, that the presence of molten adhesive at the rear end of the barrel 80, especially within the space defined by the cooling barrel assembly 36 adjacent the discharge end of the hopper assembly 40, as well as, the coupling of the shaft 38 to the drive mechanism 42, will tend to hamper proper functioning of the extruder 30. This is particularly true during normal extruding operations, and at such time as it is desired to restart the extruder 30, after shutting it down completely to thereby permit the hot melt adhesive, which is usually thermoplastic, to harden.

Consequently, a cooling means is preferably utilized along those adhesive feeding passages before the heating unit 82 is actually traversed or encountered. To this end, the cooling fins 98 will dissipate heat out through a network of slots 108 in guard 98. In addition to the cooling fins 106, the cooling means includes the cooling barrel assembly 36, which cooperates to circulate a coolant for purposes of lowering the temperature of the ambient surrounding the rear end of the screw 38. In this connection, the cooling barrel assembly includes a barrel 110 coaxial with and forming a continuation of barrel 80. A pair of flanges 112 and 114 are mounted on the barrel 110 in spaced relationship, with the front flange 112 having anchored thereto a ring 116, which secures in place, the rear end of the barrel 80. A cylinder 118 is interposed between, the flanges 112 and 114, and cooperates therewith, as well as with the barrel 110, to provide a conduit 120 for the passage of the coolant, which under ordinary circumstances can be water. An intake pipe 122 is tapped into conduit 120 and is internally threaded at its outer end for coupling with a correspondingly threaded nipple of an inlet hose connection 124 coming from a water supply. A return pipe 126 is tapped into the base of conduit 120 and is likewise internally threaded for receiving, the nipple of a hose connection 128 for purposes of either recirculating the water or disposing of it as desired. Accordingly, if the hot melt adhesive within hopper assembly 40 be in either granular or pelletized form or the like, it will be expected that this adhesive will remain in this form until it is a relatively short distance from the heating unit 82.

The screw 38 is of progressively increased radius along its length from its rear end to the front end, to assure uniform flow characteristics of the molten adhesive through the orifice 52 of the wheel applicator 32. Under such circumstances, the quantity of adhesive driven forward by the rear part of the screw 38, will occupy substantially the entire space between, the outer faces of the forward part of the screw 38 and forward part of chamber 80. The air, that would ultimately become unde-

sirably entrapped in this lower part of chamber 80, is forced to the rear and out through the hopper assembly 40. Further details of the screw 38 will be described shortly in connection with the discussion of the drive mechanism 42 and valve 44.

As stated in the above, the present invention contemplates the use of low cost granular or pelletized hot melt adhesives, such as polyethylene, which are readily handled and result in an overall relatively simple and neat operation. Under the circumstances, the granular form of hot-melt adhesive employed may simply be poured into the hopper assembly 40. Referring now in detail to the hopper assembly 40, it will be observed that a hopper mounting guide 134 is in communication with the interior of the barrel 110 of the cooling barrel assembly 36 and extends through suitably formed openings in this barrel, as well as guard 98 and cylinder 118. This guide telescopically receives the lower cylindrical end 136 of hopper 138. A clamp ring 140 serves to retain the lower end 136 of the hopper 138 in proper relationship with respect to the mounting guide 134. In this connection, an asbestos spacer 142 may be interposed between the upper face of the guard 98 and bottom of the ring 140 to insulate any heat that may tend to be conducted to the ring. As will be appreciated, the hopper 138 may pivotally mount a cover 144 having the usual handle and a transparent gauge 146 for determining the amount of hot melt adhesive in the hopper. In this connection, the discharge of the granular adhesive into the interior of the barrel or chamber 110 can be regulated by incorporating into the hopper assembly 40, a relatively simple feed shut-off 150 which is slidable along suitable tracks on a mounting bracket 152 projecting from the hopper 138. As will be observed, the shut-off 150 is slidable into and out of the interior of the lower end 136 of the hopper 138 to close and open, respectively, the available discharge opening.

The fluid actuated mechanism 42 mentioned in the foregoing, operates to shift the screw 38 to open and close the valve 44 when it is desired to initiate and stop the flow of molten adhesive into the cavity 59. This mechanism 42, accordingly, is coupled to the rear end 156 of the screw 38 projecting beyond the corresponding end of the cooling barrel 110. A sealing ring 158 is preferably interposed between the screw 38 and this end of the barrel 110. The fluid actuated mechanism 42 is enclosed within the housing 160 of the drive means 46, which housing is suitably secured to flange 114 through the employment of a suitable number of bolts, substantially as shown. A spindle 162 keyed to the rear end 156 of the screw 38 is included in this mechanism and is rotatably received by an adapter 164 through interposed spindle bearings 166 and thrust bearings 168. The adapter 164 is formed with a radial flange 170 which is advantageously located in a correspondingly formed recess 172 in the drive housing 160. In this connection, the depth of this recess 172 is somewhat larger than the thickness of the flange 170 so that relative displacement is permissible for reasons that will become evident shortly. One or more guide pins 174 may be employed for assuring proper orientation of the adapter 164 with respect to the surfaces of the drive housing 160. Under such circumstances, the pins 174 may project from the housing 160 into suitably formed openings in the adapter flange 170 while at the same time, permitting relative longitudinal displacement of these members. A flexible diaphragm 176 extends across the recess 172 of the drive housing 160 in bearing relationship with the outer face of the flange 170 of the adapter 164, and, in most instances, is preferably secured thereto. The diaphragm 176 is employed in conjunction with a cover 178 anchored to the drive housing 160 by means of a number of suitably placed bolts, as illustrated. This cover 178 is fabricated with a substantially circular recess 180 of relatively small depth and is substantially coaxial with respect to the recess 172, but possesses a diameter of slightly lesser dimension. The recess 180

in the inner face of the cover 178 communicates with a port 182 in the cover which is adapted to be connected to a fluid pressure supply.

Thus, when the port 182 is tapped to a suitable air pressure supply, the pressurized medium will act against the diaphragm 176 and consequently displace longitudinally the flange 170 relative to recess 172. The adapter 164 will then force the spindle 162 forwardly and at the same time cause shifting of the screw 38 in this direction. As a result of such pressure actuation and movement of parts, the valve 44 will close to seal off the orifice 52 of the applicator assembly 32. Obviously when this pressure is relieved, the diaphragm 176 will function to retract the displaced parts and thereby open the valve 44.

It should be understood that the displacement of parts in the fluid actuated mechanism 42 is of relatively small magnitude because the opening and closing of the valve 44 need only traverse similarly short distances to enable the molten adhesive to be fed properly from the interior of chamber 80 into the orifice 52. The valve 44, under the circumstances, preferably includes a valve plug 186 which may be an integral extension of the screw 38. This plug is adapted to be received by valve seat 188 which may be coaxially formed with respect to the orifice 52 in the applicator head 50.

Turning now to the drive means 46 which is employed to impart the desired rotation to the screw 38, it will be observed that this means may be coupled to a main drive 192 which may be in the form of a flexible shaft. This flexible shaft may be coupled to a parent machine which may be of the type employed in bag manufacturing that supplied the material to be bonded as individual units, such as bag preforms which require their bottoms to be pasted. Accordingly, the drive means 46 will take its drive from the parent machine in rotating the screw 38. Consequently, the adhesive output can be made to be a function of the rate of material feed. As this speed goes up or down the screw speed and adhesive output increases or decreases proportionately to thusly arrive at a continuously controlled adhesive line. The drive means 46 rotates screw 38, as a result of the meshing of a worm wheel 194 secured to the spindle 162 and worm 196 keyed to a worm shaft 198. This shaft 198 has at one end thereof, a clutch plate 200 keyed thereto. This clutch plate 200 is adapted to engage and disengage clutch plate 202 in a manner to be described shortly. A needle bearing 204 is interposed between the clutch plate 202 and shaft 198. A retaining ring 206 is placed on this shaft 198 adjacent the needle bearing 204. A double row ball bearing 208 is interposed between the clutch plate 202 and the adjacent walls of the housing 160, with the retaining ring 210 performing its usual function. The housing 160 at this location may be constructed in the form of a bearing retainer 212 which is adapted to rotatably receive one end of the clutch plate 202 so that it may be coupled to a flexible drive shaft employed in the main drive 192.

The distal end of the worm shaft 198 is coupled to a fluid pressure actuated mechanism similar to that previously discussed so that the worm shaft 198 can be shifted longitudinally to cause clutch plate 200 to engage or disengage the clutch plate 202, as the case may be, for purposes of rotating or stopping the movement of the screw 38. This fluid actuated mechanism can also be of the flexible diaphragm variety, but it should be understood that a cylinder and displaceable piston type of unit can be employed.

Thus, this end of the worm shaft 198 is rotatably mounted by means of a bearing 216 to an adapter 218. The bearing 216 is suitably retained in place by means of a pin 220 and ring 222, substantially as shown. The adapter may include a central plug 224 and packing 226 together with a radial flange 228. This flange 228 is capable of shifting in an accommodating recess 230 formed in the housing 160, with the proper orientation of these parts maintained by the utilization of one or more

guide pins 232. The displacement of the flange 228 in the recess 230 should be sufficient to permit the clutch plates 200 and 202 to engage as well as disengage.

In addition, it is contemplated in some instances that this relative movement be sufficient to move the worm 196 laterally to rotate the worm wheel 194 and screw 38 radially, counter to the screw's normal rotation. This would be done to off-set any slight pistoning effect on the molten adhesive incident to the driving of the screw 38 forwardly for valve shut-off. As will be appreciated by those skilled in the art, the worm 196 and worm wheel 194 for such requirements, would be of the self-locking type to prevent the worm 196 from rotating during its retraction. Naturally distal means could be employed to lock the worm 196 to prevent it from rotating.

A flexible diaphragm 236 cooperates to shift the adapter 218 and consequently the worm shaft 198 together with the worm 196 keyed thereto. This diaphragm 236 extends across the recess 230 in the drive housing 160, and is suitably secured in place for proper functioning by means of a covering plate 238, which may be secured to the housing 160 by means of a suitable number of bolts. A threaded adapter 240 may project through the cover 238 for purposes of communicating with the outer face of the diaphragm 236 so that a suitably connected fluid pressure supply can be exposed to this face. It should be understood that an outlet or bleeding port may communicate with the inner face of the diaphragm 236. Suitable tubing and fittings may obviously be employed to connect this port to a fluid pressure supply and exhaust line. In an effort to supplement the retraction of the worm 196 and naturally shaft 198 and adapter 218, one or more compression springs 244 may be employed, substantially as shown.

Thus, when the diaphragm 236 is flexed inwardly against the outer face of the adapter 218, shaft 198 and consequently the worm 196 will be shifted axially so that the clutch plates 200 and 202 engage to permit the main drive 192 to rotate the screw 38 through interposed worm 196 and worm wheel 194. By the same token, when it is desired to stop the rotation of the screw 38 the clutch plates 200 and 202 need only be disengaged by the retraction of the diaphragm 236.

As previously stated, the shiftable bracket mount 48 is adapted to raise and lower the extruder 30 for purposes of removing or applying, respectively, the applicator wheel 51 relative to the material to be bonded. The raising and lowering of both extruder 30 and applicator assembly 32 is illustrated, respectively, by phantom and solid lines in FIG. 4. To this end, the bracket mount 48 includes a bracket 250 having a base plate 252, which is adapted to be bolted to a support platform or table 254, and vertical bracket arms 256 and 258. These arms, at their upper ends, mount a transversely extending rod 260 which rotatably mounts an end of a cylinder 262. The arms 256 and 258, in addition, include laterally extending sectors supporting a pivot pin 264 which serves to rotatably receive a pair of arms 266 and 268 which are integral projections of the drive housing 160. In this connection, the housing 160 includes a downwardly depending base 270 which had a pivot pin 272 pivotally mounting one end of link 274, as well as link 276. The base 270 is adapted to rest upon an adjustment stud 278, substantially as shown, for purposes of adjusting the position of the applicator wheel 51 with respect to the material to be bonded. The other ends of links 274 and 276 are pivotally connected to an eccentric pivot pin 280 which also mounts an eccentric lever 282 pivotally engaged with the rod 284 of the piston displaceable in cylinder 262. This lever 282 has transverse eccentric bosses on which the links 274 and 276 rest. The solid and dash lines of FIG. 7 represents the location of the foregoing parts when the applicator assembly 32 is in a position to apply molten adhesive to the material to be bonded. On the other hand, the dot-dash lines represent the relative

location of these parts when the extruder 30, and, consequently, the applicator assembly 32 are elevated. This elevation is accomplished by means of the actuation of the piston 284 relative to its mounting cylinder 262. Thus it will be seen that, the eccentric lever 282 will cause the links 274 and 276 to shift forwardly and at the same time at a fixed radius about pin 264 during this elevation. The manner in which this is done in relationship to the operation of the various other parts of the extruder 30 will be explored in detail shortly.

A control panel 306 is conveniently located for mounting and exposing the various control switches and pilot lights to actuate and indicate the operation of the aforementioned heaters. In addition the control panel may include a main operating switch and light as well as any hand levers for the pneumatic valves set forth below.

Reference is now to FIGS. 10 and 11 which illustrate schematically a pneumatic circuit usable with the present invention for purposes of placing the extruder 30 in both an operating and non-operating position independently or jointly with the overall operation of the wheel applicator 28. Accordingly, in FIG. 10, extruder 30 is shown in an operating position during which hot melt adhesive in molten form is extruder and applied to the material to be bonded by a lowered applicator wheel 51. It should be understood, that the wheel applicator 28 has such circuitry tapped into a suitable compressed air supply (not shown) which may be advantageously led into a suitable air filter (not shown) and master control switch or valve (not shown). The line pressure 308 is passed into a pressure gauge 309 into a four-way valve 310 which may be operated manually and of a type commercially available. This four-way valve 310 includes adjustable bleed controls 311 and 312 for venting or exhaust purposes. In the illustrated position of the wheel applicator 28, the compressed air passes through the four-way valve 310 into the double acting air cylinder 262 employed to shift the piston rod 284 in moving the extruder 30 and wheel applicator assembly 32 upwardly and downwardly with respect to the material to be bonded. Thus in the lowered position of the wheel applicator assembly 32, the piston rod 284 is projected with respect to its mounting cylinder 262, so that adhesive may be applied by the rotating applicator wheel 51.

The line pressure 308 is additionally branched off through pressure regulator 313 which is coupled to an air pressure gauge 314. This regulator 313 as well as gauges 309 and 314 may appear on the control panel 306, if desired, and will serve to accomplish their usual functions. The compressed air after passing through pressure regulator 313 is connected to a solenoid controlled four-way valve 315 of a type that is commercially available. This valve also includes a pair of adjustable bleed controls 316 and 317. The solenoid windings 318 are incorporated in a circuit including the pressure switch which is responsive to the air pressure in cavity 59 of the wheel applicator assembly 32. The circuit will be connected to a suitable source of electrical energy and is normally maintained opened by the pressure switch 65, which closes when a pre-set pressure is created within the cavity 59. It will be observed that the valve 315 is coupled to diaphragm 236 employed in the present invention for causing the clutch plates 200 and 202 to engage as well as disengage. The diaphragm 236 is shown in its extended position at which the clutch plates 200 and 202 are engaged so that the main drive 192 rotates the worm 196 and worm wheel 194 to turn the screw 38. Under the circumstances, the granular or pelletized hot melt adhesive contained in the hopper 138 passes down through the hopper base 136 and guide 134 into the interior of the barrel 110, from whence it is driven by the rotating screw 38 through the chamber 80 out through the orifice 52 into the cavity 59.

The valve 315 is also coupled to the diaphragm 176; and in the instant position of the extruder 30, the dia-

phragm 176 is in a retracted position thereby unseating valve 44. In this connection, the recess 130 is subjected to an exhaust passing through the valve 315 and out of the bleed control 317.

As will be appreciated, as the hot melt adhesive is thusly extruded, it will flow into cavity 59 and pass out through bore 62 onto the patterned circumferentially extending periphery of the applicator wheel 51. This wheel 51 will be experiencing a predetermined rate of rotation through a selected drive coupled to the sprocket 72; and under the circumstances, adhesive will be applied to the material to be bonded in accordance with the predetermined pattern. The parameter of the applicator parts, their relative movements and the amount of adhesive extruded will be such that molten adhesive will build-up in cavity 59, notwithstanding a constant application of adhesive by the rotating wheel 51. Consequently, the pressure of the air within cavity 59 above the adhesive build-up will increase to thereby actuate the pressure switch 65 at a pre-set value. At such time, the solenoid windings 318 will be energized to shift the valve 315 to a position equivalent to that illustrated in FIG. 11, whereby the clutch plates 200 and 202 will disengage and the valve 44 will close. Accordingly, molten adhesive will be prevented access into the cavity 59 from the extruder 30, with the result that the contained adhesive in cavity 59 will be constantly drained and the air pressure therein reduced. It should be borne in mind, that the wheel applicator 28 will still be in its lowered position, at which, the wheel 51 is adapted to apply adhesive to the material to be bonded, and will continue its rate of rotation to facilitate such adhesive drainage. When the air pressure within cavity 59 has dropped sufficiently, in accordance with the setting of the pressure switch 65, the switch will open to thereby permit the valve 315 to return to its original position, at which, the clutch plates 200 and 202 engage and the valve 44 opens. Thus, the foregoing should render it clear that there will not be any underfeeding of hot melt adhesives to the applicator wheel 51 by the extruder 30.

When it is desired to place the entire wheel applicator 28 in an inactive position, the valve 310 and 315 will assume the positions illustrated schematically in FIG. 11. Thus, the line pressure 308 will pass through valve 310, the piston within cylinder 262 will be retracted to place the extruder 30 and wheel applicator assembly 32 in their raised positions at which they are elevated from material to be bonded. The air within the cylinder 262 behind the contained piston will be exhausted out through the bleed control 311 of the valve 310.

In addition, the line pressure 308 will enter the valve 315 and will flex the diaphragm 176 outwardly and consequently force the screw 38 to shift forwardly to close the valve 44, thereby preventing further flow of the molten adhesive within the chamber 80 into bore 52 and cavity 59. At the same time, the diaphragm 236 will be retracted to disengage the clutch plates 200 and 202, with the air behind this diaphragm being exhausted out through vent 316. Accordingly, the adhesive application is deliberately stopped to be restarted by simply lowering the wheel applicator assembly after the flow characteristics of the molten adhesive within cavity 59 onto the circumferentially extending patterned periphery of the wheel 51 are proper and sufficient for purposes of attaining the desired adhesive application pattern.

Thus, the aforementioned objects and advantages are most effectively achieved. Although several preferred embodiments of the invention have been disclosed herein, it should be understood that the present application is in no sense limited thereby and should be determined by the scope of the appended claims.

I claim:

1. A hot melt adhesive applicator comprising in combination: an adhesive applicator wheel mounted for rotation and adapted to apply hot melt adhesive in molten

form to a material to be bonded; feed means for supplying the molten adhesive to said applicator wheel; control means for regulating the amount of molten adhesive fed by said feed means, said control means comprising a pressure sensitive switch means responsive to the quantity of molten adhesive fed by the feeding means to the applicator wheel; means operatively connected between the pressure sensitive means and the feed means for affecting the operation of feed means, said control means further including a fluid chamber having a gaseous medium section and a molten adhesive section, said molten adhesive section being adapted to receive molten adhesive and being in communication with outer surfaces of said wheel, said feed means communicating with said chamber and adapted to feed molten adhesive to said molten adhesive section of said chamber to said outer surfaces of said wheel; said pressure sensitive means communicating with said gaseous medium section and being free from said molten adhesive, said pressure sensitive means being set to respond to a predetermined pressure of gaseous medium in said gaseous medium section of said chamber upon compression of said gaseous medium caused by the accumulation of molten adhesive in said molten adhesive section of said chamber as said molten adhesive is fed by the feed means to the outer surfaces of the wheel, and said means operatively connecting said pressure sensitive means and said feed means being operable to stop said feed means upon experiencing said predetermined pressure by said pressure sensitive means and to restart the operation of said feed means when the pressure of the gaseous medium within said chambers drops below said predetermined pressure.

2. The invention in accordance with claim 1 wherein thermostatically controlled heating means supply heat to both said chamber and said wheel for cooperating to maintain the hot melt adhesive in molten form.

3. A hot melt adhesive applicator comprising in combination: an adhesive applicator wheel mounted for rotation and adapted to apply the hot melt adhesive in molten form to a material to be bonded; feed means for supplying the molten adhesive to said applicator wheel; control means for regulating the amount of molten adhesive fed by said means; and said feed means comprising an orifice in communication with said control means and through which molten adhesive is adapted to flow, an elongated chamber having an interior communicating with said orifice, a thermostatically controlled heater means embracing said chamber along a portion of its length adjacent said orifice for placing hot melt adhesive in said chamber in a molten condition, cooling means at an end of said chamber distal said orifice for minimizing the thermal effects of said thermostatically controlled heater means on said hot melt adhesive in said chamber at said one end, hopper means for supplying hot melt adhesive into said one end of said chamber, a rotatable screw within said chamber for forcing the hot melt adhesive through said chamber and the molten adhesive through said orifice, drive means for rotating said screw, and means for shifting said feed means to raise and lower said wheel to place said wheel away and near, respectively, the surface on which the hot melt adhesive is to be applied.

4. A hot melt adhesive applicator comprising in combination: an adhesive applicator wheel mounted for rotation and adapted to apply the hot melt adhesive in molten form to a material to be bonded; feed means for supplying molten adhesive to said applicator wheel; control means for regulating the amount of molten adhesive fed by said means; and said feed means comprising an orifice in communication with said control means and through which molten adhesive is adapted to flow, an elongated chamber having an interior communicating with said orifice, a thermostatically controlled heater means embracing said chamber along a portion of its length adjacent said orifice for placing hot melt adhesive

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in said chamber in a molten condition, cooling means at an end of said chamber distal said orifice for minimizing the thermal effects of said thermostatically controlled heater means on said hot melt adhesive in said chamber at said one end, hopper means for supplying hot melt adhesive into said one end of said chamber, a rotatable screw within said chamber for forcing the hot melt adhesive through said chamber and the molten adhesive through said orifice, drive means for rotating said screw, and said feed means further includes means for cooperating to inhibit the flow of molten adhesive from said chamber into said orifice upon cessation of operation of said screw, the inhibiting means comprising a valve including a valve plug on said screw and a valve seat at said orifice for receiving said plug and means cooperating to shift the screw to open and close the valve.

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5. The invention in accordance with claim 4 wherein said cooling means includes liquid circulating conduits and cooling fins projecting from said chamber at a location intermediate said conduits and thermostatically controlled heater means.

6. The invention in accordance with claim 4 wherein said drive means is clutch controlled and said screw increasing in root diameter along its length in a direction away from said one end and towards said orifice.

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