This invention relates to improvements in devices for applying adhesive material to surfaces of the type in which the adhesive is supplied to the device in solid rod or rope form, and in which the adhesive is heated to bring it to a plastic or liquid condition, for application to the surface to be coated by an applying roll formed part of the applying device.

An applying device of the character to which the present invention is applicable is shown in copending application Serial No. 642,013, filed February 25, 1957.

More particularly the present invention relates to means for feeding the solid rod or rope of adhesive to the heating chamber and applying roll of the applying device.

In prior devices the adhesive rope has been fed into the applying portion of the device by driven feed rolls, or under constant continuous pressure exerted by springs or similar means.

Such prior feeding methods have proved unsatisfactory because of the variation in the pressure conditions created adjacent the applying roll when the adhesive has been brought to a liquid state, resulting in variations in the amount of adhesive advanced by the roll and an objectionable build of pressure during interruptions of the operation.

It is an object of the invention to provide a feeding mechanism which is, to a substantial degree, automatically responsive to the adhesive needs of the applying roll and which is easily and finely adjustable to meet the requirements of differing operative conditions, various adhesive formulations and variations in temperature.

Other and further objects will be made apparent in the disclosures of the accompanying drawings and in the following specification and claims.

In the accompanying drawings,

Fig. 1 is a plan view of a glue applying device embodying the invention;

Fig. 2 is a sectional view substantially on line 2—2 of Fig. 1;

Fig. 3 is a detail sectional view substantially on line 3—3 of Fig. 2;

Fig. 4 is a detail sectional view substantially on line 4—4 of Fig. 2;

Fig. 5 is a sectional view substantially on line 5—5 of Fig. 2;

Fig. 6 is a detail view showing the under face of one of the feeder paws;

Fig. 7 is a detail, generally perspective view of the roll engaging face of the supply plunger, and

Fig. 8 is a detail, generally perspective view of a lip member of the housing of the plunger.

Referring to the drawings, the applying device is shown as comprising a housing generally indicated at 1, made up of a member 2 which is channelled along one side as at 3 (Fig. 5), to form a guideway in which a supply plunger 4 is mounted. The open side of channel 3 is closed by a member 5 which is provided with suitable electrical heating units 6 and a thermostat 7 by which the heating units are controlled in a conventional and well known manner. The members 2 and 5 are supported from a bracket 8, a block of heat insulating material 9 being interposed between the bracket and member 5. The members 2, 5 and 9 are secured to each other and to bracket 7 by suitably positioned cap bolts. An adhesive applying roll 15 is carried by a shaft 16 (as shown the roll is formed integral with the shaft) which is journaled as at 17 and 18 in the forward ends of members 2 and 5, the journal bearings being lubricated through a suitable system of ducts as indicated at 19, Figs. 2 and 5. The roll 15 is provided on its peripheral surface with a plurality of adhesive receiving recesses 20, spaced from each other and from the edges of the roll. The adjacent end of plunger 4 is formed with an arcuate surface 21, having the same radius as the surface of the roll, and is recessed to form a chamber 22, the arcuate surfaces of plunger 4 being dimensioned with respect to the dimensions and arrangement of the recesses 20 that the adhesive carried by the roll from chamber 22 is confined to that in the recesses 20. The plunger 4 is formed with a bore 23 opening from chamber 22 to the rear end of the plunger in which a tubular member 24 is threaded with a Friedrichs 25 extending outwardly from the rear end of the plunger. A coupling member 25 formed of heat insulating material is threaded on the rearwardly extending portion of member 24 and turned into tight engagement with the adjacent end of the plunger 4. A tubular member 26 is threaded into the rear end of coupling member 25 to tightly couple the members 24 and 26 together with a heat insulating washer 27 interposed between their adjacent ends. The open rear end of the channel 3 in member 2 is bridged by a strip 29, of heat insulating material, secured to the rear end of member 2 by a pair of nuts 30 and held spaced therefrom by sleeves 31 surrounding the screws. Coupling member 25 is formed with a flange 32 and a coiled spring 33 compressed between strip 29 and flange 32 resiliently urges the arcuate end of the plunger 4 against the peripheral surface of roll 15. The plunger 4 is held in proper radial alignment to the guidance by guide screws 35 extending through member 2 into the channel 3.

Rearwardly of coupling member 25 the member 26 extends through a heating block 36 secured to the member 26 by screws 37. Block 36 carries an electric heating element 40 and a thermostat 41 by which the heating element is controlled in a conventional and well known manner.

The adhesive is supplied to the device in a solid rod or rope form as indicated at A, and is fed into the rear end of tubular member 26 by means which are automatically responsive to a change in back pressure on the rope. Rearwardly of the entrance to member 26 the rope A passes along the bottom of grooves 45 and 46 formed respectively in successive, spaced blocks 47 and 48, and beneath paws 49 and 50 pivoted respectively in grooves 45 and 46, which paws are pressed into engagement with the rope A by respective leaf springs 52 which bridge the grooves and are fixed to the blocks by screws 53. The springs engage screw 54, threaded in the paws, by which the pressure exerted by the springs 52 on the rope A may be adjusted. The paws are conveniently provided with finger pins 55 by which the paws are manually raised for initially passing the rope beneath the paws. As shown the rope engaging face of each paw is recessed as at 57 to provide forwardly directed sharp edges 58 engaging the side portions of the rope, preventing rearward movement of the latter.

Block 48 is fixed by screws 60 to a transverse extension 61, Fig. 1, of bracket 8. Block 47 is carried by an arm 63 fixed to one end of a rock shaft 65 journaled in a bearing 66 extending from bracket 8. An arm 67, fixed
to the opposite end of shaft 65, carries a cam follower 68 which engages a cam 69 fixed in the housing and a shaft 70 journaled in a bearing formed in member 61. The cam 69 is formed of two members held in adjusted angular relation to each other by screw and slot connections 71 so that the length of the high and low dwells may be adjusted. The cam roll 68 is urged against cam 69 by a spring 73 connected at one end to a breaker 9 and at the other end being connected to the end of a threaded rod 75 extending through block 47 and provided with a knurled nut 76 by which the effective tension of spring 73 may be adjusted. A set screw 77 holds rod 75 in adjusted position in block 47.

Cam shaft 70 carries a sprocket 80 connected by a sprocket chain 81 to a sprocket 82 on a counterbalance main drive shaft 83 powered from any suitable source. Shaft 83 also carries a sprocket 84 connected by a sprocket chain 85 connected to a sprocket 86 on a cross shaft 87. Shaft 87 carries a second sprocket 88 which is connected by a sprocket chain 89 to a sprocket 90 carried by shaft 16 of applying roll 15. Thus the applying roll 15 and cam 69 are constantly driven. A pivoted idler sprocket or roll 91 maintains desired tension on the sprocket chain 89.

As block 47 is oscillated by cam 69 the rod or rod A of solid adhesive is engaged by pawl 49 on its forward stroke and the cam roll 68 is urged against cam 69 and into the tubular members 26 and 24, and into chamber 22. A screw 92 having a knurled head 93 is threaded through block 47 into engagement with stationary block 48 to advantageably limit the forward movement of block 47 and the length of the feeding stroke of pawl 49. A set screw 94 maintains screws 92 in adjusted position. As the rod A advances through members 26 and 24 it is softened and brought to a liquid state in chamber 22 by the heat supplied by heaters 40 and 6 as later more fully described.

As previously described the formed end of plunger 4 makes an accurate contact with the peripheral surface of roll 15 under the pressure of spring 33 so that the adhesive advanced from chamber 22 at the roll rotates, in the direction of the arrow in Fig. 2, is confined to the recesses 20. The chamber 22 is provided with a transverse baffle 95, held in place by a screw 96, which is triangular in cross section so that as the fluid adhesive is forced into the narrowing space between the face of the roll 15 and the adjacent faces of the baffle by the pressure on the adhesive in chamber 22 the pressure increases assuring a complete filling of the recesses 20.

The walls of channel 3 opposite the peripheral surface of roll 15 are formed as arcuate surfaces on a radius slightly greater than that of the roll so that the roll rotates as indicated at 97 with its peripheral surface coating an adjacent but free of contact with the housing formed by member 2 and block 5, the roll being heated by conduction from block 5 while the adhesive in recesses 20 is further radiantly heated from the closely adjacent housing walls as the roll surface passes outwardly of the housing for application of the adhesive in the recesses to the surface of a blank or other surface with which the portion of the roll outwardly of the housing is brought into rolling contact. Preferably and as shown, the roll makes contact with the surface to which the adhesive is to be applied immediately after the adhesive filled recesses 20 emerge from the housing and the adhesive is transferred substantially cleanly to such surface.

As shown in Fig. 7, the lower portion of the arcuate face of plunger 4 is relieved to form a channel 98 of decreasing width and depth from the outer edge of the plunger to a line adjacent to the chamber 22 so that any fluid retained at the edge of recesses 20, or on the adjacent unrelied portion of the surface of roll 15, will not be scraped or doctored off by the outer edge of the plunger but will be carried inwardly between the roll and the face of channel 98 and scraped or doctored back into the recesses 20 by the inclined edges 99 and the transverse edge 100 at the inner end of the channel 98. The decreasing depth of channel 98 and the unchannelled portion 101 between the inner end of channel 98 and chamber 22 is of such transverse dimensions that the transverse dimensions of the recesses 20 and prevents escape of adhesive from chamber 20 to the channel 98.

In case the formulation of the adhesive is such as to cause objectionable 'stringing' of the adhesive as the roll leaves the surface to which it is applied, a bar member 105, having an arcuate surface 106 spaced from roll 15, is secured to the housing, as by screws 110. Any 'string' formation is severed at the edge 107 and any portion of the 'strings' drawn inwardly by the roll is melted by the heat conducted to bar 105 and drains to the sides of the bar by outwardly extending channels 108 shown in Fig. 8.

By the structural arrangements above described the feeding of the adhesive proceeds as follows. The adhesive in solid rope or rod form is forced into the tubular passage of member 26, which extends through the block 33 which is forced by the eccentric 30, and into a passage of spring 73 acting on pawl 49. The diameter or cross sectional dimensions of the passage through member 26 with respect to the diameter or cross sectional dimensions of the rope is made such that the rope makes a relatively snug fit in the passage. Block 36 is substantially heat insulated by members 28 and 29 from the housing and the spring 1 and plunger 4 so that the heat applied to the rope in its passage through member 26 is that supplied by heater 40 under control of its thermostat 41. The heat transferred to the rope in its passage through member 26 is insufficient to soften the rope to a point where substantially form stability is lost so the rope or rod acts piston fashion to maintain hydraulic pressure on the adhesive in the forward portion of passage 23 and chamber 22 which has been brought to a liquid state by heaters 6 under the control of thermostat 7. The heat transfer to the adhesive by heaters 6 is made such that the adhesive in the chamber 22 is maintained at the best degree of viscosity for handling and application by roll 15 and under a predetermined pressure. As is apparent in Fig. 2 the passage in member 24 tapers toward the chamber 22 so that as the adhesive becomes more fluid the rate of flow under the pressure being exerted by spring 73 through pawl 49 and the solid portion of the rope or rod A is balanced to the needs of roll 15. This balance of temperature, pressure and flow conditions is nicely adjustable and automatically maintained for a given adhesive formulation by the adjustment of the spring pressure by means of screws 75, adjustment of the stroke of block 47 by screw 93, adjustment of the length of time that pressure is applied, by adjustment of the members of cam 69, and the maintenance of the needed temperatures and temperature differential between members 36 and plunger 4 by the thermostats. By way of example a temperature of 210° F. at heater 40 and a temperature of 320° F. at the heaters 6 have been found satisfactory for the temperature available in rope or rod form. The various adjustments above mentioned are empirically made to assure the needed supply of adhesive to the roll 15, without build up of excess pressure which tends to force liquoried adhesive rearwardly between the incoming solid portion of the adhesive and member 26. If at any time, at the start of or during the feeding stroke of pawl 49, the back pressure equals the pull of spring 73 the forward swing of block 57 will be inhibited and cam roll 68 will be held from contact with the low portion of the cam 69. The adjustments provided, and above described, minimize the tendency for back pressure, avoidable, slight and temporary excesses of back pressure are automatically compensated for by the described inhibiting of the feeding pawl movement, and a reliably uniform leak-free operation is obtained.

The length of thermoplastic adhesive in solid rope or rod form illustratively shown at A is of a type that is
provided with longitudinal grooves a and accordingly the cross-sectional shape of the rear portion at least of the passages in member 26 is made to conform to the cross-section of the solid adhesive by means of screws 37 having points b which conform in shape to, and fill, the grooves a. Where the length of adhesive is round in cross-section the points b will be omitted, and it will be understood that if the length of solid adhesive is supplied in octagonal or other cross-sectional form the passages in member 26, or at least its rear portion will be made to conform to that shape. Most, if not all, the thermoplastic adhesive formulations expand upon melting. The grooves a in effect enlarge the capacity of the passages in members 24 and 26 in proportion to the volume of solid adhesive moving in the passages forwardly of the restricting screw points b. As the pressure builds up in chamber 22 and the adjacent portion of the passage 23, liquified, or partially liquified adhesive will be forced back along the grooves a. As will be obvious the same effect will be obtained by providing longitudinal grooves in the wall of the passage in member 26, beyond the points b, or otherwise increasing the cross-sectional dimensions of that portion of the passage. In either case the back flow of heated material which tends to warm the incoming length of solid adhesive, and the differential in the heat supplied by the heaters 6 and 40 will be adjusted accordingly. The recesses presented opposite chamber 22 form part of the volumetric capacity of the chamber. As the recesses 20 enter the chamber empty, and fill with liquid adhesive a drop in pressure results, and this drop, while slight, may, in conjunction with a drop in pressure during the rearward movement of the feeding pawl or from other causes such as temperature fluctuations or the fact that because of the speed of rotation of the roll the air in the entering empty pockets may not be completely displaced by uniform pressure in the chamber, result in an incomplete filling of one or more of the recesses 20 before the recessive chamber. This danger is avoided by the baffle 95, the narrowing of the space between the baffle and the adjacent face of the roll which assures proper filling of the recesses under the operating conditions established by the previously described adjustments. It will also be understood that the pressure exerted by the pawl spurs 82 be adjusted by screws 54 to provide the needed feeding and holding grip of the pawls on the solid adhesive.

As illustrated the bracket 8 is formed with a saddle member 111 which seats on a frame member F of a tray forming machine by means of a strap plate 112 which clamps the bracket 8 to the frame member by screws 113.

As indicated in Fig. 1 an applying device may be mounted adjacent each corner of the mandrel M of a tray machine, and it will be understood that the device of the invention may be similarly used in various container forming, carton or bag closing or wrapping machines.

What is claimed is:

1. A adhesive applying device comprising a housing, an adhesive applying roll rotatably mounted in the housing for rotation free of peripheral contact therewith and having a portion of its peripheral surface extending outwardly from the housing, the peripheral surface of the roll being relieved to provide a plurality of recesses separated from each other and the peripheral edges of the roll by unrelieved portions of said surface, a plunger mounted in the housing and having an arcuate surface engaging and conforming to a portion of the peripheral surface of the roll within the housing, a passage extending longitudinally through said plunger for supplying adhesive to the peripheral portion of the roll exposed therein, means yieldingly urging the portion of said arcuate surface surrounding said passage against the unrelieved portions of the peripheral surface of the roll, the said portions of said arcuate surface being of sufficient extent to confine the adhesive carried by the roll to said recesses, and means to apply a solid length of adhesive to the outer end of said passage, the outer end portion, at least, of said passage substantially conforming in cross sectional shape and dimensions to the cross sectional shape and dimensions of the length of adhesive, means to heat the roll and the portion of said passage adjacent thereto to a temperature to liquify the adhesive, supplying means applying yielding pressure to the length of solid adhesive outwardly of said passage to advance the length into and along said passage and apply hydraulic pressure to the liquified adhesive in the forward portion of the passage, and means to adjust the yielding pressure applied by said oscillating means to said solid length of adhesive whereby the stroke of said oscillating means is automatically reduced in response to a predetermined rise in the hydraulic pressure of the liquified adhesive to thereby maintain said hydraulic pressure constant.

2. An adhesive applying device as in claim 1 having a baffle extending transversely of said passage adjacent the roll, the face of said baffle adjacent the roll being inclined to provide a narrowing passage between the opposed faces of the baffle and roll in the direction of rotation of the roll.

3. An adhesive applying device as in claim 1, the rear portion of said passage being heat insulated from the forward portion to maintain that portion of the length of adhesive which is in said rear portion of the passage in a solid condition.

4. An adhesive applying device as in claim 3, the rear portion of said passage being in the form of a tubular extension coupled to the plunger by a heat insulating coupling.

5. An adhesive applying device as in claim 4 having means to heat said tubular extension to a temperature only sufficient to soften the surface of the length of adhesive passing therethrough to effect a lubrication of the wall surface of the passage through said extension.

6. An adhesive applying device comprising a housing, an adhesive applying roll rotatably mounted in the housing for rotation free of peripheral contact therewith and having a portion of its peripheral surface extending outwardly from the housing, the peripheral surface of the roll being relieved to provide a plurality of recesses separated from each other and the peripheral edges of the roll by unrelieved portions of said surface, a plunger mounted in the housing and having an arcuate surface engaging and conforming to a portion of the peripheral surface of the roll within the housing, a passage extending longitudinally through said plunger for supplying adhesive to the peripheral portion of the roll exposed therein, means yieldingly urging the portion of said arcuate surface surrounding said passage against the unrelieved portions of the peripheral surface of the roll, the said portions of said arcuate surface being of sufficient extent to confine the adhesive carried by the roll to said recesses, means to supply a solid length of adhesive to the outer end of said passage, the outer end portion, at least, of said passage substantially conforming in cross sectional shape and dimensions to the cross sectional shape and dimensions of the length of adhesive, means to heat the roll and the portion of said passage adjacent thereto to a temperature to liquify the adhesive, an oscillating pawl engaging the length of solid adhesive outwardly of said passage, spring means to advance the pawl and thereby advance the length into and along said passage and apply hydraulic pressure to the liquified portion of the adhesive in the forward portion of the passage, a cam member limiting the forward movement of the pawl and returning it to its rearward position, the forward stroke of the pawl permitted by the cam being automatically reduced when the hydraulic pressure of the liquid adhesive exceeds the power of said spring, and holding means preventing retrograde movement of the
length of adhesive during the rearward movement of the pawl.

7. An adhesive applying device as in claim 6, the rear portion of said passage being in the form of a tubular extension coupled to the plunger by a heat insulating coupling.

8. An adhesive applying device as in claim 6 having means to adjust the power of said spring.

9. An adhesive applying device as in claim 8 having means to adjust the length of stroke permitted the pawl by the cam.

10. An adhesive applying device as in claim 9, said cam being a rotary cam and means to drive said roll and cam in timed relation.

11. An adhesive applying device as in claim 10, the cam being angularly adjustable to vary the dwell of the pawl in its forward and rear positions.

12. An adhesive applying device comprising a housing, an adhesive applying roll rotatably mounted in the housing for rotation free of peripheral contact therewith and having a portion of its peripheral surface extending outwardly of the housing, the peripheral surface of the roll being relieved to provide a plurality of recesses separated from each other and the peripheral edges of the roll by unrelieved portions of said surface, a plunger mounted in the housing and having an arcuate surface engaging and conforming to a portion of the peripheral surface of the roll within the housing, a passage extending longitudinally through said plunger for supplying adhesive to the peripheral portion of the roll exposed therein, means yieldingly urging the portion of said arcuate surface surrounding said passage against the unrelieved portions of the peripheral surface of the roll, the said portions of said arcuate surface being of sufficient extent to confine the adhesive carried by the roll to said recesses, means to supply a solid length of adhesive to the outer end of said passage, the outer end portion, at least, of said passage substantially conforming in cross sectional shape and dimensions to the cross sectional shape and dimensions of the length of adhesive, means to heat the roll and the portion of said passage adjacent thereto to a temperature to liquify the adhesive, the rear portion of said passage comprising a tubular extension coupled to the plunger by a heat insulating coupling, an oscillating pawl engaging the length of solid adhesive outwardly of said passage, spring means to advance the pawl and thereby advance the length into and along said passage and apply hydraulic pressure to the liquified portion of the adhesive in the forward portion of the passage, a cam member limiting the forward movement of the pawl and returning it to its rearward position, the forward stroke of the pawl permitted by the cam being automatically reduced when the hydraulic pressure of the liquid adhesive exceeds the power of said spring, holding means preventing retrograde movement of the length of adhesive during the rearward movement of the pawl, and means, operating independently of said heating means, to raise the temperature of the surface only of said length of solid adhesive to effect a lubricated movement of said length through said tubular extension.

13. An adhesive applying device comprising a housing, an adhesive applying roll rotatably mounted in the housing and having a peripheral portion extending outwardly of the housing, said housing including a member making a fluid tight engagement with an arcuate portion of the peripheral surface of the roll within the housing, said member being provided with a passage extending therethrough and opening at one end outwardly of the housing and at the other end to the said engaged peripheral surface portion of the roll, means to supply a solid length of adhesive to the outer end of said passage, the outer end portion, at least, of said passage substantially conforming in cross sectional shape and dimensions to the cross sectional shape and dimensions of the length of adhesive, means to heat said roll and said passage adjacent thereto to a temperature to liquify the adhesive, the peripheral surface of said roll being provided with a plurality of recesses spaced from each other and the peripheral edges of the roll, means to apply pressure to the length of solid adhesive in the direction of said roll, and means actuating said pressure applying means to intermittently advance said length of adhesive into and along said passage a distance determined by the hydraulic pressure of the liquid adhesive between said roll and the length of solid adhesive resulting from the advance of the latter.

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