April 30, 1963 F. RUZA 3,087,390

METHOD AND APPARATUS FOR COOLING AND CURLING EDGES OF POLYETHYLENE COATED PAPER CUPS

Filed June 29, 1961 2 Sheets-Sheet 1

FIG. 1

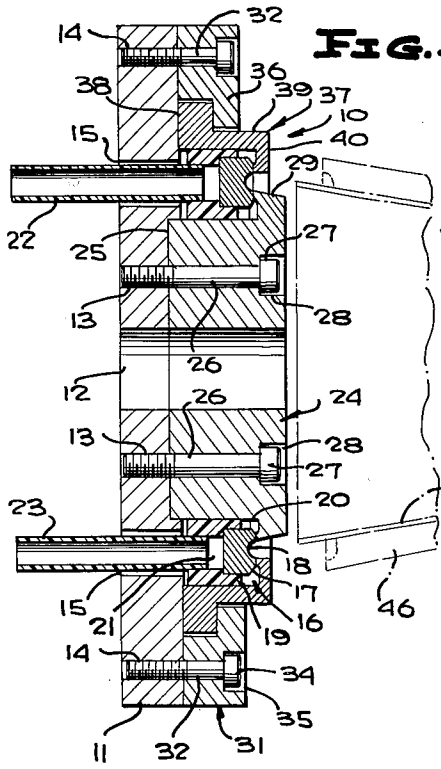


FIG. 3

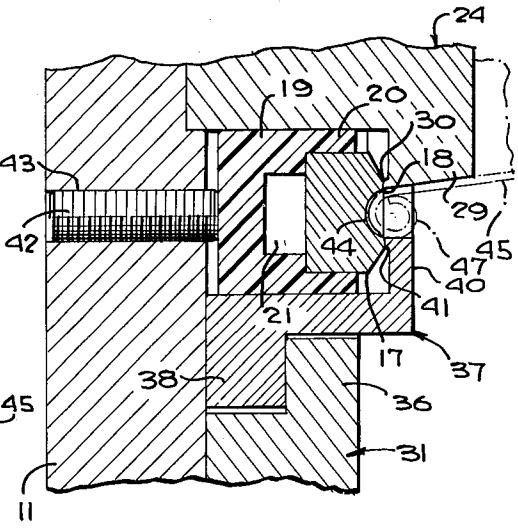
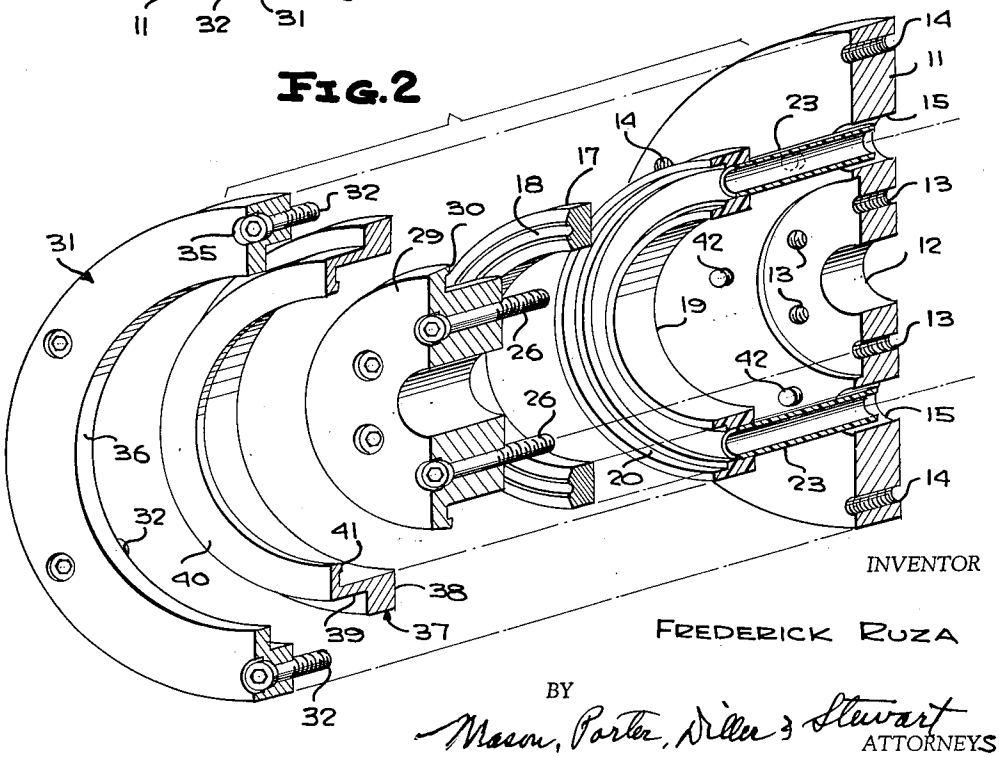


FIG. 2



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Filed June 29, 1961 2 Sheets-Sheet 2

FIG. 4

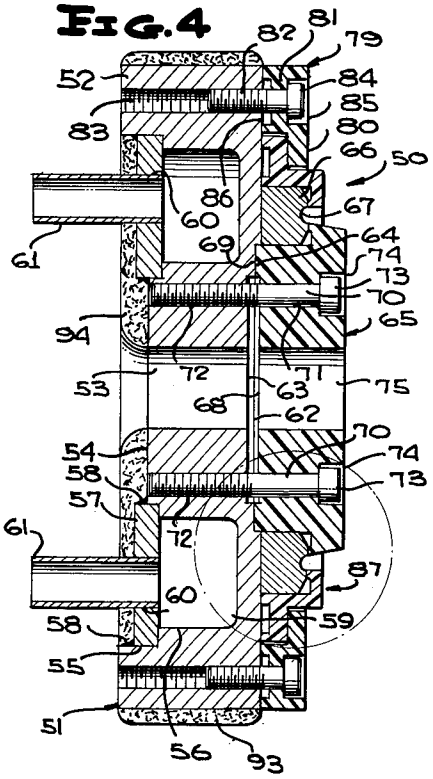


FIG. 6

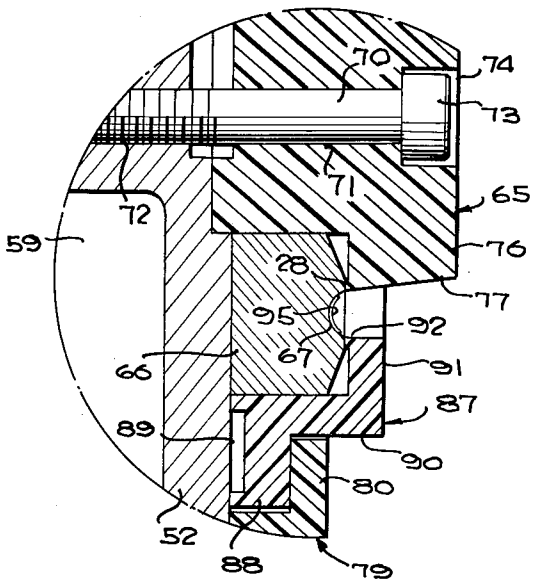
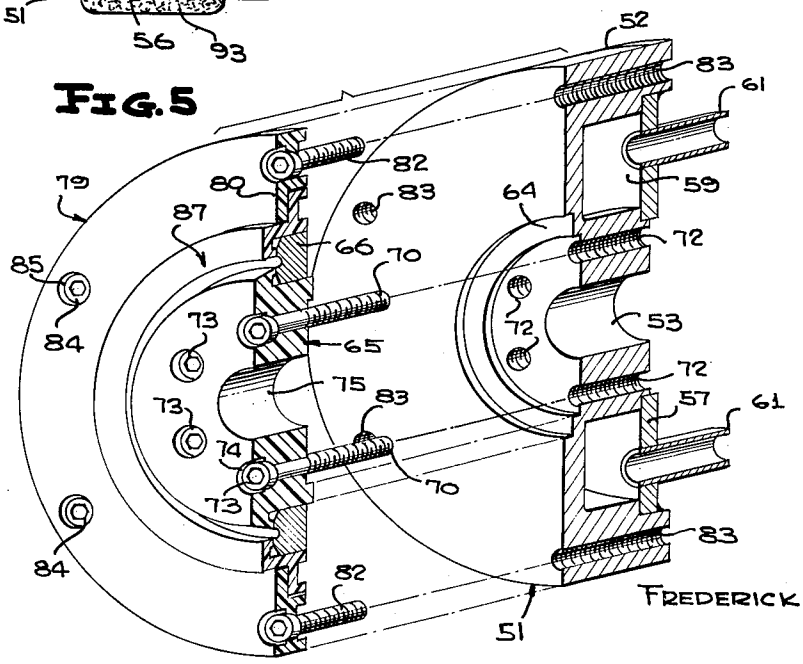


FIG. 5



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METHOD AND APPARATUS FOR COOLING AND CURLING EDGES OF POLYETHYLENE COATED PAPER CUPS

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11 Claims. (Cl. 93—36.5)

This invention relates in general to new and useful improvements in the manufacture of paper cups, and more particularly relates to a novel method and apparatus for use in the curling of edges of polyethylene coated paper cups to form the usual beads on the upper ends of such cups.

The beads on paper cups have been formed through the use of a curling die, which curling die is annular and has a generally U-shaped cup engaging surface. Paper slides freely along the metal surface of the curling die and no problems of sticking of the paper are encountered during a curling operation. This is not true with plastic coated papers, for example, paper having a polyethylene coating thereon.

The soft resilient polyethylene coating is readily adaptable for surface finish of paper and is impervious to liquid penetration, the polyethylene having a characteristic convex meniscus and a very suitable sealing quality. However, polyethylene coated paper has a major detrimental factor inherent in the processing of this material. This is the lack of contact slip quality.

Due to the high resistance of polyethylene and similar plastics to penetration, it has been very difficult to apply a slip agent thereto to facilitate the formation of a curled or beaded rim on a cup. The application of a suitable slip agent does not solve the problem. Because of the characteristics of the polyethylene or similar plastics, the slip agent wipes off in the curling process, leaving only a small percentage of the surface of either the curling die or the cup well lubricated and a good percentage only partially lubricated. This holds true whether the slip agent is applied to either the paper coating or the curling die. It is therefore obvious that the slip agent cannot be loose so as to be displaceable.

It is therefore the primary object of this invention to provide a curling die for use in curling a rim of a cup with a slip agent which is permanently adhered to the curling die and is not wiped off by the polyethylene or similar plastic coating of the paper from which the cup is formed.

Another object of this invention is to provide a novel slip agent for a curling die used for curling the rims of paper cups, particularly paper cups having plastic coatings such as polyethylene, the slip agent being in the form of an ice coating on the curling die, which ice coating forms a permanent slip agent for the curling die.

Another object of this invetion is to provide novel means for setting a polyethylene or similar plastic coated paper after the curling thereof, the means for setting the plastic coated paper being in the form of coolant applied to a curling die for reducing the temperature of the plastic material and setting the material immediately subsequent to the curling operation.

Still another object of this invention is to provide novel means for refrigerating a curling die for curling paper cup rims, the means for refrigerating the curling die including a support for the curling die, the support carrying a coolant chamber adapted to transfer heat from the curling die and thus reduce the temperature of the curling die to a temperature below the freezing temperature of water in order that moisture deposited upon the curling die will freeze to form an ice coating, the coolant chamber

having suitable fittings for attachment to a system which includes a circulating coolant.

A further object of this invention is to provide a novel curling die for use in curling the rims of plastic coated paper cups, the curling die being carried by a suitable support and being cooled by means of a coolant chamber disposed closely adjacent thereto and for receiving heat therefrom, the coolant chamber having means for attachment to a supply of low temperature coolant, and there being provided means for restricting the exposure of the refrigerated curling die to moist air whereby the formation of an ice coating on the curling die is restricted to the cup engaging surface thereof.

Still another object of this invention is to provide a novel method of forming a beaded or curled rim on a plastic coated paper cup wherein the plastic coated paper has a tendency to swing back after being curled, the method of curling the rim of the cup including the step of cooling the plastic coated paper so that the plastic of the coating is set immediately subsequent to the curling operation and spring-back of the paper is substantially eliminated.

Still another object of this invention is to provide a novel method of forming a slip agent on the cup engaging surface of a curling die for rims of cups, the method including the steps of refrigerating the curling die to the extent that the temperature thereof is below the freezing temperature of water, and exposing the curling die to moist air whereby the moisture in the air will condense and settle out on the curling die, after which the moisture is frozen to provide an iced coating on the curling die, which ice coating is the slip agent for the curling die.

A still further object of this invention is to provide a novel method of curling plastic coated paper cups to form a curled or beaded rim thereon, the method including the cooling of a conventional type of curling die to a temperature below the freezing temperature of water to condense out of moist air water which, in turn, is frozen to provide an ice coating on the curling die, and then utilizing the ice coated curling die in the steps of curling the plastic coated paper cup.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawing.

In the drawing:

FIGURE 1 is a vertical sectional view taken through a refrigerated curling die formed in accordance with the invention and shows the same with a cup positioned adjacent thereto for the purpose of being curled to have a curled or beaded rim formed thereon.

FIGURE 2 is an exploded perspective view on a slightly reduced scale showing the elements of the refrigerated curling die, each of the elements being cut in half and shown in section.

FIGURE 3 is an enlarged fragmentary vertical sectional view showing on a much larger scale the details of the mounting of the curling die of FIGURE 1 and the relationship of a cup which has just had a rim thereof curled by the curling die, with respect to the curling die.

FIGURE 4 is a vertical sectional view similar to FIGURE 1 and shows a modified form of refrigerated curling die.

FIGURE 5 is a fragmentary perspective view on a reduced scale of the refrigerated curling die of FIGURE 4, the parts being exploded and shown in section.

FIGURE 6 is an enlarged fragmentary sectional view through that portion of the curling die shown in the circle in FIGURE 4, and shows the specific details of mounting of the curling die.

Referring now to the drawings in detail, it will be seen

that there is illustrated in FIGURES 1, 2 and 3 a first form of refrigerated curling die in accordance with this invention, the curling die assembly being referred to in general by the numeral 10. The curling die assembly 10 includes a circular support 11 in the form of a plate which may be secured in any desired manner to conventional support means for a curling die assembly or curling head. The support 11 is provided with a central opening 12 and a plurality of internally threaded bores 13 are disposed in circumferentially spaced relation concentric of the axis of the opening 12. A second set of concentrically spaced internally threaded bores 14 extend through the support 11 adjacent the periphery thereof, the bores 14 being disposed concentric to the opening 12 and the bores 13. The support 11 is also provided with a pair of diametrically spaced openings 15 therethrough, the openings 15 being disposed intermediate the bores 13 and 14.

A curling die unit 16 is carried by the support 11 forwardly thereof. The curling die unit 16 includes a conventional curling die 17 which is in the form of a ring and which has an annular recessed cup engaging surface 18, the surface 18 being arcuate in cross-section. The curling die unit 16 also includes a ring 19 which is of a channel-shaped cross-section. The ring 19 is open forwardly and is provided with a forward seat 20 in which the rear portion of the curling die 17 is seated. The curling die 17 is sealed to the ring 19 in any suitable manner and together with the ring 19 defines a coolant chamber 21. A pair of tubes 22 and 23 are secured to the rear portion of the ring 19 and open into the coolant chamber 21. The tubes 22 and 23 extend through the openings 15 beyond the rear of the support 11 and serve as coolant inlet and coolant outlet to be connected to any suitable source of circulating refrigerated coolant.

A plurality of clamp members are provided for securing the curling die unit 16 in place. These clamp members include a central clamp member 24 which has a rear portion thereof seated in a seat 25 formed in the front face of the support 11. The clamp member 24 is removably secured to the support 11 by means of bolts 26 which are threaded into the bores 13. The bolts 26 have heads 27 which are disposed within recesses 28 formed in the front face of the clamp member 24.

The front portion of the clamp member 24 includes an outwardly directed annular flange 29 which has a rearwardly projecting portion 30 seating on the front face of the curling die 17 immediately inwardly of the cup engaging surface 18 thereof. This is best shown in FIGURE 3.

The clamp members for holding the curling die unit 16 is place also include an outer annular clamp member 31. The clamp member 31 is seated against the outer portion of the support 11 and is secured in place on the support 11 by means of circumferentially spaced bolts 32 which are threaded into the bores 14. The bolts 32 have enlarged heads 34 which are recessed within recesses 35 formed in the front face of the clamp member 31. The clamp member 31 is provided with an inwardly projecting annular flange 36 along the front face thereof.

The clamp members further include a generally Z-shaped clamp member 37 which includes a base flange 38 abutting the front face of the support 11 and clamped thereagainst by the clamp member 31. The flange 36 of the clamp member 31 engages the base flange 38. The clamp member 37 also includes an upstanding web 39 which forms a guide for the outer surface of the ring 19. The inner surface of the ring 19 abuts against the outer surface of the clamp member 34 to further position the ring 19 with respect to the support 11. The clamp member 37 further includes an outer flange 40 which is provided with a rearwardly projecting portion 41. As is best shown in FIGURE 3, the portion 41 engages the front face of the curling die 17 outwardly of the cup engaging surface 18.

In order to assure the proper seating of the curling ring unit 16, the support 11 is also provided with a plurality of setscrews 42 which are threaded in bores 43 through the support 11 and which abut against the rear surface of the ring 19. These setscrews assure the proper engagement of the curling die 17 with the clamp members 24 and 37 as well as the proper seating of the curling die 17 in the ring 19.

In the use of the curling die assembly or curling head 10, suitable refrigerant is circulated through the coolant chamber 21 through the tubes 22 and 23. This coolant is at a temperature to lower the temperature of the cup engaging surface 18 of the curling die 17 below the temperature of water. Thus, when the cup engaging surface 18 is exposed to the atmosphere, the moisture within the atmosphere condenses out on the cold cup engaging surface 18 and is frozen. As a result, an iced coating 44 is formed on the cup engaging surface 18 and forms a slip agent for a plastic coated paper cup, such as a polyethylene coated paper cup. At this time, it is pointed out that under normal operating conditions, the moisture within the air will be sufficient to provide the moisture for the ice coating 44. However, if it is desired to control the thickness of the ice coating 44 or if the moisture in the air is in sufficient to provide the necessary ice coating, humid air may be supplied to the cup engaging surface 18 under controlled conditions. Under normal operating conditions, the thickness of the ice coating 44 will be approximately 0.0005".

In FIGURES 1 and 3, there is illustrated diagrammatically a paper cup 45 which is formed of a plastic coated paper with the plastic being normally polyethylene. The cup 45 is illustrated as being mounted within a suitable holder with the portion of the cup to be curled projecting beyond the holder. The holder, for purposes of identification, is referred to by the numeral 46. As the edge of the cup 45 is fed into the curling die 17, the edge of the cup is curled to form a beaded rim 47 (FIGURE 3) in the customary manner without any undesired sticking of the polyethylene or other plastic coating to the surface of the curling die 17. In addition, the cooling of the relatively soft plastic coating results in the setting of the coating after it has been curled so that there is substantially no spring-back of the beaded rims 47 subsequent to the curling operation.

Referring now to FIGURES 4, 5 and 6, it will be seen that there is illustrated another form of curling die assembly or curling head, which is generally referred to by the numeral 50. The curling head 50 includes a support 51 which may be secured to any usual supporting structure in the normal manner. The support 51 is in the form of a relatively thick plate 52 having a central bore 53 therethrough. The rear surface of the plate 52 is provided with a large diameter, shallow circular recess 54. The recess 54 is concentric with the bore 53.

The rear surface of the plate 52 is also provided with an annular recess 55 which is concentric with the bore 53 and which is relatively shallow. The annular recess 55 has the outer surface thereof aligned with the outer surface of the recess 54. The plate 52 is provided with a further annular recess 56 which is relatively deep. The recess 56 is concentric with the bore 53 and is centered with respect to the recess 55, but is narrower than the recess 55.

An annular member 57 is seated in the recess 55 and is suitably secured to the plate 52, as by welding 58. The annular member 57 closes the rear part of the recess 56 and together with that portion of the plate 52 which defines the walls of the recess 56, forms a coolant chamber 59. The annular member 57 is provided with a pair of diametrically opposed bores 60 in which there are seated ends of tubes 61. The tubes 61 form an inlet and an out-

let for coolant which may be circulated through the coolant chamber 59.

The front surface of the plate 52 is provided with a recess 62 which is concentric with the bore 53. The recess 62 is relatively shallow and has disposed concentrically therewith a further recess 63. The recess 63 is of a smaller diameter than the recess 62 and in effect forms a stepped continuation of the recess 62. The recesses 62 and 63 combine to define an annular seat 64 on which there is seated a clamp member 65.

The clamp member 65 is one of a plurality of clamp members which are utilized to secure in place a conventional curling die 66 which may be identical with the curling die 17. The curling die 66 is provided on the front surface thereof with a recessed cup engaging surface 67. The cup engaging surface 67, like the curling die 66, is annular in outline. The cup engaging surface 67 is arcuate in cross-section, as is best shown in FIGURE 6.

The clamp member 65 is provided with a circular recess 68 in the rear surface thereof, the diameter of the recess 68 being identical with the diameter of the recess 62, whereas the diameter of the rear portion of the clamp member 66 is identical with the diameter of the recess 62. As a result, a seat 69 is formed on the rear surface of the clamp member 65 which corresponds with the seat 64 on the front face of the plate 52, the two seats 64 and 69 being in abutting engagement.

The clamp member 65 is held in place by a plurality of circumferentially spaced bolts 70 which extend through bores 71 in the clamp member 65 and which are threadedly engaged in internally threaded bores 72 extending through the plate 52 inwardly of the coolant chamber 59. The bolts 70 have heads 73 which are recessed within recesses 74 formed in the front face of the clamp member 65. Incidentally, the clamp member 65 also has a central bore 75 which is aligned with the bore 53 in the plate 52.

As is best shown in FIGURE 6, the clamp member 65 has an overhanging front annular flange 76 having a tapered outer surface 77 which is aligned with an inner edge of the cup engaging surface 67 of the curling die 66. The flange 76 further has a rearwardly projecting seat 78 which is seated on and contacts the front surface of the curling die 66 immediately inwardly of the cup engaging surface 67.

The curling head 50 also includes an outer clamp member 79. The outer clamp member 79 is of an annular configuration and has an inwardly projecting annular flange 80 at the forward surface thereof. The clamp member 79 has a plurality of circumferentially spaced bores 81 receiving bolts 82 which are threadedly engaged in bores 83 in the plate 52. The bolts 82 have heads 84 which are countersunk within recesses 85 formed in the front surface of the clamp member 79. The rear surface of the clamp member 79 is relieved by means of an annular recess 86 which is centered about the bolt pattern of the bolts 82.

The clamp member 79 holds in place a Z-shaped cross-sectional annular clamp member 87. The clamp member 87, as is best shown in FIGURE 6, includes a base flange 88 which directly opposes the front surface of the plate 52 and is clamped thereagainst by the flange 80 of the clamp member 79. The rear surface of the base flange 88 is relieved by means of an annular recess 89 formed therein.

The clamp member 87 includes a web 90 which is integrally formed with the base flange 88 and forms an outer abutment for the curling die 66. An outer flange 91 is connected to the web 90 and generally overlies the curling die 66. The flange 91 is provided with a rearwardly extending projection 92 which abuts against the curling die 66 immediately outwardly of the cup engaging surface 67 thereof to clamp the curling die 66 against the front surface of the plate 52.

Reference is made to FIGURE 4 in particular, wherein insulation is mounted on the curling head 50. The insulation includes an outer ring of insulation surrounding the plate 52, the insulation ring being referred to by the numeral 93. Also, the rear surface of the plate 52 is covered by an insulation disk 94.

At this time, it is pointed out that the clamp members 65 and 87 are formed of a suitable insulating material, such as nylon, so as to restrict the transfer of heat to the curling die 66 and to limit the engagement of moist air with the curling die 66 to the cup engaging surface 67 thereof. Also, if desired, the clamp member 79 may also be formed of a suitable insulating material, such as nylon. In addition to forming these components of the curling head 50 of an insulating material, if it is so desired, the curling head 10 may be constructed with the clamp members 24, 31 and 37 formed of the insulating material, such as nylon. Further, the curliing head 10 may be insulated with insulating material of the type shown in FIGURE 4 and including the insulation 93 and 94.

It is to be understood that the temperature of the coolant supplied to the coolant chamber 59 will be sufficient to maintain the curling die 66 at a temperature below the freezing temperature of water, whereby moisture may be removed from moist air and the moisture deposited upon the cooled cup engaging surface 67 to form an ice coating 95 thereon. As in the case of the ice coating 44, the ice coating 95 functions as a permanent slip agent. By forming the clamp members 65 and 87, in particular, of an insulating material, it will be readily apparent that these members are not unduly chilled so as to result in the bulid-up of an ice coating thereon.

The use of the curling head 50 will be the same as that of the curling head 10. A rim of a cup, such as the cup 45, will be curled utilizing the curling head 50. Sticking of the polyethylene coating or similar plastic coating on the curling die is prevented by means of the ice coating, and at the same time, the temperature of the polyethylene is reduced sufficiently to effect the setting of the curl.

From the foregoing, it will be seen that novel and advantageous provision has been made for carrying out the desired end. However, attention is again directed to the fact that variations may be made in the example apparatus disclosed herein without departing from the spirit and scope of the invention, as defined in the appended claims.

I claim:

1. A curling head for curling an end of a cup body to form a bead thereon, comprising a curling die, and means connected to said curling die for cooling said curling die below the freezing temperature of water whereby moisture in the atmosphere will collect and freeze on said curling die to provide an iced surface thereon to facilitate the slipping of the cup relative to said curling die.

2. The curling head of claim 1 wherein said curling die has a cup engaging surface portion, and means engaging said curling die to restrict the formation of ice on said curling die to said cup engaging surface portion.

3. The curling head of claim 1 wherein said curling die cooling means includes a coolant chamber disposed closely adjacent said curling die.

4. A curling head for curling an end of a cup body to form a bead thereon, comprising a support, cooling means including a coolant chamber for circulating coolant carried by said support, a curling die, and clamp means carried by said support and clamping said curling die in position for being cooled from said collant chamber to a temperature below the freezing temperature of water whereby moisture in the atmosphere will collect and freeze on said curling die to provide an iced surface thereon to facilitate the slipping of the cup relative to said curling die.

5. The curling head of claim 4 wherein said curling die has a cup engaging surface portion, and said clamp means having portions engaging said curling die immediately adjacent to and surrounding said cup engaging sur-

face to restrict the formation of ice on said curling die to said cup engaging surface portion.

6. The curling head of claim 5 wherein those portions of said clamp means engaging said curling die are formed of an insulating material.

7. The curling head of claim 4 wherein said coolant chamber is formed in said support and said curling die is clamped against said support.

8. The curling head of claim 4 wherein said coolant chamber is separate from said curling die and said curling die forms a wall of said coolant chamber.

9. A method of forming a bead on a plastic coated paper product and the like without spring-back comprising the steps of curling the plastic coated paper product to produce the desire bead, and while curling the product cooling the product to set the plastic thereof.

10. A method of providing a curling die with a slip material to prevent the sticking of products having a plastic surface comprising the steps of cooling the curling die to a temperature below the freezing temperature of water, and subjecting the cooled curling die to moist air to condense and freeze the moisture thereof and provide an ice coating on the curling die.

11. A method of forming a bead on products presenting a plastic surface comprising the steps of providing a curling die with an ice coating, and moving the product against the curling die with the ice coating forming a slip agent and preventing sticking of the product to the curling die during the bead forming operation.

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