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(71)(72) Applicants and Inventors: SORENSEN, Soren, Christian [DK/US]; 12630 Carmel Country Road, #110, San Diego, CA 92130 (US). SORENSEN, Jens, Ole [DK/US]; P.O. Box 2274, Rancho Santa Fe, CA 92067 (US).

(74) Agent: CALLAN, Edward, W.; 3033 Science Park Road, San Diego, CA 92121 (US).

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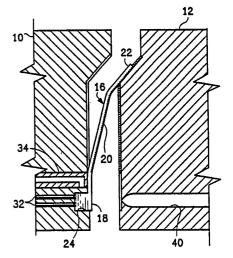
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(54) Title: RAPID INJECTION MOLDING OF CABLE TIES

(57) Abstract

A nylon cable tie (16) having a head (18) and a strap (20) terminating in a tip-(22) is formed in a mold cavity defined by a first mold part (10) combined with a second mold part (12) by injecting molten nylon material into the mold cavity through an insulated runner system (40) and a gate that converges from the runner system toward the mold cavity and does not have a hot tip adjacent thereto. The mold parts (10, 12) are separated while retaining a portion of the head (18) in a head region (24) in the first mold part (10) and a portion of the tip (22) in a tip region in the second mold part (12), in order to separate the head (18) from the second mold part (12), to separate the tip (22) from the first mold part (10), and to separate a major portion of the strap (20) from the first and second mold parts. The mold parts (10, 12) are further separated while retaining said portion of the head (18) in the head region (24) to thereby remove said portion of the tip (22) from the second mold part (12). The head (18) is ejected from the head region (24) by protracted ejector pins (32) that penetrate the head region from within the first mold part (10). A component (34) containing a nozzle coupled to a source of compressed air and positioned closely adjacent the head region (24) is protracted from the first mold part (10) and pushes on the strap (20) to push the ejected head (18) of the cable tie (16) away from the ejector pins (32). The cable tie (16) is then ejected from between the mold parts (10, 12) by imparting against the ejected head (18) of the cable tie a forceful stream of compressed air directed from the nozzle in the component (34).



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RAPID INJECTION MOLDING OF CABLE TIES

BACKGROUND OF THE INVENTION

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The present invention generally pertains to injection molding of cable ties and is particularly directed to methods and apparatus for reducing the cycle time for injection molding of cable ties.

A cable tie is an adjustable strap for bundling together articles such as cables or the like. Cable ties are also known as cable straps, cable clamps, cable clips, bundling ties, bundling straps, bundling clips, bundle ties, bundling belts, wire ties, ring clamps, adjustable clamps, harnessing devices, strap seals, binding straps, and ties. A typical cable tie includes an elongated strap with an adjacent locking head at one end of the strap, a tip at the opposite end of the strap and ratchet teeth on one side of the strap. The locking head defines an opening for allowing the tip end of the strap to be pulled through the opening and thereby form a closed loop around a bundle of articles. The locking head typically further includes a pawl having teeth with surfaces for engaging the ratchet teeth to lock the strap in the locking head after the tip end of the strap has been pulled through said opening. Examples of cable ties are described in United States Patents Nos. 3,739,429, 3,924,299, 3,965,538, 4,473,524 and 4,573,242.

Cable ties are manufactured economically by a cyclic injection molding method, in which molten plastic material is injected into a mold cavity defining the cable tie and then allowed to solidify within the mold cavity. The mold parts defining the mold cavity are then separated and the cable tie is ejected, first from the mold parts and then from the space between the mold parts. A preferred material for cable ties is nylon.

SUMMARY OF THE INVENTION

The present invention provides methods and apparatus for rapid injection molding of cable ties and further provides the cable ties made according to said methods.

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In accordance with one aspect of the present invention, a method of injection molding a cable tie having a head and a strap terminating in a tip for passing through said head, includes the steps of (a) forming the cable tie by injecting molten plastic material into a mold cavity defined by a first mold part combined with a second mold part, wherein the first mold part includes a head region defining a portion of the head of the cable tie and the second mold part includes a tip region defining a portion of the tip of the cable tie; (b) separating the first mold part from the second mold part while retaining said portion of the head of the cable tie in the head region of the first mold part and said portion of the tip of the cable tie in the tip region of the second mold part, to separate the head from the second mold part, to separate the tip from the first mold part, and to separate a major portion of the strap of the cable tie from the first and second mold parts; (c) further separating the first mold part from the second mold part while retaining said portion of the head of the cable tie in the head region of the first mold part to thereby remove said portion of the tip of the cable tie from the second mold part; and (d) ejecting the head of the cable tie from the head region of the first mold part. By retaining a portion of the head in the first mold part and a portion of the tip in the second mold part, while the first and second mold parts are separated from each other, the major portion of the strap is quickly peeled from the first and second mold parts to reduce the overall cycle time.

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In accordance with another aspect of the present invention, a method of injection molding a cable tie having a head and a strap, includes the steps of (a) forming the cable tie by injecting molten plastic material into a mold cavity defined

by a first mold part combined with a second mold part, wherein the first mold part includes a head region defining a portion of the head of the cable tie; (b) separating the first mold part from the second mold part while retaining said portion of the head of the cable tie in the head region of the first mold part; (c) ejecting the head of the cable tie from the first mold part; (d) protracting a nozzle positioned closely adjacent said head region from the first mold part; and (e) ejecting the cable tie from between the first and second mold parts by imparting against the ejected head of the cable tie a forceful fluid stream directed from the nozzle.

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In accordance with still another aspect of the present invention, a method of injection molding a cable tie having a head and a strap, includes the steps of (a) forming the cable tie by injecting molten plastic material into a mold cavity defined by a first mold part combined with a second mold part, wherein the first mold part includes a head region defining a portion of the head of the cable tie; (b) separating the first mold part from the second mold part while retaining said portion of the head of the cable tie in the head region of the first mold part; (c) ejecting the head of the cable tie from the head region of the first mold part by pushing on the head with at least one ejector disposed to penetrate the head region from within the first mold part; and (d) pushing the ejected head of the cable tie away from said at least one ejector by pushing on the strap of the cable tie at a position that is closely adjacent the head with a component protracted from within the first mold part.

In accordance with a further aspect of the present invention, a method of injection molding a cable tie having a head and a strap, includes the steps of (a) forming the cable tie by injecting molten nylon material into a mold cavity defined by a first mold part combined with a second mold part; and (b) injecting said molten nylon material into the mold cavity through an insulated runner system. An insulated runner system is a runner system in which the injected plastic solidifies near the walls of the runner system to provide insulation between the walls of the

runner system and a fluid stream of molten plastic through the core of the runner system, and from which the solidified plastic residue must be removed when cyclic operation is discontinued.

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Heretofore, insulated runner systems have not been used in the manufacture of nylon cable ties because nylon's high heat conductivity causes it to cool so rapidly that it completely solidifies in the runner system between injection cycles. By reducing the cycle time in accordance with one or more of the other aforementioned aspects of the present invention, the overall cycle time is reduced sufficiently to enable the use of an insulated runner system in the manufacture of nylon cable ties. The use of an insulated runner system further reduces the overall cycle time by decreasing the amount of time required to solidify the injected plastic because less heat is conducted to the mold cavity. Further reduction of the overall cycle time is obtained when the insulated runner system communicates with the mold cavity forming the cable tie through only a gate and not through a sprue cavity for forming an ejectable sprue, whereby no ejectable sprue is formed. An ejectable sprue typically takes longer to cool than the cable tie.

Additional features and advantages of the present invention are described in relation to the description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWING

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Figure 1 is a sectional view of a preferred embodiment of the mold apparatus of the present invention, with the mold parts being combined to define the mold cavity for forming a cable tie.

Figure 2 is a sectional view taken along lines 2-2 in Figure 1 of a portion of the mold cavity, without the cable tie being present therein.

Figure 3 is a view of that portion of Figure 1 illustrated the juncture of the runner system with the mold cavity, with such portion being enlarged to illustrate the gate by which the runner system communicates with the mold cavity.

Figure 4 is a sectional view of the mold apparatus of Figure 1, with the mold parts being separated and the cable tie being partially removed from the mold cavity.

Figure 5 is a sectional view of the mold apparatus of Figures 1 and 4, with the mold parts being further separated and the tip of cable tie being completely separated from the mold cavity.

Figure 6 is a sectional view of the mold apparatus of Figures 1, 4 and 5, with the mold parts being further separated and the cable tie being completely ejected from the mold cavity.

Figure 7 is a sectional view of the mold apparatus of Figures 1, 4, 5 and 6, with the cable tie being ejected from between the mold parts by a forceful fluid stream directed from a closely adjacent nozzle after the cable tie is completely ejected from the mold cavity and separated from the ejector pins.

The various features shown in the drawing are not drawn to scale.

DESCRIPTION OF THE PREFERRED EMBODIMENT

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Referring to Figure 1, a preferred embodiment of the injection molding apparatus of the present invention includes a first mold part 10 and a second mold part 12. The first mold part 10 is combined with second mold part 12 to define a mold cavity 14 for forming a cable tie 16. The cable tie 16 has a head 18 and a strap 20 terminating in a tip 22 for passing through the head 18.

The first mold part 10 includes a head region 24 defining a major portion of the head 18 of the cable tie; and the second mold part 12 includes a tip region 26 defining a portion of the tip 22 of the cable tie. The tip region 26 extends at an angle from a portion 28 of the mold cavity 14 defining most of the strap 20, with said extension being directed away from the bulk of the first mold part 10.

Referring to Figure 2, the tip region 26 includes an undercut region 30 from which the portion of the tip 22 formed therein can be removed only by sliding the tip 22 from the undercut region 30 by pulling the strap 20 of the cable tie 16 from the direction of the head 18.

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Again referring to Figure 1, the first mold part 10 further includes a pair of protractable ejector pins 32 and a protractable component 34 containing a nozzle 36 and an air passage 38 that communicates with a source of compressed air (not shown). The ejector pins 32 are disposed to penetrate the head region 18 from within the first mold part 10, when the ejector pins 32 are protracted.

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The second mold part 12 includes a runner system 40, through which molten plastic material, such as Nylon 6.6, is injected into the mold cavity 14 to form the cable tie 16.

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Referring to Figure 3, the runner system 40 is an insulated runner system that communicates with the mold cavity 14 through a gate 42 that converges toward the mold cavity 14. It is pointed out that the runner system 40 communicates with the mold cavity 14 through only the gate 42 and not through a sprue cavity for forming an ejectable sprue, whereby no ejectable sprue is formed.

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Unlike prior art apparatus for injection molding cable ties, the converging gate 42 does not have a hot tip adjacent thereto for applying heat to the plastic being injected into the mold cavity 14. A heated tip is unnecessary because of the

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shortness of the injection cycle achieved in accordance with the method of the present invention. Heretofore, it has not been possible to injection mold nylon products as light as from one to five grams while using an insulated runner system without heated tips. Through use of the present invention, it has been proven possible to injection mold products in a range of one to five grams at a weight per cycle-time-squared of from 0.1 to 0.5 grams per square second.

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By providing a gate 42 that converges toward the mold cavity 14, the cable tie 16 separates from the molten plastic at the edge 44 of the mold cavity 14 when the cable tie is separated from the mold cavity 14 to thereby at least substantially reduce the size of any gate spill formed on the cable tie 16. The method of the present invention has been successfully practiced with a gate opening diameter at the edge 44 of the mold cavity 14 being within a range of between approximately 1.5 mm and approximately 2.5 mm, and with the angle of convergence between the walls of the gate 42 being within a range of between approximately 15 degrees and approximately 30 degrees. A gate opening diameter of 1.8 mm and an angle of convergence of 22 degrees are preferred when injecting Nylon 6.6.

Referring to Figure 4, the first mold part 10 is separated from the second mold part 12 while retaining the major portion of the head 18 of the cable tie 16 in the head region 24 of the first mold part and a portion of the tip 22 of the cable tie 16 in the undercut region 30 of the second mold part 12, in order to separate the head 18 of the cable tie from the second mold part 12, to separate the tip 22 from the first mold part 10, and to separate a major portion of the strap 20 of the cable tie 16 from both the first and second mold parts 10, 12. By retaining a portion of the head 18 in the first mold part 10 and a portion of the tip 22 in the second mold part 12, while the first and second mold parts 10, 12 are separated from each other, the major portion of the strap 20 is quickly peeled from the first and second mold parts 10, 12 to reduce the ejection portion of the overall cycle time.

Referring to Figure 5, the first mold part 10 is further separated from the second mold 12 part while still retaining the major portion of the head 18 of the cable tie 16 in the head region 24 of the first mold part 10 to thereby remove the tip 22 of the cable tie from the tip region 26 of the second mold part 12 by pulling the strap 20 of the cable tie 16 from the direction of the head 18 to slide the tip 22 from the undercut region 30. It is noted that due to such pulling action, the angle at which the tip 22 of the cable tie 16 extends away from a straight line along most of the length of the strap 20 is less than the angle at which the tip region 26 of the mold cavity 14 extends away from a vertical line through the portion 28 of the mold cavity defining most of the length of the strap 20.

Referring to Figure 6, the first mold part 10 is further separated from the second mold 12 part, and the ejector pins 32 are protracted to eject the head 18 of the cable tie 16 from the head region 24 of the first mold part 10 by pushing on the head 18 with the ejector pins 32. At the same time the component 34 is also protracted to push on the strap 20 of the cable tie 16 at a position that is closely adjacent the head 18.

Referring to Figure 7, the first mold part 10 is further separated from the second mold 12 part, and only the component 34 is further protracted to push the ejected head 18 of the cable tie 16 away from the ejector pins 32 by pushing on the strap 20 of the cable tie at the position that is closely adjacent the head 18. The ejector pins 32 are not further protracted. A forceful stream of air is then imparted on the head 18 from the closely adjacent nozzle 36 within the protracted component 34 to thereby quickly eject the cable tie 16 from between the first and second mold parts 10, 12.

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The stream of air from the nozzle 36 also cools the head 18 of the cable tie 16 so that the cable tie can be ejected at an earlier time in the overall cycle.

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The present invention obviates the need for ejection pins along most of the length of the mold cavity 14, as used in the prior art.

The present invention preferably is used in multi-cavity injection molding apparatus.

CLAIMS

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A method of injection molding a cable tie having a head and a strap
 terminating in a tip for passing through said head, the method comprising the steps of

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(a) forming the cable tie by injecting molten plastic material into a mold cavity defined by a first mold part combined with a second mold part, wherein the first mold part includes a head region defining a portion of the head of the cable tie and the second mold part includes a tip region defining a portion of the tip of the cable tie;

- (b) separating the first mold part from the second mold part while retaining said portion of the head of the cable tie in the head region of the first mold part and said portion of the tip of the cable tie in the tip region of the second mold part, to separate the head from the second mold part, to separate the tip from the first mold part, and to separate a major portion of the strap of the cable tie from the first and second mold parts;
- (c) further separating the first mold part from the second mold part while retaining said portion of the head of the cable tie in the head region of the first mold part to thereby remove said portion of the tip of the cable tie from the second mold part; and
- (d) ejecting the head of the cable tie from the head region of the first mold part.
- A method according to Claim 1, wherein the tip region includes an
 undercut region; and

wherein step (c) includes removing the tip from the tip region by pulling
the strap of the cable tie by further separating the first mold part from the second
mold part while retaining said portion of the head of the cable tie in the first mold
part.

- 3. A method according to Claim 2, wherein the tip can be removed by sliding the tip from the undercut region by pulling the strap of the cable tie from the direction of the head; and
- wherein step (c) includes sliding said portion of the tip of the cable tie from the undercut region of the second mold part.
 - 4. A method according to Claim 2, wherein the tip region extends at an angle from a portion of the second mold part defining most of the strap, with said extension being directed away from the bulk of the first mold part.

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- 5. A method according to Claim 1, wherein the tip region extends at an angle from a portion of the second mold part defining most of the strap, with said extension being directed away from the bulk of the first mold part.
 - 6. A method according to Claim 1, further comprising the step of
- (e) injecting said molten plastic material into the mold cavity through an insulated runner system.

7. A method according to Claim 6, wherein the head is ejected from the first mold part by ejecting means, further comprising the step of

(f) pushing the ejected head of the cable tie with a pushing means that is separate from the ejecting means to push the ejected head away from the ejecting means after the head has been ejected from the head region of the first mold part.

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- 8. A method according to Claim 1, further comprising the step of
- 2 (e) injecting said molten plastic material into the mold cavity through an insulated runner system that communicates with the mold cavity through a gate that converges toward the mold cavity and does not have a hot tip adjacent thereto.
- 9. A method according to Claim 1, wherein the head is ejected from the first mold part by ejecting means, further comprising the step of
 - (e) pushing the ejected head of the cable tie with a pushing means that is separate from the ejecting means to push the ejected head away from the ejecting means after the head has been ejected from the head region of the first mold part.
 - 10. A method according to Claim 1, further comprising the step of

2	(e) ejecting the cable tie from between the first and second mold parts by imparting against the ejected head of the cable tie a forceful fluid stream directed
4	from a closely adjacent nozzle after the head is ejected from the first mold part.
	11. A method of injection molding a cable tie having a head and a strap.
2	the method comprising the steps of
4	(a) forming the cable tie by injecting molten plastic material into a mold cavity defined by a first mold part combined with a second mold part, wherein the
_	first mold part includes a head region defining a portion of the head of the cable tie;
6	uc,
8	(b) separating the first mold part from the second mold part while retaining said portion of the head of the cable tie in the head region of the first mold part;
10	(c) ejecting the head of the cable tie from the first mold part;
	(d) protracting a nozzle positioned closely adjacent said head region from the first mold part; and
12	the first floid part, and
14	(e) ejecting the cable tie from between the first and second mold parts by imparting against the ejected head of the cable tie a forceful fluid stream directed from the nozzle.

12. A method according to Claim 11, further comprising the step of

2 (f) pushing the ejected head of the cable tie away from the first mold part by pushing on the strap of the cable tie at a position that is closely adjacent the head with a protracted component containing the nozzle.

13. A method according to Claim 11, further comprising the step of

(f) injecting said molten plastic material into the mold cavity through an insulated runner system.

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14. A method according to Claim 11, further comprising the step of

2 (f) injecting said molten plastic material into the mold cavity through an insulated runner system that communicates with the mold cavity through a gate that converges toward the mold cavity and does not have a hot tip adjacent thereto.

- 15. A method of injection molding a cable tie having a head and a strap, the method comprising the steps of
- (a) forming the cable tie by injecting molten plastic material into a mold cavity defined by a first mold part combined with a second mold part, wherein the first mold part includes a head region defining a portion of the head of the cable tie;
- (b) separating the first mold part from the second mold part while retaining said portion of the head of the cable tie in the head region of the first mold part;

10 12	(c) ejecting the head of the cable tie from the head region of the first mold part by pushing on the head with at least one ejector disposed to penetrate the head region from within the first mold part; and
14	(d) pushing the ejected head of the cable tie away from said at least one ejector by pushing on the strap of the cable tie at a position that is closely adjacent the head with a component protracted from within the first mold part.
2	16. A method according to Claim 15, further comprising the step of(e) injecting said molten plastic material into the mold cavity through an insulated runner system.
2	17. A method of injection molding a cable tie having a head and a strap, the method comprising the steps of
4	(a) forming the cable tie by injecting molten nylon material into a mold cavity defined by a first mold part combined with a second mold part; and
6	(b) injecting said molten nylon material into the mold cavity through an insulated runner system.
2	18. A method according to Claim 17, wherein the mold cavity defines only the cable tie; and

wherein said molten nylon material is injected into the mold cavity
through an insulated runner system that communicates with the mold cavity
through only a gate and not through a sprue cavity for forming an ejectable sprue.

whereby no ejectable sprue is formed.

- 19. A method according to Claim 17, wherein said molten nylon material is injected into the mold cavity through an insulated runner system that communicates with the mold cavity through a gate that converges toward the mold cavity and does not have a hot tip adjacent thereto.
 - 20. A cable tie made according to the method of Claim 1.
 - 21. A cable tie made according to the method of Claim 2.
 - 22. A cable tie made according to the method of Claim 11.
 - 23. A cable tie made according to the method of Claim 15.
 - 24. A cable tie made according to the method of Claim 16.
 - 25. A cable tie made according to the method of Claim 17.
- 26. Apparatus for injection molding a cable tie having a head and a strap terminating in a tip for passing through said head, comprising

a first mold part and a second mold part, which when combined, define a mold cavity for forming the cable tie, wherein the first mold part includes a head region defining a portion of the head of the cable tie and the second mold part includes a tip region defining a portion of the tip of the cable tie;

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means for injecting molten plastic material into the mold cavity to form the cable tie;

wherein the first mold part is separable from the second mold part while retaining said portion of the head of the cable tie in the head region of the first mold part and said portion of the tip of the cable tie in the tip region of the second mold part;

wherein when the first mold part is separated from the second mold part while retaining said portion of the head of the cable tie in the head region of the first mold part and said portion of the tip of the cable tie in the tip region of the second mold part, the head is separated from the second mold part, the tip is separated from the first mold part and a major portion of the strap of the cable tie is separated from the first and second mold parts;

wherein the first mold part is further separable from the second mold part while retaining said portion of the head of the cable tie in the head region of the first mold part; and

wherein when the first mold part is further separated from the second mold part while retaining said portion of the head of the cable tie in the head region of the first mold part, said portion of the tip of the cable tie is thereby removed from the second mold part; and

26 means for ejecting the head of the cable tie from the head region of the first mold part.

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27. Apparatus according to Claim 26, wherein the tip region includes an
 undercut region; and

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wherein when the first mold part is further separated from the second mold part while retaining said portion of the head of the cable tie in the first mold part, the tip is removed from the tip region by pulling the strap of the cable tie.

28. Apparatus according to Claim 27, wherein the tip can be removed by sliding the tip from the undercut region by pulling the strap of the cable tie from the direction of the head; and

wherein when the first mold part is further separated from the second mold part while retaining said portion of the head of the cable tie in the first mold part, said portion of the tip of the cable tie is slid from the undercut region of the second mold part.

29. Apparatus according to Claim 27, wherein the tip region extends at an angle from a portion of the second mold part defining most of the strap, with said extension being directed away from the bulk of the first mold part.

30. Apparatus according to Claim 26, wherein the tip region extends at an angle from a portion of the second mold part defining most of the strap, with said extension being directed away from the bulk of the first mold part.

31. Apparatus according to Claim 26, further comprising

means defining an insulated runner system for injecting said injected molten plastic material into the mold cavity.

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32. Apparatus according to Claim 31, further comprising

means separate from the ejecting means for pushing the ejected head of the cable tie away from the ejecting means after the head has been ejected from the head region of the first mold part by the ejecting means.

33. Apparatus according to Claim 31, further comprising

2 means defining a gate that converges toward the mold cavity and does not have a hot tip adjacent thereto for directing said injected molten plastic from the insulated runner system into the mold cavity.

34. Apparatus according to Claim 26, further comprising

means separate from the ejecting means for pushing the ejected head of the cable tie away from the ejecting means after the head has been ejected from the head region of the first mold part by the ejecting means.

35. Apparatus according to Claim 26, further comprising

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2	means for ejecting the cable tie from between the first and second mold parts by imparting against the ejected head of the cable tie a forceful fluid stream directed from a closely adjacent nozzle after the head is ejected from the first mold
	part.

36. Apparatus for injection molding a cable tie having a head and a strap, comprising

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- a first mold part and a second mold part, which when combined, define a mold cavity for forming the cable tie, wherein the first mold part includes a head region defining a portion of the head of the cable tie;
- means for injecting molten plastic material into the mold cavity to form the cable tie;
- wherein the first mold part is separable from the second mold part while retaining said portion of the head of the cable tie in the head region of the first mold part;
- means for ejecting the head of the cable tie from the first mold part after
 the first mold part is separated from the first mold part; and
- means for ejecting the cable tie from between the first and second mold

 parts by imparting against the ejected head of the cable tie a forceful fluid stream directed from a closely adjacent nozzle protracted from the first mold part.

37. Apparatus according to Claim 36, further comprising

means for pushing the ejected head of the cable tie away from the first mold part by pushing on the strap of the cable tie at a position that is closely adjacent the head with a protracted component containing the nozzle.

38. Apparatus according to Claim 36, further comprising

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means defining an insulated runner system for directing said injected molten plastic material into the mold cavity.

39. Apparatus according to Claim 38, further comprising

means separate from the ejecting means for pushing the ejected head of the cable tie away from the ejecting means after the head has been ejected from the head region of the first mold part by the ejecting means.

40. Apparatus according to Claim 38, further comprising

means defining a gate that converges toward the mold cavity and does not have a hot tip adjacent thereto for directing said injected molten plastic from the insulated runner system into the mold cavity.

41. Apparatus for injection molding a cable tie having a head and a strap, comprising

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4	a first mold part and a second mold part, which when combined, define a mold cavity for forming the cable tie, wherein the first mold part includes a head region defining a portion of the head of the cable tie;
6	means for injecting molten plastic material into the mold cavity to form the cable tie:
8	wherein the first mold part is separable from the second mold part while retaining said portion of the head of the cable tie in the head region of the first
10	mold part;
12	means for ejecting the head of the cable tie from the first mold part by pushing on the head with at least one ejector disposed to penetrate the head region from within the first mold part; and
14	means for pushing the ejected head of the cable tie away from said at least one ejector by pushing on the strap of the cable tie at a position that is
16	closely adjacent the head with a component protracted from within the first mold part.
2	42. Apparatus according to Claim 41, further comprising means defining an insulated runner system for injecting said injected molten plastic material into the mold cavity.
2	43. Apparatus for injection molding a nylon cable tie having a head and a strap, comprising

a first mold part and a second mold part, which when combined, define a mold cavity for forming the cable tie:

means for injecting molten plastic nylon material into the mold cavity to form the cable tie; and

means defining an insulated runner system for directing said injected molten plastic material into the mold cavity.

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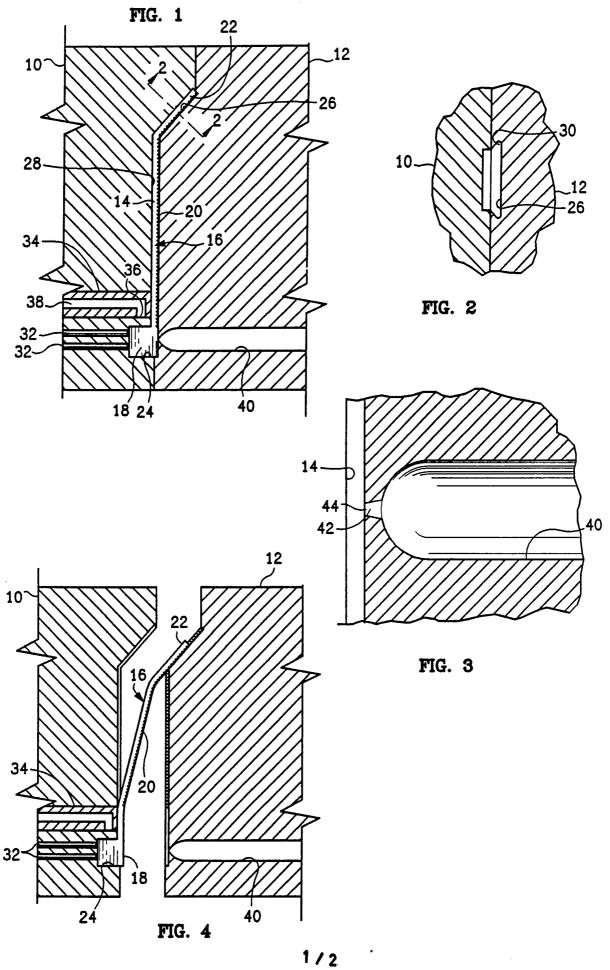
44. Apparatus according to Claim 43, wherein the mold cavity defines only the cable tie; and

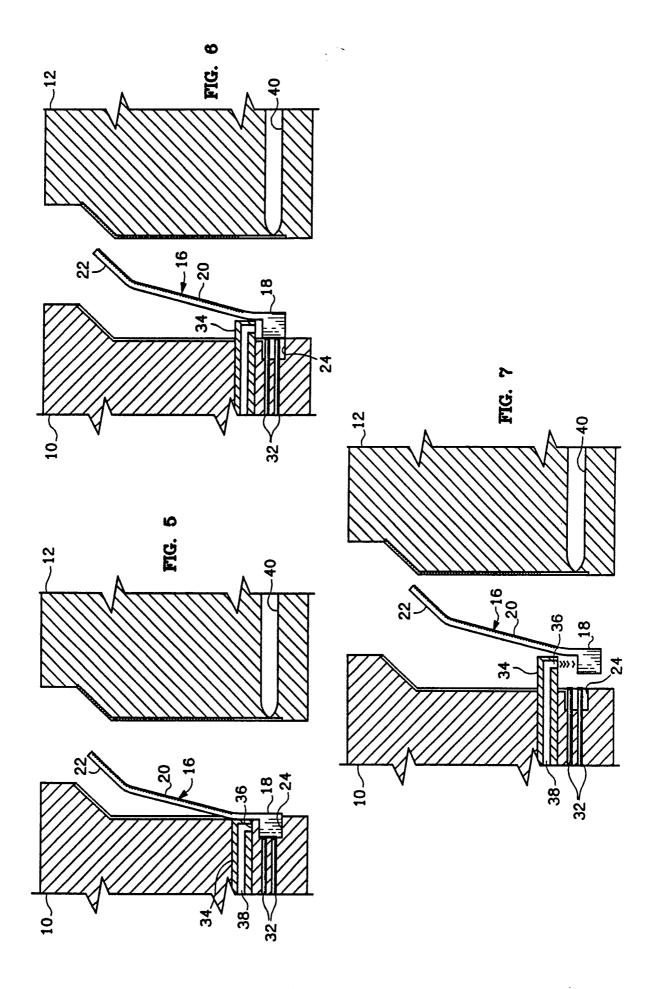
wherein the insulated runner system communicates with the mold cavity through only a gate and not through a sprue cavity for forming an ejectable sprue, whereby no ejectable sprue is formed.

45. Apparatus according to Claim 43, further comprising

2 means defining a gate that converges toward the mold cavity and does not have a hot tip adjacent thereto for directing said injected molten plastic from the insulated runner system into the mold cavity.

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INTERNATIONAL SEARCH REPORT

International application No. PCT/US92/10880

A. CLASSIFICATION OF SUBJECT MATTER	A5/1 A
IPC(5) :B65D 63/10, 67/00; B29C 33/18,33/42,33/44,45/03, US CL :425/556; 441; 443 264/318,334; 24/16PB,30.5P	43/14
According to International Patent Classification (IPC) or to both n	national classification and IPC
B. FIELDS SEARCHED	
Minimum documentation searched (classification system followed	by classification symbols)
U.S. : 264/275,294,328.1,328.15,511;425/129.1,588	
Documentation searched other than minimum documentation to the	extent that such documents are included in the fields searched
Electronic data base consulted during the international search (nan	ne of data base and, where practicable, search terms used)
C. DOCUMENTS CONSIDERED TO BE RELEVANT	
Category* Citation of document, with indication, where app	ropriate, of the relevant passages Relevant to claim No.
Y US,A, 3,537,676 (Miller) 03 November	r 1970 see entire document. 1-19
Y US,A, 3,737,490 (Nicholson 05 June 19	973 See entire document. 1-25
Y US,A, 4,005,164 (Procter) 25 January	1977 See entire document. 1-19
Y US,A, 4,192,701 (Martin et al.) 11 document.	March 1980 See entire 26-45
Y US,A, 4,562,990 (Rose) 07 January 198	86 See entire document. 26-45
X Further documents are listed in the continuation of Box C.	See patent family annex.
	- · ·
 Special categories of cited documents: "A" document defining the general state of the art which is not considered 	I* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
to be part of particular relevance	X* document of particular relevance; the claimed invention cannot be
"E" earlier document published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is	considered novel or cannot be considered to involve an inventive step when the document is taken alone
cited to establish the publication date of another citation or other	Y document of particular relevance; the claimed invention cannot be
"O" document referring to an oral disclosure, use, exhibition or other means	considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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Washington, D.C. 20231 Facsimile No. NOT APPLICABLE	elephone No. (703) 308-4446

INTERNATIONAL SEARCH REPORT

International application No. PCT/US92/10880

C (Continu	ation). DOCUMENTS CONSIDERED TO BE RELEVANT	
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	US,A, 4,833,741 (Mizuno et al.) 30 May 1989 see entire document.	1-19,26-45
Y	US,A, 4,902,218 (Leonard et al.) 20 February 1990 See entire document.	1-19,26-25
Y	US,A, 5,002,480 (Geuert et al.) 26 March 1991 See entire document.	1-19,26-45
Y	US,A, 5,028,225 (Staheu) 02 July 1991 See entire document.	26-45
Y	US,A, 5,053,179 (Masui et al.) October 1991 See entire document.	1-19,26-45
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A,P	US,A, 5,096,651 (LeConte) 17 March 1992 See entire document.	1-45
A,P	US,A, 5,135,694 (Akahane et al.) 04 August 1992 See entire document.	1-45
A,P	US,A, 5,123,686 (Wenk) 23 June 1992 See entire document.	20-25
A,P	US,A, 5,131,613 (Kamiya et al.) 21 July 1992 See entire document.	20-25
A,P	US,A, 5,146,654 (Caveney et al.) 15 September 1992 See abstract.	20-25
	US,A, 3,965,538 (Caveney et al.) 29 June 1976 see entire document.	20-25
l l	US,A, 4,473,524 (Paradis) 25 September 1984 see entire document.	20-25
	US,A, 4,688,302 (Caveney et al.) 25 August 1987 see entire document.	20-25
Y	US,A, 4,730,615 (Sutherland) 15 March 1988 See abstract.	20-25
r l	US,A, 4,776,067 (Sorenson) 11 October 1988 See abstract.	20-25
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International application No.
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		PC1/U392/1086	
C (Continua	tion). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages Relevant		Relevant to claim N
Y	US,A, 4,944,475 (Ono et al) 31 June 1990 See abstrac	t.	20-25
Y	US,A, 5,042,535 (Schlottke), 27 August 1991 See figu	re (7).	20-25

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