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(54) **INJECTION MOLDING NOZZLE SCREWED INTO A MOUNTING BASE**

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Related U.S. Patent Documents

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(52) **U.S. Cl.** **425/549**; 264/328.15; 425/572
(58) **Field of Search** 425/549, 572, 425/588; 264/328.15

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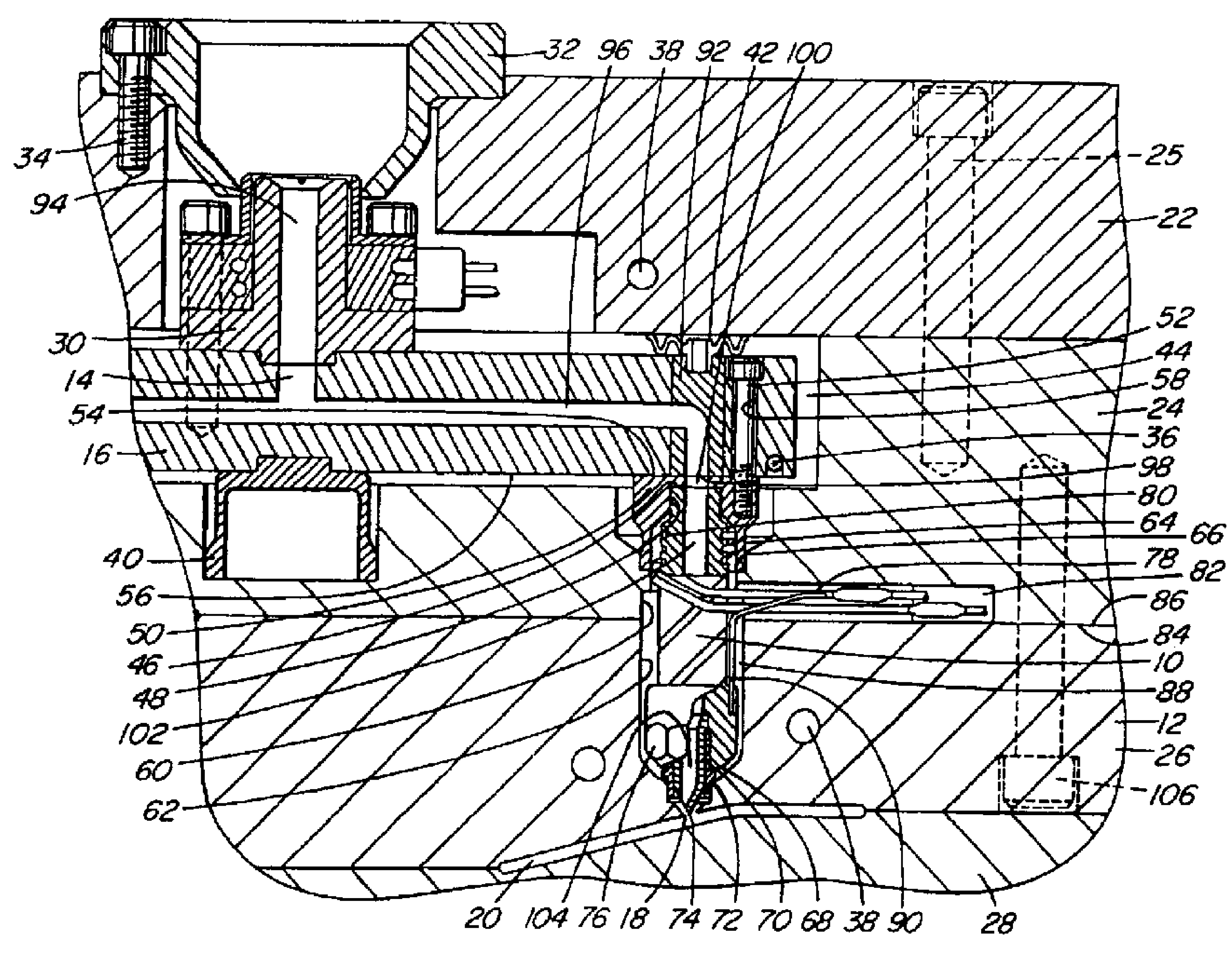
(57) **ABSTRACT**

Multiple nozzle injection molding apparatus wherein each heated nozzle is screwed into a socket in a mounting base secured in place adjacent a melt distribution manifold. Each heated nozzle extends through an opening in the manifold plate and has a nut-like engageable portion extending forwardly of the cavity plate. This allows each of the heated nozzles to be easily removed for cleaning or replacement without removing the cavity plate.

36 Claims, 2 Drawing Sheets



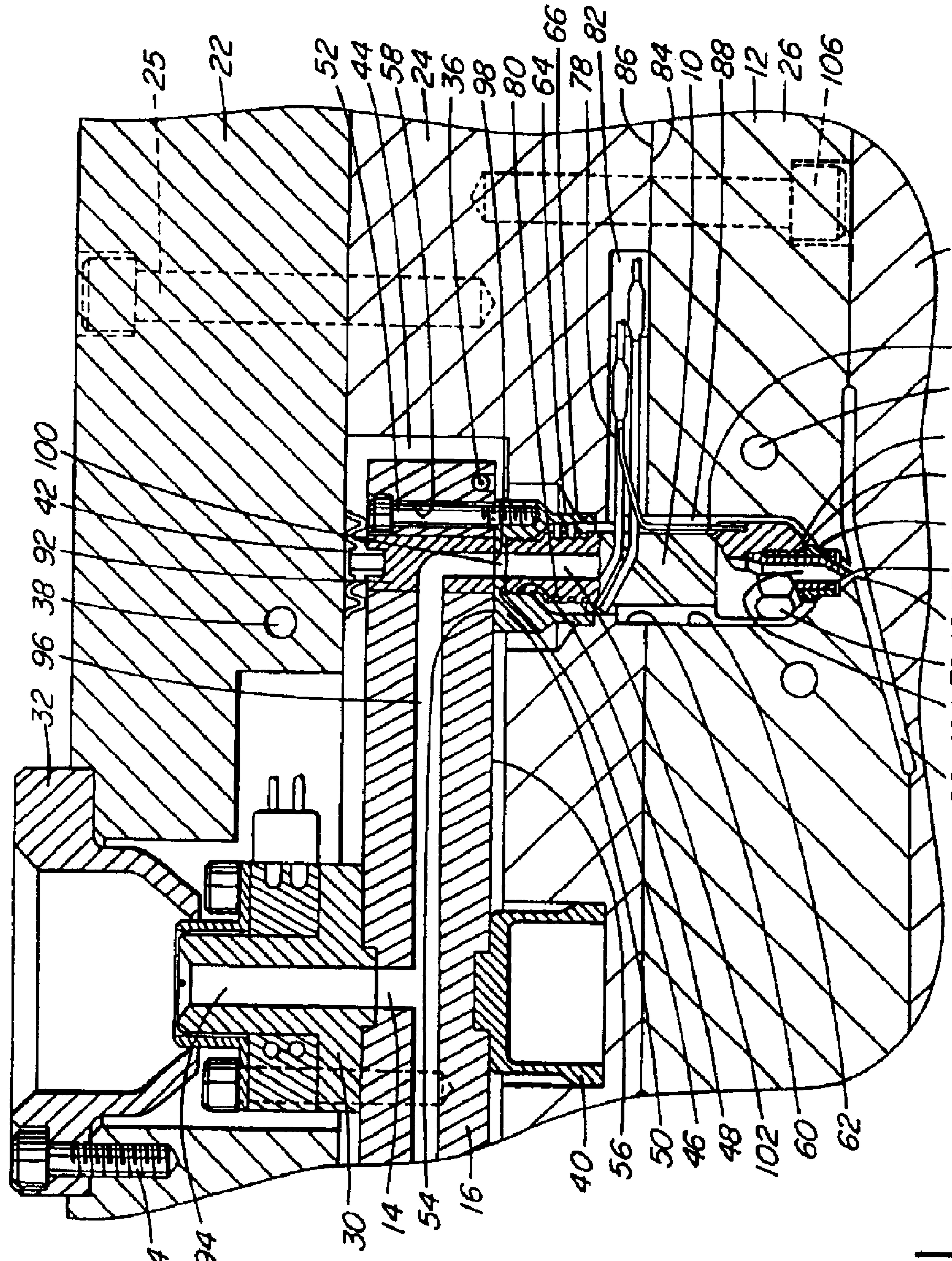


FIG. 1

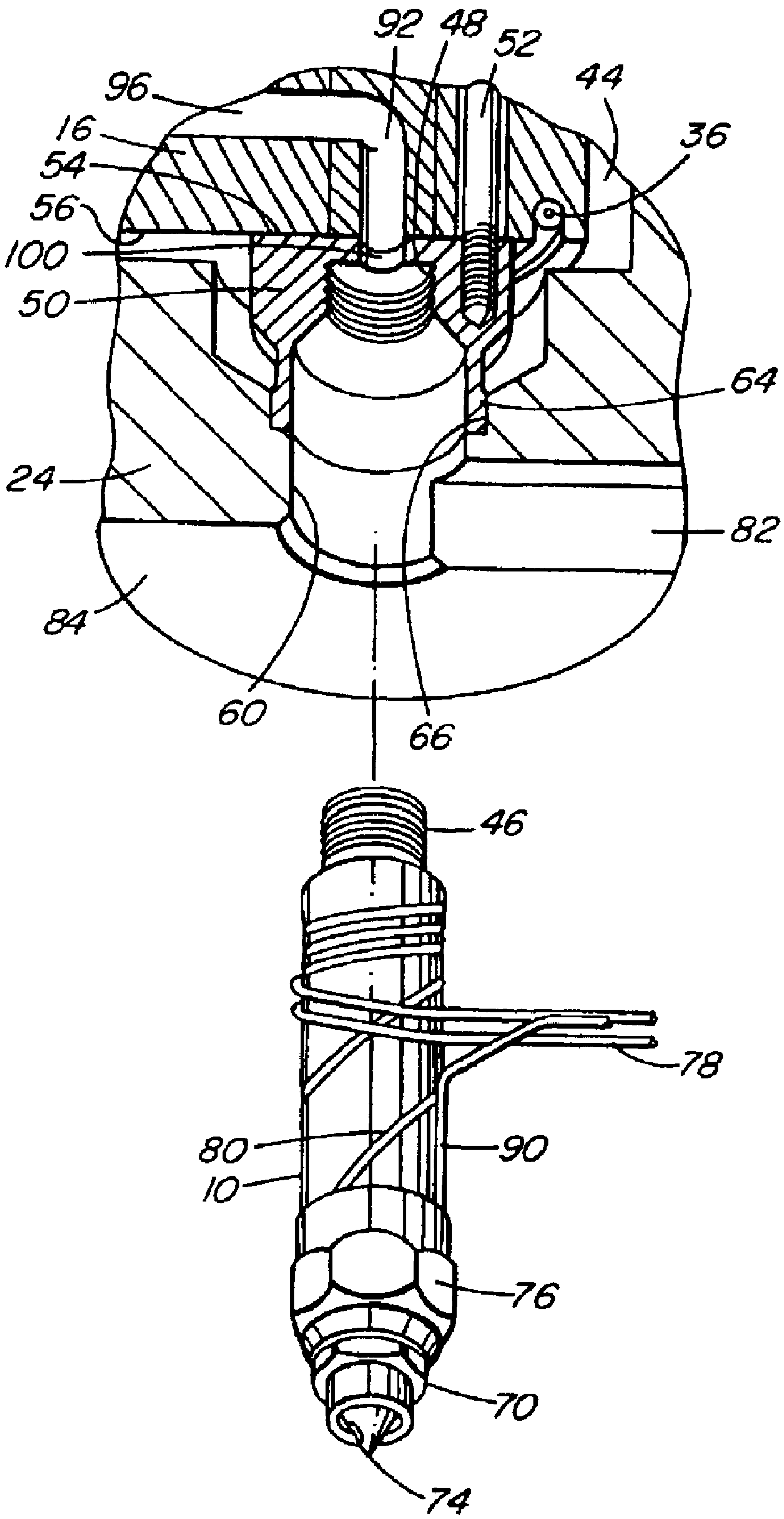

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FIG. 2

INJECTION MOLDING NOZZLE SCREWED INTO A MOUNTING BASE

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

This invention relates generally to multiple nozzle injection molding apparatus and more particularly to such apparatus wherein each nozzle is screwed into a socket in a mounting base secured in place adjacent a melt distribution manifold.

Injection molding apparatus having a number of heated nozzles extending from a heated melt distribution manifold into a cooled mold are well known. U.S. Pat. No. 5,282,735 to Gellert which issued Feb. 1, 1994 shows the rear end of the heated nozzles being attached to the melt distribution manifold by being screwed into it. However, it is usually necessary to locate both the front and rear ends of the heated nozzle in the mold to allow the melt distribution manifold to move slightly laterally relative to the rear end of the nozzles to allow for heat expansion and contraction of the melt distribution manifold. This is usually done by securing a rear collar portion of the nozzle to the melt distribution manifold with screws which allow sufficient lateral movement to provide for thermal expansion and contraction. As shown, for instance in U.S. Pat. No. 4,768,283 to Gellert which issued Sep. 6, 1988, the collar portion is usually an integral part of the heated nozzle. However, as seen in U.S. Pat. No. 5,507,635 to Gellert which issued Apr. 16, 1996, the collar portion can be separable from the rest of the heated nozzle. In U.S. Pat. No. 5,268,184 to Gellert which issued Dec. 7, 1993, the nozzle has separate front and rear parts. Another variation of a removable collar portion having two segments held together by a retaining ring is shown in U.S. Pat. No. 5,429,491 to Gellert which issued Jul. 4, 1995. However, all of these previous configurations have the disadvantage that in order to remove one of the thermocouple or one of the nozzles for cleaning or replacement, it is necessary to first remove the mold from the molding machine and the manifold and cavity plates from the rear back plate.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to at least partially overcome the disadvantages of the prior art by providing multiple nozzle injection molding apparatus wherein each heated nozzle is screwed into a mounting base which allows removal of the heated nozzles by removing only the cavity plate.

To this end, in one of its aspects, the invention provides injection molding apparatus having a heated melt distribution manifold and a plurality of heated nozzles mounted in a mold. Each heated nozzle has a threaded rear end and a melt bore extending therethrough to convey melt to a gate leading to a cavity. The melt distribution manifold has a front face and a melt passage extending therethrough. The melt passage has a number of branches extending outwardly from a common inlet portion to an outlet on the front face of the melt distribution manifold aligned with the melt bore extending through one of the heated nozzles. Each heated nozzle extends from a mounting base having a rear end abutting against the front face of the melt distribution manifold. Each mounting base has a frontwardly open threaded seat and a melt bore extending rearwardly therethrough from the threaded seat to the rear end. The rear end of each heated nozzle is screwed into the threaded seat of one of the mounting bases. The melt bore through the mounting base extends from one of the outlets of the melt passage to the aligned melt bore extending through the heated nozzle.

Furthers objects and advantages of the invention will appear from the following description taken together with accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional view of a portion of a multi-nozzle injection molding apparatus wherein each heated nozzle is screwed into a mounting base attached to the melt distribution manifold according to a preferred embodiment of the invention, and

FIG. **2** is an isometric view showing how the heated nozzle is removed.

DETAILED DESCRIPTION OF THE INVENTION

Reference is first made to FIG. **1** which shows a multi-nozzle injection molding apparatus or system wherein a number of heated steel nozzles **10** are mounted in a mold **12** to convey melt from a melt passage **14** in an elongated heated steel melt distribution manifold **16** to gates **18**, each of which lead to a cavity **20**. While only a single heated nozzle **10** is shown for ease of illustration, normally this type of apparatus will have a larger number of heated nozzles **10** extending forwardly in the mold from the heated elongated melt distribution manifold **16**. Similarly, while the mold **12** can have a greater number of plates depending upon the application, in this case, only a rear back plate **22** and a manifold plate **24** secured together by bolts **25**, as well as cavity plate **26** and a core plate **28** are shown for ease of illustration.

The melt distribution manifold **16** has a heated inlet portion **30** which is surrounded by a locating ring **32** secured to the top clamp plate **22** by screws **34**. The melt distribution manifold **16** is heated by an integral electrical heating element **36** and the surrounding mold **12** is cooled by pumping a cooling fluid such as water through cooling channels **38**. The melt distribution manifold **16** is mounted between the rear back plate **22** and the manifold plate **24** by a central manifold locator **40** and a number of pressure discs **42** to provide an insulative air space **44** between the heated melt distribution manifold **16** and the surrounding cooled mold **12**.

Each heated nozzle **10** has a threaded rear end **46** which screws into a threaded seat or socket **48** in a mounting base **50** according to the invention. In this embodiment, the mounting base **50** is secured by screws **52** extending through holes **58** through the melt distribution manifold **16** with its rear end **54** abutting against the front face **56** of the melt distribution manifold **16**. Each heated nozzle **10** extends from the Mounting base **50** forwardly through an opening **60** through the manifold plate **24** into an opening **62** in the cavity plate **26** extending to one of the gates **18** leading to a cavity **20**. Each of the mounting bases **50** has a forwardly extending circular flange portion **64** which is received in a circular seat **66** extending around the opening **60** in the manifold plate **24** to locate the rear end **46** of the heated nozzle **10**. In this embodiment, the front end **68** of heated nozzle **10** is located by a two-piece nozzle seal **70** which is screwed into the front end **68** of the heated nozzle **10** and extends forwardly into a seat **72** in the cavity plate **26** to ensure the tip end **74** of the nozzle seal **70** is accurately aligned with the gate **18**. Thus, the heated nozzles **10** are very accurately secured in place.

With the heated nozzle **10** secured in this position, there is an insulative air space **88** between it and the surrounding cooled mold **12**. Each heated nozzle **10** has a nut-like portion **76** which is engageable by a suitable tool (not shown) to tighten it into or loosen it out of the threaded seat or socket **48** in the mounting base **50**. Each heated nozzle **10** also has wires **78** from an integral heating element **80** extending through a channel **82** in the front face **84** of the manifold plate **24**. In the embodiment shown, a thermocouple element **90** also extends through the channel **82** and the air space **88** and into the nozzle **10** to control the operating temperature.

The melt passage **14** in the melt distribution manifold **16** extends outwardly from an inlet portion **94** in the inlet portion **30** of the melt distribution manifold **16** through a number of branches **96**. Each branch **96** extends through an insert or plug **92** to an outlet **98** on the front face **56** of the melt distribution manifold **16**. Each mounting base **50** has a melt bore **100** extending rearwardly therethrough from the threaded seat or socket **48** to its rear end **54**. The melt bore **100** is the same size and is in alignment with one of the outlets **98** from the melt passage **92** in the melt distribution manifold **16**. Each heated nozzle **10** also has a matching central melt bore **102** which is aligned with the melt bore **100** through the mounting base **50** and a melt bore **104** through the two-piece seal **70**.

If it is necessary to remove one or more of the heated nozzles **10** for cleaning or replacement, the mold **12** is opened and the cavity plate **26** is removed by unscrewing bolts **106**. As can be seen, this exposes the front ends **68** and the nut-like portions **76** of the heated nozzles **10**. Thus, the provision of the mounting bases **50** with the threaded seats or sockets **48** according to the invention allow any of the heated nozzles **10** to be easily removed without removing the manifold plate **24** by unscrewing it from the socket **48** with a wrench and then cleaned or replaced by a new one.

In use, the system is assembled as shown. Electrical power is applied to the electrical heating elements **36**, **80** in the melt distribution manifolds **16** and the heated nozzles **10** to heat the melt distribution manifolds **16** and the heated nozzles **10** to a predetermined operating temperature. Pressurized melt is then applied from a molding machine (not shown) to the inlet portion **94** of the melt passage **92** according to a predetermined injection cycle. The melt flows through the heated nozzle **10**, mounting bases **50**, and gates **18** into the cavity or cavities **20**. After the cavity **20** is filled and a suitable packing and cooling period has expired, injection pressure is released. The mold **12** is then opened to eject the molded product. After ejection, the mold **12** is closed and the cycle is repeated continuously every 15 to 30 seconds with a frequency depending upon the wall thickness and the number and size of the cavities **20** and the exact material being molded.

While the description of the hot runner injection molding apparatus having the heated nozzles **10** screwed into threaded seats or sockets **48** in mounting bases **50** adjacent the melt distribution manifold **16** has been given with respect to a preferred embodiment, it will be evident that various modifications are possible without departing from the scope of the invention as understood by those skilled in the art and as defined in the following claims. For instance, the mounting bases **50** may be secured in place adjacent the melt distribution manifold **16** by means other than screws **52**.

The embodiments of the invention in which an exclusive property or privilege is claimed is defined as follows:

1. In an injection molding apparatus having a heated melt distribution manifold **(16)** and a plurality of nozzles **(10)** mounted in a mold **(12)**, each nozzle **(10)** having a threaded rear end **(46)** and a melt bore **(102)** extending therethrough to convey melt to a gate **(18)** leading to a cavity **(20)**, the melt distribution manifold **(16)** having a front face **(56)** and a melt passage **(14)** extending therethrough, the melt passage **(14)** having a plurality of branches **(96)** extending outwardly from a common inlet portion **(94)** to an outlet **(98)** on the front face **(56)** of the melt distribution manifold **(16)** aligned with the melt bore **(102)** extending through one of the nozzles **(10)**, the improvement comprising:

each nozzle **(10)** extending from a mounting base **(50)** having a rear end **(54)** secured against the front face of the melt distribution manifold **(16)**, each mounting base **(50)** having a frontwardly open threaded seat **(48)** and a melt bore **(100)** extending rearwardly therethrough from the threaded seat **(48)** to the rear end **(54)**, the rear end **(46)** of each nozzle **(10)** being screwed into the threaded seat **(48)** of one of the mounting bases **(50)** with the melt bore **(100)** through the mounting base **(50)** extending from one of the outlets **(98)** of the melt passage **(14)** to the aligned melt bore **(102)** extending through said nozzle **(10)**.

2. An injection molding apparatus as claimed in claim **1**, wherein each mounting base **(50)** is secured to the melt distribution manifold **(16)**.

3. An injection molding apparatus as claimed in claim **2** wherein the mold **(12)** comprises at least a manifold plate **(24)** with a front surface **(84)** and a cavity plate **(26)** with a rear surface **(86)**, the front surface **(84)** of the manifold plate **(24)** abuts against the rear surface **(86)** of the cavity plate **(26)**, each nozzle **(10)** extends forwardly through an opening **(60)** through the manifold plate **(24)**, and each mounting base **(50)** has a circular flange portion **(64)** extending forwardly into a circular seat **(66)** extending around said opening **(60)** through the manifold plate **(24)**.

4. An injection molding apparatus as claimed in claim **3** wherein each nozzle **(10)** has a portion **(76)** engageable by a tool.

5. An injection molding apparatus as claimed in claim **4** wherein a channel is provided in at least one of the front surfaces **(84)** of the manifold plate **(24)** and the rear surface **(86)** of the cavity plate **(26)** in which to run wires **(78)** to each nozzle **(10)**.

6. An injection molding apparatus as claimed in claim **1** wherein each nozzle **(10)** has a heating element **(80)**.

7. An injection molding apparatus comprising a heated mold manifold **(16)** including a melt channel portion **(92)**, a mounting base **(50)** securely attached solely to said manifold **(16)** by a fastener **(52)** partially located in said manifold **(16)** having a threaded portion **(48)** and a melt channel portion **(100)** in alignment with melt channel portion **(92)** of the manifold, and an injection nozzle **(10)** having a threaded end portion **(46)** and a melt channel **(48)**, whereby said injection nozzle **(10)** is connected to said mounting base **(50)** via its threaded portion **(46)** so that melt channel **(48)** is in alignment with melt channel portion **(100)** of said mounting base **(50)** and with the melt channel portion **(92)** of the manifold **(16)** during the thermal expansion of said manifold **(16)** due to heating.

8. An injection molding apparatus according to claim **7** where said mounting base **(50)** further includes flange portion **(64)** which is received in a circular seat **(66)**.

9. An injection molding apparatus comprising a mold manifold **(16)** including a melt channel portion **(92)**, an injection nozzle **(10)** having a threaded end portion **(46)** and a melt channel **[(48)]** *(102)*, a mounting base **(50)** located entirely between said manifold **(16)** and said injection nozzle **(10)**, said mounting base having a threaded portion **(48)** and a melt channel portion **(100)** in alignment with melt channel portion **(92)** of the manifold, whereby said injection nozzle **(10)** is connected to said mounting base **(50)** via **[**its**]** *the* threaded portion **(46)** *of the injection nozzle* so that melt channel **[(48)]** *(102)* is in alignment with melt channel portion **(100)** of said mounting base **(50)** and with the melt channel portion **(92)** of the manifold **(16)** during the thermal expansion of said manifold **(16)** due to heating and whereby said mounting base **(50)** is securely and solely attached to said manifold **(16)** via a fastener **(52)** partially located in said manifold **(16)**.

10. An injection molding apparatus according to claim **9** where said mounting base **(50)** further includes flange portion **(64)** which is received in a circular seat **(66)**.

11. An injection molding apparatus comprising a heated mold manifold **(16)** including a melt channel portion **(92)**, a mounting base **(50)** having a threaded portion **(48)** and a melt channel portion **(100)** in alignment with melt channel portion **(92)** of the manifold, and an injection nozzle **(10)** having a threaded end portion **(46)** and a melt channel **[(48)]** *(102)*, said injection nozzle **(10)** being connected to said mounting base **(50)** via *the* threaded portion **(46)** *of the injection nozzle,* whereby said mounting base **(50)** is securely and solely attached to said manifold **(16)** by a fastener **(52)** partially located in said manifold **(16)**.

12. An injection molding apparatus according to claim **11** where the mounting base **(50)** is entirely located between said manifold **(16)** and said nozzle **(10)**.

13. An injection molding apparatus according to claim **11** where said mounting base **(50)** further includes flange portion **(64)** which is received in a circular seat **(66)**.

14. An injection molding apparatus comprising:

a melt distribution manifold including a melt passage;

a mounting base having a threaded connecting portion; and

an injection nozzle having a threaded connecting portion and a melt channel,

wherein said injection nozzle is coupled to said mounting base via the respective connecting portions of said mounting base and said injection nozzle, and said mounting base is secured against said manifold.

15. The injection molding apparatus of claim 14, wherein the melt channel of said injection nozzle is aligned with the melt passage of said melt distribution manifold.

16. The injection molding apparatus of claim 15, wherein said mounting base is secured against a front face of said melt distribution manifold using a fastener.

17. The injection molding apparatus of claim 16, wherein said fasteners are screws partially located in said melt distribution manifold.

18. The injection molding apparatus of claim 14, wherein said melt passage of said melt distribution manifold includes a plurality of branches extending outwardly from a common inlet portion to a plurality of outlets on a front face of the melt distribution manifold; and

wherein said injection nozzle and said mounting base are located at the outlet of one of said plurality of branches and an injection nozzle and mounting base are located at the outlet of each of the remaining plurality of branches, each nozzle having a threaded rear end and a melt bore extending therethrough to convey melt to a gate leading to a cavity, the melt bore of each nozzle aligned with the respective melt passage of each of said plurality of branches.

19. The injection molding apparatus of claim 14, further comprising a mold, wherein the mold comprises a manifold plate with a front surface and a cavity plate with a rear surface, the front surface of the manifold plate abutting against the rear surface of the cavity plate, wherein said nozzle extends forwardly through an opening through the manifold plate, and said mounting base includes a circular flange portion extending forwardly into a circular seat extending around said opening through the manifold plate.

20. The injection molding apparatus of claim 19, further comprising a channel provided in at least one of the front surface of the manifold plate and the rear surface of the cavity plate in which to run wires to the injection nozzle.

21. The injection molding apparatus of claim 20, wherein the injection nozzle has a portion engageable by a tool.

22. An injection molding apparatus comprising:

a mold including at least a manifold plate with a front surface and a rear surface and a cavity plate with a rear surface, the front surface of the manifold plate abutting against the rear surface of the cavity plate;

a melt distribution manifold including a melt passage mounted in said mold, the melt distribution manifold including a front surface facing the rear surface of said manifold plate;

a heated injection nozzle having a threaded end portion and a melt channel mounted in said mold, wherein said injection nozzle is coupled to said melt distribution manifold; and

a channel provided in at least one of the front surface of the manifold plate and the rear surface of the cavity plate in which to run wires to the injection nozzle.

23. The injection molding apparatus of claim 22, wherein the melt channel of said injection nozzle is aligned with the melt passage of said melt distribution manifold.

24. The injection molding apparatus of claim 22, further comprising a mounting base including a threaded seat, wherein said injection nozzle is coupled to said melt distribution manifold through said mounting base.

25. The injection molding apparatus of claim 24, wherein said mounting base is secured against a front face of said melt distribution manifold using a fastener.

26. The injection molding apparatus of claim 25, wherein said fasteners are screws partially located in said melt distribution manifold.

27. The injection molding apparatus of claim 22, wherein separation of the cavity plate from the manifold plate exposes a front portion of said injection nozzle and permits removal of said injection nozzle from said mold.

28. The injection molding apparatus of claim 27, wherein the front portion of the injection nozzle is engageable by a tool.

29. An injection molding apparatus comprising:

a mold including at least a manifold plate with a front surface and a cavity plate with a rear surface and a front plate, the front surface of the manifold plate abutting against the rear surface of the cavity plate;

a melt distribution manifold including a melt passage mounted in said mold;

an injection nozzle having a threaded end portion and a melt channel mounted in said mold, wherein said injection nozzle is coupled to said melt distribution manifold;

a bolt entering from said front surface of said cavity plate for mounting said cavity plate to said manifold plate, *wherein removal of said bolt separates the cavity plate from the manifold plate and exposes a front portion of said injection nozzle and permits removal of said injection nozzle from said mold.*

30. The injection molding apparatus of claim 29, further comprising a channel provided in at least one of the front surface of the manifold plate and the rear surface of the cavity plate in which to run wires to the injection nozzle.

31. The injection molding apparatus of claim 29, wherein the melt channel of said injection nozzle is aligned with the melt passage of said melt distribution manifold.

32. The injection molding apparatus of claim 29, further comprising a mounting base including a threaded seat, wherein said injection nozzle is coupled to said melt distribution manifold through said mounting base.

33. The injection molding apparatus of claim 32, wherein said mounting base is secured against a front face of said melt distribution manifold using a fastener.

34. The injection molding apparatus of claim 33, wherein said fasteners are screws partially located in said melt distribution manifold.

35. The injection molding apparatus of claim 29, wherein the front portion of the injection nozzle is engageable by a tool.

36. An injection molding system comprising:

a manifold having a melt channel;

a nozzle having a threaded rear end removably connected to the manifold and having a heater;

a plate surrounding the nozzle, the plate having a front surface facing opposite the manifold; and

a bolt entering from the front surface of the plate for mounting the plate around the nozzle, wherein removal of the bolt and plate provides access to the nozzle and nozzle heater in order to remove and attach the nozzle and nozzle heater with respect to the molding system.

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