# United States Patent [19]

**Gordon**

[11] **3,718,166**

[45] **Feb. 27, 1973**


[54] **MANIFOLD AND ADJUSTABLE NOZZLE ASSEMBLY FOR MOLDING MACHINES**


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[73] Assignee: **Midland-Ross Corporation**



[22] Filed: **Oct. 2, 1970**

[21] Appl. No.: **77,620**

**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 774,648, Nov. 12, 1968, abandoned.

[52] **U.S. Cl.** .....**141/236,** 425/247, 141/279, 141/387

[51] **Int. Cl.** .....**B65b 1/04**

[58] **Field of Search**...18/30 JA, 30 AP, 30 NM, 30 NA, 18/30 NB, 30 NH, 30 NP, 30 NR, 30 NT, 30 NV, 30 NW, 30 NS, 30 NY, 30 NZ; 141/236, 284, 279, 387; 425/191, 192, 242, 247



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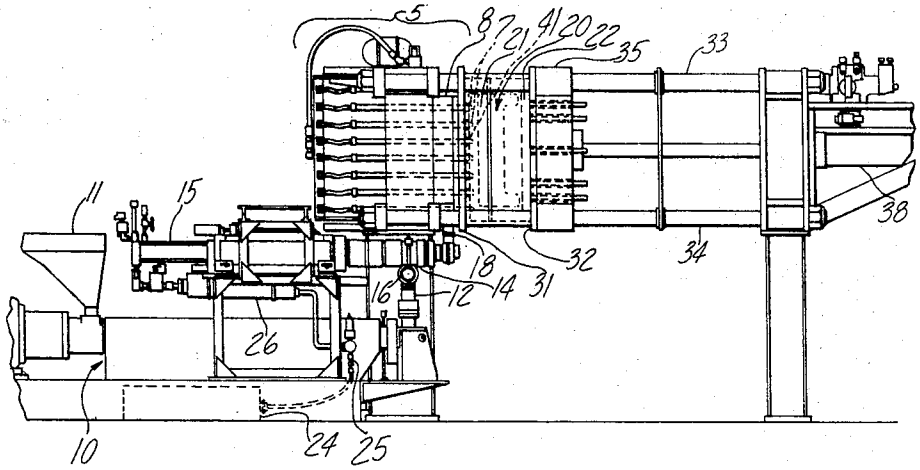
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*Attorney*—Woodrow Portz et al.



[57] **ABSTRACT**

A manifold and nozzle assembly within injection-molding equipment comprising, e.g., an extruder, an accumulator, a manifold, and a plurality of nozzles wherein the nozzles are universally pivotable with respect to the manifold. This invention is especially directed to sleeve structure by which the nozzles are attached to and pivotally supported by the manifold, and to nozzles of the type comprising a shutoff valve.


**17 Claims, 9 Drawing Figures**



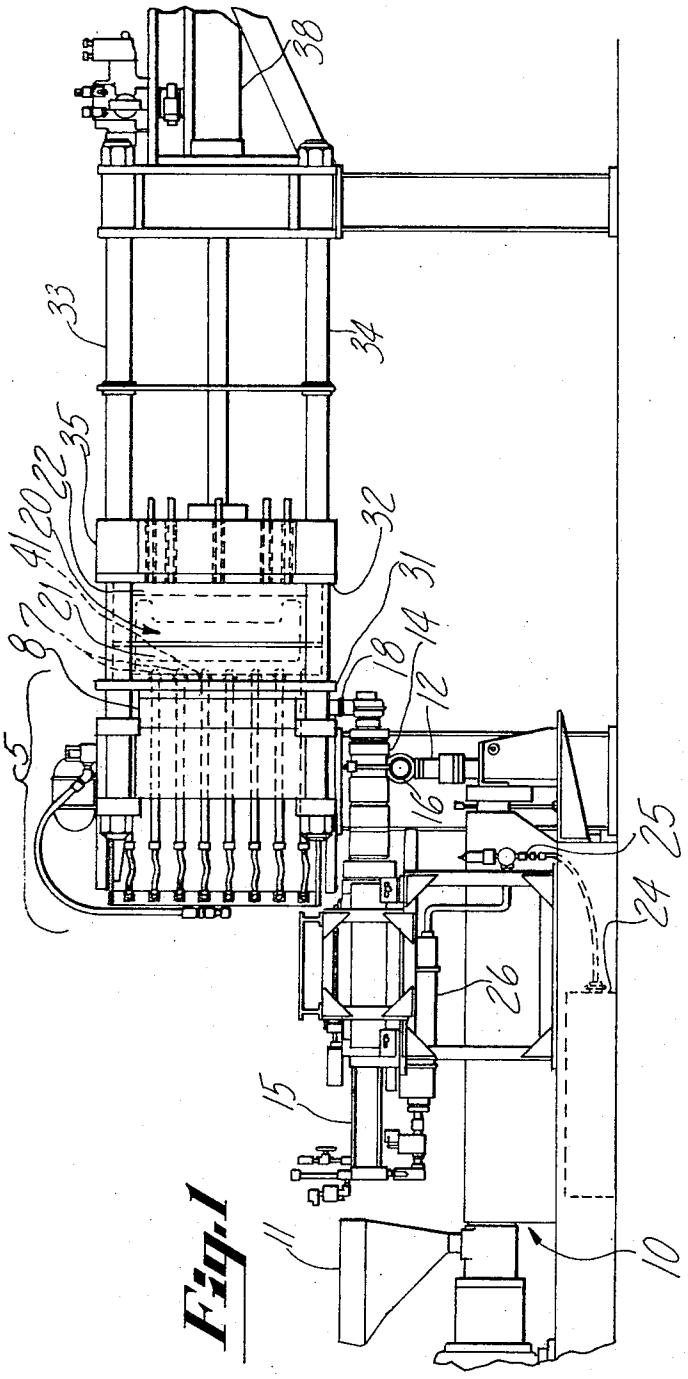



Fig. 1

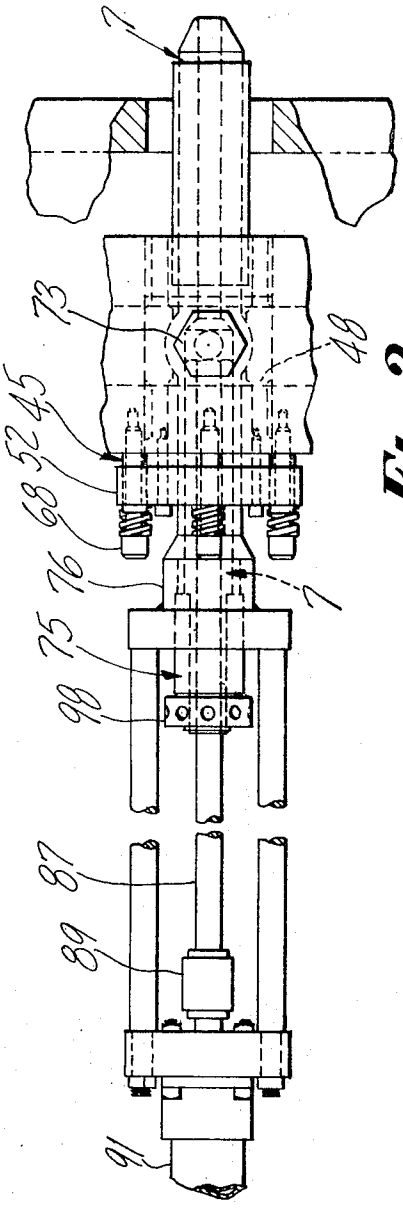



Fig. 2

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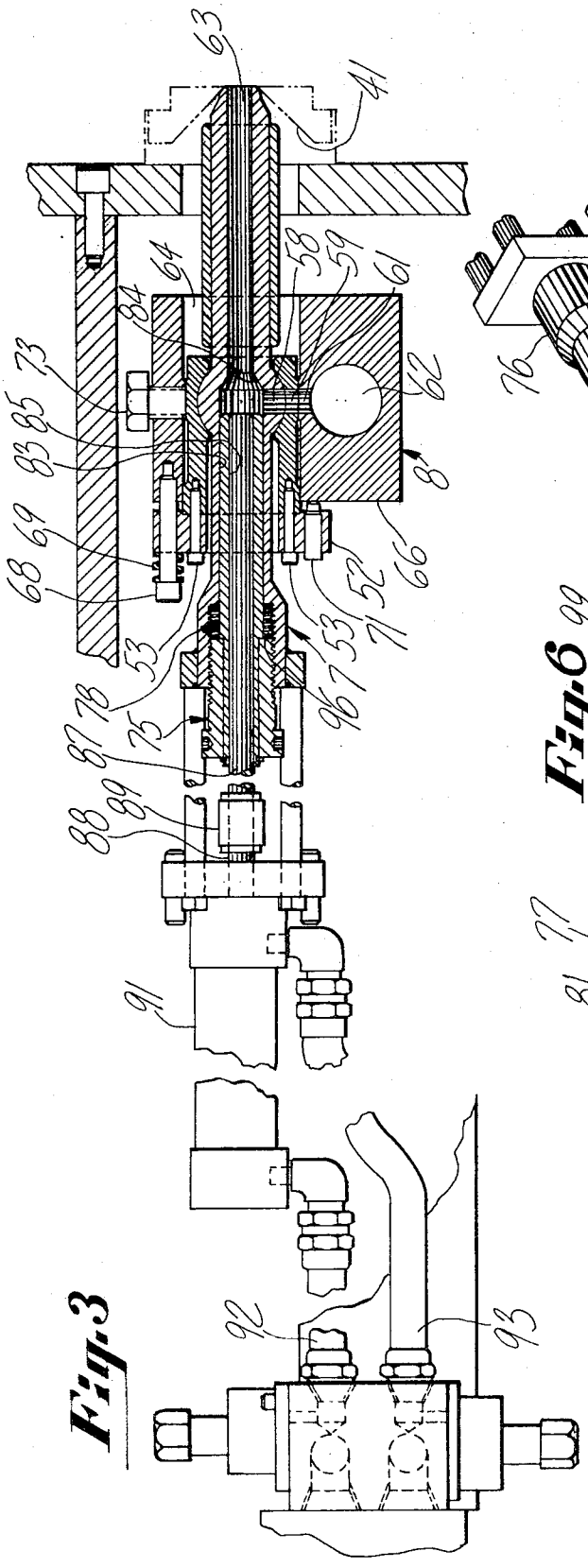


Fig. 3

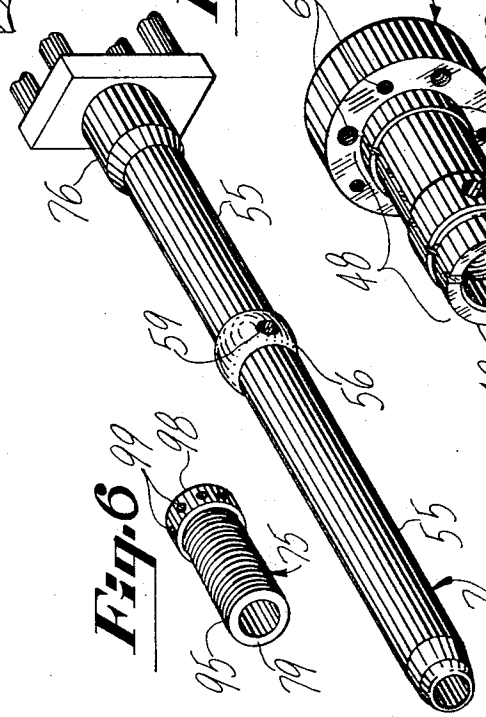


Fig. 5



Fig. 4

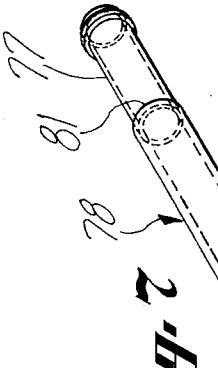


Fig. 6



Fig. 7

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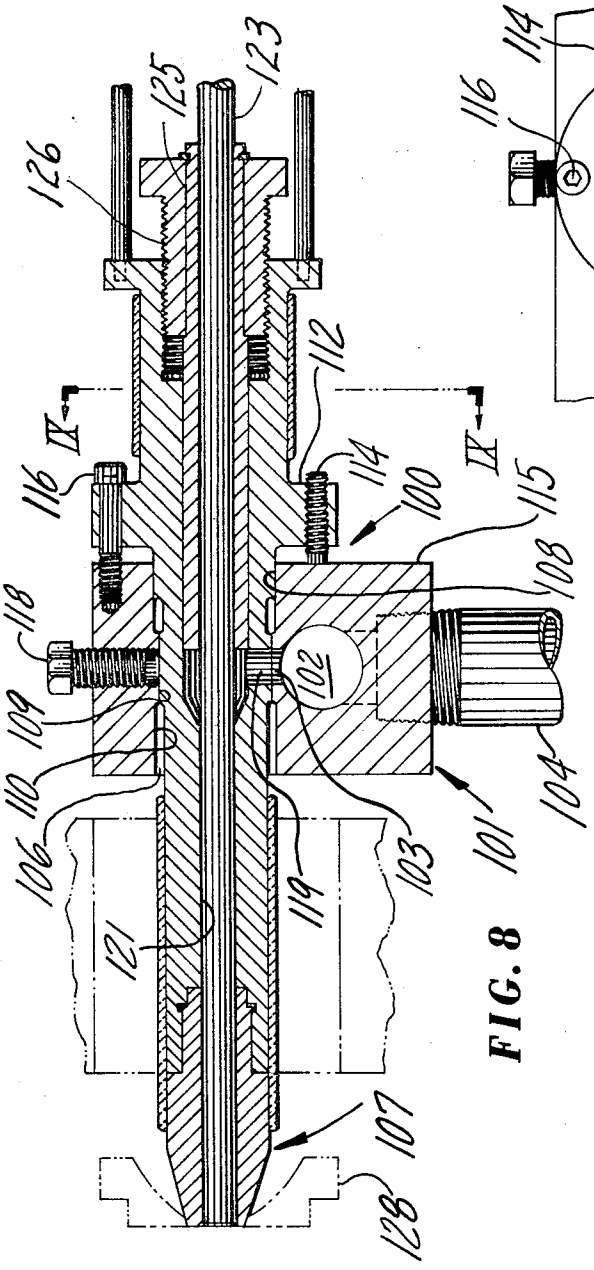



FIG. 8

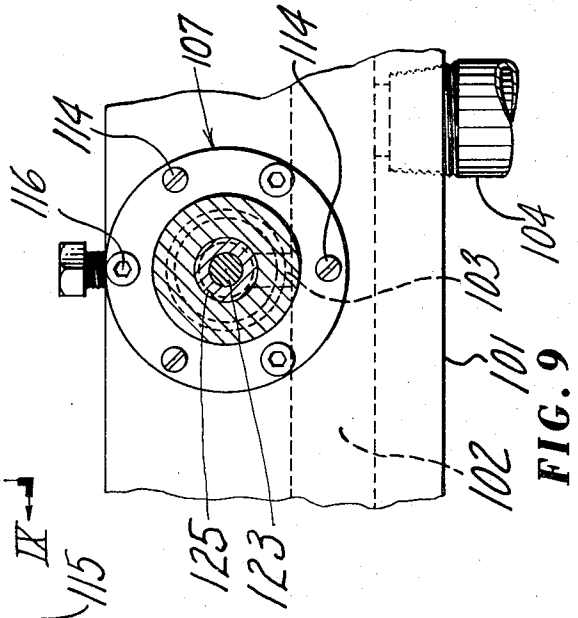



FIG. 9

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# MANIFOLD AND ADJUSTABLE NOZZLE ASSEMBLY FOR MOLDING MACHINES

This is a continuation-in-part application of Pat. application Ser. No. 774,648 filed Nov. 12, 1968, now abandoned.

## DESCRIPTION

While the prior art contains a number of examples of nozzles in universally pivoting relation with a manifold or other fluid-supplying member, a type of nozzle of more recent design, respecting which the present invention provides an improvement, includes shutoff and duct-cleaning valve mechanism which results in a highly elongated nozzle unit. Such a unit has conventionally been rigidly attached to the manifold with any adjustability of the nozzle tip being obtained through movement of the manifold-nozzle assembly in its entirety. Consequently, the nozzles are not yieldable or adjustable with respect to each other or the manifold. This necessitates the construction of the manifold, the nozzles, and the nozzle-seating surfaces on the mold to extremely close tolerances in three dimensions to avoid escape of material from between engaged surfaces of the nozzle tips and the mold sprue ports. However, because of the substantial forces to which the nozzles are subjected, the parts are of such massive, unyielding construction as to cause difficulty in maintaining the nozzle tips in proper seating relation with the sprue bushings if there happen to develop differences in expansion of the equipment and the mold as a result of differences in temperature. Furthermore, there may be a tendency of engaged parts to move out of registry because of the change in temperature differences between the temperatures of parts during a start-up period and sustained equilibrium operating conditions. Hence, it is difficult to construct conventional rigidly connected nozzle and manifold assemblies which will be leakproof with respect to corresponding molds under all operating conditions.

A primary object is to provide nozzle and manifold structure wherein the nozzles may adjust automatically or be adjusted manually in respective longitudinal directions to bring effective seating relationship and nearly equal pressure on all sprue seats afforded by a mold supported in opposition to the manifold.

An important object of the present invention is to provide nozzle an manifold structure for injection-molding machinery wherein the nozzles are self-aligning with respect to corresponding sprue entrances or ports of cooperating contour on a mold.

To achieve these and other objects, a manifold and nozzle assembly is provided in injection-molding machinery wherein the manifold has a plurality of substantially parallel bore-like openings through which the nozzles extend and beyond which the distal ends of the nozzles may separately engage sprue bushings or other sprue orifices of a mold and, as a basis for the present invention, the manifold nozzle assembly includes mechanism for supporting the nozzle adjustably lengthwise of the axis of its respective opening in the manifold. In one form of the invention, structure is provided for limiting the movement of the nozzle to movement along the axis of the opening. In another form, structure is disclosed for supporting the nozzle in both linearly axial and universally pivoting adjustability relative to a manifold. For example, a sleeve received in each opening in closely fitting slidable relation with internal surfaces defining each opening as structure for directly supporting the nozzle received within the sleeve. The sleeve and the nozzle have complementary surfaces conforming to a sphere centered generally along the axis of the nozzle, establishing a ball-in-socket type of connection enabling the nozzle to be universally pivotable with respect to the manifold. Further structure such as set screws carried by the nozzle acting in an axial direction on a portion of the manifold render the sleeve and the associated nozzle adjustable in the lengthwise direction of the opening. Laterally extending apertures form a passageway contiguous with the central bore of the nozzle and a branch passageway to the manifold are provided in the joint structure of the nozzle and the sleeve.



In the drawing with respect to which the invention is described:

FIG. **1** is an elevation view of injection-molding equipment in which the manifold and nozzle assembly of this invention is incorporated;

FIG. **2** is a fragmentary shortened side view illustrating a nozzle and an adjacent portion of a manifold in which the nozzle is supported;

FIG. **3** is a fragmentary shortened plan view partly in section of the nozzle of FIG. **2**, a portion of a mold cooperating therewith, and a valve and valve-actuating mechanism associated therewith;

FIG. **4** is a perspective view of a partially split sleeve normally occupying an opening in the manifold of the previous figures;

FIG. **5** is a perspective view of a nozzle adapted to extend through and be supported in ball-in-socket relationship by the sleeve of FIG. **4**;

FIG. **6** is a perspective view of an adjustment bushing adapted to fit within the head end of the nozzle of FIG. **5**;

FIG. **7** is a perspective view of a tubular valve element having portions receivable in the bushing of FIG. **6** and the bore of the nozzle of FIG. **5**;

FIG. **8** is a fragmentary plan view in section of a modified nozzle-manifold assembly limiting the nozzle to axial adjustment; and

FIG. **9** is a fragmentary section view of the nozzle-manifold assembly taken along line IX—IX of FIG. **8**.

FIG. **1** is provided for general illustration, with many details lacking, of the type of molding equipment in which the manifold and nozzle assembly **5** is typically incorporated. Except for the structure disclosed herein for pivotally mounting mold-feeding nozzles **7** in a manifold **8**, the apparatus for supplying a plastic material to the manifold **8** is known and need be only generally discussed. The equipment shown in FIG. **1** for supplying the fluid plastic to the manifold **8** includes an extruder **10** having a hopper **11** into which pellets or granules of thermoplastic resin are fed and begin passage through the equipment shown. The resin is converted by the extruder to a fluid state and passed upwardly through a duct **12** into an accumulator **14** actuated by hydraulic cylinder **15**. As shown, a duct **12** joins with a manifold **16**, shown merely in end view in FIG. **1**, which may connect also with another accumulator (not shown) disposed in parallel relation with the accumulator **14**. In a manner known, the extruder **10** may serve other manifold and nozzle assemblies not

shown similar to assembly 5 from the manifold 16. The accumulator 14, in essence a hydraulic cylinder, stores the molten plastic continuously received from the extruder and upon demand, ordinarily from a programmed control system operating the cylinder 15 and certain valves associated with the accumulator and manifold 14, discharges a plastic material through a feed pipe 18 into the manifold 8.

As the equipment shown is especially useful in injecting foamable plasticized material into a mold 20 consisting of halves 21, 22, elements 24, 25, 26 may be provided for use in supplying a foaming agent into the barrel of the extruder 10. The molten plastic discharged by the extruder is retained under such pressure as to avoid foaming until it is injected into the cavity of the mold 20.

The mold halves 21, 22 are connected to mold-mounting plates 31, 32, respectively. The plate 31 is movably supported on four tie rods (see rods 33, 34) of the press. The mounting plate 32 is fixed to a movable platen 35. The manifold 8 is fixed to the fixed frame or platen structure 36 which has appropriate openings therethrough to accommodate actuating mechanism for the valve parts of the various nozzles 7. Hence, as the movable platen 35 moves to the mold-closing position at a predetermined mold-closing force exerted by its hydraulic actuating cylinder 38, the mold half 21 is supported at a substantially fixed molding position by the substantially non-yielding nozzle 7.

The term "substantially non-yielding" is meant to be applicable to the present invention although nozzles provided in accordance with this invention are supported in pivotal joint structure which permits longitudinal adjustment of the nozzles on yielding of the structure to enable minute shifting of the pivot centers of the nozzles relative to the manifold. It is inevitable that small differences will occur in the accuracy with which nozzle tips simultaneously engage corresponding or mating sprue ports of a mold as provided, for example, by sprue bushings 41. Although universal pivoting of the nozzles will allow corrections of alignment with sprue ports, pivotal joint structure of rigidly fixed pivot centers readily leads to overstressing of some nozzle structure and leaking between the tips of other nozzles and mating sprue ports of a multi-sprue mold.

Hence, an essential feature of the present invention resides in pivotal joint structure for nozzles which is yieldable or adjustable in the lengthwise direction of the nozzles. The part of the joint structure attached to the manifold 8 is provided in a sleeve 45, shown separately in FIG. 4, which has raised cylindrical surfaces 46,47 along its generally cylindrical longitudinally split tubular portion 48 consisting of transversely arcuate sections 49,51. The sleeve 45 further comprises a one-piece annular flange to which the arcuate or half-sections 49,51 are secured by means, such as cap screws 53, with a small clearance between the sections along the plane in which the tubular portion 48 is split.

The interior surface of the sleeve is necessarily of a configuration providing clearance with the outer generally cylindrical surface 55 of the nozzle 7 except for nozzle joint surface 56 and joint surface 57 of the sleeve normally engaged with surface 56. Surfaces 56 and 57 are of equatorial configuration approximately concentric to the same sphere. To enable universal movement of the nozzle relative to the sleeve, the surface 57 is preferably of greater width than the surface 56. The surface 57 is preferably centered as shown in radial alignment with the outer raised nozzle surface 46.

The sleeve and the nozzle (in assembled condition) have radially aligned apertures 59,58, respectively, which are in alignment with a branch passageway or aperture 61 which together provide a connecting passageway which connects passageway 62 running longitudinally of the manifold 8 with the bore 63 of the nozzle. While apertures 58,59 are shown in coaxial alignment with the aperture 61, it is possible for these apertures to move slightly out of coaxial alignment with aperture 61, as the sleeve and the nozzle are adjusted lengthwise of the manifold opening 64 to establish seating relation of the nozzle tip with the sprue busing 41 or other seating surface.

As an essential feature of the invention, adjustability of the nozzle is enabled, for example, by extension of the flange 52 over an annular surface portion of a lateral manifold surface 66 and fastening means connecting the overlapping portions of the flange and the surface 66. In the embodiment shown, the flange 52 has holes 67 spaced along a circumference concentric to the axis of the sleeve 45 in parallel relation with such axis. Alternate holes 67 receive cap screws 68 which extend slidably through the flange 52 into the manifold 8 in threaded relation with the latter. Each cap screw 68 extends through a spring 69 normally maintained in a condition of compression between the head of the cap screw and the flange 52. The sleeve 52 thus has a range of movement afforded by the compressibility range of the springs 69. Another alternate group of holes 67 are threaded and receive set screws 71. In use, such screws project beyond their openings in the flange 52 into engagement with the manifold surface 66 to provide a desired spacing between the sleeve flange and the manifold. In practice, the manifold is brought into position relative to a mold to cause the nozzles supported by the manifold to bear against respective seating surfaces defining sprue entrances in the manner shown in FIGS. 1 or 7. At this juncture, the nozzle tips and the set screw tips may be examined with respect to contact with respective seats. If the nozzle is found to be in imperfect contact with the sprue entrance, the screws 71 of a nozzle may be adjusted outwardly or to the left as viewed in FIG. 3 until the screws lose contact with the surface 66. In this manner, the screws 71 provide a sensing device as to the effective seating relationship between the nozzle tips and corresponding sprue entrance seats. This adjustment may be made while the machine is cold and inoperative. This adjustment is performed preferably with a set screw 73 backed off from solid contact with the surface 46 of the sleeve 45. The set screw 73 is normally tightened against the sleeve to prevent any leakage of hot plastic between the sleeve and the manifold at the junction of openings 59,61.

If preferred, the platen pressure of the press in which the manifold 8 is mounted may be raised to a level which causes the movable platen 35 to be moved toward the stationary platen supporting the nozzles sufficiently to move all nozzle and sleeve assemblies to the

left as viewed in FIG. 3 until contact of the nozzle tip having the greatest original spacing from its seat is established. If reasonable machining tolerances are observed in the construction of the molding machine, such relative movement of the manifold and the mold providing the nozzle tip seating surfaces need not exceed more than 0.001 inch. With the set screws **73** relieved slightly, the cap screws **71** may then be adjusted to attain uniformity in the pressure of the various nozzles against the mold.

Disclosed herein are separate flow-control valve and shutoff valve mechanisms. The flow-control valve mechanism comprises an exteriorly threaded bushing **75** received in an enlarged proximal end portion **76** of the nozzle. The bushing has an internal bore suitably cylindrical to fit around the outer cylindrical surface **77** of a barrel **78**. The end surface **79** of the bushing normally engages a shoulder **81** of the barrel **78**. The shoulder **81** joins the surface **77** with another cylindrical surface **82** of the barrel of larger diameter complementary to a cylindrical surface or bore **83** of the nozzle. It will be noted in FIG. 3 that bore **83** is of larger diameter than bore **63** and that the bores join in a frustro-conical surface **84**. However, the internal surface or bore **85** of the barrel **78** is of the same diameter as the nozzle bore **63** to provide a passageway substantially throughout the length of the nozzle of uniform diameter for receiving a rod or plunger **87**, which in conjunction with that portion of the nozzle defining the bore **63** functions as a shutoff valve. The plunger **87** is connected with a piston rod **88** by coupling **89** and is thus traversable by the piston of a hydraulic cylinder unit **91** the full length of the bore **63**. The unit **91** is of the double-acting type with oil supplied thereto by a suitable supply system including tubes **92** and **93**.

Illustrated herein but claimed in a companion application Ser. No. 774,851 now issued as Pat. No. 3,561,062 as a separate invention is the flow-control mechanism incorporated within the nozzle **7**. Such mechanism includes the bushing **75** having its external threaded surface **95** in threaded relation with a threaded counterbore **96** within an enlarged proximate end portion **76** of the nozzle. Since the other end of the bushing **75** bears against the barrel shoulder **81**, the barrel is adjusted toward the distal end of the nozzle by screwing the bushing **75** inwardly of the bore **96**. Any inward movement of the barrel **78** will cause it to move across the inner end of the aperture **18** and thus restrict the flow of fluid material from the manifold passageway **62** into the bore **63**. To facilitate turning of the bushing within the enveloping portion of the nozzle, the bushing has a head portion **98** having cylindrical apertures **99** opening the lateral surface thereof adapting the bushing for being rotated by a pin spanner wrench.

The flow-control mechanism is necessitated, for example, by progressive pressure drop along the length of the manifold which causes substantial variation in the pressure and, hence, the rate of delivery to the various nozzles supported by the manifold. The flow-control valve mechanism disclosed enables selective restriction at each nozzle in the flow of material thereinto in accordance with the manifold delivery pressure at that point. Thus, the various nozzles can be adjusted to dispense the fluid plastic at substantially equal rates.

It will be appreciated that the sleeve mounting about which the presently claimed invention is concerned may be easily disconnected from the manifold **8** by removing the cap screws **68**. The entire tube unit, including the sleeve **45** and the actuating cylinder unit **91**, may be removed upon disconnecting the lines **92,93**.

FIGS. **8** and **9** will illustrate a modified nozzle and manifold assembly **100** in which a manifold **101** is provided with a longitudinally extending passageway **102** for delivering a fluid to a plurality of branch passageways, such as passageway **103**, from a supply tube **104**. The manifold **101** has an opening **106** extending therethrough for receiving a nozzle **107**. The manifold is normally provided with a plurality of openings **106** arranged along parallel axes passing transversely through the manifold and in transverse relation to a passageway **102**. Each of such openings **106** is connected with passageway **102** by a branch passageway **103**.

As shown, the opening **106** is defined by circular surfaces **108**, **109** and **110** of which **109** is of smaller diameter. The shank of the nozzle is provided with enlarged circular surface portions of differing diameters complementary to manifold surfaces **108**, **109** which enable the manifold to receive the nozzle in closely fitting, axially slidable relationship. The engaged surface portions of the nozzle and the manifold are sufficiently axially spaced to hold the nozzle free of any wobble or universal movement relative to the manifold. Thus, the nozzle is closely confined to merely axial movement relative to the manifold and, when secured in the manifold by means such as a set screw, is supported with its axis in parallel to coaxial relation with the axis of its respective opening.

In the embodiment shown, adjustability of the nozzle in its axial direction relative to the manifold is obtained through two sets of screws acting between a flange **112**, or other radial extension of the nozzle body, and the manifold. One set of screws, typified by set screw **114**, has threaded relationship with the flange **112**, and bearing or compressive engagement with the rear-facing surface **115** of the manifold. The other set of screws, typified by cap screw **116**, has its head in seating relation with the flange **112** and threaded relation with the body of the manifold adjacent surface **115**. The two sets of screws are adjusted in opposite directions relative to the threaded portions of the manifold or the nozzle to obtain axial change of position relative to the manifold. A set screw **118** bears against a side of the nozzle shank opposite a lateral or transaxially extending aperture **119** of the nozzle. This aperture is located in contiguous intermediate relation with a central bore **121** of the nozzle and a branch passageway **103** of the manifold. A purging plunger **123**, shown fully inserted through the nozzle, may be operated by a pneumatic cylinder mechanism shown in the previously described embodiment or by other equivalent actuator.

FIG. **8** illustrates flow-controlling mechanism similar to that disclosed in the earlier described embodiment comprising a barrel **125** concentrically disposed between a complementary bore surface of the nozzle body and the plunger **123** in complementary relation with its inner surface. The barrel **125** is adjusted axially

to different positions covering the aperture **119** by a bushing **126** secured thereon against end movement for rotation relatively thereto. The bushing has a threaded outer surface in threaded relation with a recess of the nozzle body as shown.

In operation the nozzle is adjusted toward a mold seat **128** therefor to establish non-leaking contact therewith by adjustment of the two sets of set screws **112, 116**. Passage of fluid through the nozzle may be properly interrelated with the fluid delivery of other nozzles sharing the manifold **101** by manipulation of the flow-control mechanisms of the various nozzles just described above.

What is claimed is:

**1**. In machinery for injection molding:

a nozzle supporting member having openings extending therethrough along axes which are substantially parallel and in transverse relation with the length of the member;

a plurality of nozzle holders, each holder received by the member in one of said openings and comprising arcuate wall portions in closely fitting generally concentric relation with a surface defining the opening, an adjustable means connecting with the member and each holder and acting therebetween for locating and securing the holder at different positions within a range of movement of the nozzle relative to the member and lengthwise of said opening;

an elongate nozzle extending through each holder, said nozzle and said holder having cooperating ball-in-socket means for supporting the nozzle at a fixed pivotal point within said holder, said nozzle except for said ball-in-socket means having clearance with the interior surface of the holder to permit limited universal movement of the nozzle relative to the holder and the member, said nozzle having a distal end disposed outwardly of the member and a longitudinal bore opening in said distal end for discharging a fluid therefrom.

**2**. In machinery for injection molding:

a nozzle supporting member having openings extending therethrough along axes which are substantially parallel and in transverse relation with the length of the member;

a plurality of sleeves; each sleeve received by the member in one of said openings in closely fitting generally concentric relation with surfaces defining said opening, adjustable means connecting with each sleeve and the holder and acting for locating and securing the sleeve within a range of positions relative to the member and along the axis of said opening, said sleeve having an internal surface defining a hole therethrough normally centered along the axis of the respective opening, said surface having a concentric longitudinally concave portion which conforms to an equatorial surface of a sphere;

a plurality of elongated nozzles, each nozzle having a bore for discharging fluid material from its distal end, said nozzle being received within one of said sleeves with its distal end disposed outwardly from the end of the corresponding opening receiving said sleeve, said nozzle having an annular enlargement within said sleeve defining a longitudinally convex surface conforming generally to an equatorial surface of said sphere, said concave sleeve surface receiving said convex nozzle surface for movement of the nozzle therein in ball-in-socket relationship;

said nozzle, in portions other than said enlargement, having clearance with the sleeve and the member enabling limited universal movement of the nozzle within said opening and said hole.

**3**. The machinery of claim **2** wherein:

the sleeve is longitudinally bifurcate and comprises an annular flange element at one end of the sleeve and a tubular portion split into two transversely arcuate elements to dispose the elements on opposite sides of a diametral plane, each arcuate element having one end thereof secured to said flange element in concentric relation with the longitudinal axis of the sleeve; and means on the member adjustable therewith for applying force on one of said semi-cylinder elements in a direction toward said plane.

**4**. The machinery of claim **3** wherein:

said flange element extends radially outwardly relative to the sleeve axis into overlapping relation with an area of the member surrounding one end of said opening; and

said adjustable means comprises fastening means extending loosely through firstly a resilient means and then said flange element into attachment with the manifold.

**5**. The machinery of claim **4** comprising:

set screws in threaded relation with said flange element and extending outwardly therefrom into bearing relation with said manifold area.

**6**. In machinery for injection molding:

an elongate manifold having openings extending therethrough along axes which are substantially parallel and in transverse relation with the length of the manifold;

a plurality of sleeves, each sleeve received by the manifold in one of said openings in closely fitting generally concentric relation with surfaces defining said opening, means for securing the sleeve to the manifold within a range of positions along the axis of said opening, said sleeve having an internal surface defining a hole therethrough normally centered along the axis of the respective opening, said surface having a concentric longitudinally concave portion which conforms to an equatorial surface of a sphere;

a plurality of elongated nozzles, each nozzle having a bore for conducting a fluid material to its distal end, said nozzle being received within one of said sleeves with its distal end disposed outwardly from the end of the corresponding opening receiving such sleeve, said nozzle having an annular enlargement within said sleeve defining a longitudinally convex surface conforming to an equatorial surface of said sphere, said concave sleeve surface receiving said convex nozzle surface for movement of the nozzle therein in ball-in-socket relationship;

said nozzle, in portions other than said enlargement, having clearance with the sleeve and the manifold enabling limited universal movement of the nozzle within said opening and said hole; and

said manifold having branch passageways and said sleeve surrounding said nozzle having an aperture therethrough, said bore of each nozzle being in contiguous relation with said aperture of the adjacent sleeve and one of said passageways through said concave surface portion and said convex surface.

7. The machinery of claim 6 wherein:

said nozzle aperture is located intermediately between said distal end and a proximal end of the nozzle and said bore extends between said ends; and

the nozzle comprises shutoff valve mechanism including a plunger received in said bore which is traversable from a portion of the bore extending between said aperture and the proximal end to a portion between said aperture and said distal end.

8. The machinery of claim 6 wherein:

the sleeve is longitudinally bifurcate and comprises an annular element at one end and a tubular portion split into two transversely arcuate elements to dispose the elements on opposite sides of a diametral plane, each arcuate element having one end thereof secured to said flange in concentric relation with the longitudinal axis of the sleeve; and

said machinery includes set screw means in threaded relation with said manifold on the side of said opening opposite from said opening an aligned for adjustment toward and away from said aperture.

9. The machinery of claim 8 wherein:

said annular element is a flange which extends radially outwardly relative to the sleeve axis into overlapping relation with a manifold area surrounding one end of said opening; and

means for securing the sleeve includes resilient means affording slight yielding movement of the nozzle and sleeve carrying the annular element from said area.

10. The machinery of claim 8 comprising:

set screw means in threaded relation with said annular element for engaging said area.

11. In machinery for injecting molding:

a nozzle-supporting member having openings therethrough along axes which are substantially parallel and in transverse relation with the length of the member;

a plurality of elongate nozzles, each positioned in one of said openings and having a longitudinal bore opening in a distal end thereof for discharging a fluid therefrom; and

adjustable means associated with each nozzle attaching it to said member in positions wherein said nozzle extends through the member with said distal end thereof disposed outwardly of the member;

said adjustable means being adjustable to locate the nozzle at different positions along the axis of its respective opening of said openings.

12. In machinery according to claim 11 wherein:

said adjustable means comprises means for fixing said positions of the nozzle.

13. In machinery according to claim 11 comprising:

means for supporting a nozzle in fixed parallel to coaxial alignment with the axis of its respective opening.

14. In machinery according to claim 11 wherein:

said adjustable means comprises screw means acting between the nozzle and the member simultaneously in opposite directions to fix the axial position of the nozzle relative to the member.

15. In machinery according to claim 12 wherein:

said adjustable means comprises one set of screws acting between the nozzle and the member in tension and another set acting in compression to fix the axial position of the nozzle relative to the member.

16. Machinery according to claim 11 wherein:

said member is a manifold having a longitudinal passageway and branch passageways leading therefrom to said openings; and

the nozzles have lateral apertures contiguous with said bore and in registry with said branch passageway.

17. The machinery of claim 15 comprising:

set screw means in threaded relation with the manifold and lateral engagement with said nozzle on a side thereof diametrically opposite the aperture of said nozzle.

* * * * *

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# UNITED STATES PATENT OFFICE
# CERTIFICATE OF CORRECTION

Patent No. 3,718,166 Dated March 27, 1973

Inventor(s) John Goron

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The name of the inventor is -- John Goron --.

Column 1, line 48, "an" should be -- and --.

Column 3, line4, the numeral -- 10 -- should be inserted after "truder".

Column 4, line 18, "busing" should be -- bushing --.

Column 9, line 29, "an" should be -- and --.

**Signed and sealed this 20th day of November 1973.**

**(SEAL)**
**Attest:**

**EDWARD M.FLETCHER,JR.**
**Attesting Officer**

**RENE D. TEGTMEYER**
**Acting Commissioner of Patents**