PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : C03B 9/00, 9/38 — A1

(11) International Publication Number: **WO 94/13594**

(43) International Publication Date: 23 June 1994 (23.06.94)

(21) International Application Number: PCT/US93/11990

(22) International Filing Date: 9 December 1993 (09.12.93)

(30) Priority Data:
07/987,655 9 December 1992 (09.12.92) US

(71) Applicant: AMERICAN NATIONAL CAN COMPANY [US/US]; 8770 West Bryn Mawr Avenue, Chicago, IL 60631 (US).

(72) Inventors: JOHNSON, Robert, S.; 4045 North Huntington Road, Marion, IN 46952 (US). HALL, Robert, D., Sr.; 701 South Western Avenue, Marion, IN 46952 (US). ERB, Roger, L.; 908 Berkley Drive, Marion, IN 46952 (US).

(74) Agents: STINE, Thomas, K. et al.; Wallenstein, Wagner & Hattis, Ltd., 311 South Wacker Drive, 53rd floor, Chicago, IL 60606-6604 (US).

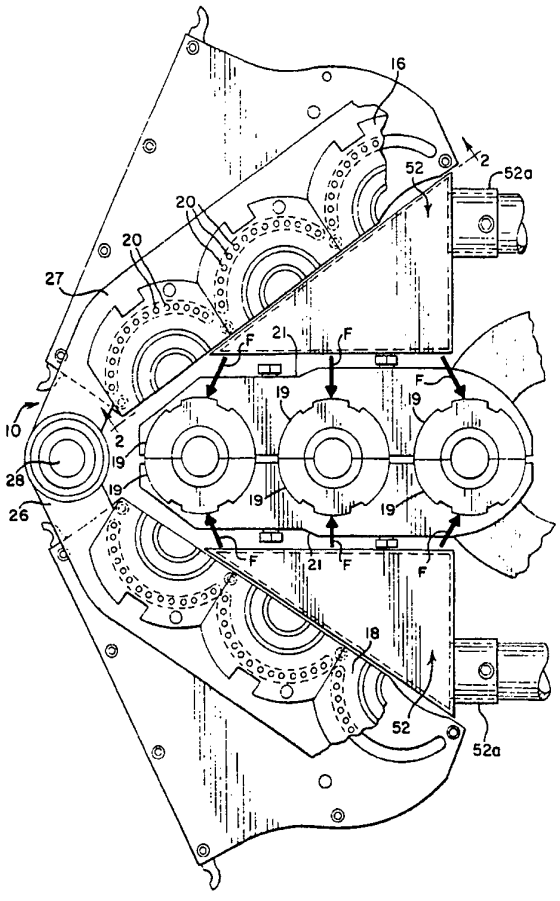
(81) Designated States: AT, AU, BB, BG, BR, BY, CA, CH, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, KZ, LK, LU, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: COOLING DEVICE FOR GLASS CONTAINER FORMING MACHINE

(57) Abstract

A cooling system (10) for neck ring molds (19) in a glass molding machine having retractable parison-forming molds (16, 18) engageable with the neck rings (19) employs air jets (F) directed at exposed portions (56) of the neck ring molds (19). The neck ring molds (19) are configured to extend out of the bottom of the main parison molds (16, 18) and to engage with neck ring hangers (21). The neck ring molds (19) are configured sufficiently long that a space (d) is created between the bottoms of the main parison molds (16, 18) and the hangers (21) to permit direct access to portions (56) of the neck ring molds (19). Air supplied in the form of air jets (F) from a pair of cooling air plenums (52) is directed at the exposed portions (56) of the neck ring molds (19) to provide cooling.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**GB**	United Kingdom	**MR**	Mauritania
AU	Australia	**GE**	Georgia	**MW**	Malawi
BB	Barbados	**GN**	Guinea	**NE**	Niger
BE	Belgium	**GR**	Greece	**NL**	Netherlands
BF	Burkina Faso	**HU**	Hungary	**NO**	Norway
BG	Bulgaria	**IE**	Ireland	**NZ**	New Zealand
BJ	Benin	**IT**	Italy	**PL**	Poland
BR	Brazil	**JP**	Japan	**PT**	Portugal
BY	Belarus	**KE**	Kenya	**RO**	Romania
CA	Canada	**KG**	Kyrgystan	**RU**	Russian Federation
CF	Central African Republic	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CG	Congo			**SE**	Sweden
CH	Switzerland	**KR**	Republic of Korea	**SI**	Slovenia
CI	Côte d'Ivoire	**KZ**	Kazakhstan	**SK**	Slovakia
CM	Cameroon	**LI**	Liechtenstein	**SN**	Senegal
CN	China	**LK**	Sri Lanka	**TD**	Chad
CS	Czechoslovakia	**LU**	Luxembourg	**TG**	Togo
CZ	Czech Republic	**LV**	Latvia	**TJ**	Tajikistan
DE	Germany	**MC**	Monaco	**TT**	Trinidad and Tobago
DK	Denmark	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**US**	United States of America
FI	Finland	**ML**	Mali	**UZ**	Uzbekistan
FR	France	**MN**	Mongolia	**VN**	Viet Nam
GA	Gabon				

COOLING DEVICE FOR GLASS CONTAINER FORMING MACHINE

DESCRIPTION

Technical Field

This invention relates generally to an apparatus for cooling molds used to form glass containers. More particularly, it pertains to an apparatus which provides cooling to neck ring molds.

Background of the Invention

Glass containers, including glass bottles, are formed in a process that is well-known in the art. The various components of the glass are heated until they have melted. A gob of this melted glass is next formed into a parison in a so-called blanking or parison mold. The parison formed is moved from the parison mold to a finishing or blow mold, where the finished bottle is shaped.

Mass production of glass bottles is generally carried out in a well-known IS (individual section) glass forming machine which has a plurality of glass forming means integrated into a single plural-section machine fed by a single source of molten glass. The sections are operated in synchronism in such relative phase relationship to permit the several sections to acquire gobs of molten glass in ordered sequence from the single source.

Thus, as one of the sections is receiving a gob from the feeding means, another section is delivering a finished article to an output conveyor and other sections are engaged in various forming steps between receipt of the gob and production of the finished article. The sequence of operation is controlled by a timing mechanism that may be either mechanically or electronically controlled. This timing mechanism sequentially initiates mechanical devices in a predetermined synchronized sequence through automatic control systems.

The IS machines have two types of molds in each individual mold section whereby a gob is received in a first mold, called a parison mold, for the initial process of forming a parison, followed by transfer of the parison to a second mold, called the blow or finishing mold, for blowing the parison to its final configuration. A transfer arm is pivoted between the parison mold and the finishing mold, and the parison is formed in an inverted position in the parison mold and is transferred to the finishing mold in an upright position. This process is generally disclosed in U.S. Patent No. 3,762,907, incorporated herein by reference.

The parison and finishing molds are subjected to extremely high temperatures. For example, the parison mold can reach temperatures as high as 1200°F or more, while the finishing mold can reach temperatures as high as 1100°F. As a result, the heat that is transferred to these molds by the gob of molten glass during the molding process cannot be adequately dissipated into the ambient air by convection without slowing down the process.

A variety of auxiliary cooling means or methods have been utilized for these molds. U.S. Patent No. 4,983,203 issued to Erb et al., and assigned to the assignee of this application, discloses a glass forming system wherein parison mold halves are movable between a retracted position and a closed position at a parison-forming station. A pair of neck ring mold halves forming a neck ring mold are held

together at the parison-forming station and are configured for nesting surrounding engagement by the parison mold halves when brought together. The parison mold halves are provided with a number of vertical interior cooling passages generally peripherally disposed within each parison mold half. Mold air supply plenums are provided disposed below each mold half at the retracted station. During the period that the mold halves spend in the retracted state, they are continuously cooled by air flowing from the plenum up through the individual mold cooling passages. This system provides for cooling of the parison mold halves, but relies upon the physical contact between the cooled parison mold halves and the neck ring molds for neck ring mold cooling during the parison-forming operation. The heating of the neck ring mold during cyclic operation of such a glass forming machine has proven to be the speed-limiting factor. A significant reduction of the neck ring mold temperature would allow increased speed of operation.

U.S. Patent No. 4,629,488, issued to Doud et al., discloses a cooling system for cooling a neck ring mold and the parison mold in the portion of an individual section glass molding machine in which the parison is formed. The means for cooling the neck ring mold and the parison mold includes a plurality of first cooling holes in an upper receiver cap, a plurality of second cooling holes in the neck ring mold that communicate with the plurality

of first cooling holes, and a plurality of third cooling holes in the parison mold that communicate with the plurality of second cooling holes. Specifically, the neck ring mold is cooled by a flow of cooling air that flows upwardly through a plurality of vertically disposed and circumferentially spaced second cooling holes in the neck ring mold, and is cooled by a portion of the cooling air flowing radially out through the radially disposed notches in the neck ring mold. The cooling is carried out on the parison mold side of the glassware forming machine since the neck ring mold is on the parison side about 80% of the time during normal operation. In addition, the neck ring mold receives more cooling than the parison mold since it provides mechanical strength and stability to the finish portion.

The Doud system is complex to machine, and hence costly. Additionally, it requires a source of compressed air to be supplied to an inlet port which implies either a rapid plug-in and withdrawal air supply system for each neck ring mold, or in the alternative, a carry-along high pressure manifold which will allow the neck ring mold to be moved from the parison-forming station to the final forming station. Here again, additional complexity is engendered, and a possible loss of reliability through high pressure seal failure may be expected.

U.S. Patent No. 4,659,357, issued to Doud, also discloses an apparatus and method for cooling the neck ring mold and parison

mold. In this patent, the cooling system utilizes fan air from a fan box for cooling the neck ring mold, thus eliminating the expense of providing compressed air for cooling. Specifically, the neck ring mold is cooled by a flow of fan air that flows upwardly through a plurality of vertically disposed and circumferentially spaced cooling holes in the neck ring mold, and is cooled by a portion of the cooling air flowing radially out through the radially disposed notches in the neck ring mold. The remainder of the fan air is directed upwardly through a plurality of vertically disposed and circumferentially spaced cooling holes in the parison mold. Here again, an expensive series of passages must be machined for each particular design of neck ring mold.

U.S. Patent No. 4,813,995, issued to Knoth et al., discloses an apparatus for manufacturing containers out of glass which has a cooling means comprised of a ring of nozzles by which jets of cooling air are directed to the neck ring mold portion of the parison mold. The neck ring mold is cooled during heating of the parison to prevent the neck portion of the parison from flowing and causing the collapse of the parison to the bottom of the parison mold cavity. The parison mold itself has an internal cavity to which cooling air is supplied. The air leaves the chamber through cylindrical passages formed in the mold. Here optimal cooling efficiency cannot be secured because the air reaching the neck ring mold is already severely preheated by its passage

through the parison mold.

It is an object of the invention to provide a simple low cost way of providing adequate cooling to a neck ring mold at a parison-forming station.

Summary of the Invention

A glass molding machine employs pairs of parison mold halves having associated therewith a neck ring mold configured for nesting engagement with lower portions of the parison mold halves. The neck ring mold is provided with extensions extending out of the parison mold halves and configured for engagement with movable hanger means for holding the neck ring mold at a parison-forming station. The extensions are dimensioned to leave portions thereof between the bottoms of the parison mold halves and the top of the movable hanger means exposed to direct external access. An air supply is positioned at the parison-forming station and directs a flow of cooling air at exterior surfaces of the neck ring mold extensions, thereby exerting a cooling action even when the parison mold halves are closed around the neck ring mold.

In the preferred form of the invention, the mold halves are carried by mold support arms mounted for rotation about a vertical axis so as to be rotatable between retracted stations and the parison-forming station, and the neck ring mold air supply is provided by plenums disposed between each of the retracted stations and adapted for

connection with a source of cooling air. Each of the neck ring mold air supply plenums is disposed at a distance below the path of movement of the lowest portions of the parison mold halves and has sidewalls provided with flow-directing outlet apertures for directing a flow of cooling air towards the exposed neck ring mold extensions.

Other advantages and aspects of the invention will become apparent upon making reference to the specification, claims, and drawings to follow.

Brief Description of the Drawings

Figure 1 is a plan view of a parison mold incorporating an air cooling mechanism in accordance with the present invention, and showing the mold halves of three parison molds pivoted away from each other and into a position above a parison mold air supply plenum cover;

Figure 2 is a side view of the mold halves of the three molds of Figure 1, taken along lines 2-2 of that Figure 1, and also showing the parison mold air supply plenum and its adjacent air supply means;

Figure 3 is a top view of the parison mold air supply plenum cover;

Figure 4 is a top view of one embodiment of the parison mold air supply plenum, with the mold air supply plenum cover removed;

Figure 5 is a top view of another embodiment of the parison mold air supply

plenum, with the plenum cover removed;

Figure 6 is a partially cutaway side view of one of the three parison mold halves shown in the upper portion of Figure 2, and showing engagement with half of a neck ring mold; and

Figure 7 is a partial end elevational view of the leftmost neck ring mold shown in Figure 1 showing its support by a pair of support arms.

Detailed Description of the Preferred Embodiment

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail preferred embodiments of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the broad aspect of the invention to embodiments illustrated.

Referring now to the figures, an air cooling mechanism 10 for a conventional IS machine 12 for molding glass objects from molten glass, is disclosed. The mechanism 10 and the relevant portion of the IS machine are generally shown in Figures 1 and 2. The mechanism 10 and the IS machine 12 include a plurality of blanking or parison molds 14, and each of those molds have a plurality of air passages 20. Although the present embodiment contemplates the use of a parison mold 14,

where a parison rather than the finished product is molded, it is contemplated that the mechanism 10 may also be advantageously used with a finishing mold.

Each parison mold comprises two mold halves 16 and 18. Because the mold halves and their function in relation to the present invention are identical, the mold halves 16 and 18 of only one of the molds 14 will be referred to in this discussion.

Each of these mold halves is mounted on a mechanical means 26 for moving them alternatively into engagement and away from each other. When the mold halves 16 and 18 are closed or in engagement, they together facilitate formation of the parison-forming cavity 15. When the mold halves 16 and 18 are drawn away from each other or opened, the parison is released for transport to the finishing mold (not shown). As may be best seen in Figure 6, a separate split neck ring mold portion 19 is included for shaping the finish or threaded portion of the parison. The neck ring mold portion 19 is meshingly received in the parison mold halves 16 and 18 by a dove-tail connection 19a. A pair of such neck ring mold portions 19 are held together at each parison-forming station by a pair of supporting hanger arms 21 to form a neck ring mold 19b (See Figure 7). The neck ring molds 19b are used as part of the transfer mechanism for transferring the finished parison into the finishing mold, as is well known in the art.

Air enters into the passage 20 of the

mold 14 through its bottom, and particularly adjacent the split neck ring mold portions 19. As a result of the relatively straight and smooth flow path of the cooling air to the mold passages 20, the pressure of that air does not drop significantly, and efficient cooling of the neck area and the entire parison mold 14 is provided.

As may be seen in Figure 1, several of these parison molds 14 are typically arranged in close proximity to each other. Figure 1 shows three such molds 14 adjacent to each other. In fact, current technology employs up to four of these molds 14 mounted in the contiguous manner shown in Figure 1; however, additional molds 14 could be possible. Each of these parison molds 14 may be secured to the mechanism 26 for moving the mold halves 16 and 18 from their engaged position (See Figure 7) to their spaced-apart retracted positions (Figure 1). The support mechanism 26 includes a pair of hanger arms 27 pivoted on a fixed pivot pin 28 and movable between opened and closed positions by a suitable drive means (not shown).

Each parison mold 14 is made of a high heat conductivity material, and is generally a metallic substance. The molten glass which is poured into the parison mold 14 is at an extremely high temperature. In addition, each individual parison mold forms up to twenty or more of these parisons per minute. As a result of these combined factors, the typical parison and finishing molds reach

temperatures as high as 1200 and 1100°F, respectively. Without auxiliary cooling aids, the molds 14 could not possibly disperse this heat through the ambient air. It is for this reason that an air cooling mechanism is necessary.

Figures 1 and 6 show side or sectional views of one of the two mold halves 16 and 18 of one of the outermost mold of Figure 1. Air passages 20 are formed along and traverse the entire length of these mold halves 16 and 18. To ensure adequate heat transfer from these mold halves 16 and 18, the air passages 20 should be spaced a certain distance from each other. In the embodiment of Figure 1, the axial centers of air passages 20 are disposed along a radial arc.

The axial cooling hole centers are spaced on radial centers generally equidistant from the mold cavity.

The cooling source includes a fixed mold air supply plenum 22 which has a substantially unrestricted supply of pressurized cooling fluid or air delivered from a source, such as a cooling fan (not shown). As may be seen in Figure 3, this mold air supply plenum 22 defines a pressure chamber which includes a mold air supply plenum cover 30 having a plurality of slots 24. High pressure air enters this fixed mold air supply plenum 22, and then moves towards this slot 24. This slot 24 serves as a discharge port for the air from the fixed mold air supply plenum 22, and facilitates its movement to the air

passages 20 of the mold halves 16 and 18. Air supply means 28 (Figure 2) provides pressurized air to the mold air supply plenum 22 through one of six ports 32 (Figures 4 and 5). Any type of regulating means (not shown) may be used to control the flow of air from supply means 28 to mold air supply plenum 22, and may be controlled by the timing mechanism to minimize pressurized air loss.

As indicated above and as shown in Figure 1, pivot means 26 are provided for pivoting the mold halves 16 and 18 from a first, closed position where the mold halves form a cavity for an article or parison to be molded, to a second, open position away from the article to be molded. Figure 1 shows these mold halves 16 and 18 in this second open position when the passages 20 are aligned with slots 24. In this position, the air enters the air passages 20 of the mold and cools the mold halves 16 and 18 only when those mold halves are in this second position.

In this second position, as may also be seen in this Figure 1, one of the ends of each of a group of air passages 20 in each of the mold halves is in registry with a slot 24 in the mold air supply plenum cover 30. When the air passages 20 and the slot 24 are in registry, air moves from the ports 32 into the fixed mold air supply plenum 22 and upwardly towards the mold air supply plenum cover 30. The air exits the mold air supply plenum 22 through the slot 24, and is then discharges into the air passages 20 of the corresponding

mold 14.

In another embodiment, as shown in Figures 1 and 3, the slots 24 have an arcuate shape. In this way, each slot 24 overlies one end of each of the air passages 20 when that slot 24 and its respective group of air passages 20 are in registry.

In one embodiment, as shown in Figure 4, the parison mold air supply plenum is divided into a plurality of channels 34, 36 and 38. Each of these channels terminates at a point defined by only one exit slot 24. Cooling air passes through each of the channels 34, 36 and 38 towards one of the slots 24 at one end of the channels for discharge into the air passages 20.

In this embodiment, the amount of air delivered to each slot 24 can be regulated by throttle valves (not shown) in entrance ports 32.

In yet another embodiment, as shown in Figure 5, the mold air supply plenum is also divided into a plurality of channels 40, 42, 44, 46, 48 and 50. However, each slot is fed by two channels, rather than one. As in the embodiment of Figure 4, cooling air in the embodiment of Figure 5 passes through each adjacent pair of channels (for example, channels 40 and 42) and towards its corresponding slot 24 for discharge into the air passages. This latter embodiment acts as a means of throttling the volume of cooling air to a given mold half. If a lesser volume of air is to be sent to a given mold half, the

operator may close the port 32 leading to one of the two channels, for example channel 40, feeding each slot. With one port closed in this manner, the volume of air transported to the single slot 24 fed by channels 40 and 42 is halved.

As will be appreciated from the above description, the fixed mold air supply plenums provide substantially unrestricted flow to the bottoms of the axial cooling openings without any significant pressure drops below the source pressure. Moreover, the openings 20 extend the entire length of the molds and therefore provide a measure of cooling of the neck ring mold 19 through conduction.

After the parison mold opens, the neck ring mold 19b is used to transport the parison to the finishing or blow mold side of the machine where the neck ring mold is opened by a parallel parting of two hanger arms 21, and the parison is placed into the blow mold.

Referring now to Figures 1 and 7, it will be noted that a stand-off distance "d" is provided between the lower surface of the parison mold halves 16, 18 and the upper surfaces 21a of the ring mold hanger arms 21. The neck ring mold 19b is configured to provide an extension portion 52a which is accessible to external air. On either side of the neck ring mold hanger arms 21, a neck ring mold air supply 52 is disposed. Cooling air is supplied through air fittings 52a and exits through specially oriented wall passages 54 to direct a flow of cooling air at each neck ring mold half

19 shown in Figure 1. It is contemplated that cooling air flow of approximately 20 cfm will adequately cool each of the neck rings at a normal production speed. The air flow generally indicated by F will be directed at the entire exposed length of the neck ring mold halves 19 when the parison molds 16, 18 are in a retracted position and will continue to supply air to the exposed extension 56 during the peak temperature cycle attendant to the forming of the parison.

While the specific embodiments have been illustrated and described, numerous modifications come to mind without markedly departing from the spirit of the invention. The scope of protection is thus only intended to be limited by the scope of the accompanying claims.

CLAIMS

1. A glass molding machine comprising:

a pair of parison mold halves having associated therewith a neck ring mold configured for nesting engagement with lower portions of said parison mold halves, said neck ring mold having extensions extending out of said parison mold halves and configured for engagement with movable hanger means for holding said neck ring mold at a parison-forming station; and

air supply means for directing a flow of cooling air at exterior surfaces of said extensions at said forming station.

2. The glass molding machine of claim 1 wherein said hanger means include a pair of elongated parallel arms forming a pair of outwardly facing sides and having top surfaces facing lower surfaces of said mold halves at a distance therefrom to expose portions of said extensions to external access, and said air supply means is configured to direct said flow of cooling air at said portions of said extensions from regions disposed adjacent at least one outwardly facing side of said pair of arms.

3. The glass molding machine of claim 2 wherein said air supply means is configured to direct said flow of cooling air at said portions of said extensions from

regions adjacent both outwardly facing sides of said pair of arms.

4. The glass molding machine of claim 3 including a pair of mold support arms for supporting said parison mold halves, said mold support arms being mounted for rotation about a vertical axis so as to be rotatable between retracted stations and said forming station.

5. The glass molding machine of claim 4 wherein said air supply means includes a neck ring air supply plenum disposed between each of said retracted stations and said forming station and adapted for connection to a source of cooling air, each of said neck ring air supply plenums having a generally planar upper wall, a lower wall, and sealing sidewalls, each of said upper walls being disposed at a distance below the path of movement of the lowest portions of said parison mold halves, said sidewalls of each said neck ring air supply plenum being provided with flow-directing outlet apertures for directing a flow of cooling air at said portions of said exterior surfaces of said extensions.

6. A glass molding machine comprising:

a pair of parison mold halves each mounted for movement between a parison-forming station and a retracted station away from said forming station, each said pair of parison mold halves having associated therewith a pair of neck ring mold halves configured for nesting engagement with lower portions of said parison mold halves, said neck ring mold halves having extensions extending out of said parison mold halves and configured for engagement with movable hanger means for holding said neck ring mold halves together at said forming station; and

first air supply means for directing a flow of cooling air at exterior surfaces of said extensions at said forming station.

7. The glass molding machine of claim 6 wherein said hanger means include a pair of elongated parallel arms forming a pair of outwardly facing sides and having top surfaces facing lower surfaces of said mold halves at a distance therefrom to expose portions of said extensions to external access, and said first air supply means is configured to direct said flow of cooling air at said portions of said extensions from regions disposed adjacent at least one outwardly facing side of said pair of arms.

8. The glass molding machine of claim 7 wherein said first air supply means is

configured to direct said flow of cooling air at said portions of said extensions from regions adjacent both outwardly facing sides of said pair of arms.

9. The glass molding machine of claim 8 including a pair of mold support arms for supporting said parison mold halves, said mold support arms being mounted for rotation about a vertical axis so as to be rotatable between said retracted stations and said forming station.

10. The glass molding machine of claim 9 including second air supply means for cooling said molds at said retracted stations, said second air supply means including cooling passages extending vertically through each said mold half, mold air supply plenums at each said retracted station adapted for connection to a source of air and having a top surface closely confronting the bottom surfaces of said parison molds when at said retracted stations, and exit passages in said mold air supply plenums disposed to supply cooling air to said cooling passages.

11. The glass molding machine of claim 10 wherein said first air supply means includes a neck ring air supply plenum disposed between each of said retracted stations and said forming station and adapted for connection to a source of cooling air, each of said neck ring air supply plenums having a generally

planar upper wall, a lower wall, and sealing sidewalls, each of said upper walls being disposed at a distance below the path of movement of the lowest portions of said parison mold halves, said sidewalls of each said neck ring air supply plenum being provided with flow-directing outlet apertures for directing a flow of cooling air at said portions of said exterior surfaces of said extensions.

12. A glass molding machine comprising:

a pair of parison mold halves each mounted for movement between a parison-forming station and a retracted station away from said forming station, each said pair of parison mold halves having associated therewith a pair of neck ring mold halves configured for nesting engagement with lower portions of said parison mold halves, said neck ring mold halves having extensions extending out of said parison mold halves and configured for engagement with movable hanger means for holding said neck ring mold halves together at said forming station; and

air supply means for directing a flow of cooling air at exterior surfaces of said extensions at said forming station, said air supply means including a neck ring air supply plenum disposed between each of said retracted stations and said forming station and adapted for connection to a source of cooling air, each of said neck ring air supply plenums having a generally planar upper wall, a lower wall, and sealing sidewalls, each of said upper walls being disposed at a distance below the path of movement of the lowest portions of said parison mold halves, said sidewalls of each said neck ring air supply plenum being provided with flow-directing outlet apertures for directing a flow of cooling air at said exterior surfaces of said extensions.

FIG. 1

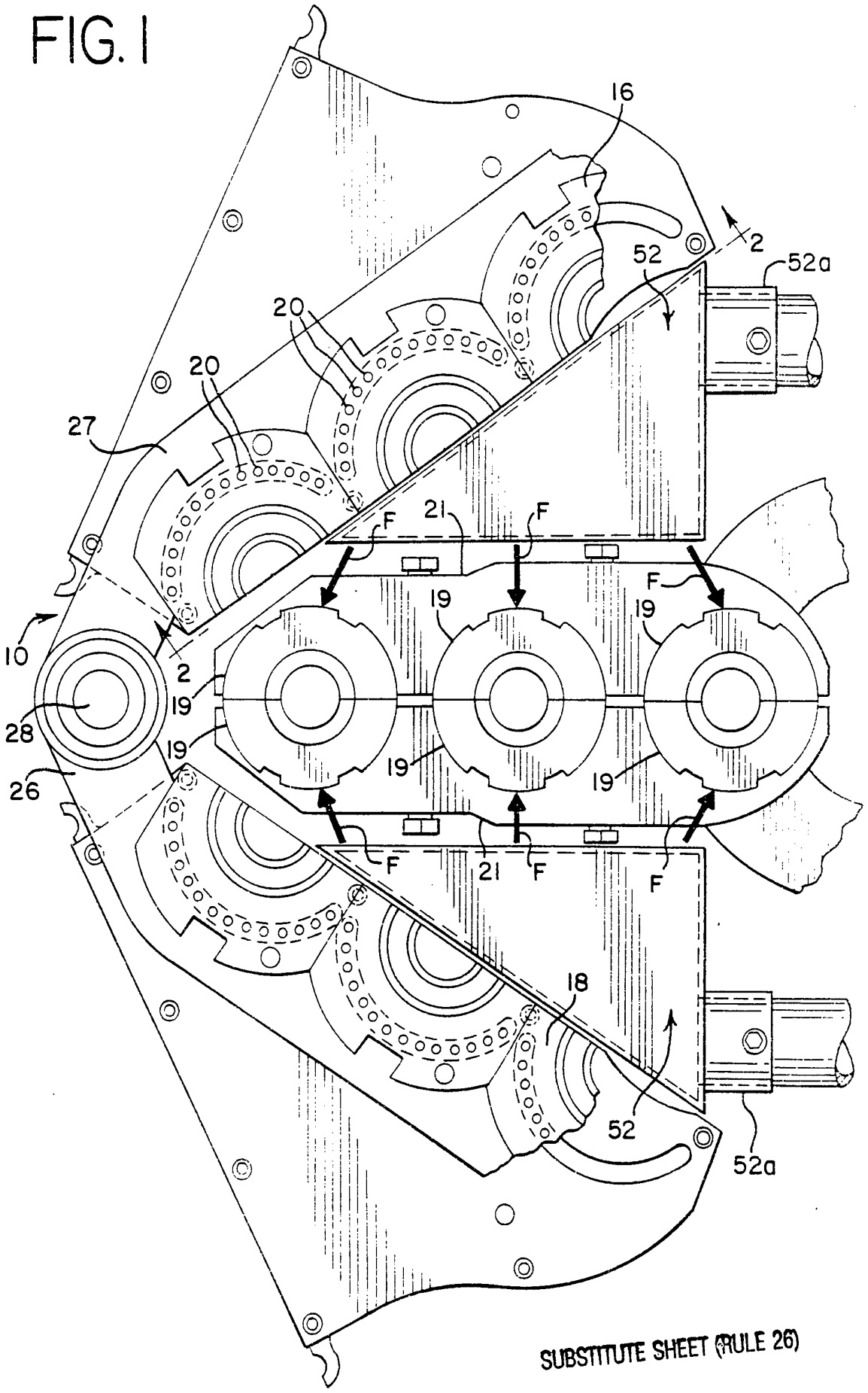

16
2
52
52a
20
20
27
F
21
F
F
19
19
19
10
2
19
28
19
19
19
26
F
21
F
F
18
52
52a

FIG. 2

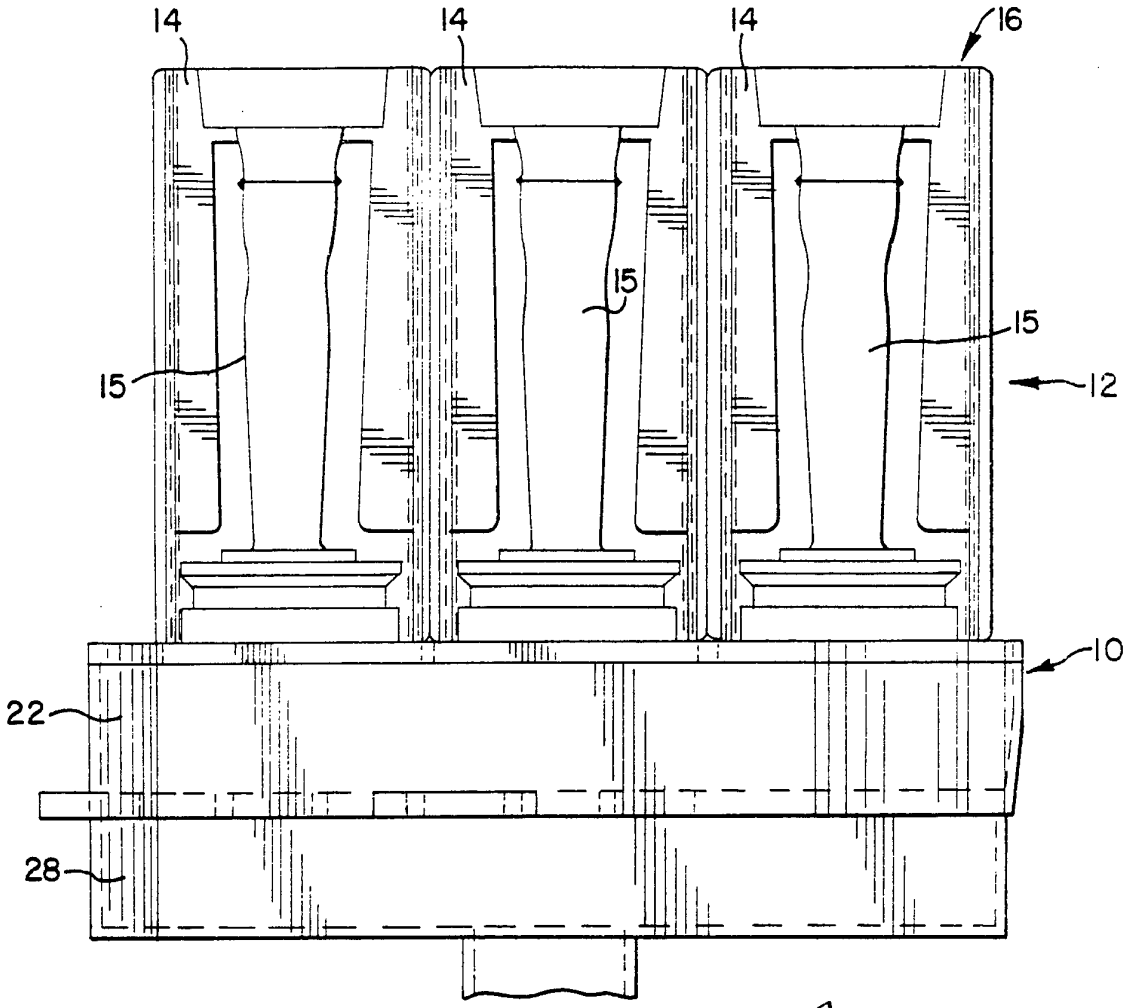


FIG.3

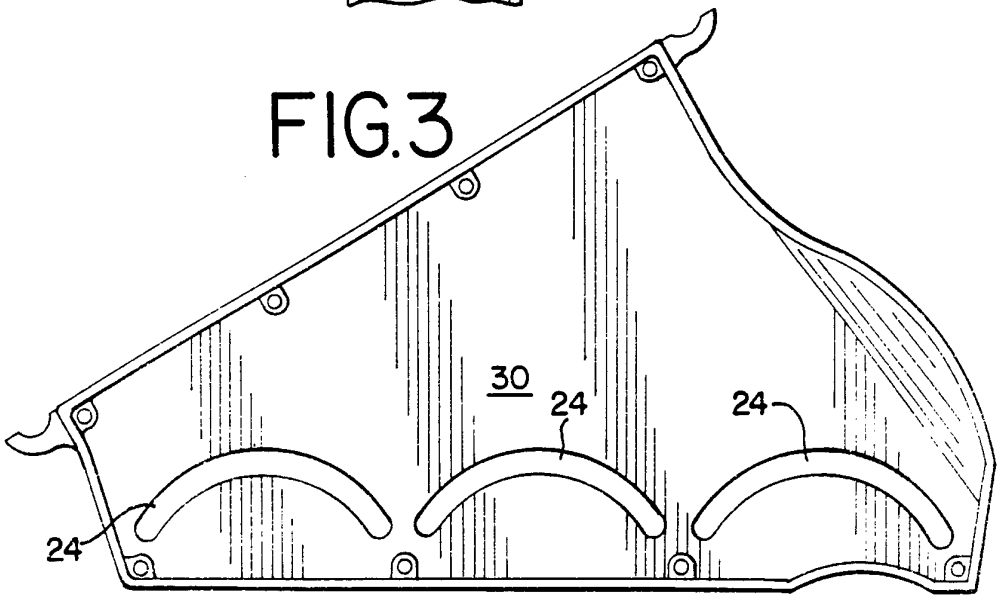


FIG. 4

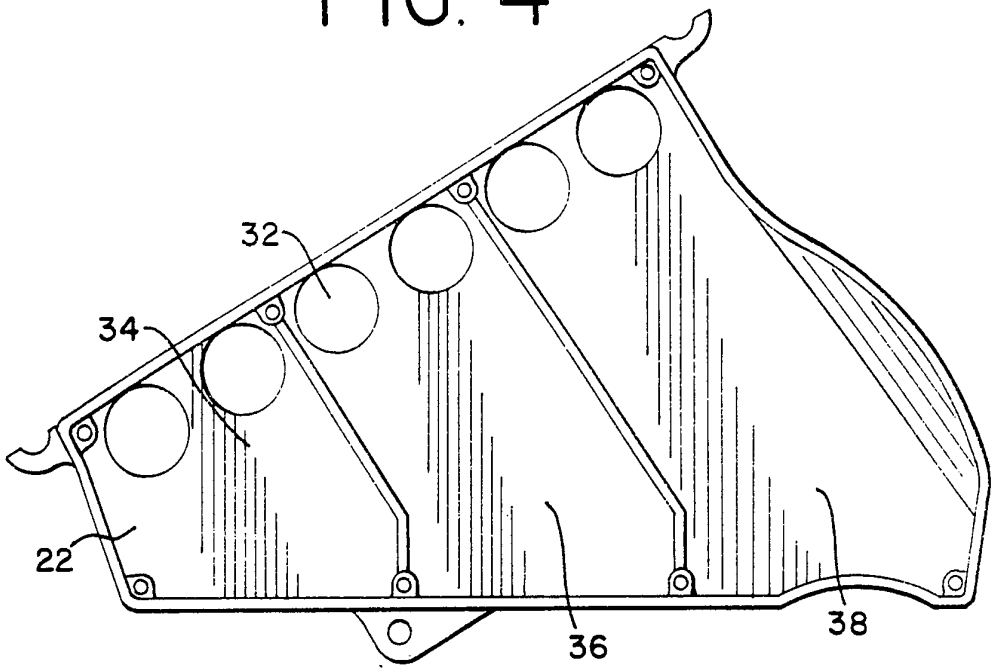


FIG. 5

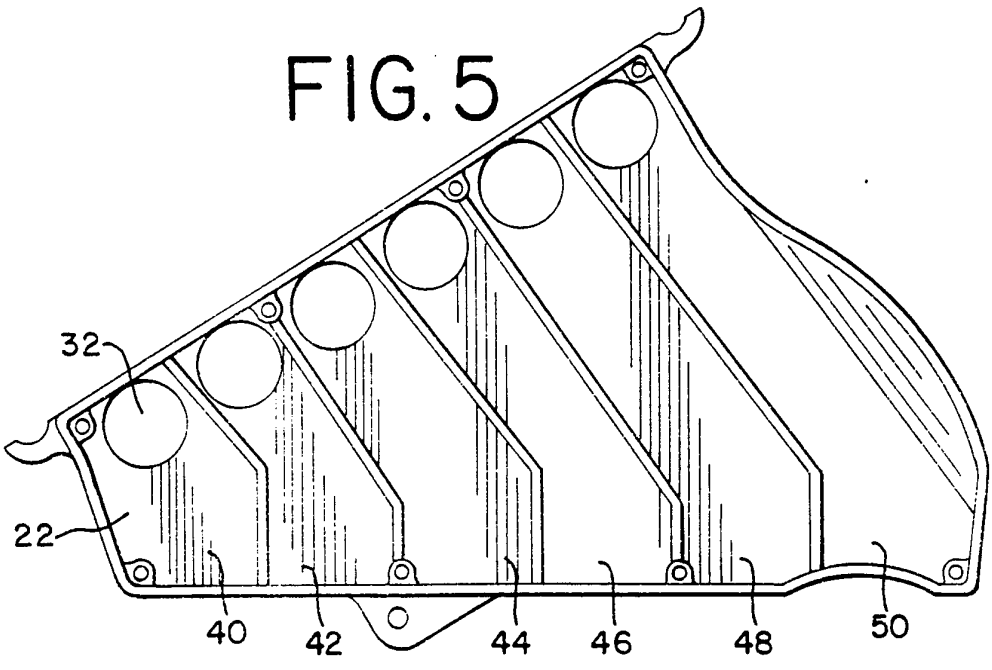


FIG. 6

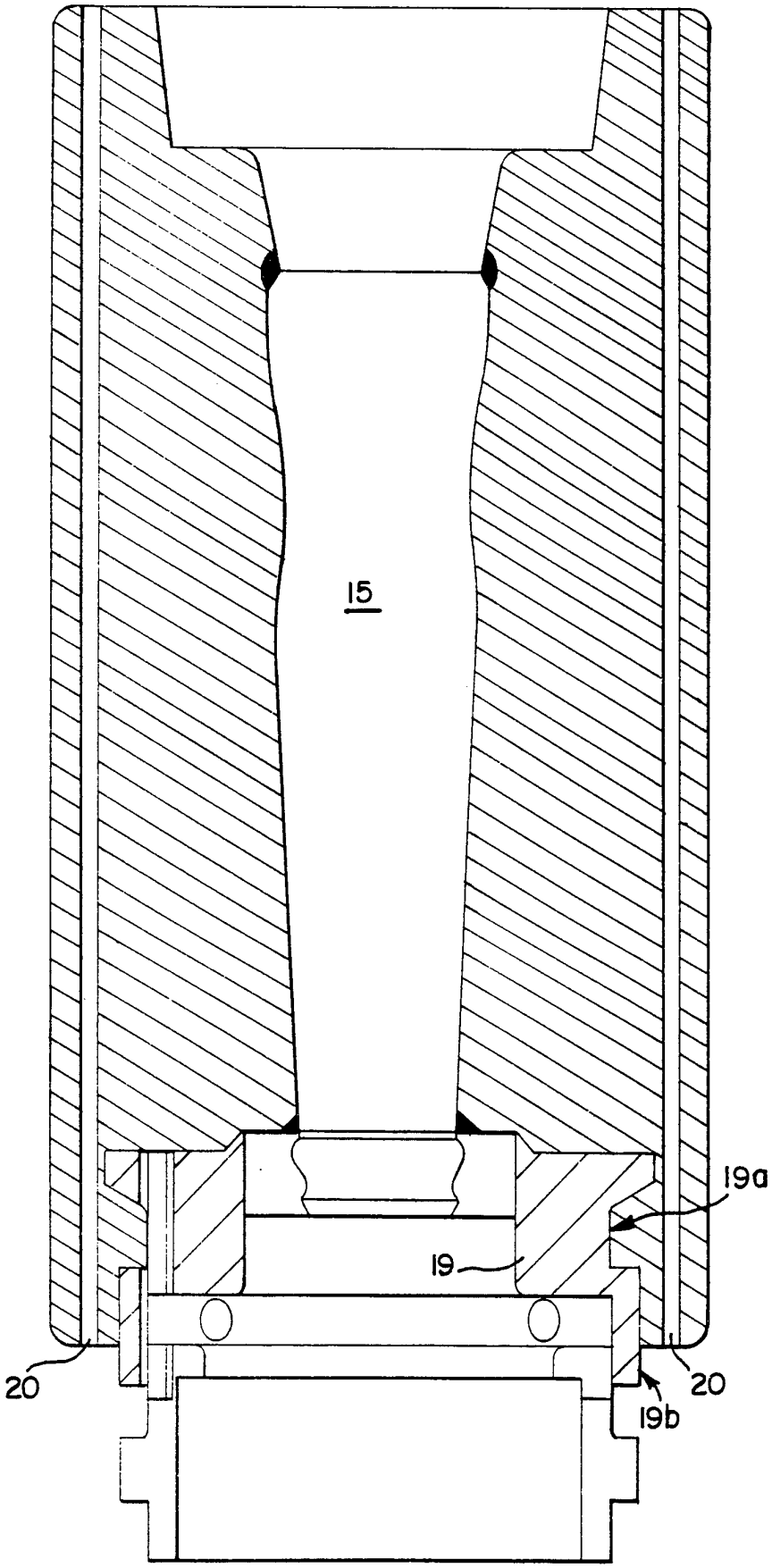
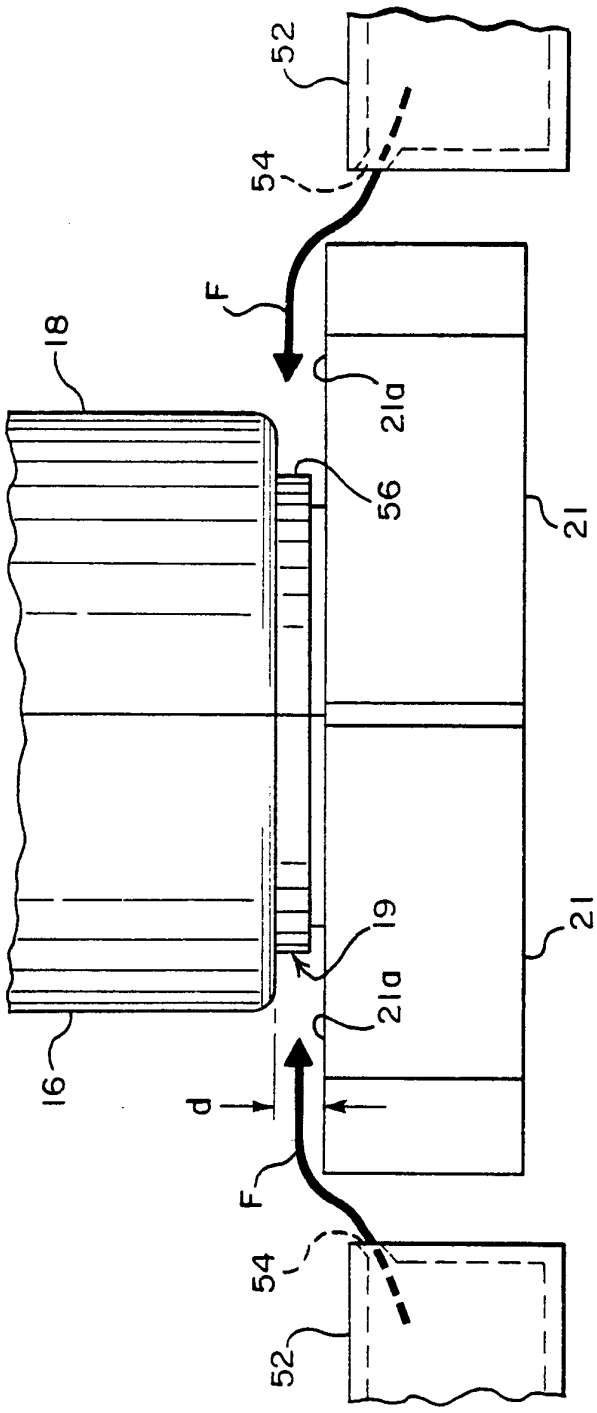


FIG. 7



INTERNATIONAL SEARCH REPORT

Inte. .onal application No.
PCT/US93/11990

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :C03B 9/00, 9/38

US CL :65/265, 267, 355, 356, 360

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 65/265, 267, 355, 356, 360, 319

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 (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,983,203 (Erb et al) 08 January 1991, Figures 1 and 6.	1-12
Y	US, A, 4,701,203 (Schneider) 20 October 1987, col. 4, lines 48-61 and Figure 1.	1-12
Y	US, A, 4,361,434 (Schneider) 30 November 1982, col. 5, lines 22-36, col. 6, lines 40-49, and Figures 1 and 2.	1-12
A	US, A, 4,750,929 (Bolin) 14 June 1988.	1-12
A	US, A, 4,659,357 (Doud) 21 April 1987.	1-12
A	US, A, 4,690,703 (Kulig) 01 September 1987.	1-12
A	US, A, 4,657,573 (Jones) 14 April 1987.	1-12

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	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
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be 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
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

01 FEBRUARY 1994

Date of mailing of the international search report

17 FEB 1994

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

STEVEN P. GRIFFIN

Telephone No. (703) 308-0651

Form PCT/ISA/210 (second sheet)(July 1992)*