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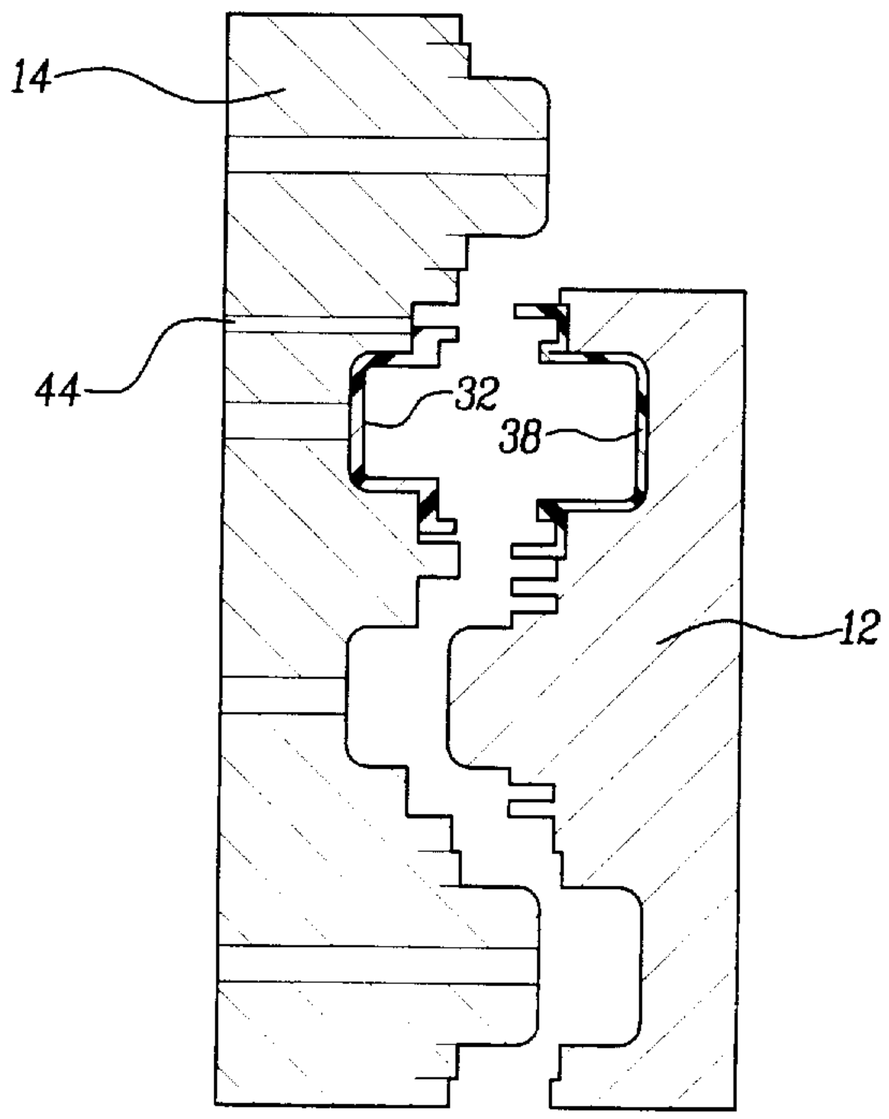
(54) **METHODE ET APPAREIL DE FABRICATION D'ENSEMBLE DE MATIERE PLASTIQUE EN DEUX MORCEAUX**

(54) **METHOD AND APPARATUS FOR MANUFACTURING A TWO-PIECE PLASTIC ASSEMBLY**



(57) A method and apparatus for manufacturing a two-piece plastic assembly from a single die set comprising a series of steps. A molding apparatus having a first mold moveable between first and second positions and a second mold is utilized for manufacturing the plastic articles. The first mold has a first surface and a second surface. The second mold has a third surface and a fourth surface. The apparatus moves the first mold to the first position and then closes. The apparatus brings the first and second molds together causing the first and third mold surfaces to define a first article cavity and the second and fourth mold surfaces to define a second article cavity. A molten first plastic material is injected into the first article cavity. A second plastic material is injected into the second article cavity. After the first and second materials have cooled, they form a first and second article respectively. The apparatus is opened and the first mold is moved to a second position. The apparatus is closed and the first mold positions the first article juxtaposed to the second article and forms a joining cavity therebetween. A third plastic material is injected into the joining cavity and joins the first and second article to form the plastic assembly.

ABSTRACT

A method and apparatus for manufacturing a two-piece plastic assembly from a single die set comprising a series of steps. A molding apparatus having a first mold moveable between first and second positions and a second mold is utilized for manufacturing the plastic articles. The first mold has a first surface and a second surface. The second mold has a third surface and a fourth surface. The apparatus moves the first mold to the first position and then closes. The apparatus brings the first and second molds together causing the first and third mold surfaces to define a first article cavity and the second and fourth mold surfaces to define a second article cavity. A molten first plastic material is injected into the first article cavity. A second plastic material is injected into the second article cavity. After the first and second materials have cooled, they form a first and second article respectively. The apparatus is opened and the first mold is moved to a second position. The apparatus is closed and the first mold positions the first article juxtaposed to the second article and forms a joining cavity therebetween. A third plastic material is injected into the joining cavity and joins the first and second article to form the plastic assembly.

198-1118

METHOD AND APPARATUS FOR MANUFACTURING A TWO-PIECE PLASTIC ASSEMBLY

Background of The Invention

1. Field of the invention

The present invention is directed to a method and apparatus for injection molding a two-piece plastic assembly. More specifically, the present invention is directed to a method and apparatus that utilizes a linearly moving shuttle mold to simultaneously mold and join a plastic assembly.

2. Description of the Related Arts

US patent number 5,413,743, teaches a method of manufacturing a two-piece headlamp assembly using a rotary platen. The rotary platen utilizes at least two die sets (two pair of matched molds) to form a plastic article. A first die set is used to manufacture a transparent lens. A second die set is used to manufacture a reflector that mates with the lens. The lens is injection molded at a first location on the rotary platen. The reflector portion is molded at a second location on the rotary platen at the same time as the lens. The reflector and lens die sets are opened and the die portion containing the lens is mated with the die portion containing the reflector in a third location on the rotary platen. When the lens and reflector are brought together, they form a cavity. A plastic material

is injected into this cavity to join the lens and reflector.

The invention described in patent number 5,413,743 utilizes at a minimum two separate die sets (four dies) requiring movement between their molding position and their joining position. This movement is achieved through a rotary table.

It is desirable to utilize an injection molding apparatus that may injection mold the two plastic components and then join the components using a single die set. It is further desirable that a single injection molding press be used to mold the components and then create a joining bond therebetween. It is also desirable that each cycle of the molding apparatus both mold the components and create a joining bond between a previously molded pair of plastic components.

Summary of the Invention

The present invention is directed to a method and apparatus for manufacturing a two-piece plastic assembly from a single die set comprising a series of steps. A molding apparatus having a first mold moveable between first and second positions and a second mold is utilized for manufacturing the plastic articles. The first mold has a first surface and a second surface. The second mold has a third surface and a fourth surface. The apparatus moves the first mold to the first position and then closes. The apparatus brings the first and second molds together causing the first and third mold surfaces to define a first article cavity and the second and

fourth mold surfaces to define a second article cavity. A molten first plastic material is injected into the first article cavity. A second plastic material is injected into the second article cavity. After the first and second materials have cooled, they form a first and second article respectively. The apparatus is opened and the first mold is moved to a second position. The apparatus is closed and the first mold positions the first article juxtaposed to the second article and forms a joining cavity therebetween. A third plastic material is injected into the joining cavity and joins the first and second article to form the plastic assembly.

The invention may optionally include additional mold surfaces so that a second pair of first and second articles may be formed while a first pair of first and second articles are joined. These additional surfaces will receive molten plastic material to form another pair of first and second articles while the first pair of first and second articles are joined together.

The invention may be practiced using a linearly moving shuttle mold. The shuttle mold includes a stationary mold and a mold linearly moveable along a line perpendicular to the mold closing movement. The shuttle mold enables a single die set to be able to mold the first and second articles and retain the molded articles within the die set as the first mold is moved between a first and second position. The first and second articles are brought together and joined when the first mold is moved to the second position. The present invention enabled the molding and joining of the two-piece assembly using a single injection molding apparatus and a single

pair of opposed molds (die sets). A completed molded article is produced with each cycling of the molding apparatus.

These and other objects, features, and advantages of the present invention will become more readily apparent when viewed in connection with the accompanying drawings wherein like reference numerals correspond to like components.

Brief Description Of The Drawings

Figure 1 is a cross-sectional view of a shuttle mold in the open first position.

Figure 2 is a cross-sectional view of the mold illustrated in Figure 1 in the closed first position.

Figure 3 is a cross-sectional view of the mold illustrated in Figure 1 in the open first position with the lens and reflector on the molds.

Figure 4 is a cross-sectional view of the mold illustrated in Figure 1 in the open second position.

Figure 5 is a cross-sectional view of the mold illustrated in Figure 1 in the closed second position and showing a joining material injected between the lens and reflector and molding another lens and reflector pair.

Figure 6 is a cross-sectional view of the mold illustrated in Figure 1 removing the completed lamp

assembly and preparing to join another lens and reflector.

Figure 7 is a plan view of the stationary mold.

Figure 8 is a plan view of the movable shuttle mold.

Detailed Description of the Preferred Embodiments

The present invention will be described through a series of drawings, which illustrate a manufacture of an automotive lens and reflector and the joining thereof. The invention maybe used to form and join together any type of plastic components. The invention also illustrates a shuttle molding apparatus having two pair of forming surfaces however a molding apparatus having single pair of forming surfaces is also useful for the invention.

Reproduced below is a word list of the items described in the drawings that is useful in understanding the invention:

10 molding apparatus

12, 14 molds

16, 18 lens cavity surfaces

20 reflector core surface

22, 24 reflector cavity surfaces

26, 28 lens core surfaces

30 first article cavity

32 second article cavity

34, 36 resin inlet

38 lens

40 reflector

42 joining cavity

44 resin inlet

46 lamp assembly

48 third article cavity

50 fourth article cavity

52 resin inlet

54 second lens

56 resin inlet

58 second reflector

60 guides

Referring to Figure 1 of the drawings, there is shown a schematic diagram illustrating the various manufacturing steps of the present invention. A shuttle molding apparatus 10 is used to manufacture a lens and reflector assembly. The injection molding press and associated equipment have not been shown for clarity. The assembly 10 includes a pair of opposed molds 12, 14. The words molds and molding dies are sometimes called dies or die sets. The mold 12 has two cavity surfaces 16, 18 and a core surface 20. The mold 14 has two cavity surfaces 22, 24 and two core surfaces 26, 28.

The molds 12, 14 are operable between open and closed position as shown in figures 1 and 2. The mold 14 is generally moved towards the mold 12 to close the molds. The cavity surface 16 and the core surface 26 mate to form a first article cavity 30 therebetween when the molds 12, 14 are moved to the closed first position as shown in figure 2. The cavity surface 22 and the core

surface 20 mate to form a second article cavity 32. Illustrated is an automotive lens made in the first article cavity 30 and a mating reflector made in the second article cavity 32. A clear molten plastic material is injected into the first article cavity 30 through a resin inlet 34. An opaque molten plastic material is injected into the second article cavity 32 through a resin inlet 36. The clear and opaque plastic material may be injected sequentially or simultaneously. The clear plastic material solidifies to form a lens 38 and the opaque plastic material solidifies to form a reflector 40.

The molds 12, 14 are then moved to the open position as shown in figure 3. The lens 38 is retained on the cavity surface 16 and the reflector 40 is retained on the cavity surface 22. The shape of the article and the mold surfaces provide sufficient retention to enable to the molded articles to be repeatably retained on the cavity surfaces. The mold 12 is then moved (shuttled) to the second position as shown in figure 4. The shuttle movement is generally linear in a plan perpendicular to the open and close axis of the molds 12, 14. The mold 14 may be moved by a mechanical, electric, hydraulic or pneumatic means. Hydraulic actuators are most common among injection molding machines.

The molds 12, 14 are then brought together as shown in figure 5. The lens 38 mates with the reflector 40 to create a joining cavity 42 therebetween. The joining cavity is a space generally bounded by a peripheral portion of the lens 38 and reflector 40 and the mold 12. The lens 38 and reflector 40 are joined by a molten

plastic material injected through a resin inlet 44. The plastic material injected through the resin inlet 44 is compatible with the clear and opaque plastic materials. The plastic fuses between the lens 38 and reflector 40 to join the articles into a lamp assembly 46.

The method optionally includes the step of forming a second lens and reflector pair during the joining step. The mold 12 includes third article cavity 48 between the reflector core surface 20 and the reflector cavity surface 24 and a fourth article cavity 50 between the lens core surface 28 and the lens cavity surface 18 when the mold 14 is moved to the closed second position. The clear plastic material is injected through resin inlet 52 to form a second lens 54. The opaque plastic material is injected through resin inlet 56 to form a second reflector 58. The second lens and reflector 54, 58 are produced during the joining step.

The mold 14 is moved to an open position and the finished lamp assembly 46 is removed from the molds 12, 14. An ejector (not shown) may be used to assist in removing the lamp assembly 46. The second lens 54 and the second reflector 58 remain in the molds 12, 14 as shown and are joined when the mold 14 is moved to the closed first position. In this fashion, each cycle of the molding operation may simultaneously form a first lens and reflector pair and join a second lens and reflector pair.

Illustrated in Figure 7 is the stationary mold 14. The mold 14 molds both the left and right lens and reflector members. Illustrated in Figure 8 is the

movable shuttle mold 12 in the first position. The mold 12 moves along the guides 60. The movable shuttle mold 12 includes means (not shown) for ejecting the molded article from the mold 12.

The invention has been described as a method and apparatus of manufacturing an automotive lens and reflector assembly using the drawings and description provided. However, any plastic components that are molded and joined may by manufactured by the method and apparatus described. While the invention has been described using different types of plastic material, the same or different plastic materials may be used at any part of the molding process. Additional, various adaptations or modifications to the method and apparatus may be made without departing from the spirit and scope of the following claims.

THE EMBODIMENTS OF THE INVENITON IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method of manufacturing a two-piece plastic assembly from a single die set comprising the following steps:

providing a molding apparatus having a first mold movable between first and second positions and a second mold, said first mold having a first surface and a second surface, said second mold having a third surface and a fourth surface;

moving said first mold to said first position and closing said apparatus, said first and third surfaces defining a first article cavity and said second and fourth surfaces defining a second article cavity;

injecting a first plastic material into said first article cavity;

injecting a second plastic material into said second article cavity;

cooling said first material to form a first article and cooling said second material to form a second article;

opening said mold;

moving said first mold to said second position;

closing said apparatus and positioning said first article juxtaposed said second article to define a joining cavity therebetween; and

injecting a third plastic materiel into said joining cavity and joining said first article to said second article to form said assembly.

2. The method of claim 1, wherein said apparatus is a shuttle-type molding apparatus.

3. The method of claim 2, wherein said first mold moves linearly between said first and second positions.

4. The method of claim 3, wherein said movement between said first and second positions is perpendicular to said opening and closing movement.

5. The method of claim 1, wherein said second mold is stationary.

6. The method of claim 5, wherein said first, second and third plastic material are injected through said second mold.

7. The method of claim 1, wherein said second mold further comprises a fifth and seventh surface and said first mold further comprises a sixth surface wherein said fifth and fourth surfaces define said second article cavity and said seventh and sixth surfaces define said first article cavity when said first mold is moved to said second position; and

injecting said first plastic material into said first article cavity between said fifth and fourth surfaces to form a duplicate first article; and

injecting a second plastic material into said second article cavity between said seventh and sixth surfaces to form a duplicate second article.

8. The method of claim 7, wherein said duplicate first article and said duplicate second article are formed during said third plastic injection step.

9. The method of claim 1, wherein said first, second and third plastic materials are different.

10. A method of manufacturing a two-piece plastic assembly from a single die set comprising the following steps:

providing a shuttle-type molding apparatus having a first mold movable between first and second positions and a second stationary mold, said first molding having a first surface and a second surface, said second mold having a third surface and a fourth surface;

moving said first mold to said first position and closing said apparatus, said first and third surfaces defining a first article cavity and said second and fourth surfaces defining a second article cavity;

injecting a first plastic material into said first article cavity;

injecting a second plastic material into said second article cavity;

cooling said first material to form a first article and cooling said second material to form a second article;

opening said mold;

moving said first mold linearly from said first position to said second position, said linear movement being perpendicular to said opening and closing movement;

closing said apparatus and positioning said first article juxtaposed said second article and forming a joining cavity therebetween; and

injecting a third plastic materiel into said joining cavity through said second mold and joining said

first article to said second article to form said assembly.

11. The method of claim 10, wherein said second mold further comprises a fifth and seventh surface and said first mold further comprises a sixth surface wherein said fifth and fourth surfaces define said second article cavity and said seventh and sixth surfaces define said first article cavity when said first mold is moved to said second position; and

injecting said first plastic material into said first article cavity between said fifth and fourth surfaces to form a duplicate first article; and

injecting a second plastic material into said second article cavity between said seventh and sixth surfaces to form a duplicate second article.

12. An apparatus for manufacturing a two-piece plastic assembly comprising:

a first mold movable between first and second positions and a second mold, said first mold having a first surface and a second surface, said second mold having a third surface and a fourth surface, said first and third surfaces define a first article cavity and said second and fourth surfaces define a second article cavity when said first mold is in said first position;

a first resin inlet communicating with said first article cavity to inject a first resin to form a first article;

a second resin inlet communicating with said second article cavity to inject a second resin to form a second article;

said first surface retaining said first article and said third surface retaining said second article when said first mold is moved to said second position and said first and second molds position said first article juxtaposed said second article and creates a joining cavity therebetween; and

a third resin inlet communicating with said joining cavity to inject a third resin between said first and second articles.

13. The apparatus of claim 12, wherein said first mold is a shuttle-type mold.

14. The apparatus of claim 13, wherein said first mold moves linearly between said first and second positions.

15. The apparatus of claim 14, wherein said movement between said first and second positions is perpendicular to said opening and closing movement.

16. The apparatus of claim 12, wherein said second mold is stationary.

17. The apparatus of claim 16, wherein said first, second and third resin inlets pass through said second mold.

18. The method of claim 12, wherein said second mold further comprises a fifth and seventh surface and said first mold further comprises a sixth surface wherein said fifth and fourth surfaces define said second article cavity and said seventh and sixth surfaces define said

first article cavity when said first mold is moved to said second position; and

a fourth resin inlet communicating with said first article cavity between said fifth and fourth surfaces to inject said first resin to form a duplicate first article; and

a fifth resin inlet communicating with said second article cavity between said seventh and sixth surfaces to inject said second resin to form a duplicate second article.

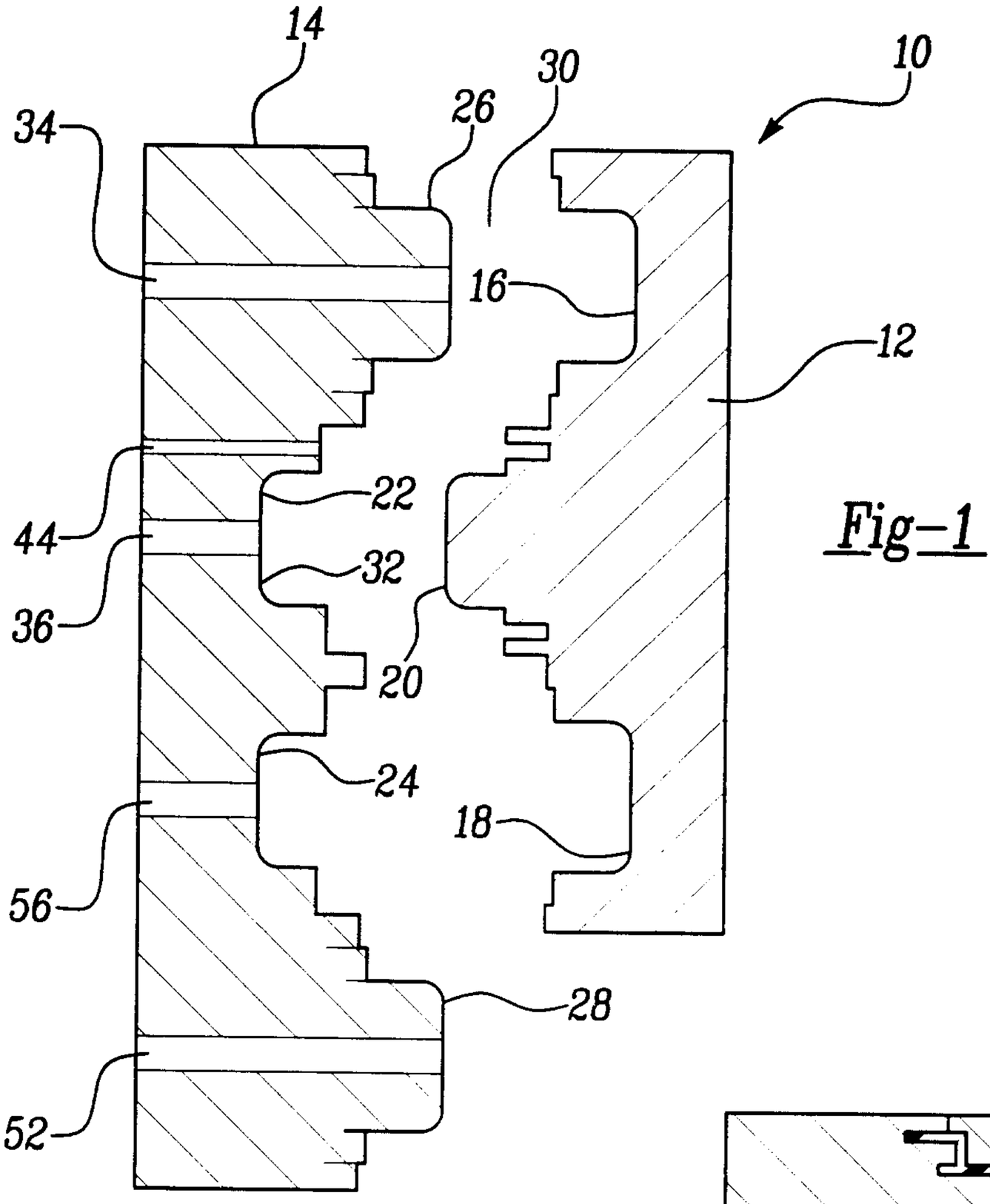


Fig-1

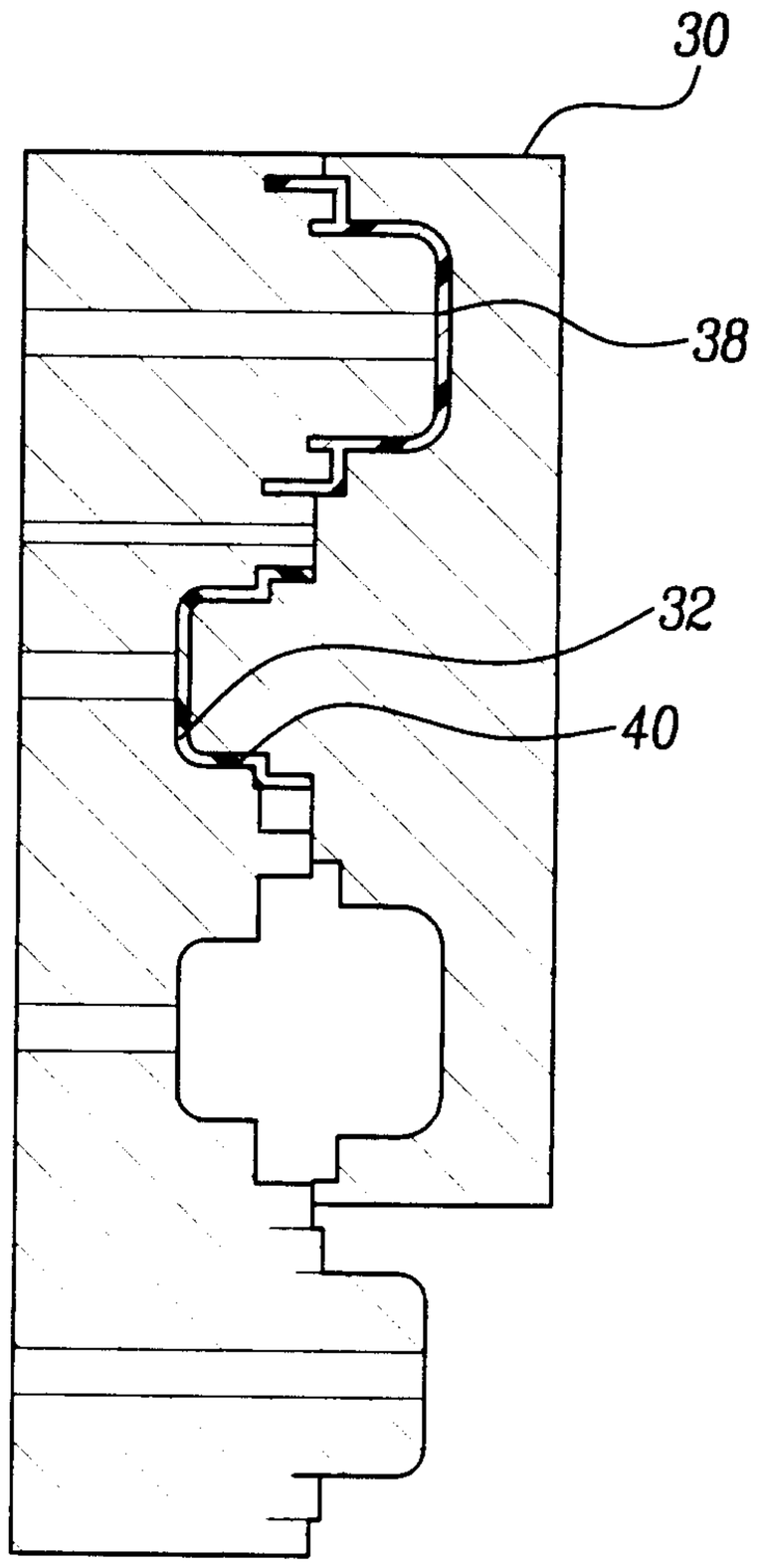


Fig-2

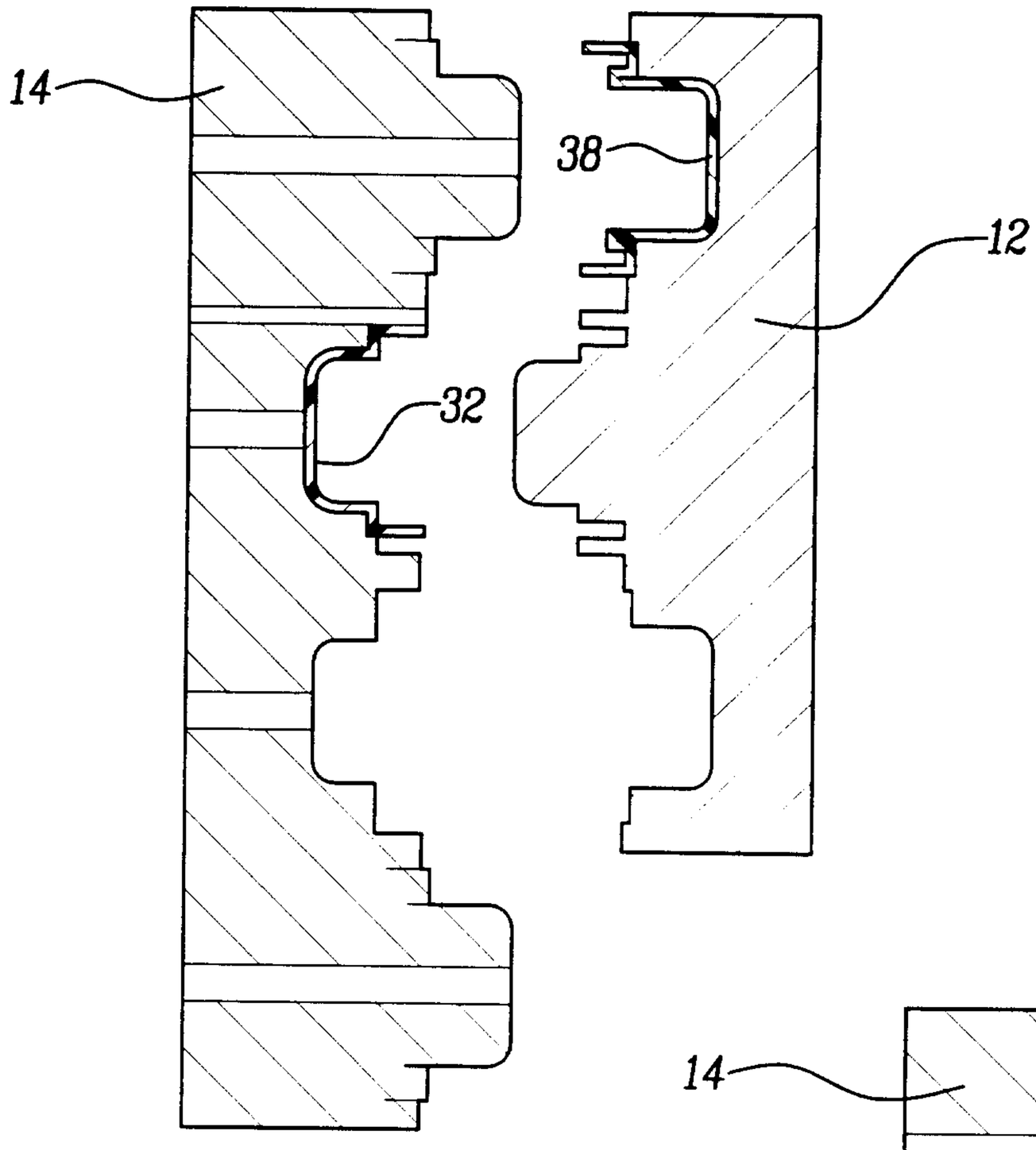


Fig-3

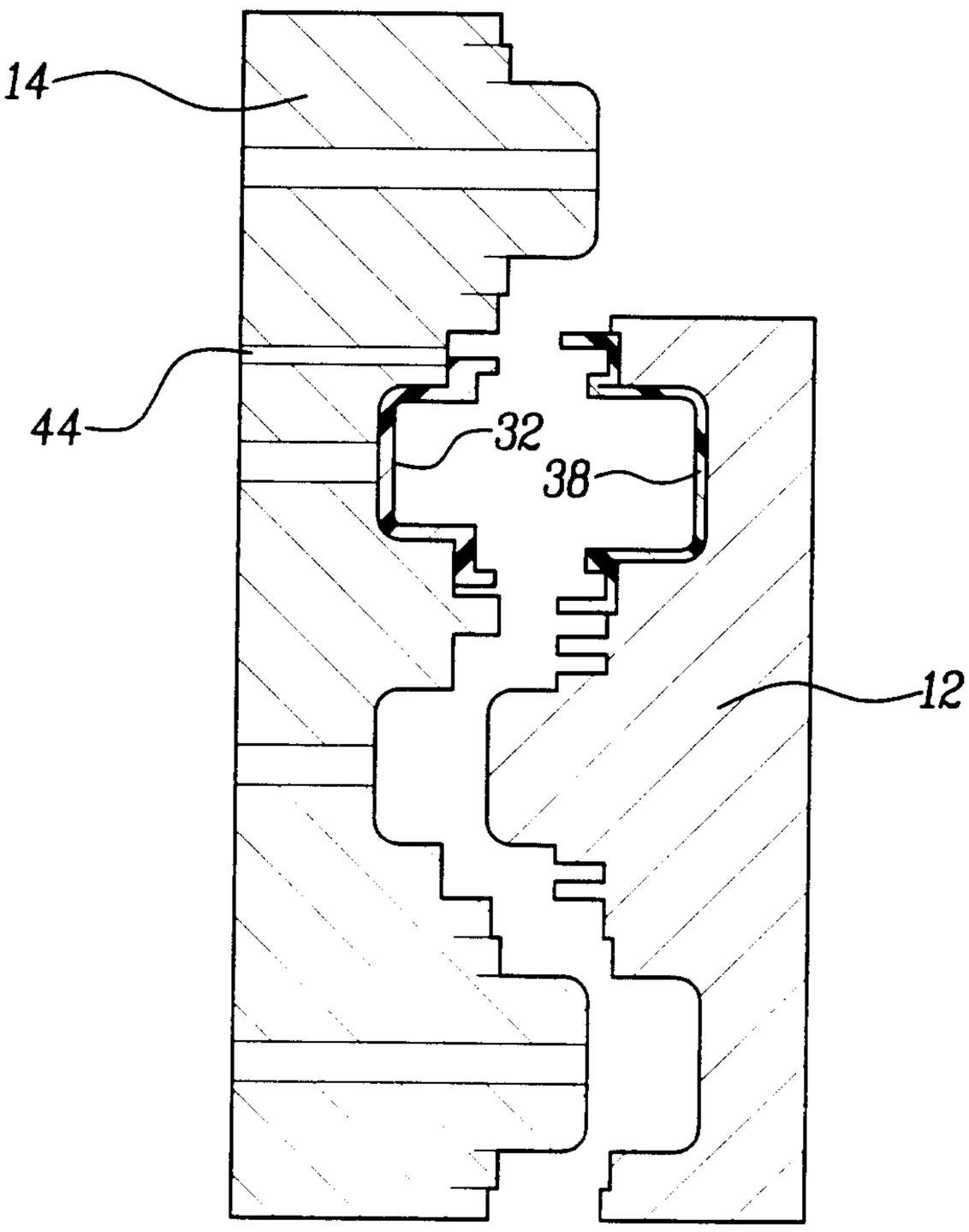


Fig-4

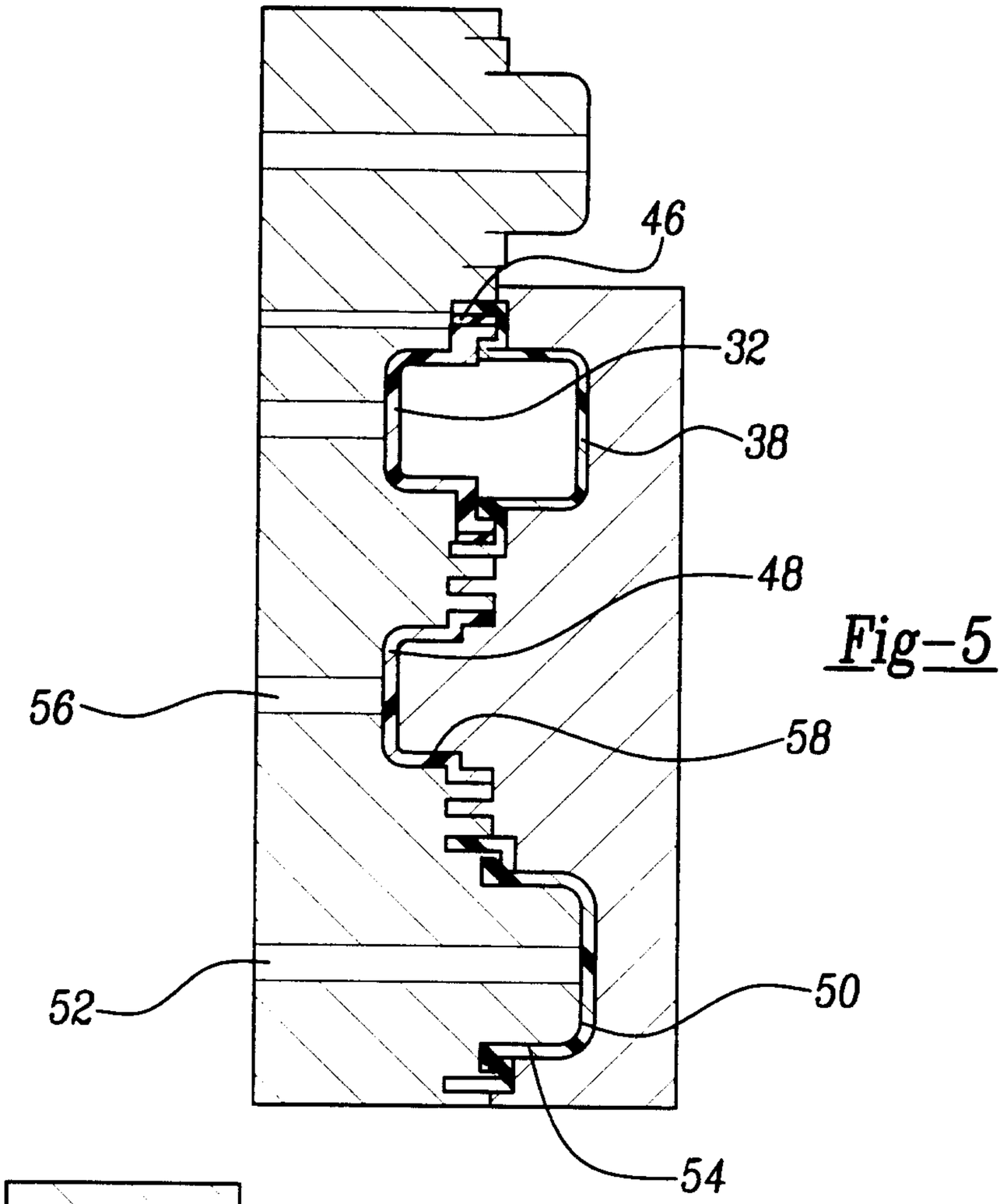


Fig-5

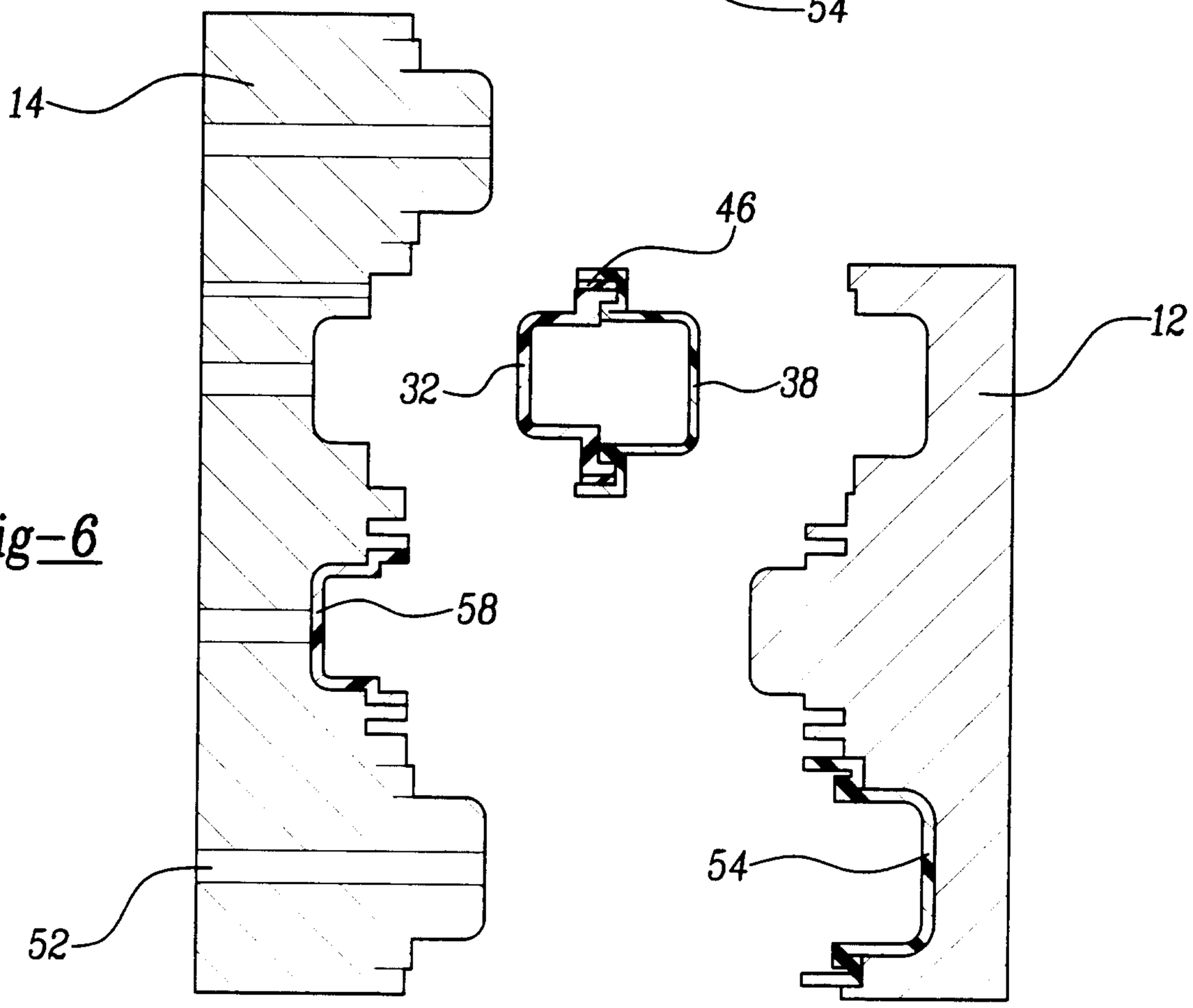


Fig-6

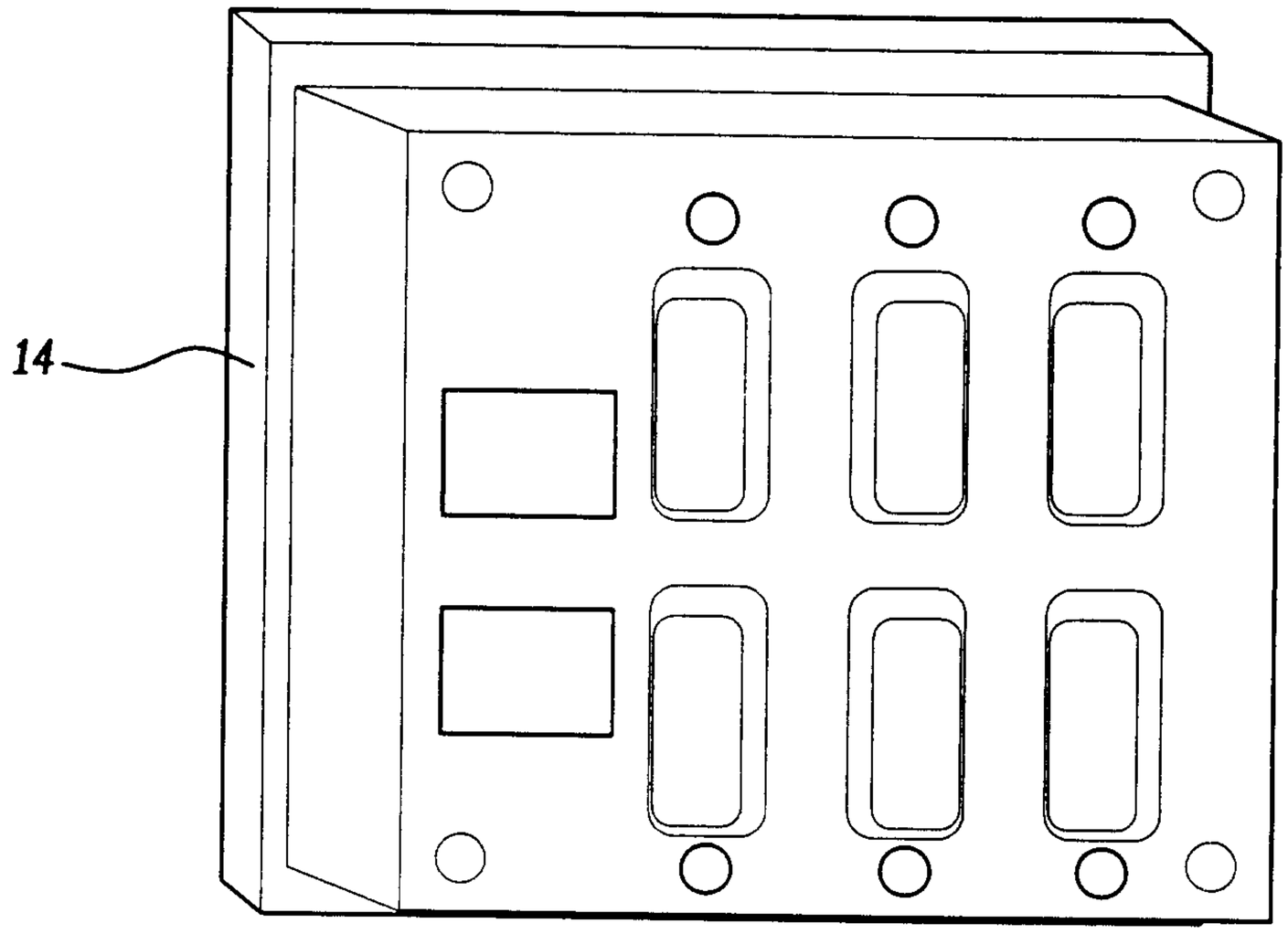


Fig-7

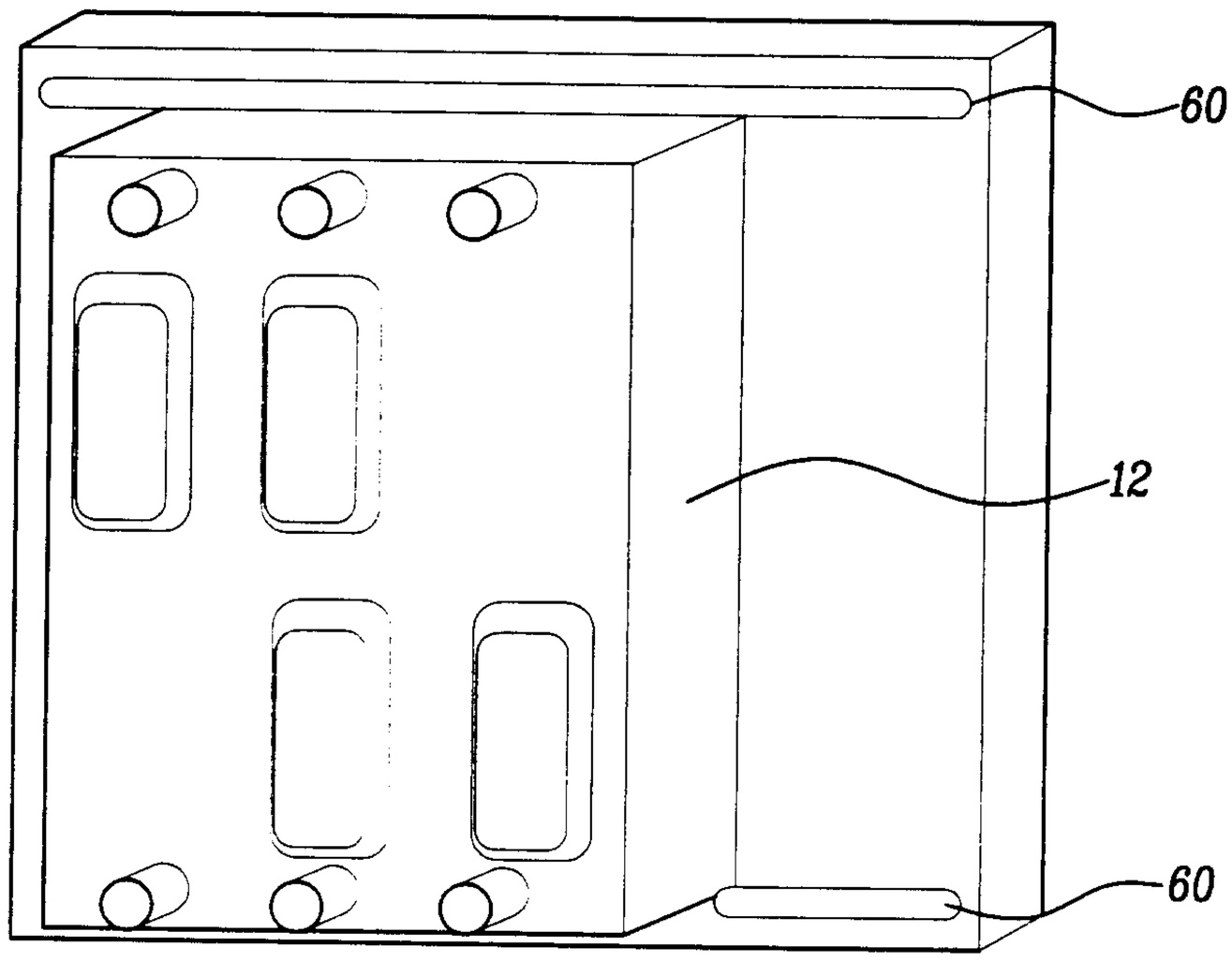


Fig-8