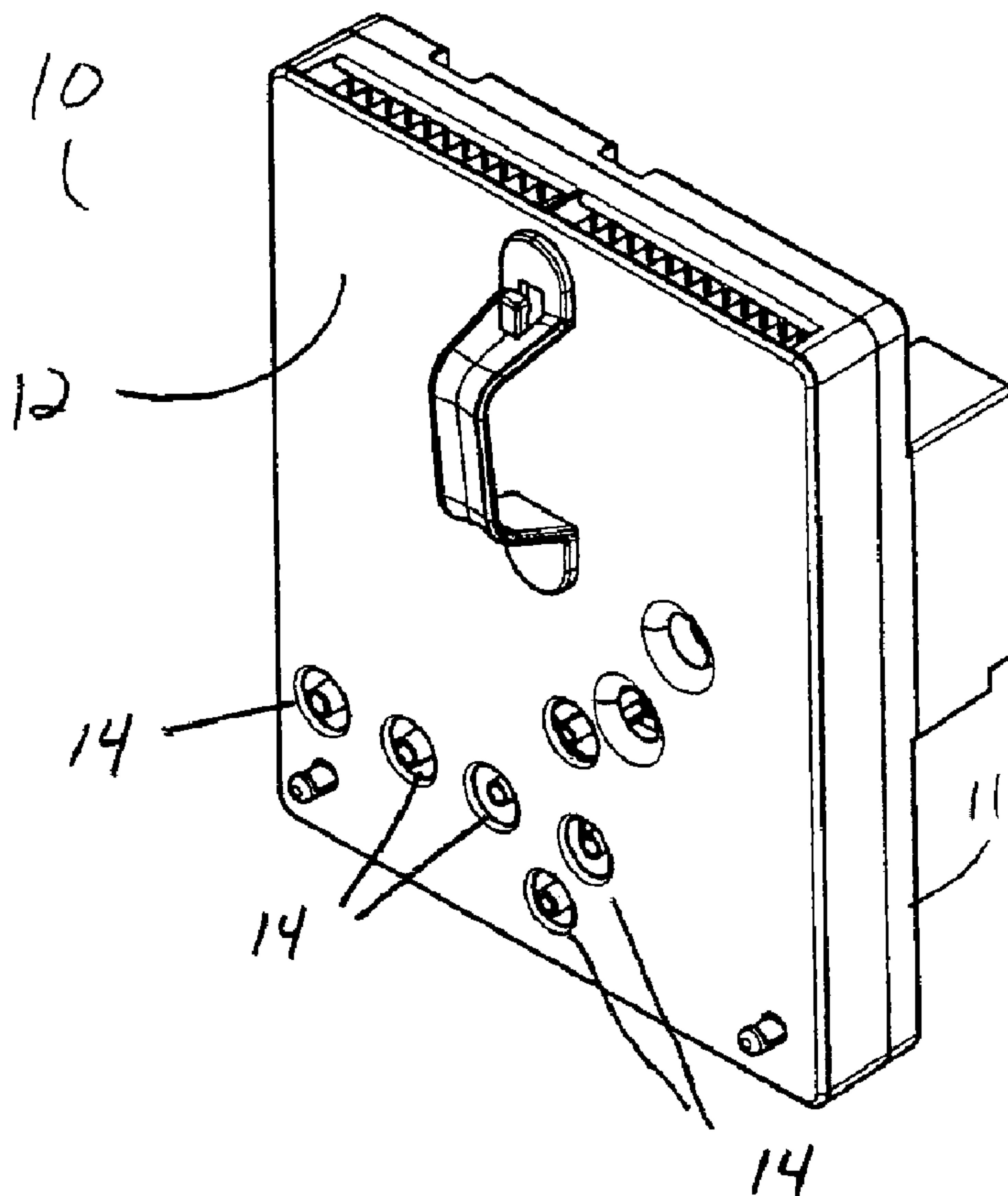




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(54) Titre : CASSETTE POURVUE DE NERVURES DE SERRAGE ELASTOMERIQUES
 (54) Title: CASSETTE HAVING ELASTOMERIC CLAMPING RIBS



(57) Abrégé/Abstract:

A cassette having a molded flow channel contained on an elastomeric sheet that is bonded or mechanically attached to a rigid substrate. A surgical console contains a cassette receiving area having a pump head with rollers that are mounted radially from the

(57) **Abrégé(suite)/Abstract(continued):**

axis of rotation of the pump motor and compress the elastomeric flow channels against the rigid substrate. The cassette is held in place against the pump head by a latching mechanism that draws the cassette against the pump head. The periphery of the elastomeric sheet contains a raised ridge or boss integrally formed as part of the elastomeric sheet at or near the area(s) of the elastomeric sheet that is/are subject to high transient or static pressures.. The ridge allows the elastomeric sheet to be firmly pressed against the cassette receiving portion of the surgical console, yet still allow the cassette to be drawn against the pump head. The firm engagement of the sheet ridge against the cassette receiving portion of the surgical console helps to ensure that the elastomeric sheet does not become dislodged when the cassette is exposed to high transient pressures.

Abstract of the Disclosure

A cassette having a molded flow channel contained on an elastomeric sheet that is bonded or mechanically attached to a rigid substrate. A surgical console contains a cassette receiving area having a pump head with rollers that are mounted radially from the axis of rotation of the pump motor and compress the elastomeric flow channels against the rigid substrate. The cassette is held in place against the pump head by a latching mechanism that draws the cassette against the pump head. The periphery of the elastomeric sheet contains a raised ridge or boss integrally formed as part of the elastomeric sheet at or near the area(s) of the elastomeric sheet that is/are subject to high transient or static pressures.. The ridge allows the elastomeric sheet to be firmly pressed against the cassette receiving portion of the surgical console, yet still allow the cassette to be drawn against the pump head. The firm engagement of the sheet ridge against the cassette receiving portion of the surgical console helps to ensure that the elastomeric sheet does not become dislodged when the cassette is exposed to high transient pressures.

CASSETTE HAVING ELASTOMERIC CLAMPING RIBS

Background of the Invention

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The present invention relates generally to peristaltic pumps and more specifically to fluidic cassettes used in ophthalmic surgical equipment.

Most prior art peristaltic pumps work by compressing or squeezing a length of flexible tubing (sometimes between a fixed race) using a rotating roller head. As the roller head rotates, the rollers pinch off a portion of the tubing and push any fluid trapped in the tubing between the rollers in the direction of rotation. Peristaltic pumps are widely used in medical applications because of their predictable, constant flow properties. These prior art systems, however, typically require manual connection of the pump tube segment around the rotating roller head.

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Prior art peristaltic pumps using rotating roller heads also typically impart unwanted pressure pulsations. Several pulsation damping devices have been developed to address this problem (see *e.g.*, U.S. Patent No.4,921,477 (Davis)).

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Another prior art pump is disclosed in U.S. Patent No. 6,293,926 B1 (Sorensen, et al.) describes a peristaltic pump having a molded flow channel contained on an elastomeric sheet that is bonded or mechanically attached to a rigid substrate. The pump head rollers are mounted radially from the axis of rotation of the pump motor and compress the elastomeric flow channels against the rigid substrate. The commercial embodiment of the invention described in this patent is sold as the INFINITI[®] Vision System by Alcon Laboratories, Inc., Fort Worth, Texas. This surgical console uses a Fluid Management System or cassette wherein the elastomeric sheet is friction fit into the rigid substrate without the use of any adhesives. Such a construction method has proven to be extremely reliable, but this commercial system is intended primarily for cataract surgery and has no other source of vacuum other than the peristaltic pump. Therefore, the fluidic system is exposed primarily to negative pressure or vacuum and is not exposed to transient high positive pressures, such as are encountered during a reflux operation in posterior segment surgical procedures using a venturi pump as the primary source of vacuum. These high positive pressures can be as high as 700 mm Hg and have the potential to cause failure at the elastomer/substrate interface if a friction fit construction technique is used.

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Accordingly, a need continues to exist for a surgical cassette that reduces the potential for cassette failure under transient positive pressures.

Brief Summary of the Invention

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The present invention improves upon prior art cassettes by providing a cassette having a molded flow channel contained on an elastomeric sheet that is bonded or mechanically attached to a rigid substrate. A surgical console contains a cassette receiving area having a pump head with rollers that are mounted radially from the axis of rotation of the pump motor and compress the elastomeric flow channels against the rigid substrate. The cassette is held in place against the pump head by a latching mechanism that draws the cassette against the pump head. The elastomeric sheet contains a raised ridge or boss integrally formed as part of the elastomeric sheet at or near the area(s) of the elastomeric sheet that is/are subject to high transient or static pressures. The ridge allows the elastomeric sheet to be firmly pressed against the cassette receiving portion of the surgical console, yet still allow the cassette to be drawn against the pump head. The firm engagement of the sheet ridge against the cassette receiving portion of the surgical console helps to ensure that the elastomeric sheet does not become dislodged when the cassette is exposed to high transient pressures.

One objective of the present invention is to provide a peristaltic pump that uses molded elastomeric flow channels.

Another objective of the present invention is to provide a peristaltic pump having radially oriented pump rollers.

Yet another objective of the present invention is to provide a peristaltic pump having pump rollers that compress elastomeric flow channels against a rigid substrate.

Still another objective of the present invention is to provide a cassette having an elastomeric sheet fitting to a rigid substrate.

Still another objective of the present invention is to provide a cassette having an elastomeric sheet fitting to a rigid substrate so that the elastomeric sheet does not become dislodged when the cassette is exposed to high transient pressures.

These and other advantages and objectives of the present invention will become apparent from the detailed description, drawings and claims that follow.

Brief Description of the Drawings

FIG. 1 is a front perspective view of the cassette of the present invention.

5 FIG. 2 is a rear perspective view of the cassette of the present invention.

FIG. 3 is a schematic representation of the surgical cassette of the present invention installed in a surgical console.

FIG. 4 is a rear perspective view of the pump elastomer sheet used on the cassette of the present invention.

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Detailed Description of the Preferred Embodiment

15 As best seen in FIGS. 1-3, cassette 10 of the present invention generally includes body 11 having front face 12 containing a plurality of fluidic connections 14 for fluidically connecting cassette 10 to infusion fluid source 20 and surgical handpiece 22 used during a surgical procedure. Cassette 10 may also include handle for assisting in installing and removing cassette 10 from surgical console 24. As best seen in FIG. 2, cassette 10 has rear
20 face 18 opposite front face 12 and adapted for mechanical and fluidic interaction with surgical console 24. Frictionally mounted on rear face 18 of cassette 10 are a plurality of elastomeric interface-forming sheets, such as pneumatics elastomer 25, infusion elastomer 26, aspiration elastomer 28, valve elastomer 100 and pump elastomer 30. Cassette 10 is mounted within console 24 so that pump elastomer 30 is pressed against pump mechanism 32 mounted
25 in console 24 by latches 38. Cassette 10 may be molded from any suitable material, such as thermoplastic and elastomers 25, 26, 28 and 30 may be molded from any suitable elastomer, such as silicone rubber.

As best seen in FIG. 4, pump elastomer 30 is generally circular, approximating the size and shape of the roller head (not shown) mounted to pump mechanism 32. Pump
30 elastomer 30 contains pumping channel 34 that interacts with pump mechanism 32 to provide peristaltic pumping action through cassette 10. The operation of cassette 10 and pump

mechanism 32 is more fully described in U.S. Patent No. 6,293,926 B1 (Sorensen, et al.). In order to assure that pump elastomers 25, 26, 28, 30 and 100 are firmly pressed against console 24, thereby helping to reduce the likelihood that elastomers 25, 26, 28, 30 and 100 can be dislodged from cassette 10 when exposed to high transient pressures, elastomers 25, 26, 28 and 30 contain raised ribs or bosses 36 extending around the entire areas of elastomers 25, 26, 28, 30 and 100 that are subject to high transient or static pressures. Ribs 36 are compressed when latches 38 press cassette 10 into console 24, thereby helping to prevent any movement of elastomers 25, 26, 28, 30 and 100.

10 This description is given for purposes of illustration and explanation. It will be apparent to those skilled in the relevant art that modifications may be made to the invention as herein described without departing from its scope or spirit.

Claims

1. A cassette, comprising:
 - a) a body having an exterior; and
 - b) a first relatively flexible elastomeric sheet frictionally attached to the5 body, the first flexible sheet having
at least one molded pumping channel projecting outwardly from the exterior
of the body; and
a raised rib extending around the entire area of the first flexible elastomeric
sheet that is subject to high transient or static pressure, said raised rib arranged to
10 compress against a cassette receiving portion of a surgical console.
2. The cassette of claim 1 further comprising at least a second flexible
elastomeric sheet, the second elastomeric sheet having a second raised rib extending
around the entire area of the second elastomeric sheet that is subject to high transient
or static pressure, said second raised rib arranged to compress against said cassette
15 receiving portion of said surgical console.
3. The cassette of claim 2 wherein the second flexible elastomeric sheet
comprises a pneumatics elastomer sheet.
4. The cassette of claim 2 wherein the second flexible elastomeric sheet
comprises an aspiration elastomer sheet.
- 20 5. The cassette of claim 2 wherein the second flexible elastomeric sheet
comprises a pump elastomer sheet.
6. The cassette of claim 2 wherein the second flexible elastomeric sheet
comprises a valve elastomer sheet.

7. The cassette of claim 2 wherein the second flexible elastomeric sheet comprises an infusion elastomer sheet.
8. A cassette, comprising:
- a) a body having an exterior; and
 - b) a first relatively flexible elastomeric sheet frictionally attached to the body, the first flexible sheet having
 - at least one portion projecting outwardly from the exterior of the body; and
 - a raised rib extending around the entire area of the first flexible elastomeric sheet that is subject to high transient or static pressure, said raised rib arranged to compress against a cassette receiving portion of a surgical console.
9. The cassette of claim 8 further comprising at least a second flexible elastomeric sheet, the second elastomeric sheet having a second raised rib extending around the entire area of the second elastomeric sheet that is subject to high transient or static pressure, said second raised rib arranged to compress against a cassette receiving portion of said surgical console.
10. The cassette of claim 9 wherein the second flexible elastomeric sheet comprises a pneumatics elastomer sheet.
11. The cassette of claim 9 wherein the second flexible elastomeric sheet comprises an aspiration elastomer sheet.
12. The cassette of claim 9 wherein the second flexible elastomeric sheet comprises a pump elastomer sheet.
13. The cassette of claim 9 wherein the second flexible elastomeric sheet comprises a valve elastomer sheet.

14. The cassette of claim 9 wherein the second flexible elastomeric sheet comprises at least one molded pumping channel.

15. The cassette of claim 9 wherein the second flexible elastomeric sheet comprises an infusion elastomer sheet.

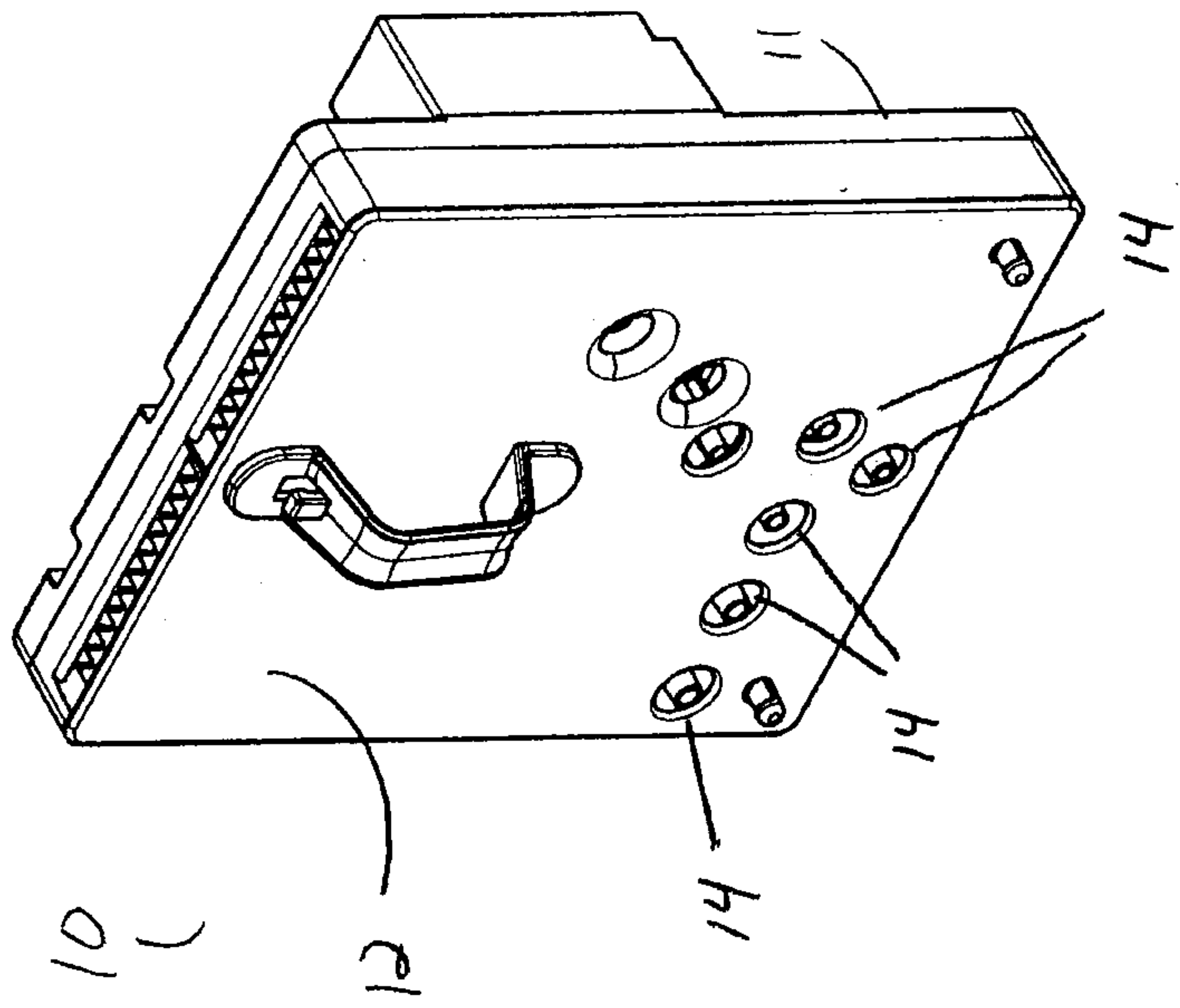


FIG. 1

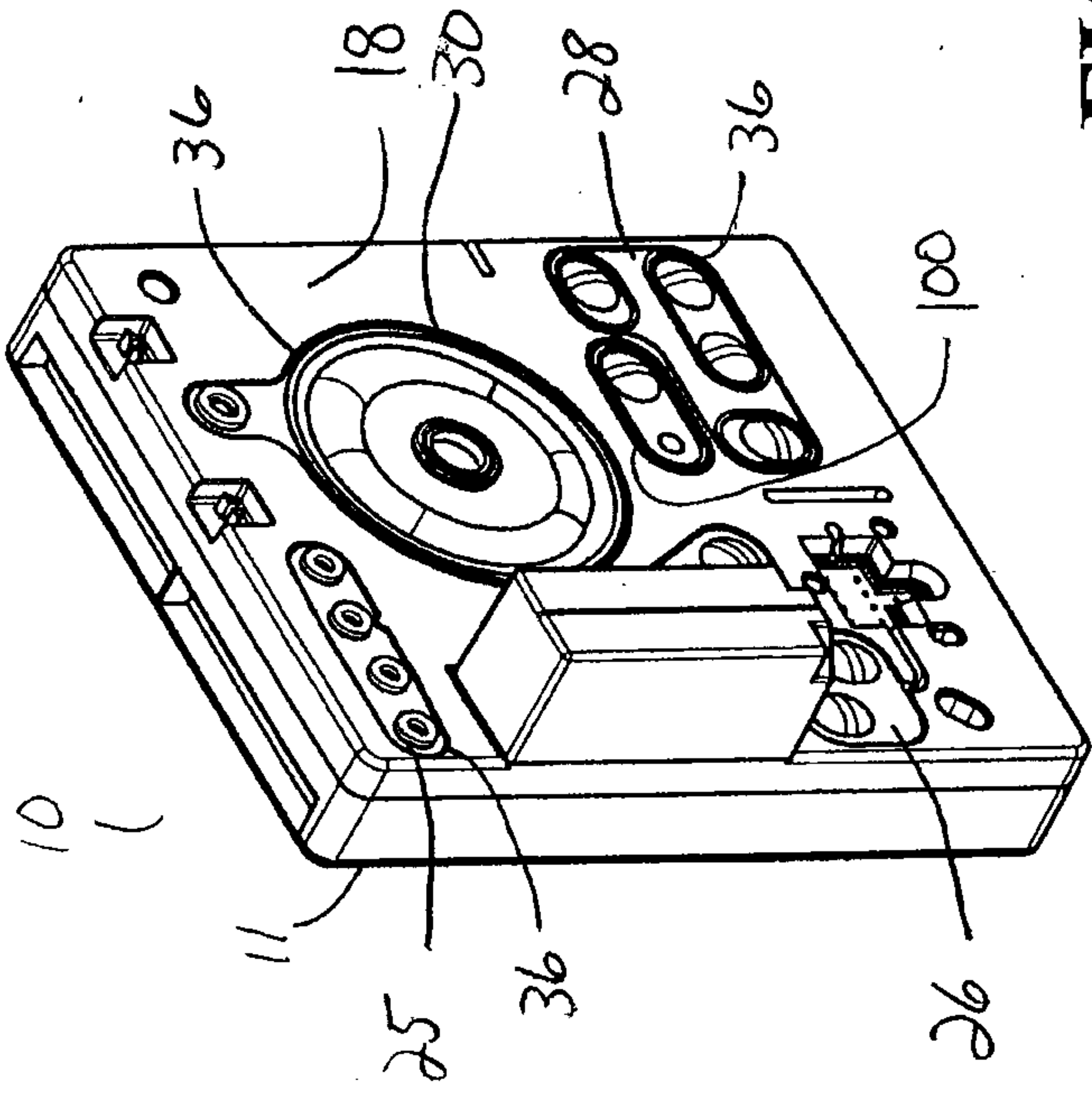


FIG. 2

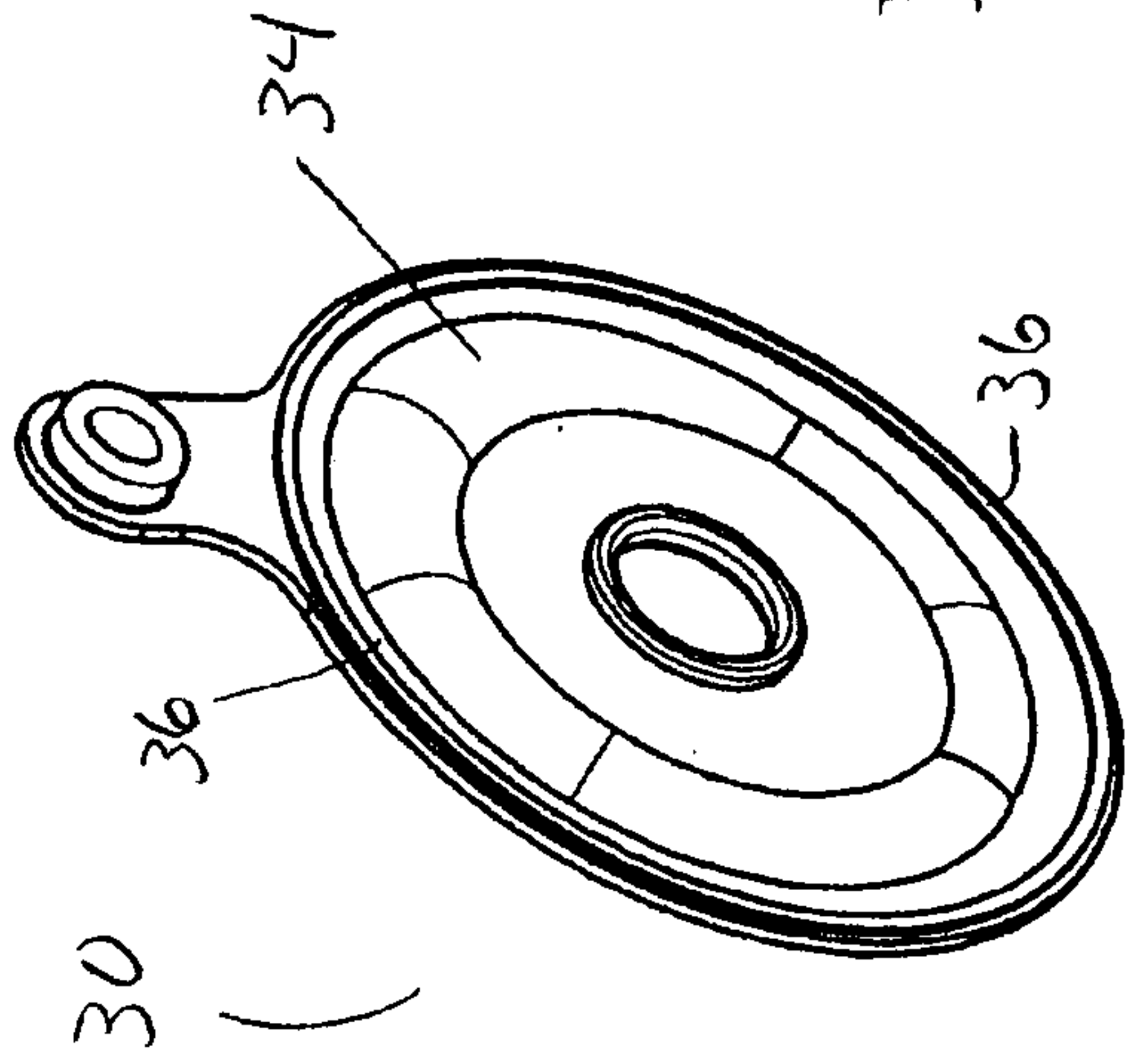


FIG. 4

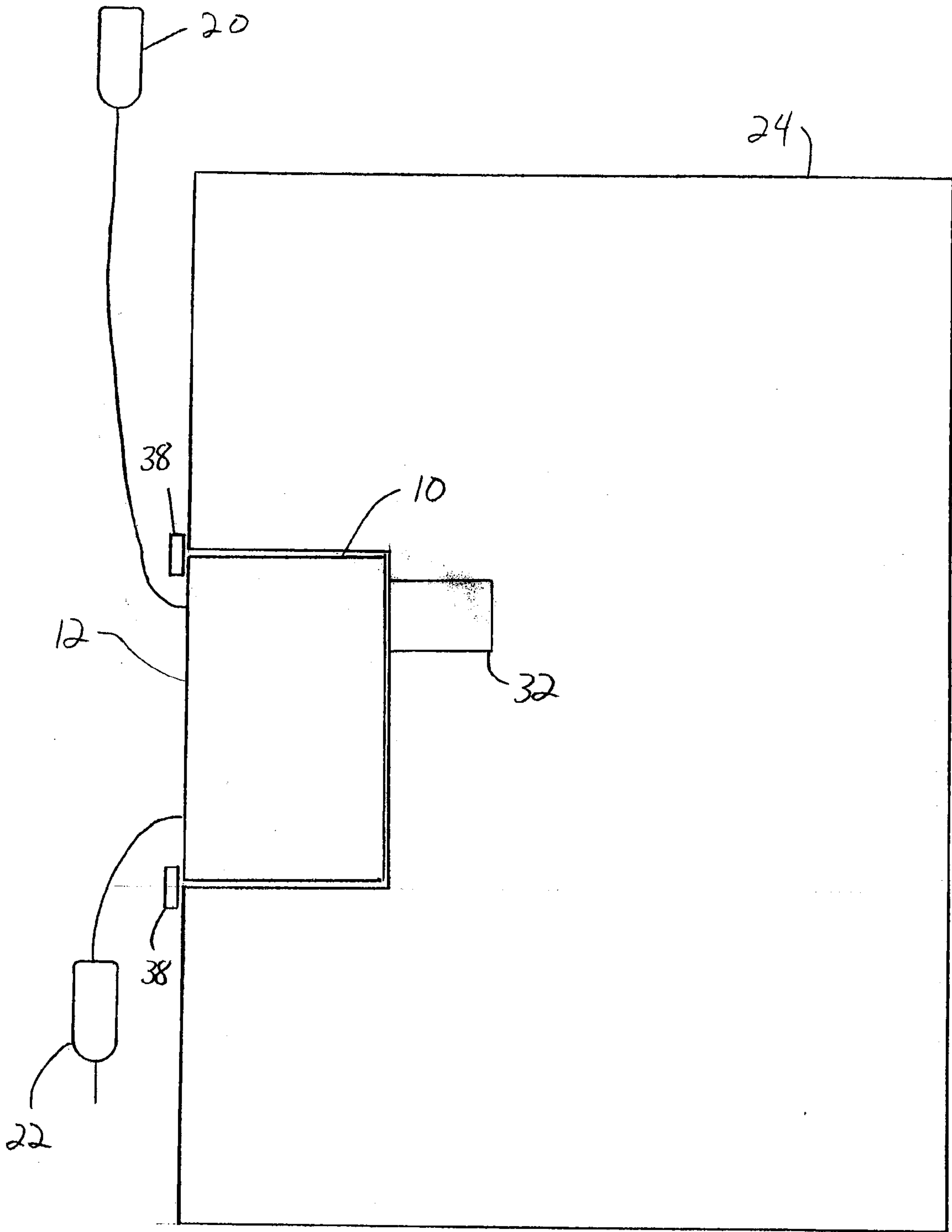


FIG. 3

