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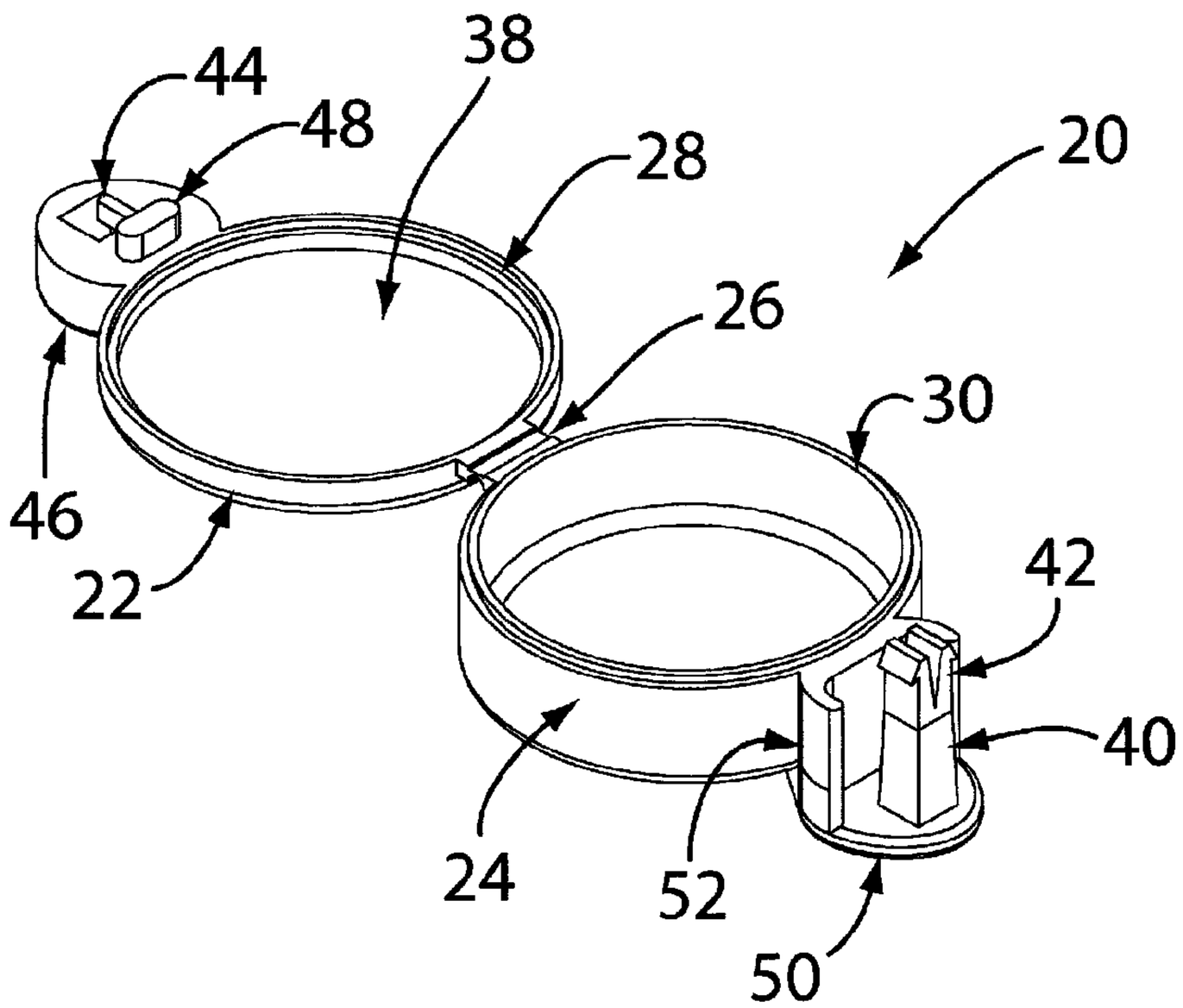
(54) Titre : DISPOSITIF DE FIXATION D'ETIQUETTE D'IDENTIFICATION PAR RADIOFREQUENCE ANTI-RAPT DE NOUVEAU-NE

(54) Title: NEWBORN ANTI-ABDUCTION RFID TAG SECURING SYSTEM



(57) Abrégé/Abstract:
This invention relates to the field of newborn abduction prevention, and to a tamper-proof RFID tag securely attached to a newborn's umbilical clamp. An RFID perimeter system triggers an alarm when a tagged and clamped infant is removed from an RFID secured area without authorization. The invention provides an RFID tag that is tenaciously secured to a newborn's umbilical clamp, using a tether with a one-way mechanical snap that locks the tether to an umbilical clamp. The RFID electronic circuits are typically embedded in a permanent enclosure. The invention provides for a secure encasement for the tag's permanent enclosure. The encasement and the tag cooperate to effect a hidden tamperproofing system, by having an optical transmitter and an optical receiver continually test the reception of a reflective beam from a surface of the encasement. If the encasement is opened, or if the optics are sufficiently disturbed to break the optical circuit, an alarm signal can be sent.

NEWBORN ANTI-ABDUCTION RFID TAG SECURING SYSTEM

ABSTRACT

This invention relates to the field of newborn abduction prevention, and to a tamper-proof RFID tag securely attached to a newborn's umbilical clamp. An RFID perimeter system triggers an alarm when a tagged and clamped infant is removed from an RFID secured area without authorization. The invention provides an RFID tag that is tenaciously secured to a newborn's umbilical clamp, using a tether with a one-way mechanical snap that locks the tether to an umbilical clamp. The RFID electronic circuits are typically embedded in a permanent enclosure. The invention provides for a secure encasement for the tag's permanent enclosure. The encasement and the tag cooperate to effect a hidden tamperproofing system, by having an optical transmitter and an optical receiver continually test the reception of a reflective beam from a surface of the encasement. If the encasement is opened, or if the optics are sufficiently disturbed to break the optical circuit, an alarm signal can be sent.

NEWBORN ANTI-ABDUCTION RFID TAG SECURING SYSTEM

SPECIFICATION

FIELD OF INVENTION

This invention relates to a novel device and method in the general field of newborn abduction prevention, and more specifically to a tamper-proof RFID tag securely attached to a newborn's umbilical clamp. The RFID perimeter system triggers an alarm when a tagged and clamped infant is removed from an RFID secured area without authorization, or when the RFID tag tamperproofing is breached by attempts to remove the tag from the clamp, or remove the clamp from the infant.

BACKGROUND OF THE INVENTION

The basic problem to be solved: there is a legitimate risk that newborn infants can be abducted from a hospital or caregivers, and that identification and monitoring systems are insufficient to defeat such crimes. A newborn begins its life in the hospital with a clamp fastened around its umbilical cord, and this is the common means used to identify the newborn throughout this initial period, usually by adding some visual identifier to the clamp, such as a unique number, color coding, etc. Visual identification systems require alert security personnel to match the correct infants with their parents or caregivers, especially when trying to prevent abductions from secure

areas. These systems can be defeated by simple means such as baby or ID swapping, forgery, distraction, or coercion. Anti-abduction systems based solely on physical tag matching such as that taught in U.S. Patent # 6212808, Safety identification assembly and method, are insufficient, and are currently being superseded by more reliable Radio Frequency Identification (RFID) methods as outlined below.

Prior art RFID methods may be divided into those which employ physical ID matching systems with RFID perimeter security devices; and those which employ RFID perimeter security devices but use either the RFID devices, or other means, to identify those authorized to remove an infant from a secured zone. RFID with physical ID matching systems include those taught by U.S. Patent # 5006830, Method and device for deterring the unauthorized removal of a newborn from a defined area (expires Oct, 2009), employing both umbilical and wristband RFID tags that determine who has authority to remove a specific infant from the secure area. U.S. Patent # 5608382, Infant identification and security apparatus, employs storage modules embedded in both wrist and umbilical tags, and which must be read by password protected terminals stationed at secured zone exits. In both these examples it is not difficult to tamper with or defeat the security measures employed, by removing, or swapping the tags, and or using another's password, to gain unauthorized egress from the secured zone.

Another category of umbilical RFID tagging systems is taught by U.S. Patent # 4899134, Newborn Anti-theft device, wherein sensors are placed at exits and throughout different secured zones which detects an embedded RF transmitter, or magnetic marker material, but again these

devices may be removed or disabled by enclosing in an RF shielding material such as tin foil. Another example is taught by U.S. Patent # 5440295, Apparatus and Method for preventing unauthorized removal of a newborn infant from a predetermined area, where the transponder of the RFID system is easily blocked or removed. Both systems do not require lockout systems as in the previous examples, but are monitoring systems, so that when they are defeated, the abduction is made easier because people assume that the infant is in the hands of an authorized person.

A solution is therefore needed that employs the use of RFID methods to control egress from secured zones by only those authorized to remove correctly identified and tagged infants, but also which is easily attached, difficult to remove, and preferably tamperproof in a hidden way – thereby making it practically impossible to remove an infant without proper observation, recording, and if necessary, perimeter lockdown when an abduction is attempted. The following summary describes a novel solution to these unresolved issues.

BRIEF SUMMARY OF THE INVENTION

The disclosed device and method is designed to provide an RFID tag that is tenaciously secured to a newborn's umbilical clamp, and which triggers an alarm if tampered with or if the umbilical clamp is removed from the newborn. By this means, once a newborn is tagged with this device, a potential abductor will trigger the RFID perimeter alarm system when a tagged and clamped infant is removed from an RFID secured area without authorization, or when the RFID tag tamperproofing is breached by any attempts to remove the tag, remove the tag from the clamp, or

remove the clamp from the infant.

With this new device, the method that prevents the abductor from removing the tagged umbilical clamp from a newborn is not the fear of potential harm to the newborn, but the fear of being caught when the device triggers an alarm when any attempt is made to remove it from the newborn.

Another advantage of this system is that the existing RFID technology can be used with both locator systems as well as perimeter protection systems, but tampering with the systems or devices raises an alarm.

The device in its basic form uses a tether with a one-way mechanical snap that locks the tether around a member forming an aperture on an umbilical clamp. The tether is affixed to an RFID tag, or to an encasement for such a tag. The RFID electronic circuits are typically embedded in a permanent enclosure. The enclosure and its embedded electronics are referred to hereinafter as the RFID tag. The RFID tag may be enclosed in an encasement as described below.

In a major enhancement of the invention, with an encasement for the tag being tethered to an umbilical clamp, the encasement and the tag cooperate to effect a hidden tamperproofing system. This is achieved by having an optical transmitter and an optical receiver continually test the reception of a reflective beam from a surface of the encasement. If the encasement is opened, or if the optics are sufficiently disturbed to break the optical circuit, an alarm signal can be sent.

The invention is thus an RFID tag securing system, comprising a loop securement member affixed to an RFID tag, or to an encasement for an RFID tag, the member having a one-way mechanical snap that locks the loop securement member around a clamp member forming an aperture on an umbilical clamp.

In a preferred embodiment the electronic circuits of the RFID tag are embedded in a permanent enclosure, and the enclosure is encased in a closable encasement that provides security for the RFID enclosure until the encasement is opened and disposed of by personnel and under conditions authorized by the RFID detection system. The encasement is eventually disposable and enables re-use of the RFID tag that has been encased.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG 1. shows an isometric top view of an open RFID tag encasement.

FIG 2. shows an isometric top view of a closed RFID tag encasement.

FIG 3. shows an isometric top view of a closed RFID tag encasement secured to the loop of an umbilical clamp.

Fig 4. shows a top view of a closed RFID tag encasement secured to the loop of an umbilical clamp.

FIG 5. shows a side view of a closed RFID tag encasement secured to the loop of an umbilical clamp.

FIG 6. shows an isometric bottom view of an open RFID tag encasement.

FIG 7. shows a top view of an open RFID tag encasement.

FIG 8. shows a side view of an open RFID tag encasement.

FIG 9. shows a closeup side view of the optical tamper-proof elements housed in the RFID tag encasement.

FIG 10. shows an isometric top view of an RFID tag enclosure, with a securing loop tether.

FIG 11. shows a side view of an RFID tag enclosure secured to an umbilical clamp.

DETAILED DESCRIPTION

By reference to the figures shown and listed below, all elements of the invention will now be introduced, and then the nature of how each element functions and interacts with each other element will be described.

Fig. 1 shows an isometric top view of an open RFID tag encasement 20, whose basic elements include the encasement top 22 with its flanged lip 28 which fits onto the corresponding lip guide 30 in the top edge of the encasement bottom 24, by folding their connecting flexible hinge 26. In order to reliably secure an umbilical clamp 12 (see Fig. 3) to the tag encasement 20 and at the same time prevent anyone from opening the tag encasement 20 once it has been properly closed, several elements must be employed together as follows.

As shown in Fig. 3, the clamp loop 18 must be first positioned such it the loop securement member 40 -- which protrudes from the base of the platform 50, and which is reinforced by the loop cordon 52 – protrudes through the clamp loop. When the encasement top 22 is folded along the hinge 26 to fit over the encasement bottom 24, the securement catch 42 at the top of the loop securement member 40 locks into the catch securement hole 44 in the securement cap 46. The securement plug 48 prevents one from unlocking the tag encasement 20, once the securement catch 42 is locked into its corresponding catch securement hole 44, by preventing lateral movement of the loop securement member.

Fig. 2 shows an isometric top view of the resulting locked and tamperproof RFID tag encasement 20, a view which reveals the loop securement member 40 in its locked position.

Fig. 3 shows the tamperproof RFID tag encasement system from an isometric top view of the locked RFID tag encasement 20 secured by the proximal clamp loop 18 of the umbilical clamp 12. (RFID tag PCB with optical tamperproof elements are inside the tag encasement) Also

shown are the clamp arms 14 which extend from the clamp loop 18, which then compresses the newborn's umbilical cord in the clamp jaws 54, which are then locked by the end securement 16 at the clamp end 56. The end securement 16 may employ a similar means as used to lock the tag encasement 20, or may employ a one way plug and hole or any equivalent securement means which ensure that the once the tether is locked around the umbilical clamp, it cannot be readily removed.

Figs. 4 and 5 show top and side views, respectively, of the same elements described above in order to more fully illustrate the tag encasement 20 and how it is secured to the umbilical clamp 12 by means of its loop 18.

Figs. 6 through 8 show bottom isometric, top, and side views, respectively, of the open RFID tag encasement 20, and serve to more fully illustrate all aspects of said encasement 20.

Fig. 9 shows a closeup side view of the optical tamper-proof elements housed in the RFID tag encasement 20. The RFID tag printed circuit board (PCB) 32 is shown without its enclosure - in the encasement 24, and shows the optical transmitter 34 and optical receiver 36 pair housed on its upper surface. In a working embodiment, the RFID tag printed circuit board (PCB) 32 would be inside a transparent or partially transparent tag enclosure, so that the optical transmitter 34 and optical receiver 36 work with respect to ray 62. The tag enclosure (shown in Figures 10 and 11) functions to protect the RFID tag printed circuit board (PCB) 32 whether the enclosure is placed inside an encasement 24 or merely attached as shown in Figures 10 and 11. The inside surface of

the encasement top 22 is a reflective surface 38 that maintains the optical pathway of the energy ray 62 from the transmitter 34 to the receiver 36. As long as the encasement top 22 is locked in place, the optical pathway is maintained, but when the pathway is broken by tampering or forced removal of the clamp arm 14, which can only be possible by the opening of the tag encasement 20, the RFID tag PCB 32 signals to the perimeter containment system that the integrity of a tag encasement 20 has been breached, so that appropriate protective measures may be taken.

Fig. 10 shows an isometric top view of an RFID tag permanent enclosure 21, in which the loop securement member is a flexible tether 58 that is locked into the catch securement hole 44 of the catch securement block 60. Fig. 11 shows a side view of the RFID tag permanent enclosure 21 secured thereby to the clamp loop 18 of an umbilical clamp 12. The flexible loop tether example of the invention can likewise be used on an encasement (such as shown in Figures 1 – 9) for the RFID tag enclosure, providing the option of the optical tamperproof system in cooperation with an optical transmitter and optical receiver built into a transparent RFID tag enclosure.

Should the design of the clamp loop 18 need to be modified, the various elements that secure the clamp loop 18 to the tag enclosure 20 may be modified to maintain encasement 20 integrity, and tamper-proof capability.

The preferred embodiment of the Newborn Anti-abduction Tamper-proof RFID system will now be described in detail. Related elements will therefore be grouped into functional units, namely encasement related elements, the loop securement mechanism, the tamper-proof system, and the

RFID perimeter security and identification system.

FURTHER ENCASEMENT DETAIL

The tag encasement 20 contains the RFID Tag PCB 32, with its optical tamperproof elements (see Fig. 9), and provides a structure for the loop securement system elements to prevent tampering without triggering an alarm. The encasement lip 28 and lip guide 30 of a properly locked tag encasement 20 seals and protects an RFID tag enclosure from environmental factors present while attached to newborn (e.g. blood from umbilical cord, etc.) No existing method provides the capability to reuse the RFID tag enclosure without sterilization after each use, in order to prevent cross-contamination between infants.

The disposable tag encasement 20 consists of the encasement bottom 24 and the encasement top 22 which are held together with a flexibile link or hinge 26, as shown best in Figs. 7 & 8. This link is flexibile enough to allow two parts to fold together and create the closed tag encasement 20 in which the RFID tag enclosure and optical tamperproof elements reside when in use.

FURTHER LOOP SECUREMENT MECHANISM DETAIL

This mechanism, which is critical for ensuring that the tamper-proof elements sound the alarm when the tag system is breached, include elements attached to the encasement bottom 24 and top 22 respectively. On the bottom 24, as shown in Fig. 1 is the loop securement member 40 with its

securement catches 42, seated on the platform 50, and reinforced by the loop cordon 52. On the top 22, is the securement cap 46, the catch securement hole 44, and the securement plug 48. As shown in Fig. 3, the clamp loop 18 must first be slid around the loop securement member 40, and then the securement cap 46 is pressed firmly onto its securement catches 42, so that the tag encasement 20 is now securely locked. This provides a method of RFID Tag attachment to the clamp loop 18 of an umbilical clamp 12 which ensures that the only way remove the tag encasement 20 is by forcing it open. Since the tag encasement 20 holds the anti-tamper mechanism, forcing it open triggers an alarm.

Tamperproof System

As shown in Fig. 9, the tamperproof system is comprised of an optical transmitter 34 which projects a ray 62, either visible light or infrared, towards the reflective surface on the inside of the encasement top 22, and which can be seen by the optical receiver 36, thereby completing a sensing loop which detects whether the encasement top 22 is securely in place.

When the tag encasement 20 is opened, the receiver 36 cannot detect the reflected ray 62 and declares through the RFID system that someone is tampering with the tag encasement 20 which is transmitted to the rest of the RFID system by means of RF communication. As outlined previously, if someone attempts to remove the encasement 20 from the clamp 12, or the clamp from the newborn, they must open the encasement 20 to do this, and thereby trigger the tamper alarm.

FURTHER RFID TAG SYSTEM DETAIL

The RFID tag system is part of a perimeter securement system that ensures that only those with passwords or other means of identification can move a specifically tagged newborn from one secured zone to another, or out of a secured zone. The present invention prevents a potential abductor from tampering with or defeating the RFID tag system by removing the tag, or swapping the tag, or swapping babies.

Various objects of the Newborn Anti-abduction Tamper-proof RFID System will now be listed, namely that the system provides:

a) a means and method of secure attachment of RFID Tags to an umbilical clamp;

b) a means and method of encasing the RFID Tag into a disposable encasement;

c) a means and method that prevent or thwart attempts to remove, switch, or defeat the perimeter securement capabilities of RFID Tags attached to umbilical clamps;

d) a means and method of secure attachment of an RFID Tag to an umbilical clamp by using a loop securement mechanism;

e) a means and method of detecting RFID Tag removal from the umbilical clamp by using a

secure Tag which employs an optical transmitter receiver pair which detects the absence of reflected rays to tell the RFID perimeter securement system when a tag encasement has been opened;

f) RFID tag and tamperproof elements that are integrated into the tag enclosure, thereby preventing removal from the encasement or from the umbilical clamp or disarming without notice.

FURTHER UTILITY AND ADVANTAGES DETAIL

The primary use for this invention is with active RFID Tags used within Real Time Location and Perimeter Protection systems which are deployed for the purpose of infant abduction prevention.

None of the disclosed prior art methods provide a robust anti-tamper capability. The only consideration that prevents RFID Tag removal from the baby is a fear of harming the baby. A person knowledgeable in handling newborns can easily overcome this obstacle and remove the RFID Tag from the baby, rendering protection systems useless.

None of the existing methods provide the capability of reusing the RFID Tag without a need to sterilize the tag after each use. Existing methods have a tag attached directly to umbilical clamp or directly to an umbilical cord. The umbilical clamp and the umbilical cord get into direct

contact with cord blood and must be sterilized in order to prevent cross-contamination between infants.

Prior mechanisms in this field that are currently commercially available can be securely attached to the clamp only while the clamp is attached to an umbilical cord. This prohibits Tag attachment to the clamp before the clamp is attached to an infant. Currently available mechanism enables Tag attachment to umbilical clamp in a way where the Tag is positioned under the clamp or above the clamp. When positioned under the clamp, the tag is pushing the clamp and umbilical cord upwards and creating undesirable tension between umbilical cord and the body. When positioned above the clamp, the Tag is unbalanced and again, it creates undesirable tension between umbilical cord and the body when it tips over on one side or the other. The present invention does not present any of these health or security issues.

ALTERNATE EMBODIMENTS

One alternate embodiment of the disclosed device is shown in Fig.'s 10 & 11 which employs a flexible loop concept whereby a loop tether 58 engages its proximal securement catch 42 into a catch securement block as shown. Other embodiments are not ruled out or similar methods leading to the same result.

The preferred materials for constructing this invention primarily include, but are not limited to, rigid or semi rigid plastics, thermoplastics, or similar materials that have sufficient resiliency to

prevent breaching the tag enclosure, and are able to be sterilized to hospital standards when required.

The foregoing description of the preferred apparatus and method of implementation should be considered as illustrative only, and not limiting. Other forming techniques and other materials may be employed towards similar ends. Various changes and modifications will occur to those skilled in the art, without departing from the true scope of the invention as defined in the above disclosure, and the following general claims.

NEWBORN ANTI-ABDUCTION RFID TAG SECURING SYSTEM

CLAIMS

We Claim:

1. An RFID tag securing system, comprising a loop securement member affixed to an RFID tag, or to an encasement for an RFID tag, the member having a one-way mechanical snap that locks the loop securement member around a clamp member forming an aperture on an umbilical clamp.

2. The RFID tag securing system of Claim 1, in which electronic circuits of the RFID tag are embedded in a permanent enclosure.

3. The RFID tag securing system of Claim 2, in which the RFID tag's permanent enclosure is encased in a closable encasement.

4. The RFID tag securing system of Claim 3, in which the closable encasement has an internal reflective surface that cooperates with an optical transmitter and an optical receiver to continually test the reception of a reflective beam from the internal reflective surface of the encasement, whereby if the encasement is opened, or if the optics are sufficiently disturbed to break the optical circuit, an alarm signal can be sent.

5. The RFID tag securing system of Claim 3, in which the closable encasement has an encasement top with a flanged lip which fits into a corresponding lip guide in a top edge of an encasement bottom by folding a connecting hinge between the encasement top and the encasement bottom.

6. The RFID tag securing system of Claim 5, in which folding a connecting hinge between the encasement top and the encasement bottom engages a securement catch on a loop securement member into a catch securement hole in a securement cap, upon which a securement plug prevents unlocking the encasement by preventing lateral movement of the loop securement member.

7. The RFID tag securing system of Claim 4, in which the RFID tag has a printed circuit board upon which is mounted the optical transmitter and the optical receiver, and in which the permanent enclosure is at least partially transparent to maintain an optical pathway between the optical transmitter, the internal reflective surface of the encasement, and the optical transmitter.

8. The RFID tag securing system of Claim 1, in which the loop securement member is a flexible tether lockable into a catch securement hole of a catch securement block.

9. The RFID tag securing system of Claim 1, in which the loop securement member with securement catches is seated on a platform reinforced by a loop cordon.

10. The RFID tag securing system of Claim 4, in which forcing the tag encasement open triggers an alarm.

11. The RFID tag securing system of Claim 1, in which a tamperproof RFID tag employs an optical transmitter receiver pair which detects the absence of reflected rays to signal an RFID perimeter securement system when a tag encasement has been opened.

12. The RFID tag securing system of Claim 3, in which the encasement is disposable and enables re-use of an encased RFID tag enclosure.

13. The RFID tag securing system of Claim 1, in which the RFID tag is attached to an unclosed umbilical clamp prior to its attachment to a newborn.

14. The RFID tag securing system of Claim 4, in which:

a) the closable encasement has an encasement top with a flanged lip which fits into a corresponding lip guide in a top edge of an encasement bottom by folding a connecting hinge between the encasement top and the encasement bottom;

b) folding a connecting hinge between the encasement top and the encasement bottom engages a securement catch on a loop securement member into a catch securement hole in a securement cap, upon which a securement plug prevents unlocking the encasement by preventing lateral movement of the loop securement member;

c) the RFID tag has a printed circuit board upon which is mounted the optical transmitter and the optical receiver, and in which the permanent enclosure is at least partially transparent to maintain an optical pathway between the optical transmitter, the internal reflective surface of the encasement, and the optical transmitter;

d) forcing the tag encasement open triggers an alarm.

15. The RFID tag securing system of Claim 14, in which the loop securement member is a flexible tether lockable into a catch securement hole of a catch securement block.

16. The RFID tag securing system of Claim 14, in which the loop securement member with securement catches is seated on a platform reinforced by a loop cordon.

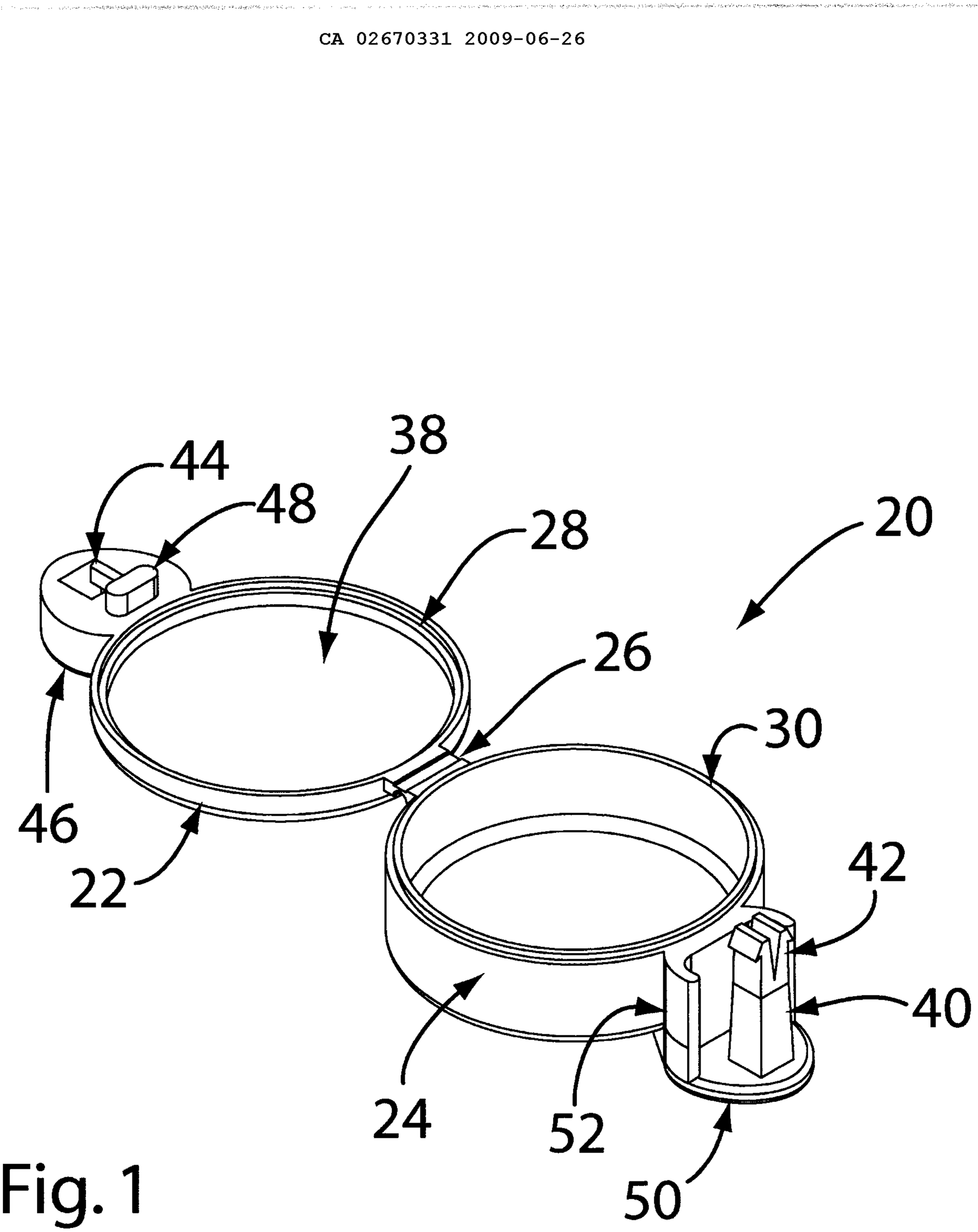
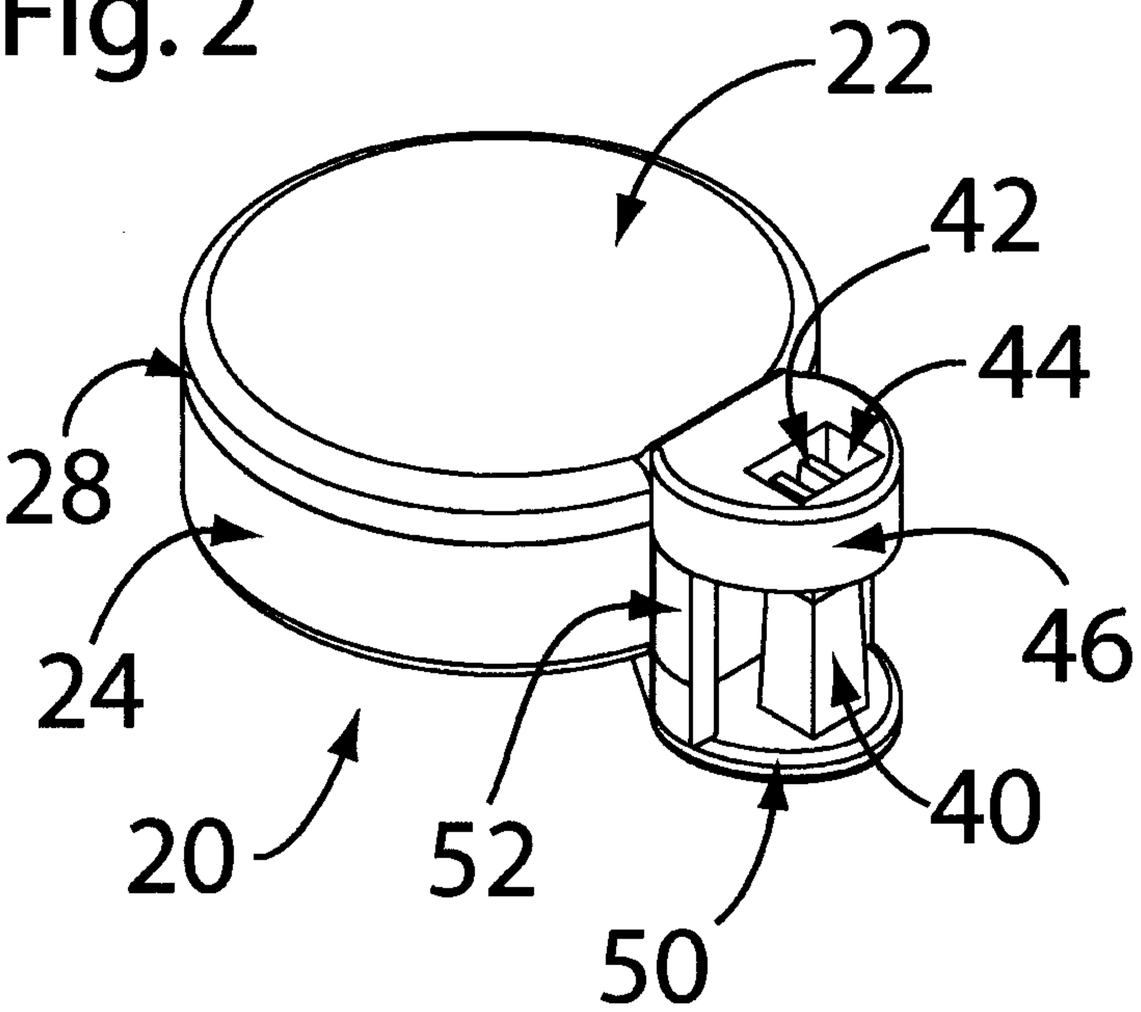


Fig. 1

Fig. 2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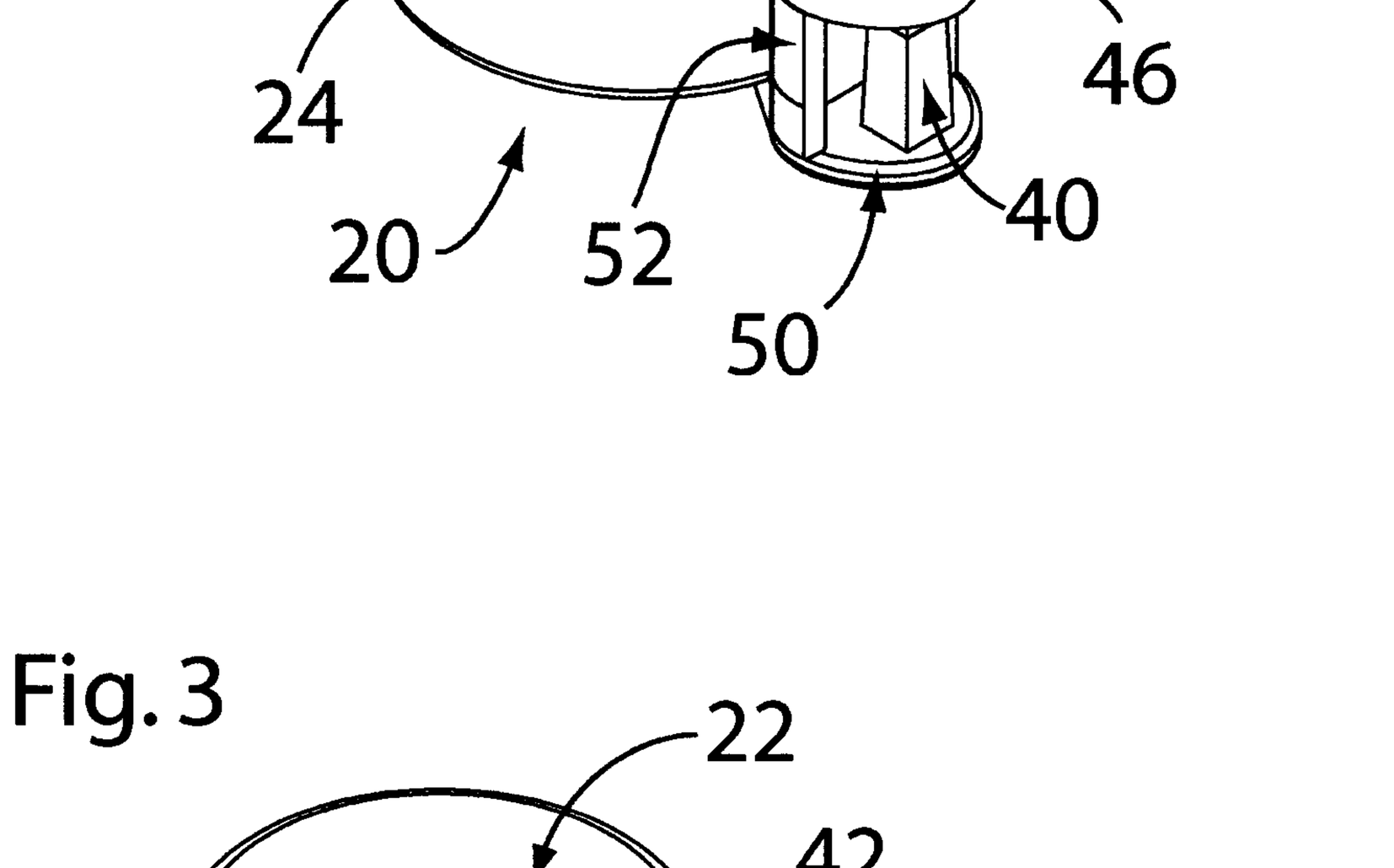
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Fig. 4

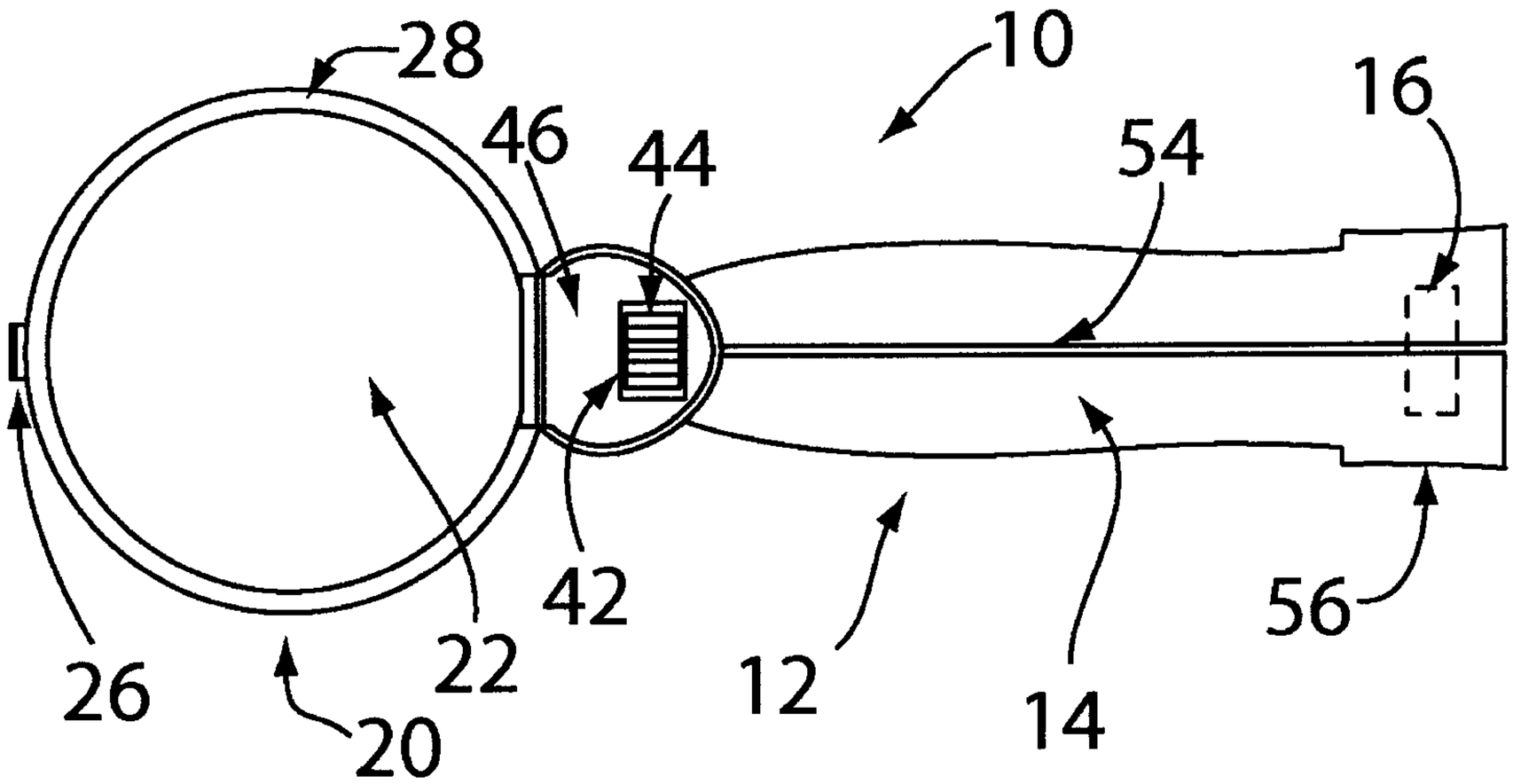
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Fig. 5

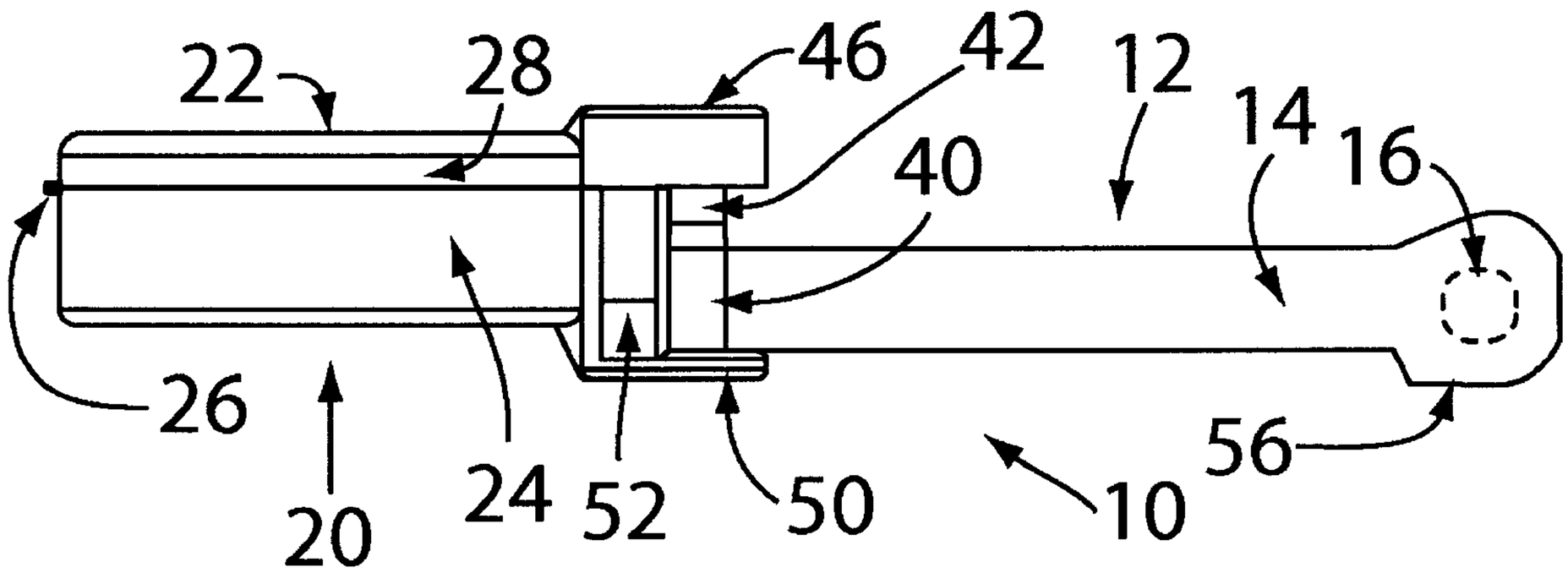
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Fig. 6

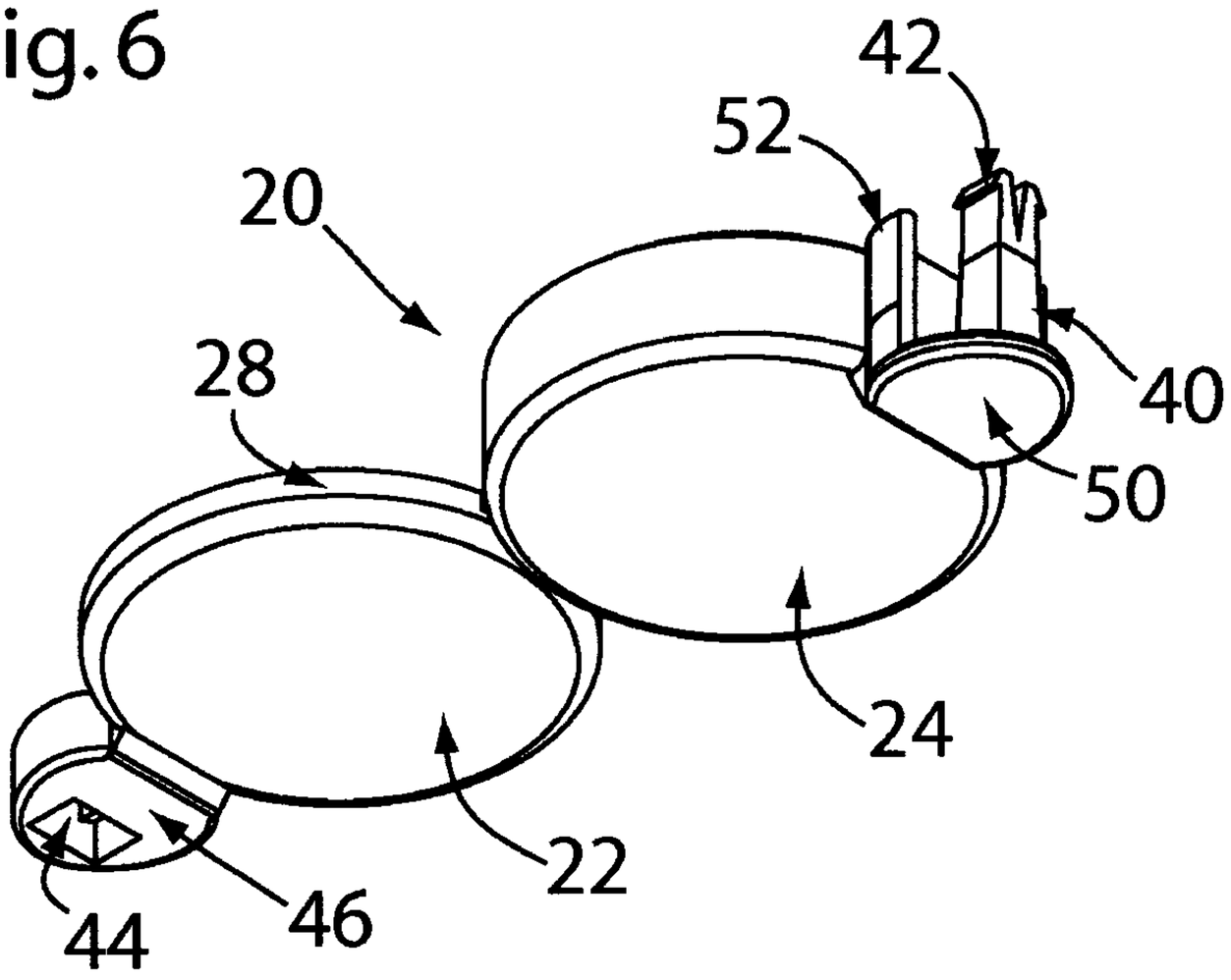


Fig. 7

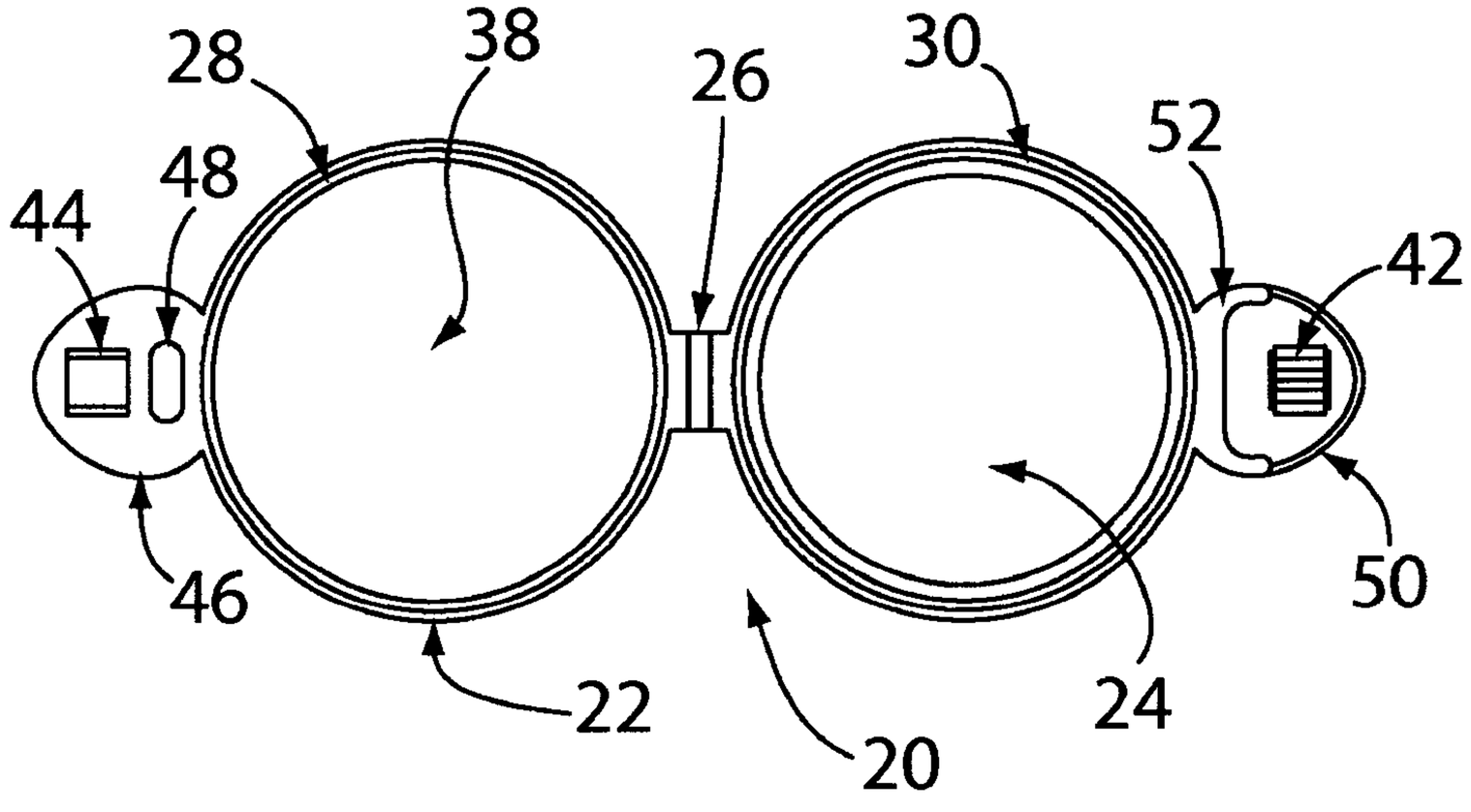


Fig. 8

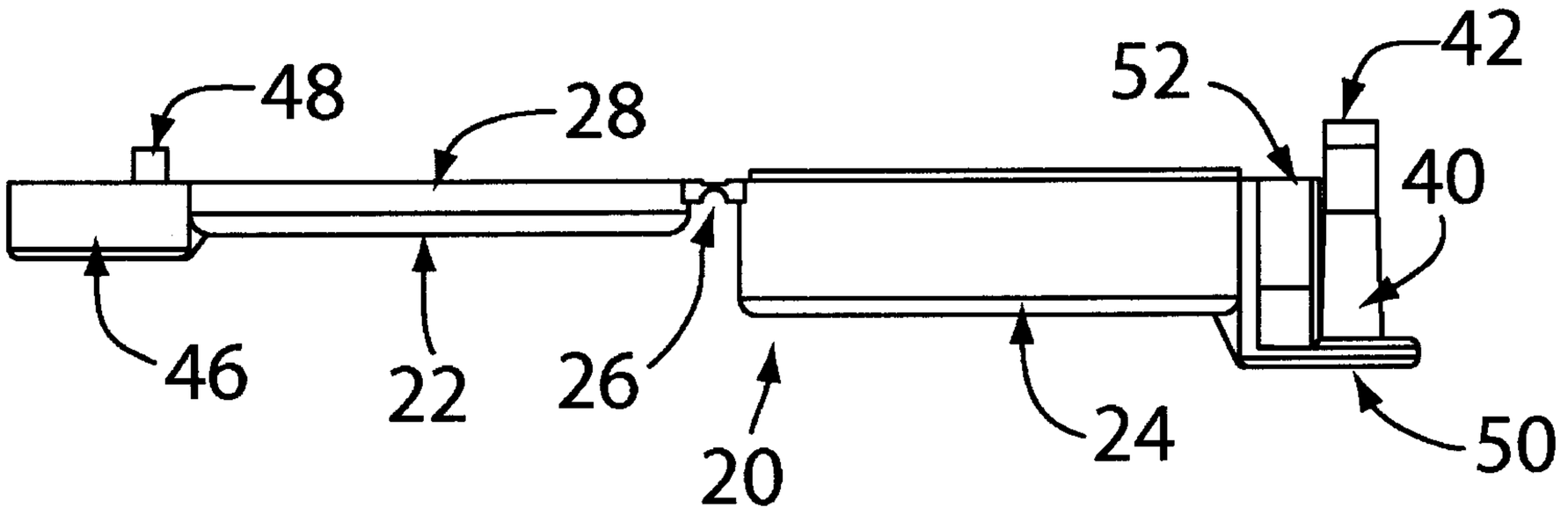


Fig. 9

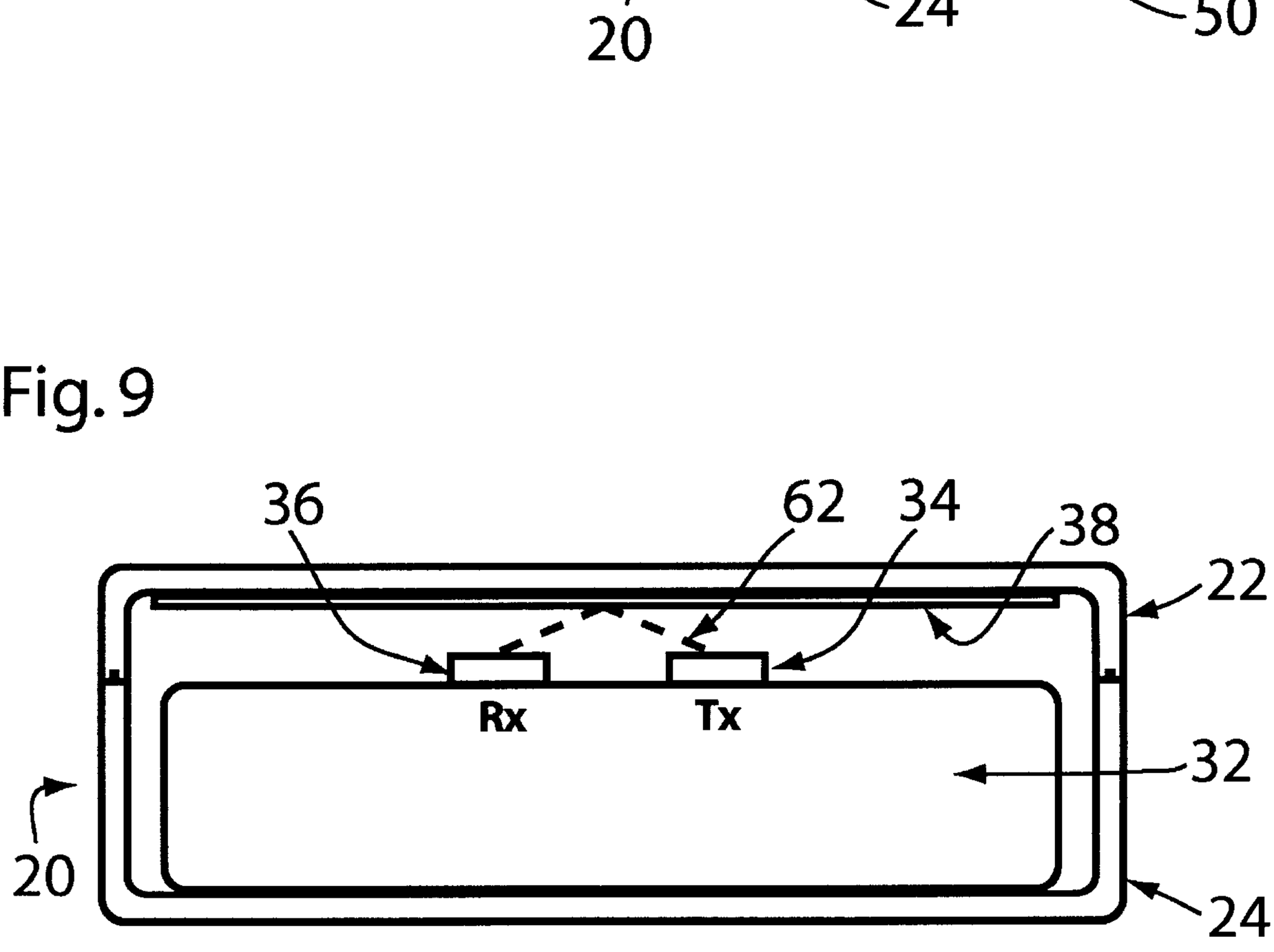


Fig. 10

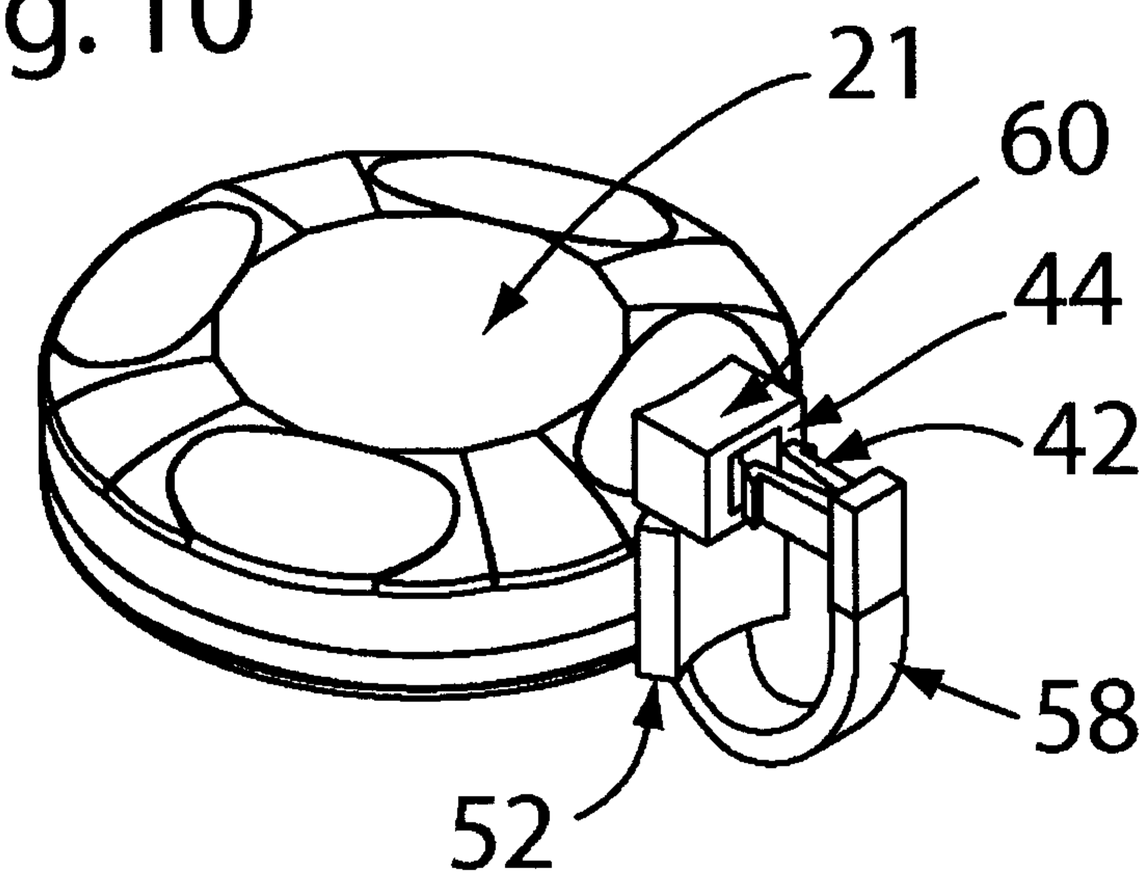
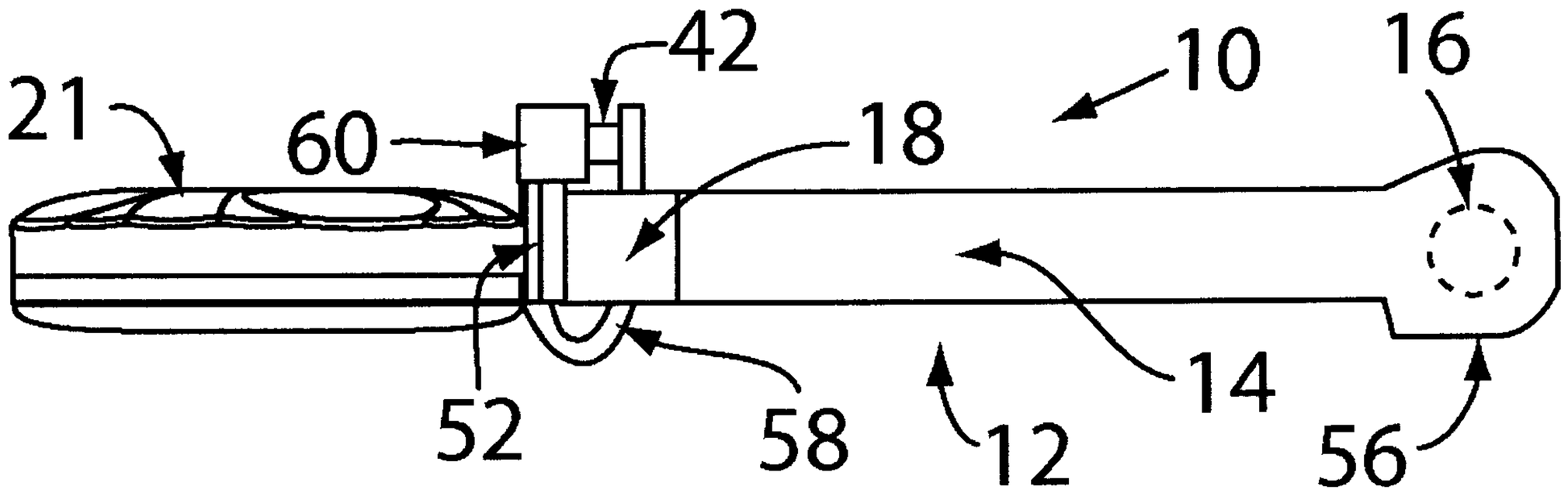
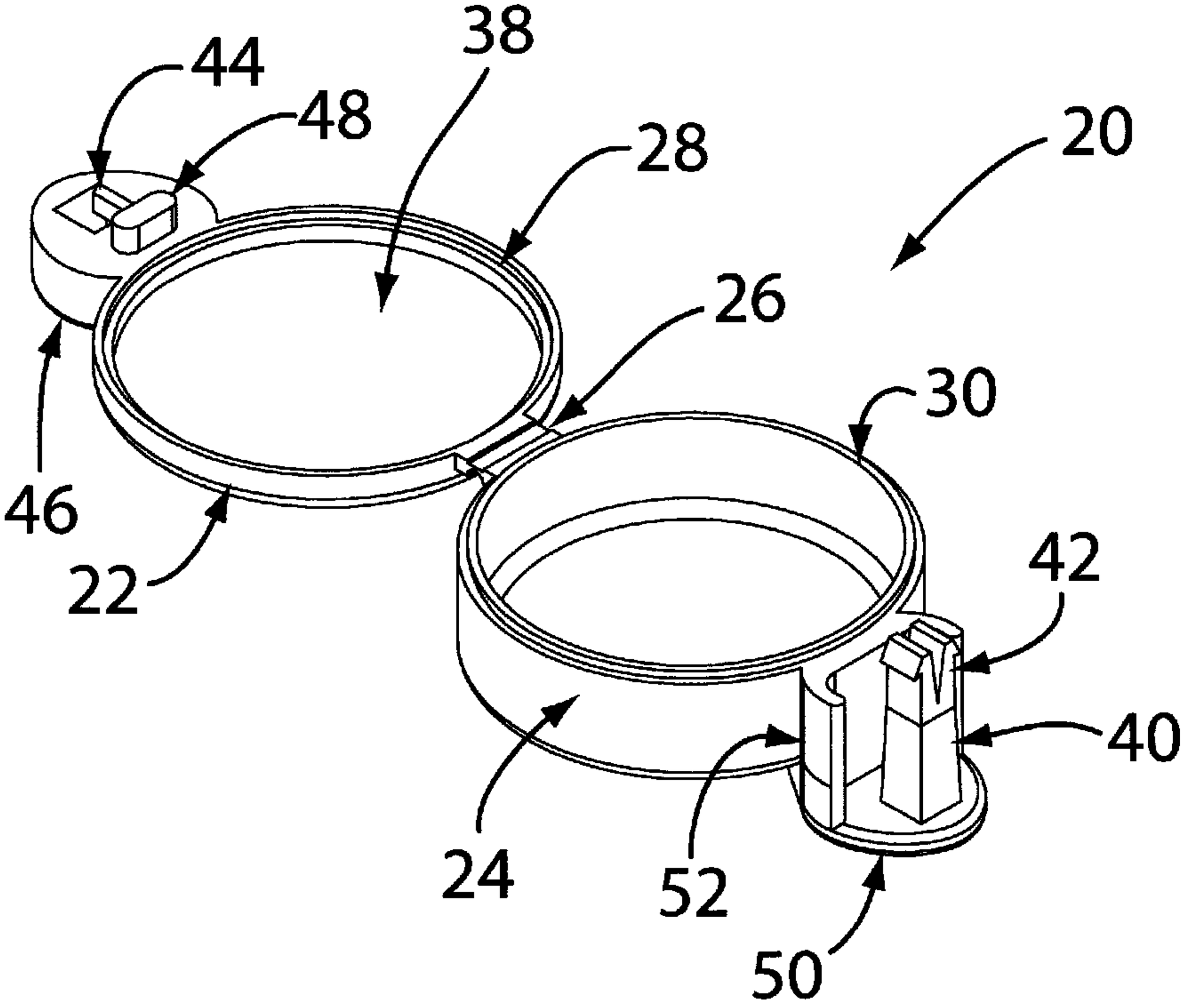


Fig. 11

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