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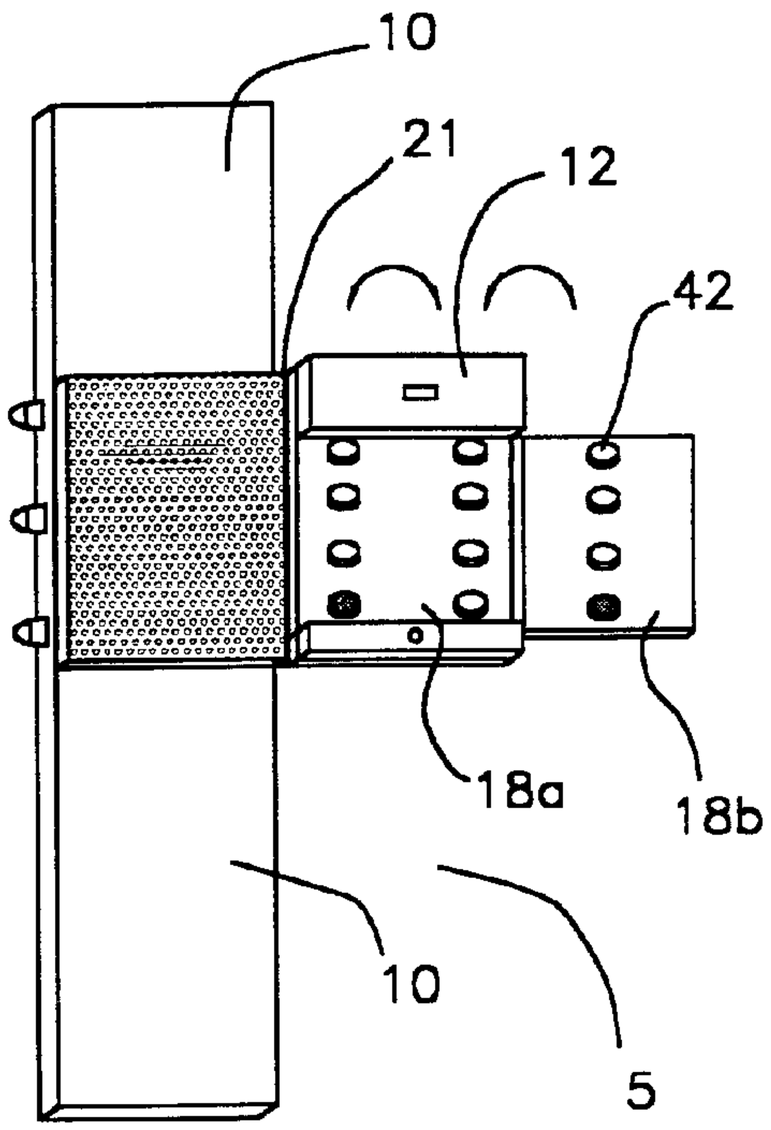
(54) Title: A WRIST COMMUNICATION DEVICE HAVING MULTI-SECTIONED KEYPAD AND ANTENNA SYSTEM



(57) Abrégé/Abstract:
A wrist-mounted communication device (5) comprising a cellular phone mechanism (20) configured to transmit and receive communication signals. The device includes an antenna system (25) so as to transmit and receive signals. The antenna system further comprises at least one antenna (25) extendable away from the horizontal plane of the communication device.

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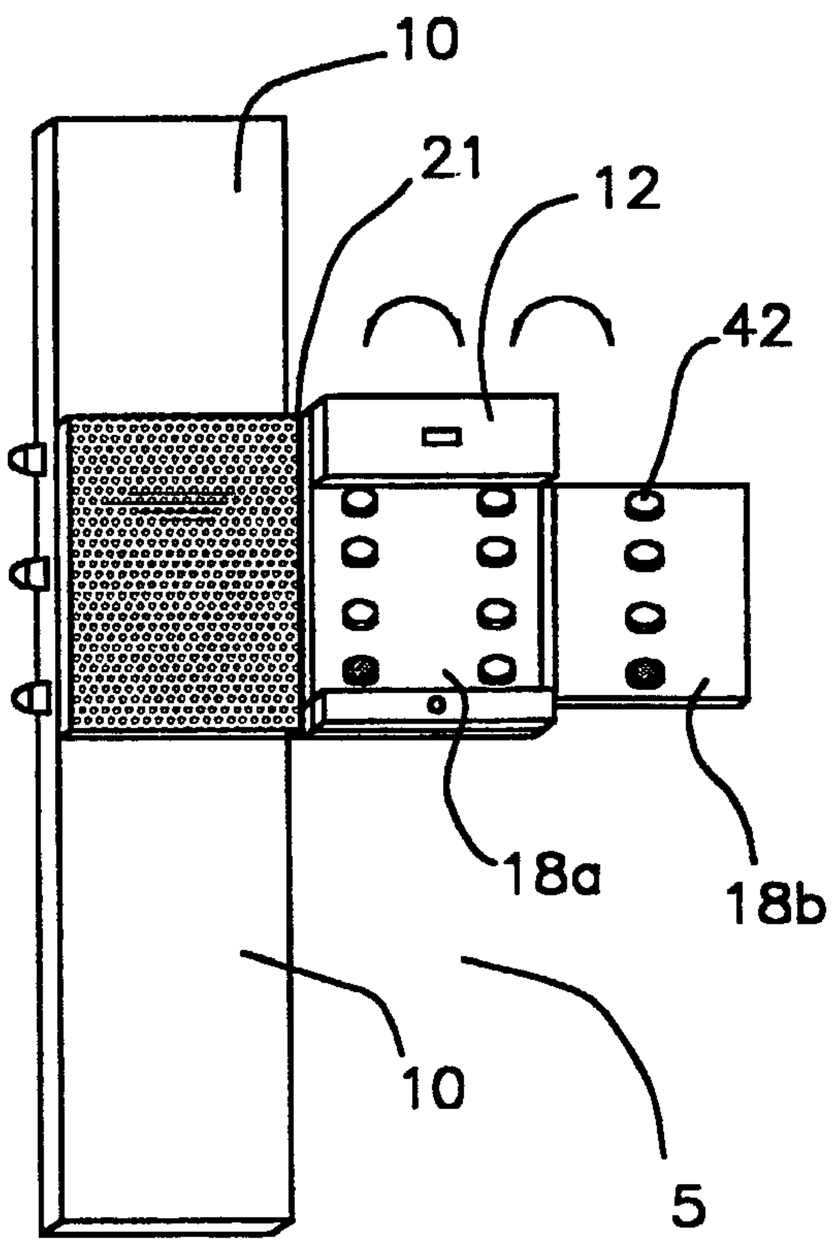

(57) Abstract: A wrist-mounted communication device (5) comprising a cellular phone mechanism (20) configured to transmit and receive communication signals. The device includes an antenna system (25) so as to transmit and receive signals. The antenna system further comprises at least one antenna (25) extendable away from the horizontal plane of the communication device.

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A WRIST COMMUNICATION DEVICE HAVING MULTI-SECTIONED KEYPAD AND ANTENNA SYSTEM

RELATED DATA

This application claims the benefit of priority of the filing date of U.S. Patent Application Serial No. 09/330,728 filed on June 11, 1999, currently pending, and U.S. Application Serial No. 09/428,228 filed on October 27, 1999, currently pending.

FIELD OF THE INVENTION

The present invention generally relates to portable cellular telephone devices, and more particularly to wrist-worn cellular telephone device having a multi-sectioned keypad and an antenna system.

BACKGROUND OF THE INVENTION

Thanks to the recent advances in wireless communication technology, cellular telephones enjoy enormous popularity. While early models were large and heavy, and therefore difficult for a user to carry comfortably, newer models have steadily decreased in size and weight. The cellular telephones which are in use today are compact enough to fit a person's pocket or purse.

While the new models enjoy increased portability, they do suffer from several drawbacks. For instance, their light weight and small size renders the telephones prone to falling, breaking, or simply being forgotten. Additionally, when a

cellular telephone user receives a call, a time loss is experienced while the user locates and retrieves the telephone (which may be in her pocket, purse, brief case, etc.). An additional time loss is experienced when the user must adjust the phone's orientation to actuate an answer mode.

In order to overcome these drawbacks, cellular telephones which can be worn on the wrist of a user have also been developed. Some of these devices are described in U.S. Patents Nos. 5,239,521; 5,274,513; 5,224,076. In all these disclosures a telephone device is typically in the form of a wristwatch fastened to the user's wrist via a strap, wherein a cellular phone mechanism replaces that of a watch in its conventional location. The main components of a cellular phone mechanism, such as transceiver, telephone call initiating means, a keyboard, a voice recognition device, a display, etc., as well as a battery power source, are accommodated within a common case. A microphone and a speaker are usually incorporated within the strap.

One of the problems which is experienced by the wrist-mounted cellular phones in the prior art is that they are difficult for a user to operate. For instance, some of the cellular telephone devices of the prior art remain attached to the user's wrist while the user is conducting a conversation. Thus, a user initiates a call by pressing the keypad of the device while the device is mounted to a wrist, then holds her wrist next to her ear in order to carry on a conversation. Because the microphone and speaker of the devices are fixed in a predetermined location on the device, the user is often required to hold his or her arm in an unusual position in order to line up the microphone and speaker with his or her mouth and ear, respectively. Alternatively, some of the cellular

telephone devices of the prior art detach entirely from the wrist of a user, thus requiring that the device be removed from the user's wrist prior to initiating or receiving a telephone call.

In addition, the decrease in size of the cellular phone to that which can comfortably be worn on a person's wrist typically results in a corresponding decrease in the overall size of the keypad of the cellular phone. The small overall size of the keypad in turn requires that the keys of the keypad be smaller and/or closer in proximity. The small, closely-spaced keys are difficult for a user to operate, in that the wrong keys may be inadvertently pressed.

A challenging aspect of wrist phone technology design is the antenna section. Typically, prior art wrist phone systems employ an antenna that is located adjacent or very close to the user's skin. In many instances the location of such antennas may lead to unnecessary signal losses. In order to avoid such losses, many users find out that for some or all of their calls they need to remove the wrist phone system from their wrist area: defeating an important purpose of such phones.

Thus, a need exists for an improved wrist-worn cellular telephone device, with improved antenna technology.

SUMMARY OF THE INVENTION

It is thus a major object of the invention to eliminate the above listed and other disadvantages of conventional wrist-mounted cellular telephone devices and

provide a novel wrist-mounted telephone device.

It is a further object of the invention to provide such a device wherein all main components of a cellular phone mechanism are configured to be attached to the user's wrist.

There is thus provided according to one aspect of the present invention a wrist-mounted telephone device for attaching to a wearer's wrist. According to one embodiment, the device comprises a wristband configured to be attached to a wearer's wrist, wherein the wristband is configured to support a cellular phone mechanism. The device also comprises a keypad attached to the wristband and coupled to the cellular phone mechanism so as to provide signals to the cellular phone mechanism. The keypad, in accordance with various embodiments of the invention, has a plurality of adjustable sections.

The device also comprises a handset, which is removably mounted to either the wristband or the keypad. The handset comprises at least one section, and has a microphone and a speaker. Advantageously, the handset comprises two or more sections which extend telescopically or fold so that, in a closed position, the handset requires a minimum of space and can easily be connected to the wristband or keypad. In the open position, the handset expands so that the microphone is disposed on one end of the handset while the speaker is disposed on the other end, and the distance between the microphone and speaker is approximately the same as the distance between a user's ear and mouth. The handset may be either wired to the wristband or may be wirelessly

connected thereto.

Preferably, the keypad comprises buttons, which when pressed, send corresponding signals to the cellular phone mechanism. In one embodiment of the invention, the keypad comprises a plurality of pressure sensitive switches that employ pressure transducers so as to operate as key elements of a keypad. As a result, the keypad in accordance with this embodiment of the invention can be made substantially thin and flexible.

The keypad may comprise one or more sections. In one embodiment, all of the keys of the keypad are located on the wristband. In another embodiment, only some of the keys of the keypad are located on the wristband, and the remaining keys are disposed on at least one additional keypad section which is attached to the wristband or cellular phone mechanism, enabling additional space to be provided between keys for easier dialing. In still another embodiment, all of the keys of the keypad are located on additional keypad sections which are coupled to the cellular phone mechanism.

Each keypad section may be attached to the wristband or cellular phone mechanism by a hinge or may be slidably attached to the wristband or cellular phone mechanism via at least one rail guide so as to extend telescopically therefrom. In those embodiments in which more than one keypad section are employed, sections of the keypad may also be coupled together by hinge so as to fold or by internal disposed parallel guides so as to extend telescopically.

Advantageously, additional keypad sections are rotatably attached to the first keypad section so as to conceal the buttons on each of the first and second sections when the second section is pivoted relative to the first section into a closed position. It is also preferred that the second section is pivotably attached to the first section so as to form a flat keypad when the second section is pivoted relative to the first section into an open position.

Preferably, the device also includes a transceiver for transmitting and receiving wireless communication signals, and an antenna, which may be telescopically extendable. The device may also comprise an indication means responsively coupled to the cellular phone mechanism for alerting, the wearer of an incoming call. The indication means preferably comprises a vibrator in the form of a mechanical assembly including a reciprocating prong for prodding the wearer's wrist.

The device may also comprise at least one data display panel. Preferably, the device also comprises a watch unit. According to one embodiment, the watch unit, at least portions of the keypad or portions of the phone mechanism are disposed in a diametrically opposite relationship on the wearer's wrist.

The cellular phone mechanism comprises an ear piece extendable towards a region of a palm of the wearer and retractable to a region of the housing. Preferably, the ear piece is extendable along an axis of the wearer's arm. The ear piece may be extended by means of a flip open cover pivotally coupled to the housing and may be further extended by at least one telescopic, or accordion like segment of the

cover. Alternatively, the ear piece of the cellular telephone mechanism may be mounted at an end of a tube having a securing arrangement for securing to a wearer's finger. Upon release of the securing arrangement, the tube is retracted into the housing by means of a resilient biasing means coupled to the end of the tube.

The battery power source may comprise a single battery circumferentially extending along at least a substantial portion of the wearer's wrist, or a plurality of batteries coupled to each other and each circuinferentially extending along the wearer's wrist. It is understood that a battery of any kind may be employed. The battery may be removably accommodated within a case.

If the plurality of batteries is employed, each of them may be accommodated within its case and the cases are coupled to each other. To this end, the device, preferably, comprises an electric circuit adapted for selectively connecting the cellular phone mechanism to a preset one of the plurality of batteries.

In accordance with another embodiment of the invention, the device includes a moveable antenna that extends outwardly from the device. Advantageously a hinge or pivot mechanism is employed that allows the antenna to rotate in a direction away from the horizontal plane of the device. The antenna may have multiple expandable sections, such as those employing telescopic mechanisms.

In accordance with another embodiment of the invention, at least a first

and second antenna are employed, wherein at least one of the antennas is moveable in a direction away from the horizontal plane of the device. During operation, the position of the two antennas with respect to each other is adjusted so that the antennas provide polarization diversity that allows the reception of signals by the device to be insensitive to its orientation.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how the same may be carried out in practice, several preferred embodiments will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figures 1(a) and (b) illustrate a wrist-worn communication device in a closed position, in accordance with one embodiment of the present invention;

Figures 2(a) and (b) illustrate side views of a wrist communication device with a detached handset, in accordance with one embodiment of the present invention;

Figures 2(c) through (f) illustrate a handset for use with a wrist communication device with a detached handset, in accordance with various embodiments of the present invention;

Figures 3(a) and (b) illustrate front views of a wrist communication device. in accordance with one embodiment of the present invention;

Figures 4(a), (b), (c) and (d) show a wrist communication device having a foldable, multi-sectioned keypad, in accordance with one embodiment of the present invention;

Figures 5(a). (b) (c) and (d) illustrate a wrist communication device with a telescopically extendable keypad, in accordance with one embodiment of the present invention;

Figure 6 illustrates a wrist communication device with one keypad section, in accordance with one embodiment of the present invention;

Figures 7(a), (b) and (c) illustrate a wrist communication device having a handset with a telescopically extendable antenna, in accordance with one embodiment of the present invention;

Figures 8(a), (b) and (c) illustrate a wrist communication device having a handset with a telescopically extendable antenna, in accordance with another embodiment of the present invention;

Figures 9(a), (b), (c), (d) and (e) illustrate a wrist communication device having a handset with a telescopically extendable antenna, in accordance with still another embodiment of the present invention;

Figures 10(a) through 10(e) illustrate a wrist communication device having a small detachable handset with a speaker and a microphone mounted on the wristband, in accordance with still another embodiment of the present invention;

Figures 11(a) and (b) illustrates a wrist communication device having a larger detachable handset with a speaker and a microphone mounted on the wristband, in accordance with another embodiment of the present invention;

Figures 12(a), (b), (c), (d) and (e) illustrate a wrist communication device wherein a handset is mounted separate from the cellular phone mechanism, in accordance with another embodiment of the present invention;

Figure 13 illustrates a wrist communication device with an independent watch unit and an additional speaker and microphone, in accordance with one embodiment of the present invention; and

Figure 14 illustrates a wrist communication device having a portion of a display unit which is permanently visible, in accordance with one embodiment of the present invention.

Figs. 15(a)-15(g) illustrate a wrist communication device employing an antenna system in accordance with another embodiment of the invention.

Figs. 16(a)-16(b) illustrate a wrist communication device employing an

antenna system in accordance with another embodiment of the invention.

Figs. 17(a)-17(b) illustrate a wrist communication device employing an antenna system in accordance with yet another embodiment of the invention.

Figs. 18(a)-18(b) illustrate a wrist communication device employing an antenna system in accordance with another embodiment of the invention.

Fig. 19 illustrates a wrist communication device employing an antenna system in still another embodiment of the invention;

Figure 20 illustrates a wrist communication device in the closed position, according to the embodiment shown in Figure 19;

Fig. 21 is a pictorial illustration of a wrist-mounted cellular phone device according to one embodiment of the invention;

Fig. 22 is a pictorial view of the device of Fig. 21 more specifically illustrating an unlocked position thereof;

Fig. 23a is a side view of the portion of the device of Fig. 22, more specifically illustrating a mini-vibrator;

Fig. 23b is a partly exploded view of the device of Fig. 21 with a

retracted flip open cover and a battery in its removed position;

Figs. 24a to 24c illustrate three more embodiments of the invention;

Fig. 25a illustrates still another embodiment of a wrist-mounted cellular phone device having a wrist-watch mounted thereon;

Fig. 25b is a cross-section of the device of Fig. 25a, more specifically illustrating a coupling means for mounting the wrist-watch on to the cellular phone device;

Figures 26(a) and 26(b) illustrate a cellular phone device having a two-sectioned keypad provided on a bracelet portion, according to one embodiment of the present invention;

Figures 27(a) and 27(b) illustrate an arrangement of buttons on a keypad which prevents the buttons from contacting each other when the cellular phone device is in the closed position, according to one embodiment of the present invention; and

Figures 28(a) through 28(d) show additional configurations of device 21 having multi-sectioned keypads 6, according to other embodiments of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figures 1(a) and (b) illustrate a wrist worn communication device 5, in accordance with one embodiment of the present invention. Figures 1(a) and (b) show device 5 when device 5 is not being operated. Wrist communication device 5 is advantageously slim and lightweight, so as to minimize the likelihood that it will get caught on the user's clothing or otherwise interfere with the user's activities.

Specifically, Figure 1(a) shows a side view of wrist communication device 5, which comprises wristband 10 and handset 12. Wristband 10 is preferably flexible so as to be worn around a user's wrist and advantageously has a fastening device at each end so as to securedly attach the device to the user's wrist.

Figure 1(b) shows a front view of wrist communication device 5. Device 5 may also comprise additional function buttons 44 positioned on the side of cellular phone mechanism 20 and along the edge of wristband 10. Buttons 44 may, according to one embodiment, enable the user to initiate a call, terminate a call, operate a menu displayed by a display unit, etc, as will be further displayed below.

Figures 2(a) and (b) illustrate side views of wrist communication device 5. In Figure 2(a), handset 12 is removed from wrist communication device 5, exposing cellular phone mechanism 20, which is noted may be positioned anywhere on wrist communication device 5. Cellular phone mechanism 20 remains attached to wrist communication device 5 and may comprise a transceiver, display unit and other typical features of a cellular telephone device, as will be discussed in greater detail below. In one embodiment, cellular phone mechanism 20 is equipped with Internet browser technology, such as the Wireless Application Protocol (also referred to as "WAP"), so as to enable a wearer to use Internet applications. In one embodiment, both handset 12 and cellular phone mechanism 20 have batteries which supply power thereto. As

previously mentioned, the battery of cellular phone mechanism 20 may be located anywhere on wristband 10. However, in one embodiment, wrist communication device 5 is configured such that a battery in cellular phone mechanism 20 also supplies power to the battery of handset 12, such as for charging purposes.

According to some embodiments, when wristband 10 is worn by a user, keypad and display sections of cellular phone mechanism 20 may be located on either the palm or the forearm sides of the user's wrists. It is important to note, however, that while various figures herein show cellular phone mechanism 20 as a single unit which is disposed on only one side of the user's wrist, the present invention is not limited in scope in that regard. Various portions of cellular phone mechanism 20, which includes the battery, transmitters, receivers, microprocessors, I/O units, antennas, etc., may instead be disposed at various locations around the wrist so as to maximize the usage of space on wristband 10.

According to various embodiments of the invention and as shown in Figure 2(a), handset 12 may be wired to cellular phone mechanism 20 via wire 30 so as to transmit and receive communication signals thereto. In this embodiment, an antenna for receiving communication signals (which will be shown in figures discussed below) is located on handset 12. Alternatively, handset 12 and cellular phone mechanism 20 may have a wireless relationship whereby communication signals are transmitted therebetween via radio waves, as will be further discussed below.

In a preferred embodiment, wire 30 is retractable so that it does not hang loose when handset 12 is mounted on wrist band 10. In one embodiment, in addition to transmitting signals between handset 12 and cellular phone mechanism 20, wire 30 may

itself function as an antenna which is configured to receive and transmit external communication signals, such as cellular communication signals to and from a base station.

The length of the wire determines the maximum distance between the handset and the wrist band. If handset 12 is wirelessly connected to cellular phone mechanism 20, the user will not be so restricted. Thus, a wireless connection between cellular phone mechanism 20 and handset 12 is advantageous in this respect, since a wired connection may render it awkward for the user to switch hands while speaking or to hand the phone to another person who desires to speak. However, the wireless connection has the requirement that handset 12 and cellular phone mechanism 20 have an additional transceiver, so that external communication signals (for example, the signals generated by a cellular base station) can be transmitted and received by one transceiver and internal signals (i.e.- the signals between cellular phone mechanism 20 and handset 12) can be received by another.

According to one embodiment of the invention, handset 12 has two telescopically extendable handset sections, 12a and 12b, part of which have a very small thickness. A speaker unit 14 is disposed on one end of handset section 12a, while a microphone 16 is disposed on an opposite end of handset section 12b. Telescopically extendable handset sections 12a and 12b slidably engage relative to each other via guides (such as parallel guides or a rail guide) between an open position and a closed position, such as by traveling along one or more guides 12d provided internal to one of the sections. In Figure 2(a), handset 12 is shown in the closed position. In the closed position, handset 12 has a small length, and occupies a small amount of space, thus rendering it easy to store between uses on wristband 10.

In Figure 2(b), handset 12 is shown in an open position. In the open position, handset 12 has a longer length than in the closed position. Thus, in the open position, speaker 14 and microphone 16 are in closer proximity to the typical user's ear and mouth during usage, although the invention is not limited in scope in this regard. For example, as shown in Figure 2(c) and (d), sections 12a and 12b of handset 12 may also fold around a linear hinge 13 in order to achieve the same extendability, or else, as shown in Figures 2(e) and (f), may rotate around pivot 13b. Still other embodiments of the invention, having different configurations of handset 12, are discussed below, and the present invention contemplates that sections 12a and 12b may be extended by other means known in the art.

Returning to Figures 2(a) and 2(b), an additional feature of handset 12 is the perpendicular extension region 32a and 32b of handset 12 at speaker unit 14 and microphone 16, respectively. When handset 12 is in the open position, extended regions 32a and 32b enable speaker unit 14 and microphone 16 to be held closer to the user's ear and mouth during operation. Extended regions 32a and 32b of handset 12 are also configured such that, when handset 12 is in the closed position, the extensions frictionally engage a corresponding mating region on wristband 10. Depending on the arrangement of handset 12, speaker unit 14 and microphone 16 may be disposed on these perpendicular extensions, as shown in Figure 2(a) and 2(b), or may be disposed elsewhere on handset 12, as shown in Figures 2(c) and 2(d). In one embodiment of the invention, handset 12 is hermetically sealed to provide protection from water, dust, etc.

Figures 3(a) and (b) are similar to Figures 2(a) and (b), except that Figures 3(a) and (b) illustrate front views of wrist communication device 5. As in Figures 2(a) and (b), handset 12 is shown in Figure 3(a) and (b) to have two

telescopically extendable handset sections, 12a and 12b, comprising speaker 14 and microphone 16, respectively. In Figure 3(a), handset 12 is shown removed from wrist communication device 5, exposing portions of cellular phone mechanism 20. In this view, additional features of cellular phone mechanism 20 are shown, such as keypad section 18, and portions of display unit 22. According to one embodiment of the invention, keypad section 18 folds over cellular phone mechanism 20, as shown in Figure 3(a). Additional embodiments in which keypad 18 has a plurality of sections are discussed in detail below.

As previously mentioned, Figure 3(a) also shows a portion of display 22, which can be viewed when handset 12 is detached from wristband 10. Display 22 may be a liquid crystal display. Advantageously, display 22 is configured to display a number currently dialed by the user when transmitting an outgoing call from the device, a number of a remote telephone device generating an incoming call (if such option is authorized by an owner of the remote telephone), a date or time, etc.

Preferably, and as shown in Figures 4(a) and in other figures which will be explained below, display 22 is large in size. Thus, according to other embodiments of the present invention, display unit 22 is large enough to display a menu for selection by a user or to display Internet applications. In one embodiment, when cellular phone mechanism 20 is equipped with Internet browser technology, such as "WAP", display 22 is configured to display data from the Internet, such as stock prices, weather and traffic reports, driving directions, etc.

As illustrated in Figures 1(b), 3(a) and 4(a) (and various other embodiments, some of which are discussed below) display 22 may be covered in its

entirety by handset 12 when handset 12 is mounted on wristband 10. For instance, in Figure 1(b), no part of display 22 is visible when handset 12 is in the closed position. Similarly, in Figures 5(a) through 5(c), which will be explained in greater detail below, display portion 22b is only visible to a user when keypad section 18b is rotated into the open position. The full display, including the larger region of display portion 22, is only visible when keypad section 18a is telescopically extended into the open position.

The present invention, however, also contemplates embodiments in which a portion of display 22 is permanently visible to the user. For instance, Figure 14 illustrates one embodiment in which display portion 22a is permanently visible to the user. While display portion 22 is shown as being relatively small in Figure 14, other embodiments may employ a larger display 22, some or all of which is visible to the user. According to various embodiments, having at least a portion of display 22 permanently visible enables a user to perform various functions without removing handset 12 or otherwise manipulating wrist communication device 5. For instance, the permanently visible portion of display 22 may display the date and time, the telephone number of an incoming call, a telephone number directory, etc.

As previously mentioned, Figures 1(b) and 2(a) are front views which show wrist communication device 5 in a partially-closed position. This configuration is likely to be worn by the user when the device is not in operation. Figure 4(a) shows wrist communication device 5 when a first section 18a of keypad 18, which is coupled to cellular phone mechanism 20, has been rotated around hinge 21 and is in an open position. Figure 4(b) shows wrist communication device 5 in a fully open position, i.e.- when both first section 18a and second section 18b of keypad 18 are in open positions. Section 18b of keypad 18 is coupled to section 18a via hinge 23, and rotates around

hinge 23 in order to be in the fully opened position (other methods, such as sliding section 18b over section 18a, are further discussed below). Figure 4(c) shows the same embodiment with handset 12 detached for operation. Figure 4(d) shows handset 12 detached from wristband 10 and extended to its full length.

As shown in Figure 4(b), when wrist communication device 5 is in a fully open position, keypad sections 18a and 18b form a substantially flat surface for easy manipulation of the keys by the user. Buttons 42 are arranged on keypad 18 in a well-known manner, such as on an ordinary telephone, and are spaced sufficiently far apart so as to minimize the likelihood of the user inadvertently pressing buttons which the user does not intend to press. Keypad sections 18a and 18b both have disposed thereon buttons 42 which the user presses in order to operate the wrist communication device 5. Specifically, keypad 18 is electrically coupled to cellular phone mechanism 20 of device 5 and sends signals to cellular phone mechanism 20 corresponding to the buttons which are pressed by the user.

Figure 4(b) also shows handset 12 mounted to keypad section 18a. As previously mentioned, the perpendicularly extended regions 32a and 32b of handset 12 frictionally mount onto keypad section 18a. Figures 4(c) and 4(d), on the other hand, shows handset 12 detached from keypad section 18a for operation by the user.

Various other embodiments of wrist communication device 5 are also possible. For instance, those elements of wrist communication device 5 which are foldable may instead be telescopically extendable, or may be adjustable by any other means. Similarly, those elements of wrist communication device 5 which are telescopically extendable may be foldable instead (or otherwise adjustable).

Similarly, Figures 1 through 4 show keypad section 18a coupled to wristband 10 via hinge 21, such that keypad section 18a may be folded over display 22. Figures 5(a), (b), (c) and (d) illustrate another embodiment, in which keypad 18 extends telescopically from wristband 10. According to this embodiment, in a closed position, keypad 18 is disposed on cellular phone mechanism 20, as is shown in Figure 5(a). Keypad 18 travels along parallel guides 28a and 28b, as shown in Figure 5(b), of cellular phone mechanism 20 to an open position. Preferably, in this embodiment (and any other embodiment in which two elements extend telescopically relative to each other) a bias spring (not shown) is employed so that a predetermined amount of force must be applied in order to return keypad 18 to the closed position after the element has been extended.

Specifically, in Figures 5(a), (b) and (c), keypad 18 comprises two sections, 18a and 18b. Keypad section 18a extends telescopically out from cellular phone mechanism 20. Keypad section 18b, on the other hand, is coupled to keypad section 18a via hinge 23, such that when keypad section 18a is in the closed position, keypad section 18b can be folded over onto keypad section 18a and cellular phone mechanism 20. In this embodiment, handset 12 is removably mounted (such as by a friction fit) to keypad section 18b so as not to restrict the telescopic movement of keypad section 18a and so that handset 12 is accessible to the user while keypad section 18a is in the closed position.

The present invention also contemplates that keypad section 18a is coupled to cellular phone mechanism 20 via a hinge and that keypad section 18b is coupled to keypad section 18a via a telescopically extendable relationship. The present invention, according to various embodiments, also contemplates that keypad 18

comprises other than two sections, wherein each section is coupled by any of the above-described means. For instance, wrist communication device 5 may comprise only one keypad section, which is either foldably or slidably connected to the device.

Figure 6 illustrates another embodiment of the present invention which has a single keypad section 18a. In this case, all of the keys 42 are disposed on keypad section 18a. Although the keys are closer together, and therefore are more difficult to operate, this configuration permits wrist communication device 5 to have a slimmer profile than embodiments having two or more keypad sections. Again, handset 12 is removably mounted on keypad section 18a for ease of operation.

The use of a multi-sectioned keypad, such as the keypads of Figures 5(b) and (c) described above, have the advantage of permitting the buttons on the keypad to be spaced further apart, or to be larger in size, without increasing the overall size of the device and renedering it cumbersome for a user to wear on his or her wrist. Additional configurations of the multi-sectioned keypad, and a detailed explanation of the advantages afforded by each, are described in detail in Applicant's co-pending application Serial No. 09/330,728, which is incorporated by reference herein as fully as if set forth in its entirety.

Generally, the use of a multi-sectioned keypad enables the size of the keypad when closed to be decreased so as to minimize the likelihood that the keypad will interfere with the user or be damaged. Additionally, multisectioned keypads conceal the keypad buttons and protect them from water, dust, etc. In a preferred embodiment, the buttons on each keypad section are positioned so as not to contact each other when section 18a is closed over section 18b. This embodiment decreases the

combined thickness of sections 18a and 18b when closed, thus rendering wrist communication device 5 less bulky on a user's wrist, and limits the wear and tear on the buttons since they will not be pressed down upon when the device is in the closed position.

According to another embodiment, multi-sectioned keypad 18 is arranged as a membrane keypad. In this embodiment, the key elements employ touch actuated switches formed on a membrane. The structure and operation of membrane keypads are well-known and described for example in United States Patent No. 3,987,259 or Patent No. 4,489,302, which are incorporated herein by reference. Briefly, a plurality of electrodes are disposed over each other in a spaced-apart relationship. When any of the key elements are pressed, some of the electrodes establish an electrical connection that can result in a signal indicating the particular key element that has been pressed. In accordance with one embodiment of the invention, such membrane keypads are made of substantially flexible material, such as plastic.

As previously mentioned, wrist communication device 5 may also be configured, according to one embodiment of the invention, to have a wireless connection between handset 12 and cellular phone mechanism 20. For instance, Figures 7(a), (b) and (c) illustrate another embodiment in which handset 12 has a telescopically extendable antenna 25. Figure 7(a) shows handset 12 removably mounted to wrist communication device 5, such as when the device is not being operated by a user. The width of handset 12 is approximately the same as the width of wristband 10.

Figure 7(b) shows handset 12 detached from the device, in the closed

position. Figure 7(c) shows handset 12 in the open position. In the open position, sections 12a and 12b slide relative to each other, and telescopically extendable antenna 25 is extended in order to receive and transmit external communication signals. As previously mentioned, if antenna 25 is configured to receive external communication signals, handset 12 is advantageously wired to wrist communication device 5 to transmit signals therebetween.

Figures 8(a), (b) and (c) illustrate still another embodiment in which handset 12 has a telescopically extendable antenna 25. Figure 8(a) shows handset 12 removably mounted to wrist communication device 5, such as when the device is not being operated by a user. In this case, the width of handset 12 is slightly wider than the width of wristband 10, in order to accomodate an antenna housing 12c . Figure 8(b) shows handset 12 detached from the device, in the closed position. Figure 8(c) shows handset 12 in the open position. In the open position, telescopically extendable antenna 25 extends into antenna sections 25b and 25c, in order to provide improved reception and transmission of the communication signals. Of course, antenna 25 may be attached to either handset section 12a or 12b, and may extend in any direction depending on the handset's configuration.

The configuration of handset 12 in Figures 8(a) through (c) may also be employed in the embodiment of the invention illustrated in Figures 9(a) through (e). Figure 9(a) shows wrist communication device 5 having keypad sections 18a and 18b. Keypad section 18a is telescopically extended over display 22. Keypad section 18b is coupled to keypad 18a via a hinge. Removably mounted to keypad 18b is handset 12. A full display 22 on wrist communication device 5 enables the user to view information such as the telephone number of the other party to the call, Internet data, etc.

Figure 9(b) illustrates handset 12a removed from keypad section 18b. It also shows keypad section 18a which is configured to slide over display 22 via parallel guides 34a and 34b. As shown, keypad section 18a is not as wide as cellular phone mechanism 20. Thus, a portion of cellular phone mechanism 20, i.e.- display unit 22, remains uncovered. The width of the portion of cellular phone mechanism 20 left uncovered by when keypad section 18a is not telescopically extended corresponds to the width of antenna housing 12c of handset 12. When handset 12 is stored on wristband 10, antenna housing 12c fits into the space not occupied by keypad 18a, and thus enables wrist communication device 5 to have a slimmer profile.

Figure 9(c) shows keypad section 18b which has been folded over keypad section 18a in order to minimize the size of the wrist communication device 5. Figures 9(d) and (e) also shows handset 12 in the closed and open positions, respectively. In Figure 9(e), handset 12 is shown having telescopically extendable antenna 25 in an extended position. It is noted that antenna housing 12c may be located at any position on handset 12 and may be configured to frictionally mate with regions on wristband 10 that are unoccupied by additional features of wrist communication device 5.

Still another embodiment of the present invention is illustrated in Figures 10(a) through 10 (e). Figure 10(a) shows wrist communication device 5 in a closed position. Figure 10(a) shows handset 12 which is very small in size. Handset 12 is mounted next to wire housing 38. In the embodiment shown, both handset 12 and housing 38 are positioned next to cellular phone mechanism 20, although the invention is not limited in scope in this respect. The figure also shows microphone 16, which is similarly configured on wristband 10. In this embodiment, microphone 16 is positioned

on an opposite side of cellular phone mechanism 20 on wristband 10, though other positions are also contemplated.

Figure 10(b) shows handset 12 detached from wristband 10, as a user would do when operating the device. Handset 12 comprises speaker unit 14, and is configured to be held between the user's fingers, such as between the user's thumb and forefinger. Handset 12 is connected to cellular phone mechanism 20 by wire 30, which advantageously retracts into wire housing 38. As previously discussed, wire 30 is configured to transmit communication signals between handset 12 and cellular phone mechanism 20.

To operate the device, a user detaches handset 12 from wristband 10 and holds it between his fingers, i.e.- with the same hand on which wrist communication device 5 is worn. The user then holds handset 12 up to his ear, so that the user can hear via speaker unit 14. Thus, wire 30 is long enough to reach from the position of wire housing 38 on the user's wrist to the tips of the user's fingers, and should be long enough to accomodate various different sizes of hands. With handset 12 positioned near his ear, the user then positions his wrist so that microphone 16, which is located on wristband 10, is near his mouth.

Figures 10(c) through 10(e) illustrate how keypad 18 and display 22 are configured on wrist band 10. For instance, Figure 10(c) shows that, according to one embodiment of the invention, keypad 18 comprises two keypad sections 18a and 18b, which are separated by hinge 23. As in the previously described embodiments, keypad 18 is configured such that section 18b can be rotated and forms a flat keypad for the user to operate.

Figure 10(d) shows keypad 18 in the closed position, but extended telescopically from cellular phone mechanism 20. As previously described, keypad 18 extends telescopically along parallel guides 28a and 28b disposed on cellular phone mechanism 20. When keypad 18 is extended, display unit 22 can be viewed by the user. Finally, Figure 10(e) shows cellular phone mechanism 20 in a fully opened position, such that keypad section 18a is telescopically extended to allow display 22 to be viewed, and keypad section 18b is rotated around hinge 23 to provide a flat keypad.

Figures 11(a) and (b) illustrate another embodiment of the invention, which combines some of the features of the embodiments shown in Figures 1 and 10. For instance, Figures 11(a) and (b) illustrates handset 12, which is approximately the same size as the handset shown in Figures 1 through 10. At one end of handset 12 is speaker unit 14. A user detaches handset 12 from wristband 10 in the same manner as previously described so as to hold speaker 14 to his ear. In addition, Figure 11(a) shows microphone 16 located on wristband 10, in this case contiguous with cellular phone mechanism 20. As described in connection with Figures 10(a) through (e), with handset 12 positioned near his ear, a user then positions his wrist so that microphone 16 is near his mouth.

In accordance with other embodiments of the invention, wrist communication device may also be configured in other ways to minimize the thickness of the wrist device. For instance, Figures 12(a) through 12(e) illustrate an additional embodiment in which handset 12 is detachably mounted along side of keypad section 18. Since handset 12 is not mounted on keypad section 18, wrist communication device 5 has a slimmer profile than is possible in other embodiments.

Figure 12(a) shows handset 12 mounted on wristband 10 next to keypad 18. Handset 12 is held in place by parallel guides 40a and 40b. Figure 12(b) illustrates handset 12 which slides relative to wristband 12 in order to be held by a user during operation. Handset 12 communicates, according to one embodiment of the invention, with wrist communication device 5 as previously discussed. Figure 12(d) shows handset 12 in a first position, having just been slid out from its mounting location on wristband 10. Figure 12(e) shows handset 12 rotated to show speaker unit 14. Advantageously, handset 12 is configured to be mounted on wristband 12 so that speaker unit 14 faces towards the user's wrist, thereby protecting the speaker from water, dust, etc., although the present invention is not limited in this regard.

Figure 12(c), on the other hand, shows handset 12 which is telescopically extended. In this embodiment, handset 12 is comprised of four telescopically extendable sections, designated as 12a through 12d, although the present invention contemplates that any number of sections may be employed. In this case, handset section 12a comprises speaker 14, while handset section 12d comprises microphone 16. As previously mentioned, the extendability of handset 12 enables it to occupy less space when closed and mounted on wristband 10, while positioning microphone 16 and speaker 14 in a more desirable configuration for operation when in the open position.

According to another embodiment of the invention, wrist communication device 5 further comprises a watch unit that operates independently from cellular phone mechanism 20. For instance, Figure 13 illustrates wrist communication device 5 comprising watch unit 50 mounted on wristband 10. Obviously, any means may be used to attach watch unit 30 to wristband 10. For

example, the watch 30 may be mounted on, or integrally formed with, its housing which, in turn, may be coupled to wristband 10 by hinges or the like. Wrist communication device 5 may be configured to have watch unit 50 at any portion of wristband 10, such as, when worn by a user, on diametrically opposite sides of the user's wrist, in relation with portions of keypad 18 or display unit 22.

Referring to Figure 13, wrist communication device may comprise handset 12, which operates in a manner discussed in the previously described embodiments. In other words, handset 12 is preferably detachable from wristband 10 in order to be held by a user during operation. Figure 13 also shows additional speaker unit 52 and microphone 54. Additional speaker unit 52 and microphone 54 may be employed in several ways.

For instance, additional speaker unit 52 may be employed, according to one embodiment of the invention, as a loud speaker, so that a user can listen to the other party of the call without placing device 5 to his ear. Advantageously, a user can activate a "hands-free" mode of operation so that the user can operate device 5 while performing other functions, such as driving. In this case, handset 12 remains mounted to wristband 10 while microphone 54 receives the user's voice and the voice of the other party to the call is audibly conveyed to the user via speaker unit 52.

Alternatively, speaker unit 52 and microphone 54 may be employed, according to another embodiment of the invention, to operate when handset 12 is broken or lost. In this way, wrist communication device 5 may be removed from the user's wrist and held in position (i.e.- with speaker unit 52 held in position near the user's ear and microphone 54 held in position near the user's mouth) like an ordinary

phone.

Each of the devices shown in the previously described figures permit wrist communication device 5 to be operated in a unique and improved manner. For instance, the embodiment in Figure 3(a) (among others) illustrates how a user may operate wrist communication device 5 when a call is received from another party. When a call is received, the user detaches handset 12 from device 5 and answers the call. The present invention, in accordance with various embodiments, enables the user to quickly detach the handset and speak into it without requiring the user to unfold keypad 18 or otherwise manipulate any keys on keypad 18 first. Of course, in one embodiment in which display 22 is configured to display the telephone number of an incoming call, the user may, if desired, first open keypad 18 to view display 22, and then detach the handset to answer the call.

On the other hand, Figures 4(a) and (b) (among others), illustrate how the user may operate wrist communication device 5 when the user desires to initiate a call, in accordance with one embodiment of the invention. Specifically, Figures 4(a) and (b) illustrates that handset 12 is removably mounted onto keypad 18, while keypad 18 is coupled to wristband 10 via hinge 21. In this manner, when a user initiates a call, the user opens keypad 18 to expose keys 42 and display 22. This step is performed with handset 12 still mounted to keypad 18 of wrist communication device 5. In addition to stabilizing the keypad while the user presses the buttons, having handset 12 remain mounted during this step eliminates the need for the user to hold the handset in his or her hand while trying to dial the phone. Only after the buttons have been pressed and the call has been initiated does the user detach the handset and begin speaking. Of course, handset 12 is removably mounted to the device so that, if the user desires to

detach the handset prior to operating the keypad, the user may do so.

One of the advantages of the wrist communication device of the present invention is that it is more comfortable to use than wrist communication devices of the prior art. This follows because the detachable handset allows the user to hold handset 12 in a position which is the most comfortable for him or her. By contrast, wrist communication devices of the prior art, which have the speaker and microphones in a fixed location on the device, force every user to adopt the same hand position, which may not be comfortable for all users. As shown in several of the embodiments, handset 12 has a shape which is comfortable for users.

Another advantage of the present invention is the ability of a user, in several embodiments, to switch handset 12 to a different hand if desired, without removing the device from his wrist. Similarly, the user has the ability, in several embodiments, to hand the telephone to a different person who wishes to speak to the caller, also without removing the device from his wrist.

Still another embodiment of the invention employs an antenna which extends away from the user's wrist. For instance, a problem which is typically experienced by wrist mounted communication devices is the close proximity of the antenna to the user's body. The close proximity of the antenna to the user's body causes the quality of the signals which are transmitted and received by the antenna to decrease. When a wrist mounted communication device is worn, its antenna is typically very close to the user's body due to the device's slim profile.

Figures 15(a) through 15(e) illustrate one embodiment of the invention

in which the antenna is extended away from the user's wrist in order to improve the quality of the signals which are transmitted and received by the antenna. Figure 15(a) shows wrist communication device 5 in a closed position, wherein handset 12 is detachably mounted on wristband 10, although the invention is not limited in scope in that respect. For example, the antenna system illustrated in Figs. 15(a) - 15(e) may be employed in other wrist phone communication devices as well. It is noted that wrist band 10 of communication device 5 may be made from a variety of materials, such as plastic, leather or metal. In accordance with one embodiment of the invention, the back cover of handset 12 is made of the same material as the wrist band so that when it is in the closed position, the entire communication device 5 appears in a uniformly integrated arrangement.

Figure 15(b) illustrates wrist communication device 5 in a partially open position. In this case, keypad section 18b is rotated around hinge 21. Handset 12 is configured to fit on keypad section 18b, such as by a friction fit. The width of keypad section 18a is configured to be smaller than the entire width of communication device 5 so as to allow space for an antenna system 58. In accordance with one embodiment of the invention, antenna system 58 includes an antenna 56, which is disposed near keypad 18a, and preferably adjacent to it. Preferably, the height of antenna 56 in its closed position is substantially the same as the height of keypad section 18b.

Antenna system 60 includes a hinge or pivot mechanism 62, so as to allow antenna 58 to open in a direction away from the horizontal plane of the wrist communication device. Pivot mechanism 62, in accordance with one embodiment of the invention, includes a spherical pivot 64 (Fig. 15(g)), which allows antenna 58 to rotate in any direction in a space above the horizontal plane of the wrist communication

device for optimum reception.

Fig. 15(c) illustrates antenna 58 in a retrieved position. As illustrated, antenna 58 extends away from the horizontal plane of the wrist communication device. It is noted that in accordance with one embodiment of the invention, antenna 58 is held in its closed position by a biasing mechanism, such as a spring bias, such that when keypad 18b is removed from keypad 18a, the biasing mechanism releases antenna 58 in a desired position, without the need for the user to do so.

Fig. 15(d), illustrates antenna system 60 in accordance with another embodiment of the invention. As shown, an extension antenna 66 is telescopically extendable from antenna 58. In accordance with one embodiment, extension antenna 66 may be extended for better reception. Additionally, a pivot or hinge mechanism 70 allows extension antenna 66 to rotate about antenna 58.

In accordance with yet another embodiment of the invention, extension antenna 66 and antenna 58 are configured to operate independently as a diversity antenna. The operation of diversity antennas is well known, and is described for example in United States Patent 5,564,082, issued October 8, 1996, and incorporated herein by reference. Thus, when extension antenna 66 is rotated about antenna 58, the two antennas may be substantially uncoupled and independent of one another. If the antennas are driven with for example, orthogonally independent signals, the angular arrangement provides polarization diversity. The arrangement of extension antenna 66 in relation with antenna 58 improves transmission and reception, regardless of the position of wrist communication device 5.

Furthermore, in accordance with another embodiment of the invention,

one of the antennas 58 or 66 may be employed for transmission, while the other one is employed for reception.

Figs. 15(d) and 16(a) illustrate exemplary positions of extension antenna 66, while Fig. 16(b) illustrate an antenna system 60 comprising antennas 58 and 66, which are both coupled to wrist communication device 5 at one of their ends. Antennas 58 and 66 are both extendable away from the horizontal plane of communication device 5.

Figs. 17(a) and 17(b) illustrate another embodiment of antenna system 60, in accordance with the principle of the present invention. Antenna system 60 comprises two antennas 74 and 76 which are attached outside the keyboard area of communication device 5. Each of the antennas 74 and 76 are extendable away from communication device 5 via pivot mechanism 80. Antennas 74 and 76 may be part of one antenna, or may operate as two independent antennas as discussed above in reference with diversity antenna arrangement.

Fig. 17(b), on the other hand, illustrates antenna 78, which extends away from communication device 5 via a pivot mechanism 82. Figs. 18(a) and 18(b) illustrates another embodiment of the invention, wherein handset 12 completely covers antenna 78 when it is in a closed position.

Finally, Figs. 19(a) and 19(b) illustrate another embodiment of the invention, wherein a base area 84 is disposed underneath antenna 58.

During operation, antenna system 60 provides for an arrangement

wherein the antenna for the wrist communication device 5 are extended away from the user's body, allowing an enhanced transmission and reception ability. Furthermore, the location of the antenna system advantageously near the keypad arrangement and the handset arrangement provides for a user friendly interface system, wherein the LCD display, the keyboard members, the handset and the antenna are conveniently located near each other, although the invention is not limited in scope in that respect.

*

Referring to Figs. 21 and 22 there is shown a device generally designated 100 which comprises a housing in the form of a bracelet 102 having two C-shaped portions 102a and 102b. The portions 102a and 102b are at one end permanently coupled by a pair of hinges 103 so as to be pivotal one relative to the other between a closed state of the bracelet 102 when being worn on a wrist 105 of the user, and an open state for removing the bracelet from the user's wrist. The portions 102a and 102b at an opposite end are interlocked by a clasp mechanism of known type, for example having a latch 104 made on an inside butt end 102c to engage a respective recess made in an interfacing butt end (not shown) of the portion 102a. It is understood that appropriate means are provided for easily unlocking the latch 104 by the user's hand.

It is also appreciated that any other coupling mechanism may be employed for the same purpose of providing such a mechanical engagement between the portions 102a and 102b that, on the one hand, is insured against accidental unlocking, and, on the other hand, is adapted to be easily unlocked by the user. For example, a magnetic clasp mechanism may be used.

As shown in Fig. 21, the bracelet 102 wraps around the user's wrist 105

in such a manner that all main components of a conventional cellular phone mechanism, except for the battery, are disposed at one- side 105a of the wrist 105, for example, a palm side. Thus, the portion 102a is provided on the outside thereof with a conventional keypad 106 easily available for the user. It is noted, however, that keypad 6 need not be disposed on the outside of C-shaped portion 102a as shown in Figure 21. but may instead be disposed on device 100 according to various different configurations, such as those shown in Figures 26 through 28 (described in detail below).

Portion 102a is also provided on the outside with a liquid crystal display 107. The display 107 is typically capable of displaying a number currently dialed by the user when transmitting an outgoing call from the device 101, and also a number of a remote telephone device generating an incoming call, if such option is authorized by an owner of the remote telephone.

Coupled to the portion 102a of the bracelet 102 is a flip open telescopic cover, generally at 108, formed of two hinged plates 109 and 110. The plate 110 is recessed and slightly larger than the plate 109 so as to receive the latter thereinside in a conventional manner. To this end, the plate 110 may be provided internally with a pair of spaced parallel guides, extending along opposite sides of the plate 110 for supporting the plate 109. Such a telescopic arrangement is well known and, therefore, is not specifically illustrated. Hence, the plate 109 is adapted for sliding movement between a folded position thereof when being partly inserted into the plate 110 (Fig. 22) and an extracted position completely projecting from the plate 110 (Fig. 21). An end 112 of the plate 109 is angled and, when in the folded position of the plate 109, protrudes from the plate 110, as better shown in Fig. 22. The plate 110 is at its one end connected by a pair

of hinges 111 to the portion 102a, so, as to be rotatable relative to the portion 102a between an open, extracted position of the plate shown in Fig. 21, and a closed, retracted position, when it partly covers the keypad 106. Such a partly retracted position is shown in Fig. 22. To this end, the cover 108 may be formed of a flexible material. A two-segment magnetic clasp, generally at 113, is suitably accommodated on the portion 102a and the plate 110, to keep the cover 108 closed.

It is appreciated that the magnetic clasp 113 may be replaced by any other suitable means, for example, a spring mechanism. It should be noted, although not specifically shown, that the display 107, or an additional suitable display may be located on either side of the plate 110.

Further provided is a conventional antenna 114 which may be a telescopic antenna, mounted on the portion 22a opposite to the display 107. The antenna 114 may be supported on either end of either portion of the bracelet 102 in a manner to extend across the supported portion, so that an axis of the antenna 114 is parallel to the user's arm. Also provided are a conventional microphone 115 (constituting a mouth piece) mounted on the portion 102a and a speaker unit 116 (constituting an ear piece) located on the angled end 112 of the plate 109.

As illustrated in Fig. 23a, one of the essential feature of the present invention is the provision of a mini-vibrator 117 having a reciprocating prong 118 projecting from the portion 102a and responsive to a ring signal for prodding the user's wrist so as to inform him/her of an incoming call without disturbing others in the vicinity. A miniature, rubber, disk-shaped washer 120 is attached to a projecting end of the prong 118, which is connected at its opposite end to a conventional cellular phone

ringer (not shown) in such a manner that the latter, when actuated by an incoming call, actuates the mini-vibrator 117 causing the reciprocation of the prong 118. In public places where the regular audible ring would disturb, it may be de-actuated, whilst still allowing the user to be informed, via the mini-vibrator 117, of an incoming call. It is evident that the above construction requires substantially small amount of power and does not cause, when in operation, vibrations of the whole device 100.

Reference is now made to Fig. 23b, illustrating another essential feature of the present invention. A battery 121 is illustrated being shaped like a part of the bracelet 102 and being dimensioned so as to be fit into and removed out of the portion 102b which is generally hollow and functions as a battery holder member. To this end, the hollow portion 102b is provided internally with a pair of peripheral slots, or guides, so as to allow the battery to be slid in and out in a conventional manner. It is understood, although not specifically shown, that the battery 121 is electrically connected to the respective components of the phone mechanism accommodated in the portion 102a. To this end, electric wires are appropriately located inside the portions 102a and 102b.

If desired, the portion 102b may be of two parts construction both parts being, for example, curved-shaped sections designed so as to accommodate a battery therebetween. The construction may be similar to that used in tapes for inserting and removing cassettes, which is known *per se* and therefore need not be specifically described except to note that it usually includes a spring arrangement actuated by a press button.

Alternatively, although not specifically shown, the battery 121 itself may

be provided with a clasp mechanism of a known type and, when attached, for example. in the manner described above with respect to the portions 102a and 102b, completes the overall bracelet shape, thus functioning as an integral portion 102b of the bracelet. The construction may be such that the portion 102b, i.e. associated with the battery, wraps around the whole wrist and the portion 102a, i.e. associated with the phone mechanism, is appropriately coupled to the portion 102b thereabove. Obviously, instead of single battery as described above, two or more batteries having appropriate electric circuit connectors may be employed. For this purpose, the portion 102b may be formed of two or more segments connected by hinges, short belts or the like, each either carrying a battery thereinside or itself being a battery. In the case of short belts, they are short enough so as not to occupy a significant portion of the wearer's wrist. It should be specifically noted that any kind of battery may be employed.

The device 100 being a cellular phone device is designed to include such features of conventional cellular phones as time, date, alarm clock, automatic dialing mode, a phone book, etc. Additionally, a sensor means is provided for automatically putting the device into an operative mode when the plate 110 of the cover is rotated into its open position, and vice versa. All these functions are well known per se and, therefore, need not be specifically described.

The user wears the cellular phone device 100 on his wrist 105, and when using the device, holds his hand to the side of his face in a natural hand position with the bracelet 102 near a region of his mouth. The microphone 115 in the bracelet portion 102a is thereby proximate the user's mouth, whilst the tips of his fingers are close to his ear. The speaker 116 in the extended plate 109 of the cover may now be held near to the user's ear. Cupping of the fingers serves to filter out background noise, and

simultaneously provide a resonant external cavity for improving the audio quality of the sound emanating from the speaker.

Reference is now made to Figs. 24a, 24b and 24c illustrating three more embodiments of the present invention, which are in general similar to the above described embodiment and, therefore, those components which are identical in all embodiments are identified by the same reference numerals. Cellular phone devices 200 and 300 are distinguished from each other and from the device 100 by somewhat different constructions of a flip open cover. Thus, as clearly shown in Fig. 24a, a cover 208 is formed of two plates 209 and 210 pivotally coupled by a pair of hinges 211 and 212, wherein the speaker is mounted on the plate 209. It will be readily understood that the cover 208 is foldable and extendable like an accordion. An additional two-part magnetic clasp is provided in a conventional manner on an inner surface 209a of the plate 209 interfacing an inner side 210a of the plate 210, which is not specifically shown. Obviously, such magnetic clasp may be replaced by any other means suitable for the same purpose. A cover 309 of the cellular phone device 300 is a three-plate telescopic cover, wherein a last plate 309 is slidingly insertable into a center plate 310 which, in turn, is receivable by a plate 311 in a manner described above with reference to Figs. 21 - 23.

Turning now to Fig. 24c, the cellular phone device 400 has no cover at all and is characterized by a flexible thin tube 409 containing connections to the speaker 416 mounted on its free end 409a. The other ends of the electrical connections are connected to an audio output of the cellular phone. As shown, the free end 409a of the wire 409 is attached to a forefinger 410 of

the user by means of a loop 411 (constituting a securing means). Thus, the user's hands

are substantially free for operating the phone device 400. A coil spring (not shown) is fixed at one end to the portion 102a and is fixed at an opposite end to the free end 409a of the tube 409. When the tube 409 is drawn into the extended operated position as shown in Fig. 24c, the coil spring is resiliently biased so as to allow for automatic retraction by the coil spring of the tube 409 when required.

It should be noted that both of the C-shaped portions of the bracelet 102 in any of the preferred embodiments described above are preferably formed with rough inner surfaces overlying the user's wrist 105 for preventing undesirable movement of the bracelet 102.

Referring to Figs. 25a and 25b, there is illustrated a cellular phone device which is similar to any of the preferred embodiments of the invention, for example the device 100, and additionally comprises a watch unit 130 mounted on the portion 102b. To this end, a conventional bolt-and-nut assembly 132 is provided. For example, a screw-threaded bolt 134 projects from a bottom side of the watch unit 130 so as to be received by a nut 136 made in the portion 102b. Obviously, any other means may be used for the same purpose. For example, the watch 130 may be mounted on, or integrally formed with, its housing which, in turn, may be coupled to the bracelet 102 by hinges or the like. It should be noted that the construction may be such that the same battery 121 of the cellular phone device 100 supplies power to the watch 130.

As previously mentioned, keypad 106 need not be disposed on the outside of C-shaped portion 102a in the configuration shown in Figure 21, but may instead be disposed on the bracelet portion of device 100 according to various different configurations. Figures 26 through 28 illustrate various embodiments of the present

invention which employ a multi-sectioned keypad 106. By employing a keypad having more than one section, the size of the keypad can be minimized when the cellular phone is not in use, and can be increased to a larger, easier-to-use size when the cellular phone is in an open, operating mode.

For instance, Figures 26(a) and 26(b) illustrate the cellular phone device 100 of the present invention having a two-sectioned keypad 106 provided on bracelet portion 102a, although it is noted that the multi-sectioned keypad may be provided on portion 102b of device 100, or on any other part of a wrist-worn cellular phone device, according to other embodiments of the invention. It is also noted that the multi-sectioned keypad 106 of the present invention may be employed with any wrist-worn cellular communication device, regardless of the configuration of the cellular phone mechanism and the battery power source on the device.

In the embodiment shown, keypad 106 has two sections, sections 106a and 106b, which are attached to each other by hinge 140. Section 106a is attached directly to portion 102a of device 100 and section 102b is configured to pivotably rotate relative to section 106a around hinge 140. Sections 106a and 106b both have disposed thereon pressure sensitive buttons 142 which the user presses in order to operate the cellular phone. Specifically, keypad 106 is coupled to the cellular phone mechanism of device 100 and sends signals to the cellular phone mechanism corresponding to the buttons which are pressed by the user.

Figure 26(a) shows device 100 in an opened, operable position, wherein section 106b of keypad 106 is pivoted around hinge 140 so as to provide access to buttons 142 of keypad 106. Preferably, keypad 106 is configured such that, when

section 102b is pivoted into the open position, sections 106a and 106b form a substantially flat surface for easy manipulation by the user. Buttons 142 are arranged on keypad 106 in a well-known manner, such as on an ordinary telephone, and are spaced sufficiently far apart so as to minimize the likelihood of the user inadvertently pressing buttons which the user does not intend to press.

In order to provide still greater space between buttons 142, device 100 is shown in Figures 106(a) and 106(b) as having additional function buttons 144 positioned on the side of keypad 106 and along the edge of portion 102a's width. These buttons 144 may, according to one embodiment, enable the user to initiate a call, terminate a call, operate a menu displayed by display 107, etc.

Figure 26(b) on the other hand shows device 100 in a closed, inoperable position, wherein section 106b of keypad 106 is pivoted around hinge 140 so as to conceal buttons 142 of keypad 106, i.e.- to prevent buttons 142 from being inadvertently pressed or to protect them from dust, water, etc. In this embodiment, keypad 106 requires only about half the space it required in the open position illustrated in Figure 26(a).

In addition to decreasing the size of the keypad as illustrated by Figures 26(a) and 26(b), a multi-sectioned arrangement of keypad 106 may also enable the overall size of device 100 to be decreased. Typically, when a keypad is disposed on the bracelet of a cellular phone device designed to be worn on the wrist, the strap is substantially the same width of the keypad. This insures that the edges of the keypad do not extend past the bracelet and rub the wrist of the user, and also decreases the likelihood that the outer edges of the keypad will be damaged by contact with other

surfaces. However, the wider bracelet adds to the size and weight of the device, causing it to be too bulky and heavy.

The present invention enables the width of the bracelet of the wrist-worn device to be substantially the same as the keypad , without requiring an uncomfortably wide bracelet. Specifically, when keypad 106 is in the closed position, its width is decreased by half. to the width of section 106a. Consequently, the corresponding width of portion 102a of device 100 may be designed with the narrower width of section 106a, so long as the bracelet is wide enough to support a sufficiently large battery power source. As previously mentioned, the design of portion 102a of device 100 having the same width as keypad 106 maximizes the aesthetic appeal of the device and minimizes the likelihood that keypad 106 will interfere with the mobility of the user's wrist or be damaged when worn by the user.

As previously mentioned, Figure 26(b) shows device 100 when it is closed and conceals buttons 142. In a preferred embodiment, buttons 142 are positioned on sections 106a and 106b, respectively, so as not to contact each other when section 106a is closed over section 106b. This embodiment decreases the combined thickness of sections 106a and 106b when closed, thus rendering device 100 less bulky on a user's wrist. In addition, it limits the wear and tear on buttons 142 since they will not be pressed down upon when the device is in the closed position.

For instance, Figures 27(a) and 27(b) illustrate an arrangement of buttons 142 on sections 106a and 106b which prevents the buttons of each section from contacting each other when the device 100 is in the closed position. Figure 27(a) shows keypad section 106a having two columns of buttons 142, one column in each of regions

145 and 146, which are located along its outer edge regions. In addition, the figure shows section 106b having one row of buttons 142 in region 147, which is located in its middle. Figure 27(b) shows that, when section 106a and 106b are brought into the closed position, regions 145, 146 and 147 do not overlap, and thus the buttons do not contact each other. It is noted, however, that the regions shown in Figures 27(a) and 27(b) are merely illustrative, and that the present invention contemplates any configuration of buttons on keypad sections 106a and 106b which prevents buttons 142 from contacting each other when the device is in the closed position.

Figures 28(a) through 28(d) show additional embodiments of device 100 having multi-sectioned keypads 106. For instance, Figure 28(a) shows keypad 106 having three sections. A middle section 106b is connected on opposite sides to sections 106a and 106c by hinges 140. In this embodiment, the space required by keypad 106 in the closed position is only approximately one third of the space required by keypad 106 in the open position. Figure 28(b) illustrates the same keypad as illustrated in Figure 28(a) in the fully opened position, having a substantial space between each of buttons 142.

Figure 28(c) illustrates another embodiment in which keypad 106 comprises three sections, wherein two of the sections are provided having a telescopic arrangement relative to each other. For instance, section 106a is connected to section 106b by hinge 140. However, section 106b is also provided internally with a pair of spaced parallel guides extending along opposite sides of section 106b for supporting section 106c. Figure 28(d) illustrates still another embodiment in which keypad 106 comprises three sections, wherein two of the sections are provided having a telescopic arrangement relative to the third section. For instance, section 106b is provided

internally with a two pairs of spaced parallel guides extending along opposite sides of section 106b for supporting both sections 106a and 106c. As previously explained, each of the embodiment shown in Figures 26 through 28 provide for a multi-sectioned keypad 106, which decreases the space required by keypad 106 and improves wrist-worn cellular phone device 100.

While only certain features of the invention have been illustrated and described herein, many modifications, substitutions, changes or equivalents will now occur to those skilled in the art. It is therefore, to be understood that the appended claims are intended to cover all such modifications and changes that fall within the true spirit of the invention.

Claims:

I claim:

1. A wrist-mounted telephone device for attaching to a wearer's wrist, the device comprising:

a bracelet configured to be attached to a wearer's wrist, said bracelet configured to support a cellular phone mechanism accommodated in a housing and a battery power source coupled to said housing;

a keypad attached to said bracelet and coupled to said cellular phone mechanism so as to provide signals thereto, said keypad having a plurality of adjustable sections.

2. The device according to claim 1, wherein said keypad comprises buttons.

3. The device according to claim 2, wherein said signals provided by said keypad correspond to said buttons pressed by said wearer.

4. The device according to claim 1, wherein said keypad comprises two sections.

5. The device according to claim 4, wherein said keypad further comprises:

a first section attached to said bracelet; and

a second section pivotably attached to said first section by a hinge.

6. The device according to claim 5, wherein said second section is

pivotably attached to said first section so as to conceal said buttons on each said first and second sections when said second section is pivoted relative to said first section into a closed position.

7. The device according to claim 5, wherein said second section is pivotably attached to said first section so as to form a flat keypad when said second section is pivoted relative to said first section into an open position.

8. The device according to claim 5, wherein said first section of said keypad has a plurality of buttons in at least one region of said first section, and said second section of said keypad has a plurality of buttons in at least one region of said second section.

9. The device according to claim 8, wherein said at least one region of said first section is non-contiguous with said at least one region of said second section, when said second section is pivoted relative to said first section into a closed position.

10. The device according to claim 4, wherein said keypad further comprises:

a first section attached to said bracelet; and

a second section telescopically attached to said first section.

11. The device according to claim 1, wherein said keypad comprises three sections.

12. The device according to claim 10, wherein said keypad further comprises:

a first section attached to said bracelet; and

second and third sections attached to said first section.

13. The device according to claim 12, wherein said at least one of said second and third sections are pivotably attached to said first section.

14. The device according to claim 12, wherein said at least one of said second and third sections are telescopically attached to said first section.

15. The device according to claim 5, wherein said bracelet has a width which is substantially equal to a width of said first section attached to said bracelet.

16. A wrist-mounted communication device comprising:

a cellular phone mechanism configured to transmit and receive communication signals;

an antenna system attached to said communication device so as to transmit and receive signals, said antenna system further comprising at least one antenna extendable away from the horizontal plane of said communication device.

17 The device according to claim 16, further comprising a hinge mechanism that hingedly couples one end of said antenna to said communication device.

18. The device according to claim 16, further comprising a pivot mechanism that pivotally couples one end of said antenna to said communication device.

19. The device according to claim 16, wherein said communication device

further comprises a keypad unit coupled to said phone mechanism.

20 The device according to claim 19, wherein said antenna is disposed in proximate location to said keypad unit.

21 The device according to claim 16, wherein said antenna is releasably biased in a close position.

22. The device according to claim 16, wherein said antenna is expandable in its open position.

23. The device according to claim 22, further comprising an expansion antenna configured to rotate about said first antenna.

24. The device according to claim 16, further comprising at least a second antenna configured to operate independently from said first antenna.

25. The device according to claim 24 wherein said first and second antenna operate as a diversity antenna.

26. The device according to claim 24 wherein one end of said first antenna is coupled to said communication device and the other end of said first antenna is rotatably coupled to one end of said second antenna.

27. The device according to claim 24 wherein one end of said first and second antenna is rotatably coupled to said communication device such that said first

and second antennas are adjustable to form an angle in relation to each other.

**

28. A wrist-mounted communication device comprising:

a cellular phone mechanism configured to transmit and receive communication signals;

a keypad unit attached to said mechanism so as to provide signals thereto; and

a handset removably mounted on said device, said handset comprising a microphone and a speaker unit.

29. The device according to claim 28, wherein said handset is wired to said cellular phone mechanism.

30. The device according to claim 28, wherein said handset further comprises a wireless connection to said cellular phone mechanism.

31. The device according to claim 28, wherein said handset comprises more than one sections so as to be extendable.

32. The device according to claim 31, wherein said more than one handset sections are extendable by unfolding said handset via a hinge.

33. The device according to claim 31, wherein said more than one handset sections are configured to extend telescopically, such that said sections are extendable by sliding said sections relative to each other.

34. The device according to claim 28, wherein said handset further comprises a telescopically extendable antenna.

35. The device according to claim 28, wherein said wrist communication device further comprises a display unit.

36. The device according to claim 28, wherein said wrist communication device further comprises a watch unit.

37. The device according to claim 28, wherein said keypad is located on said cellular phone mechanism.

38. The device according to claim 28, wherein said keypad comprises at least one keypad section having buttons.

39. The device according to claim 38, wherein a first keypad section is attached to said cellular phone mechanism and a second keypad section is pivotably attached to said first section by a hinge.

40. The device according to claim 39, wherein said second keypad section is pivotably attached to said first keypad section so as to conceal said buttons on each said first and second keypad sections when said second keypad section is pivoted relative to said first keypad section into a closed position.

41. The device according to claim 39, wherein said second keypad section is pivotably attached to said first keypad section so as to form a flat keypad when said

second keypad section is pivoted relative to said first keypad section into an open position.

42. The device according to claim 40, wherein said first keypad section has a plurality of buttons in at least one region of said first keypad section, and said second keypad section has a plurality of buttons in at least one region of said second section.

43. The device according to claim 42, wherein said at least one region of said first section is non-contiguous with said at least one region of said second section when said second section is pivoted relative to said first section into a closed position.

44. The device according to claim 28, wherein said keypad further comprises a first section attached to said device and a second section telescopically attached to said first section.

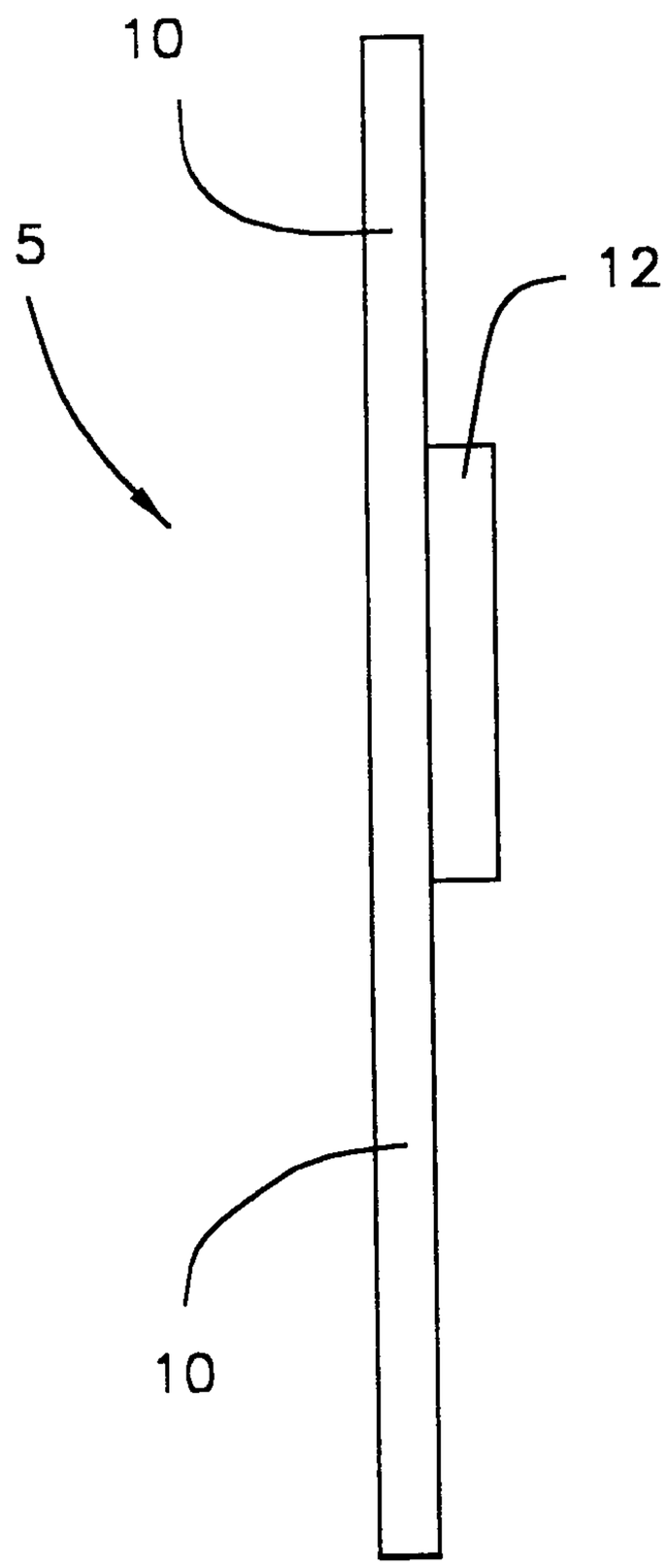

FIG. 1a

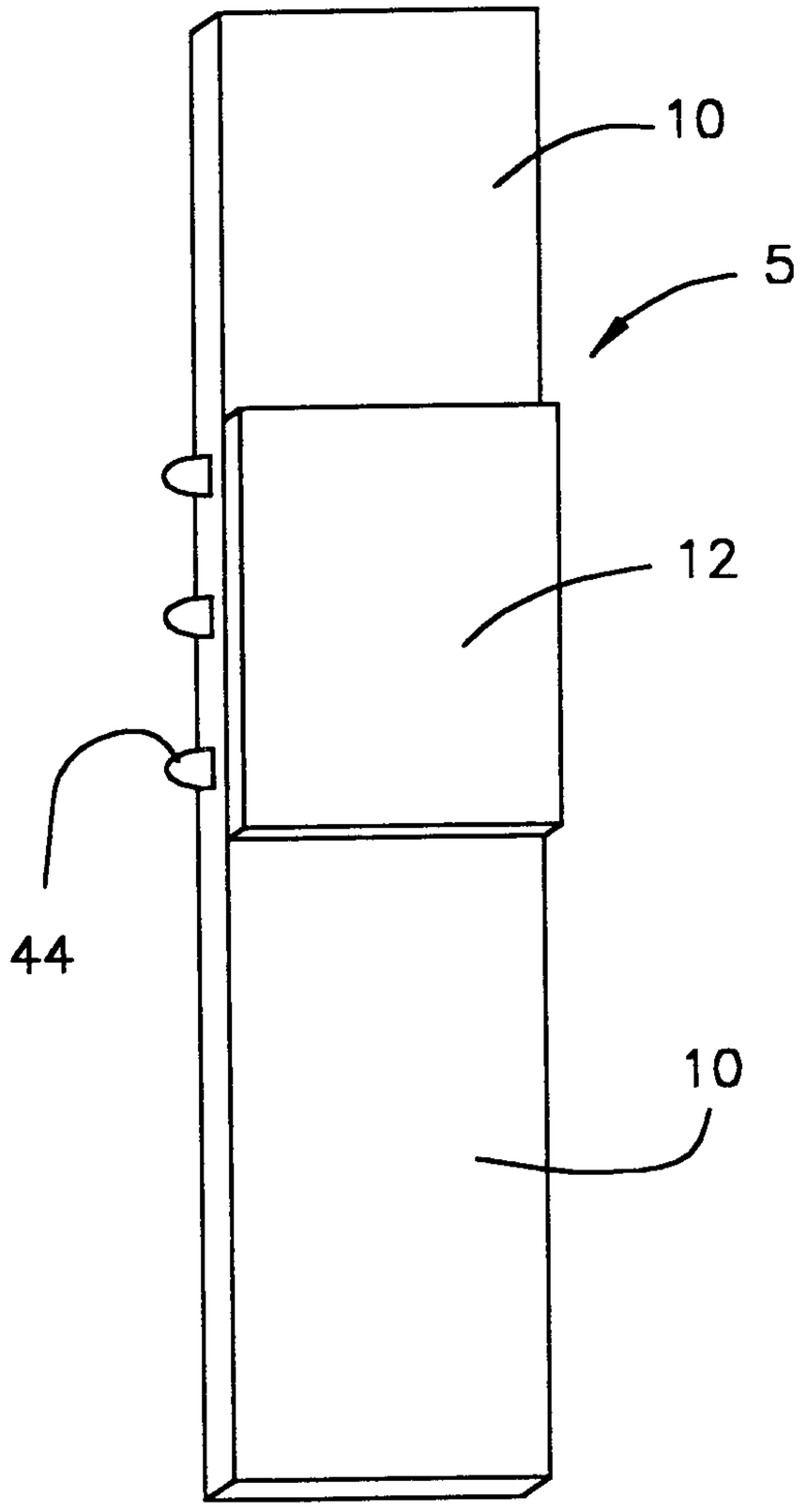

FIG. 1b

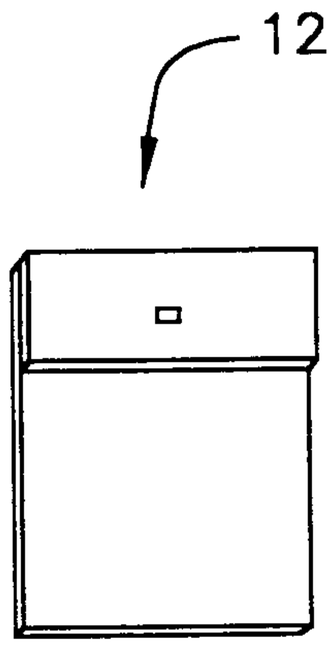

FIG. 2c

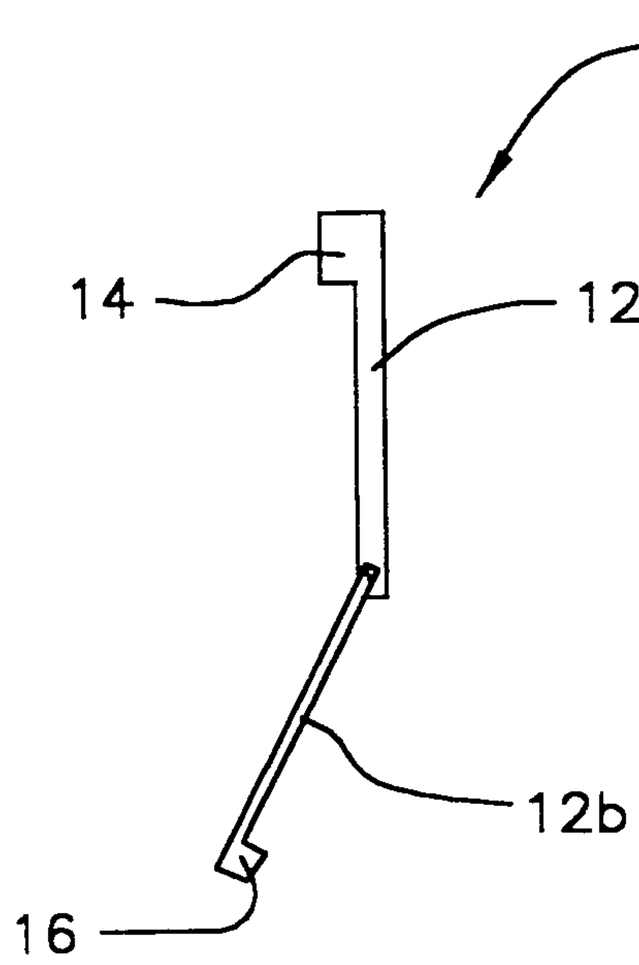

FIG. 2d

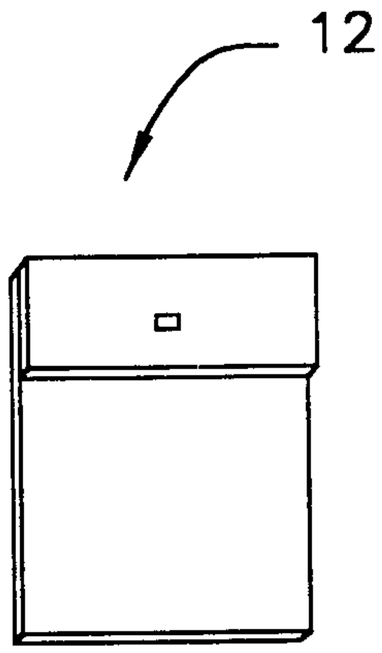

FIG. 2e

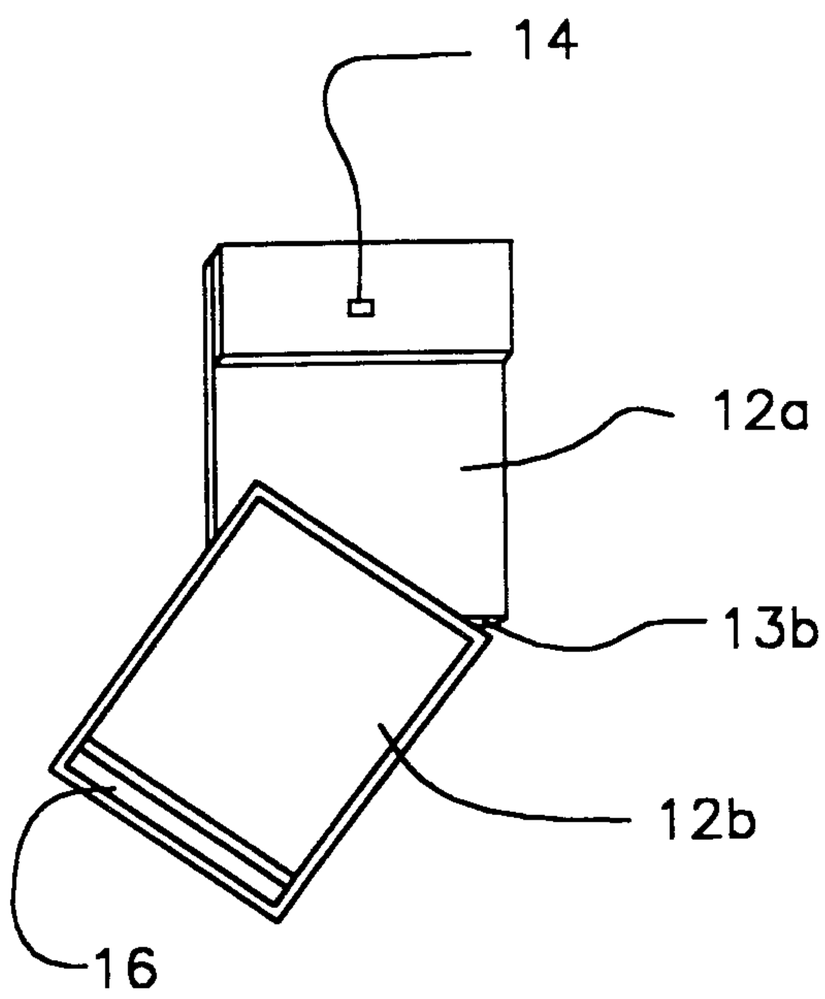

FIG. 2f

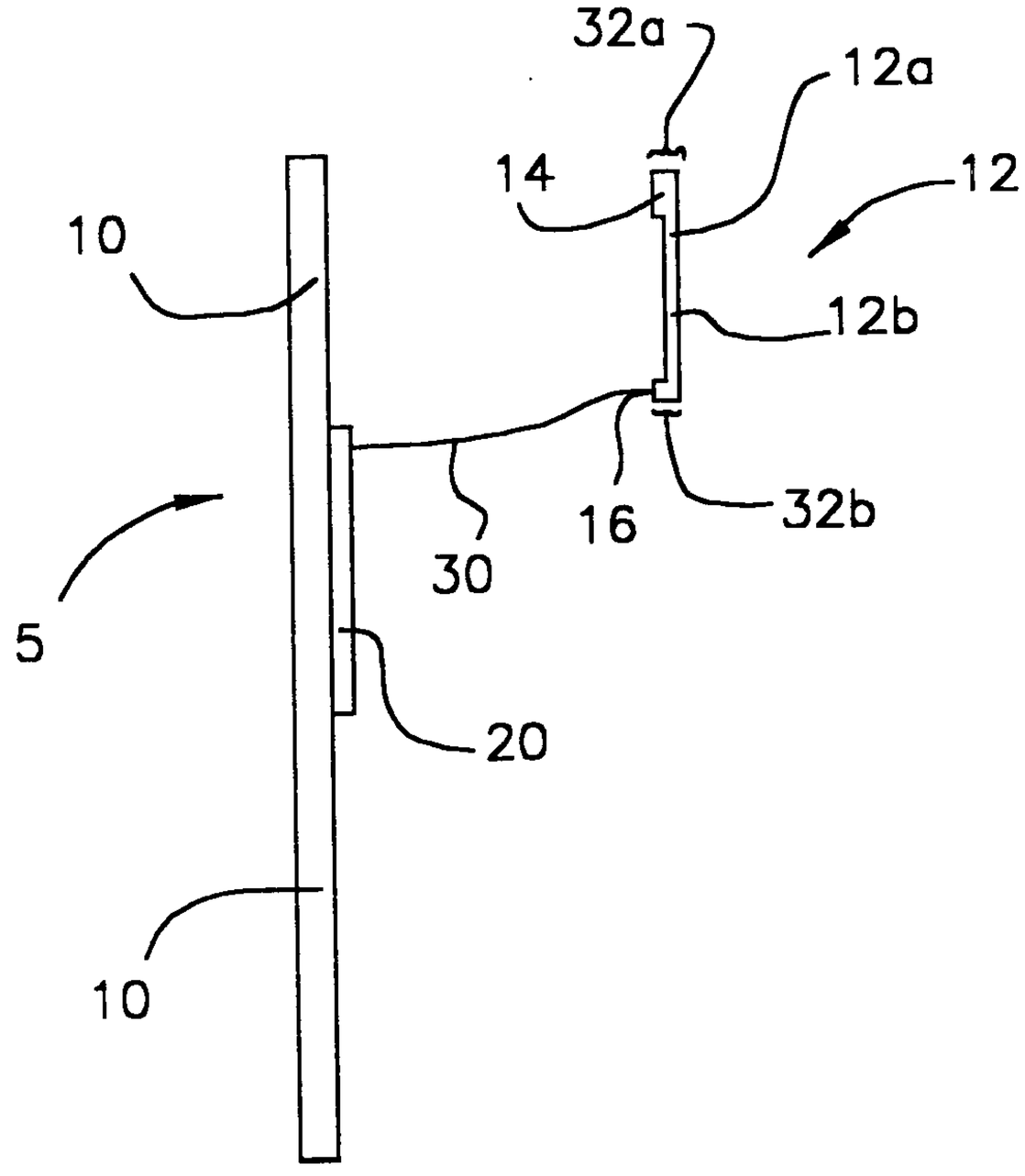

FIG. 2a

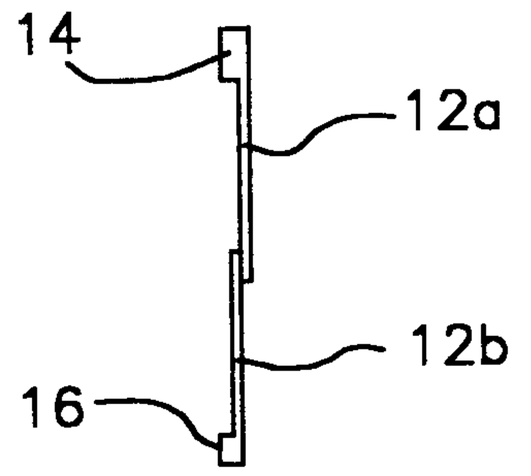

FIG. 2b

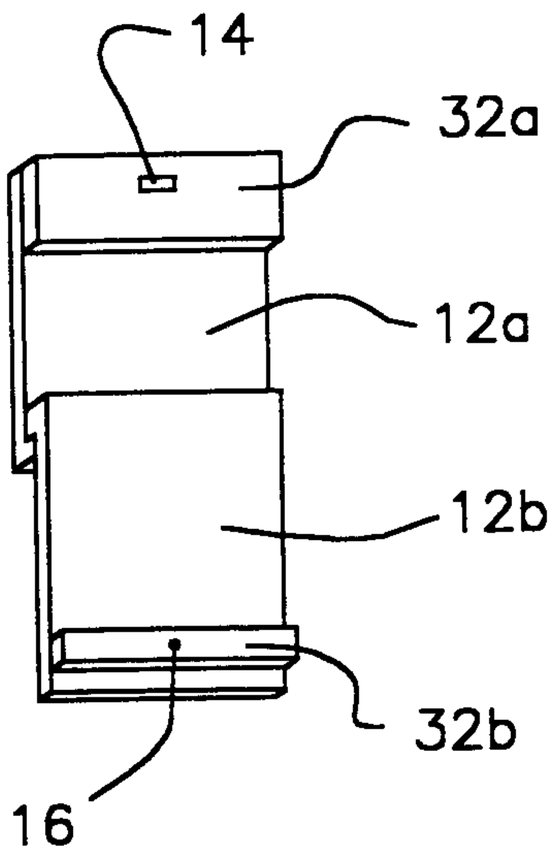

FIG. 3b

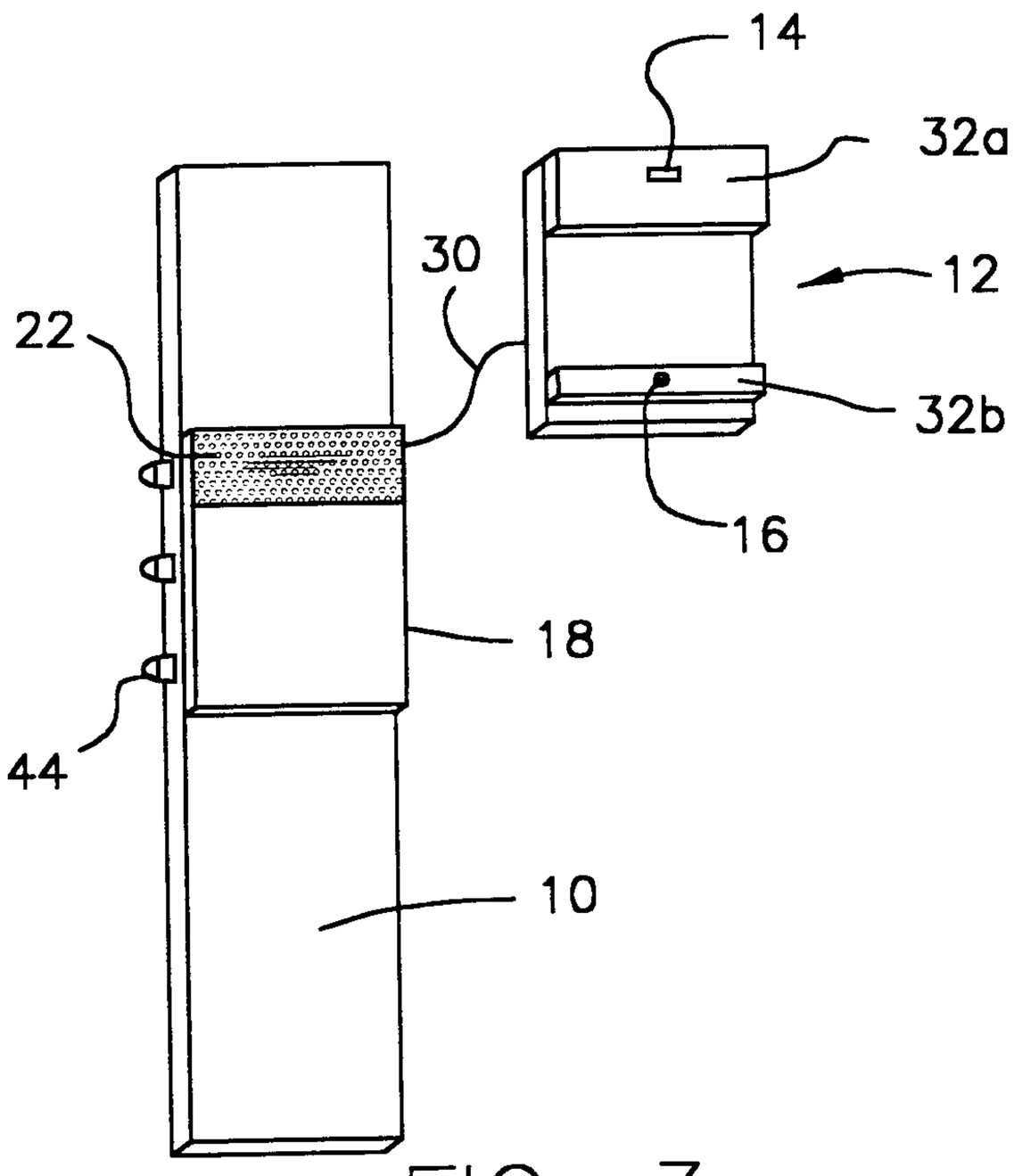

FIG. 3a

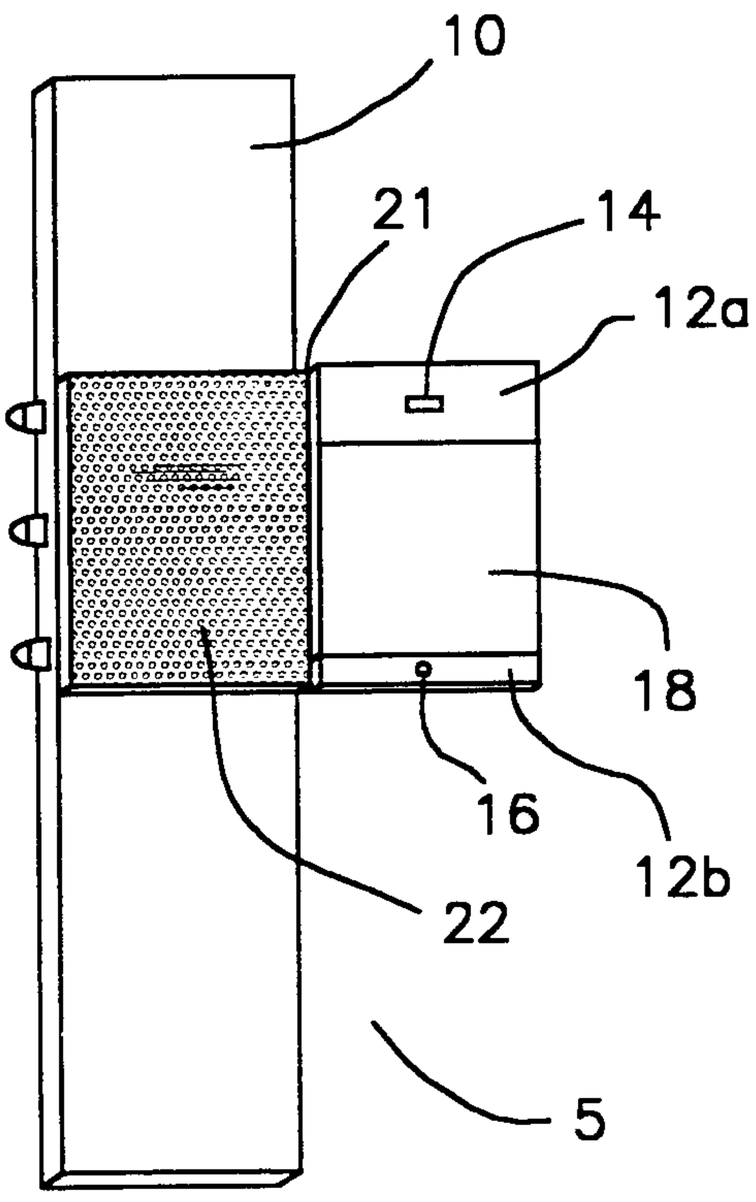

FIG. 4a

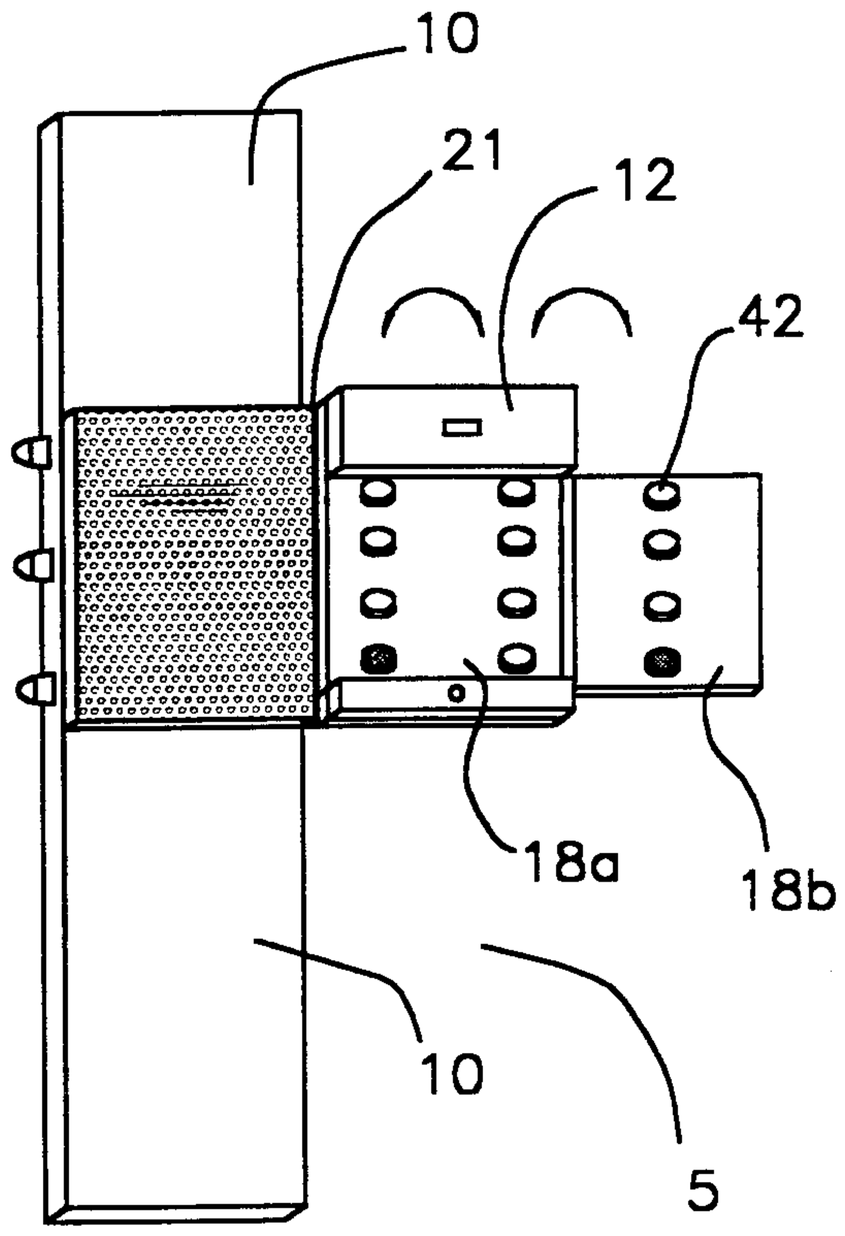

FIG. 4b

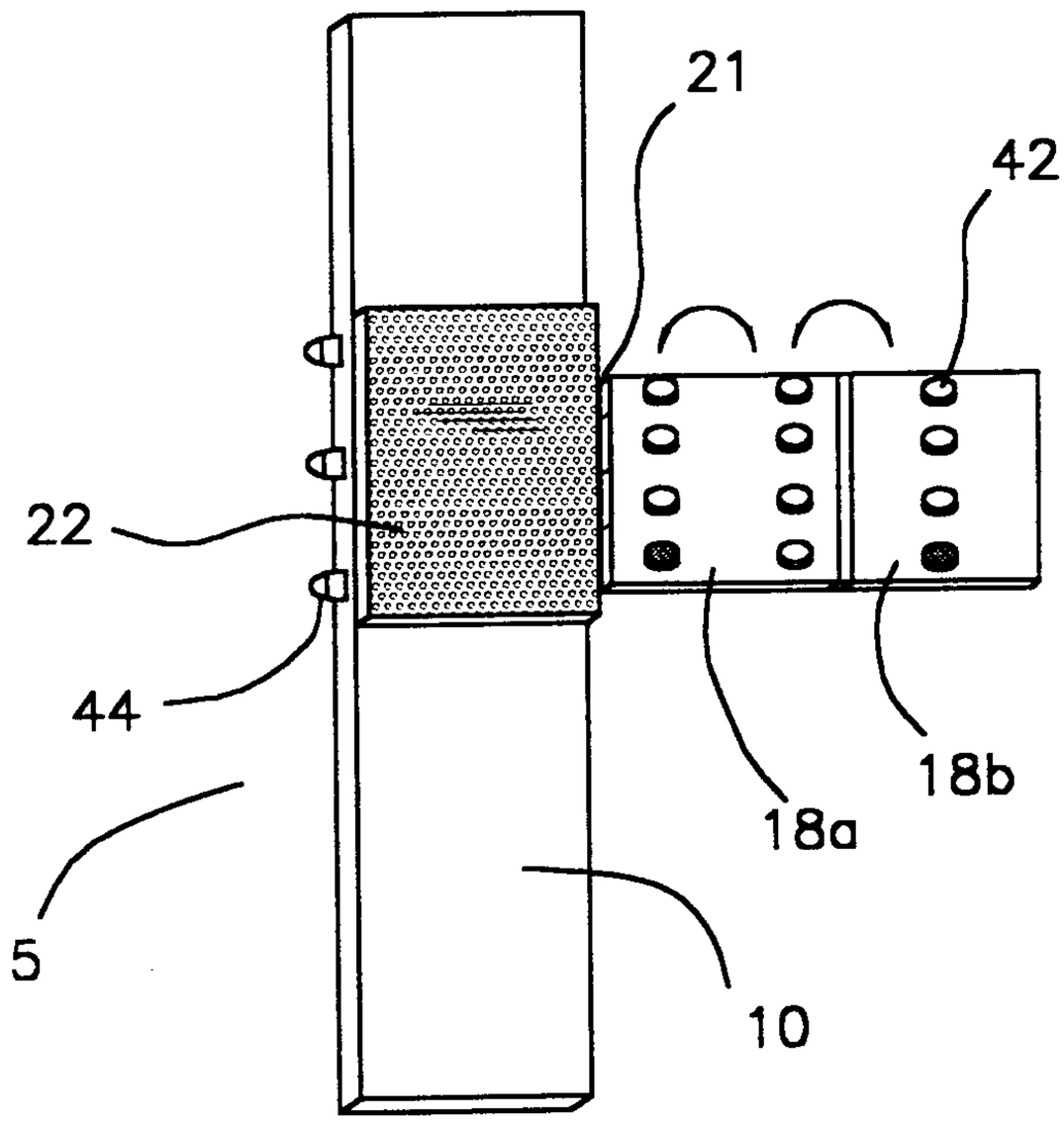

FIG. 4c

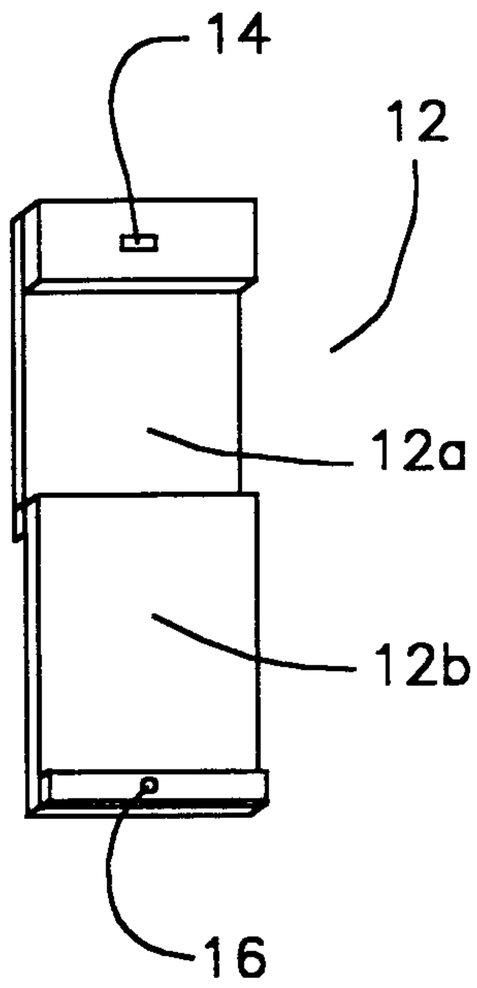

FIG. 4d

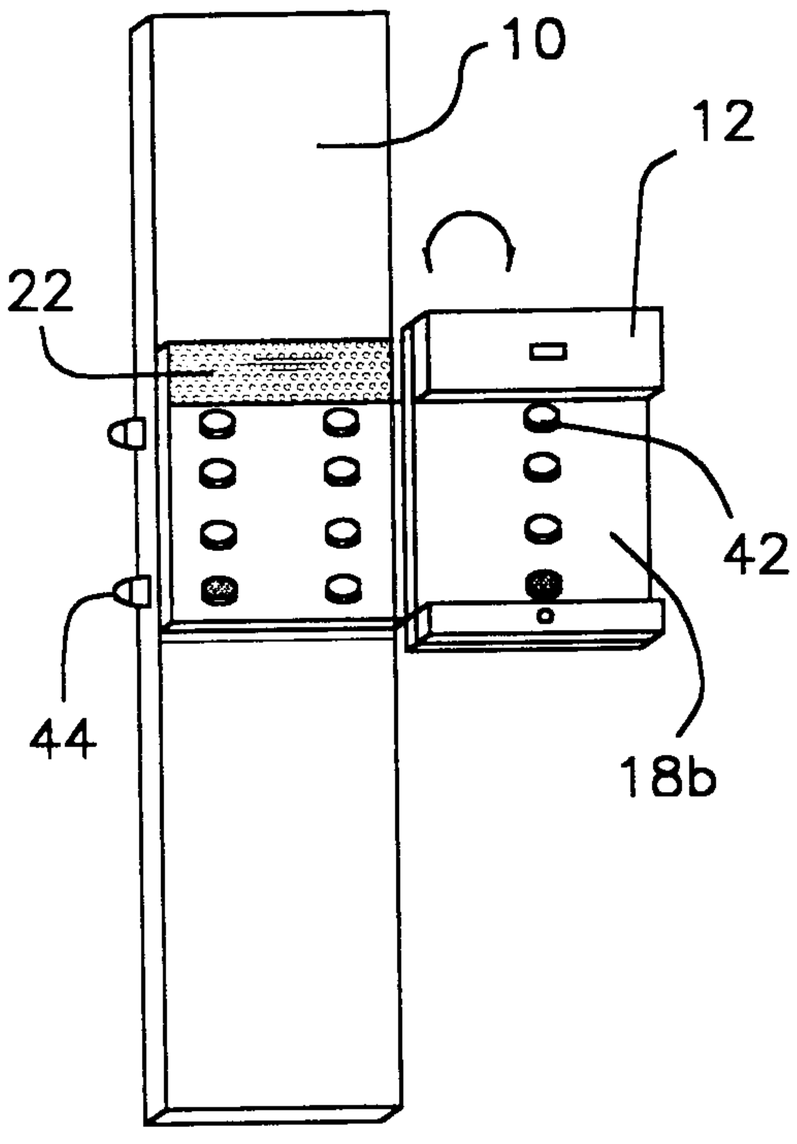

FIG. 5a

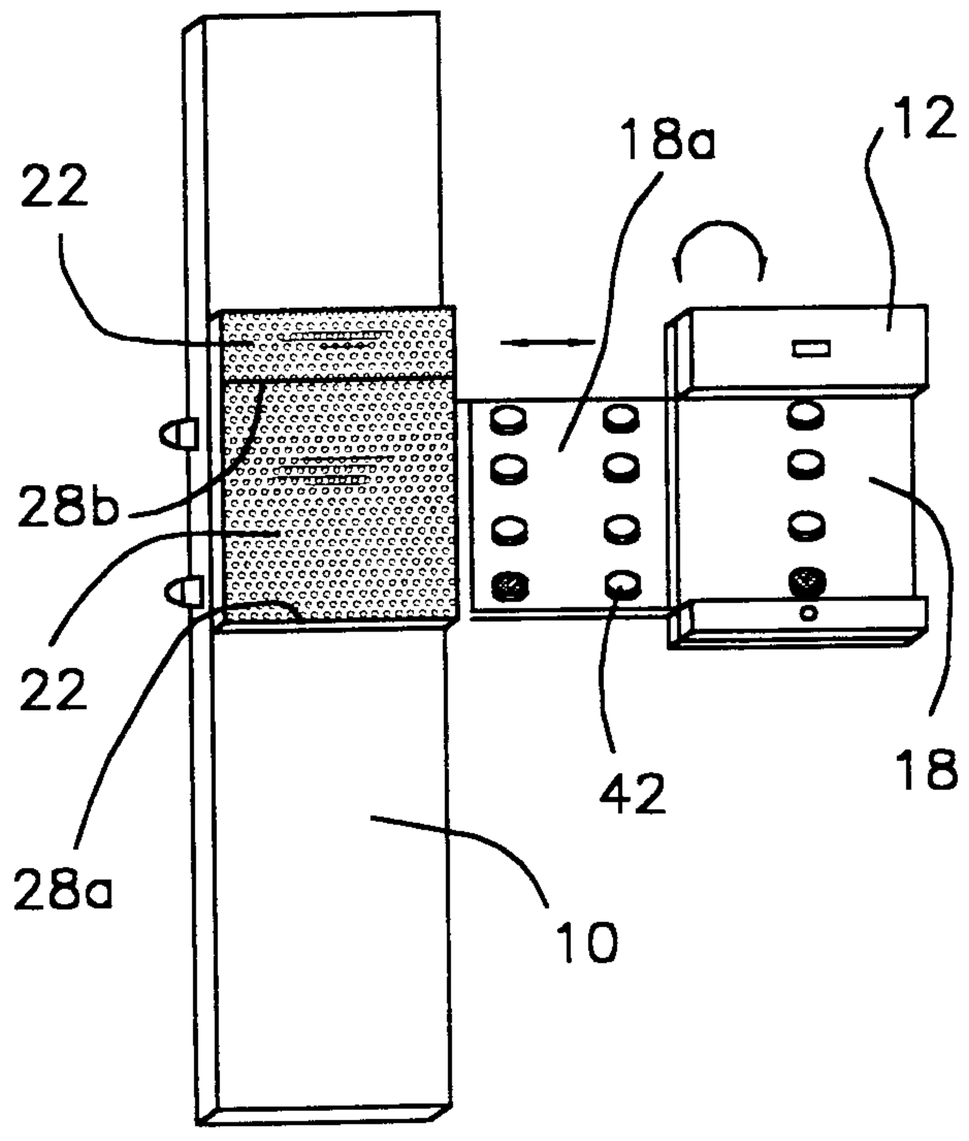

FIG. 5b

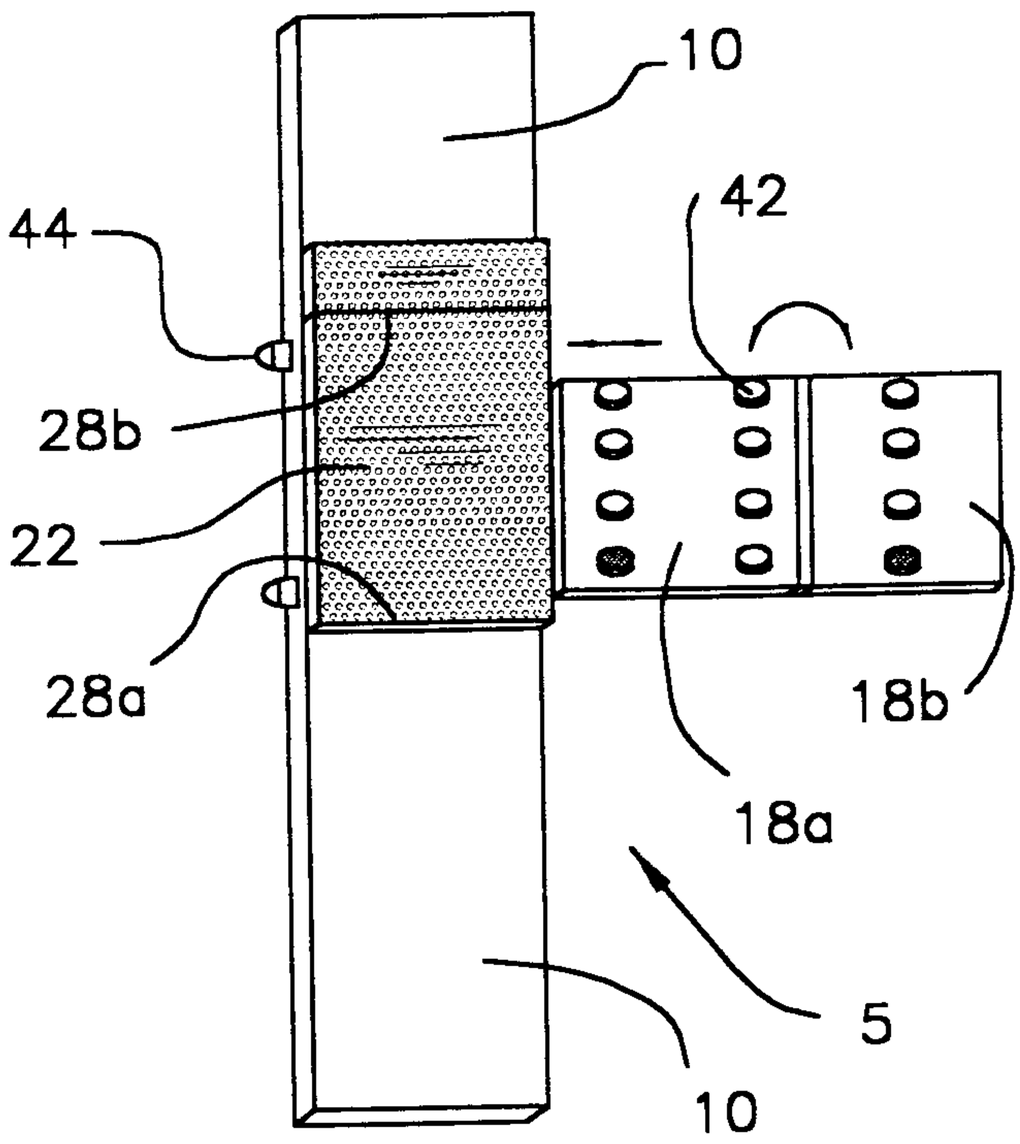

FIG. 5c

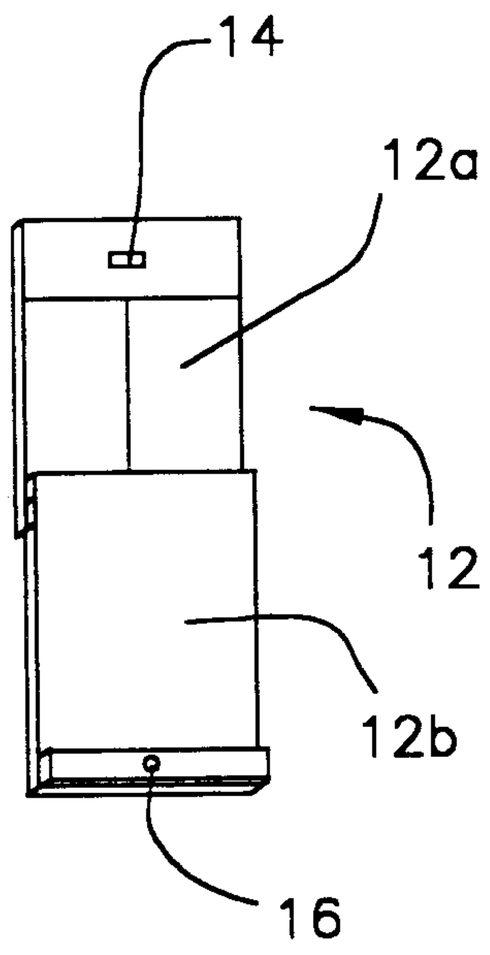

FIG. 5d

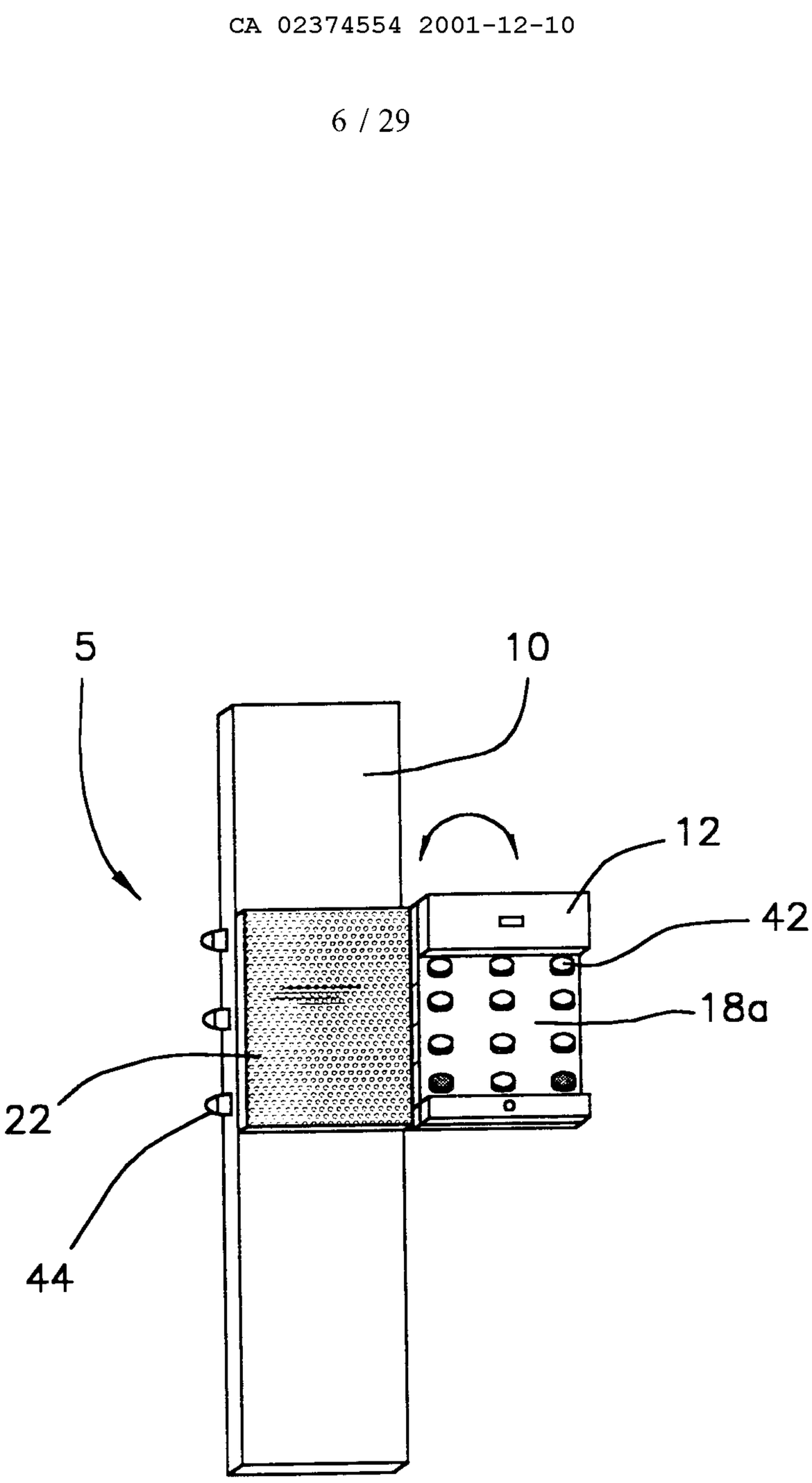

FIG. 6

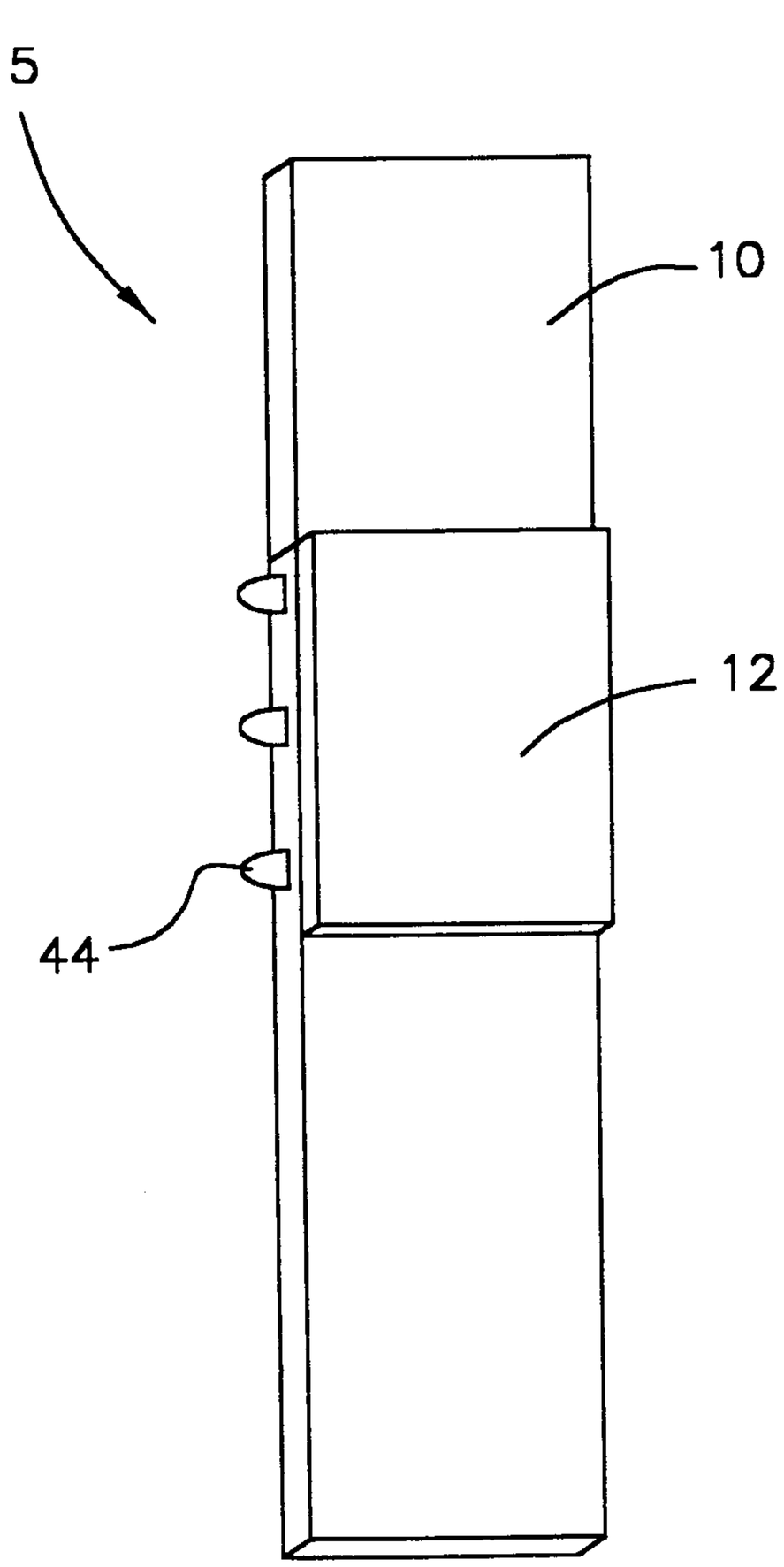

FIG. 7a

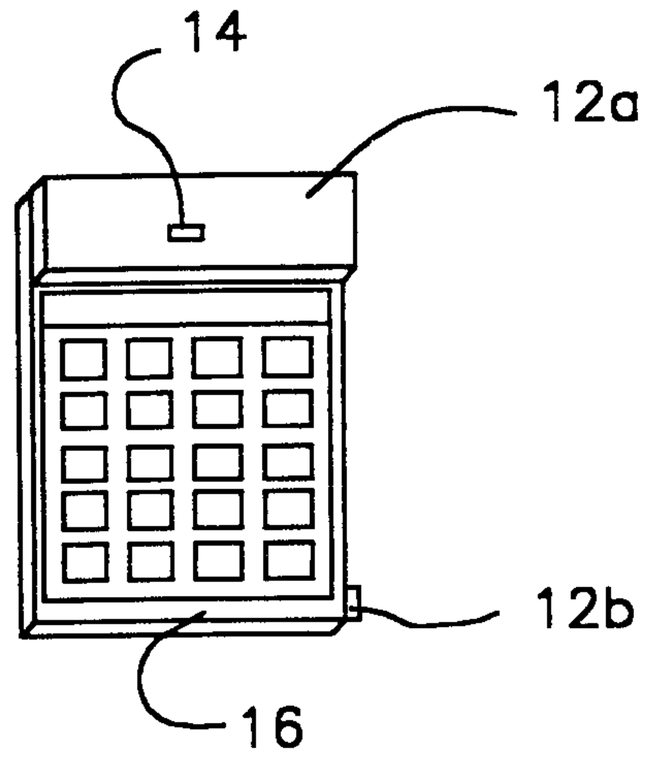

FIG. 7b

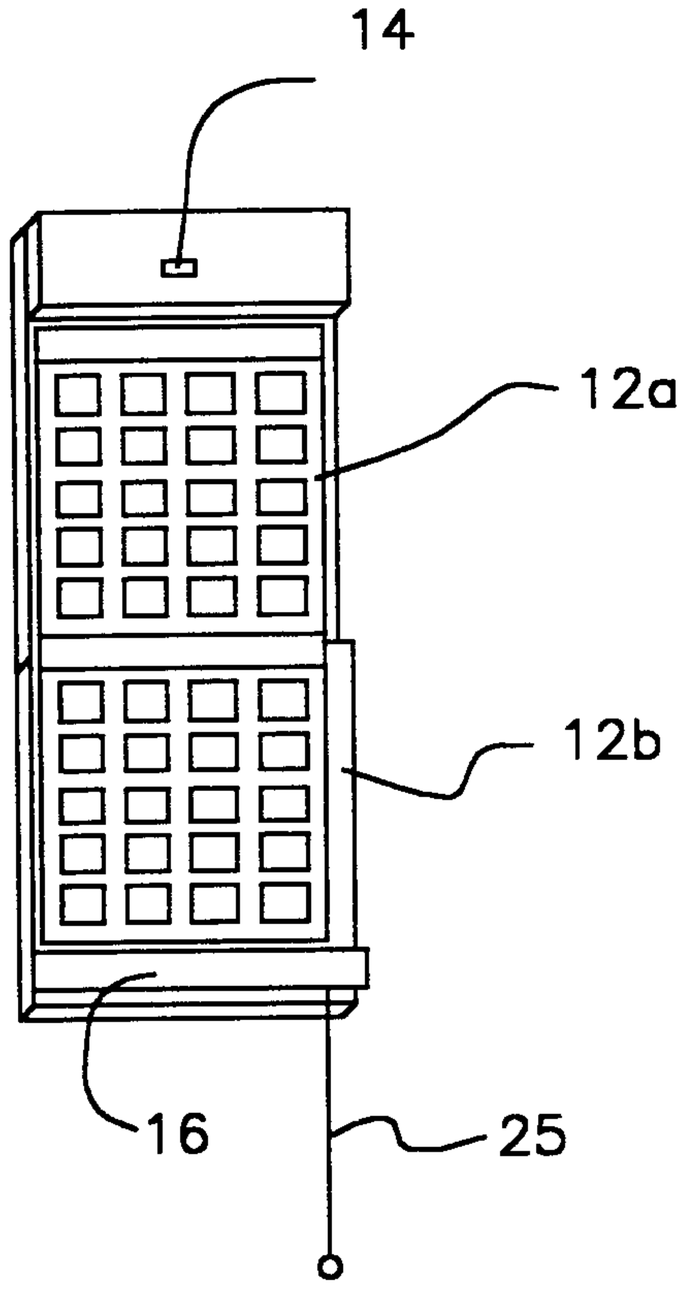

FIG. 7c

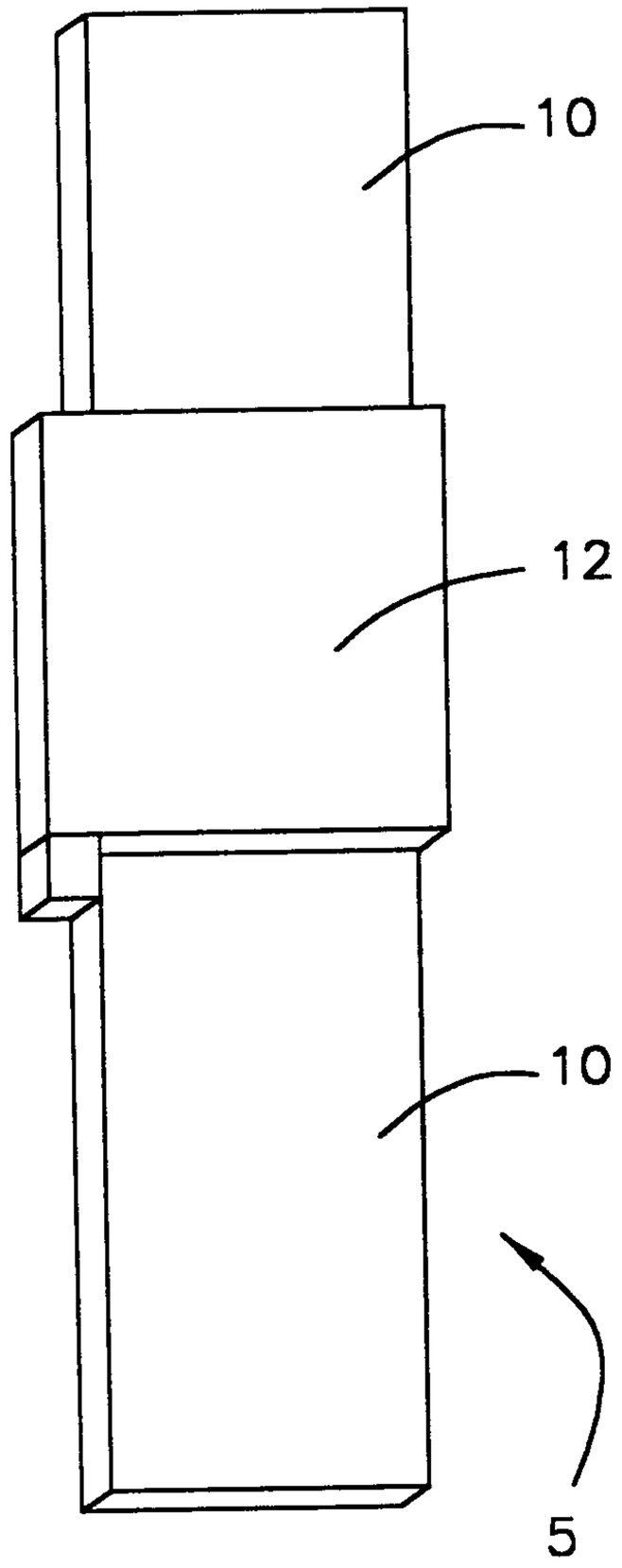

FIG. 8a

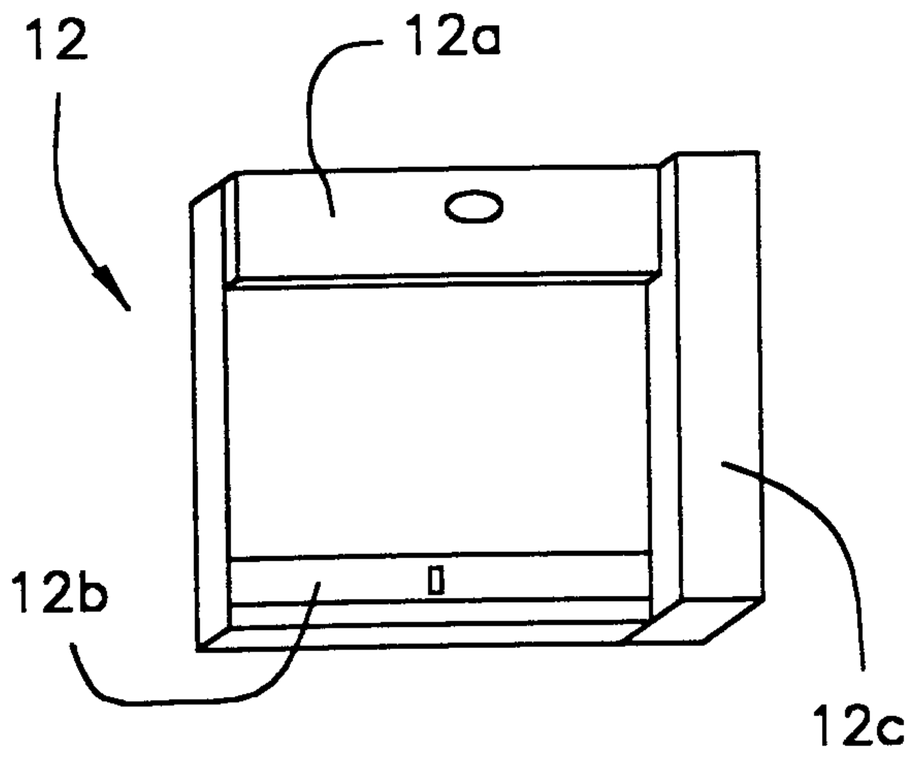

FIG. 8b

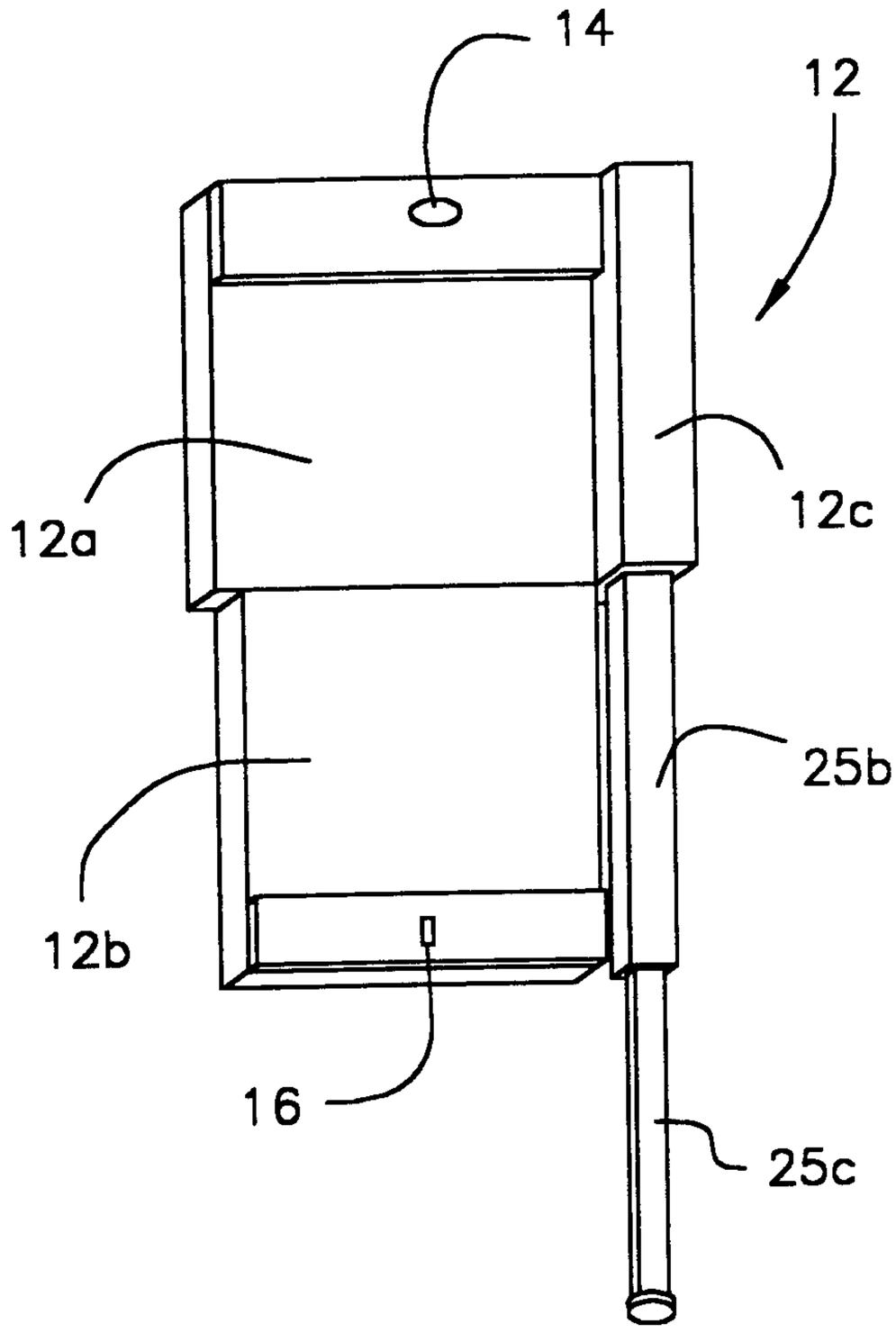

FIG. 8c

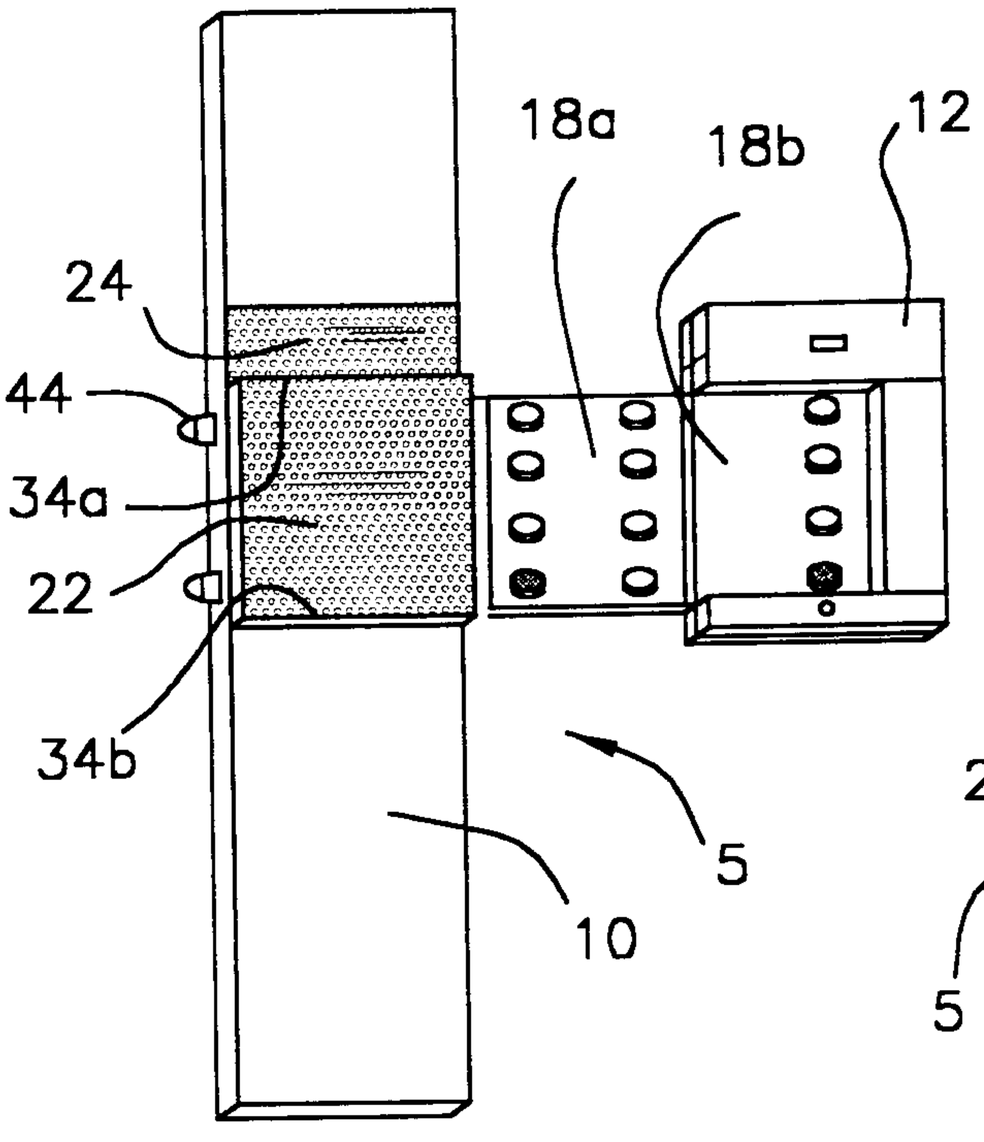

FIG. 9a

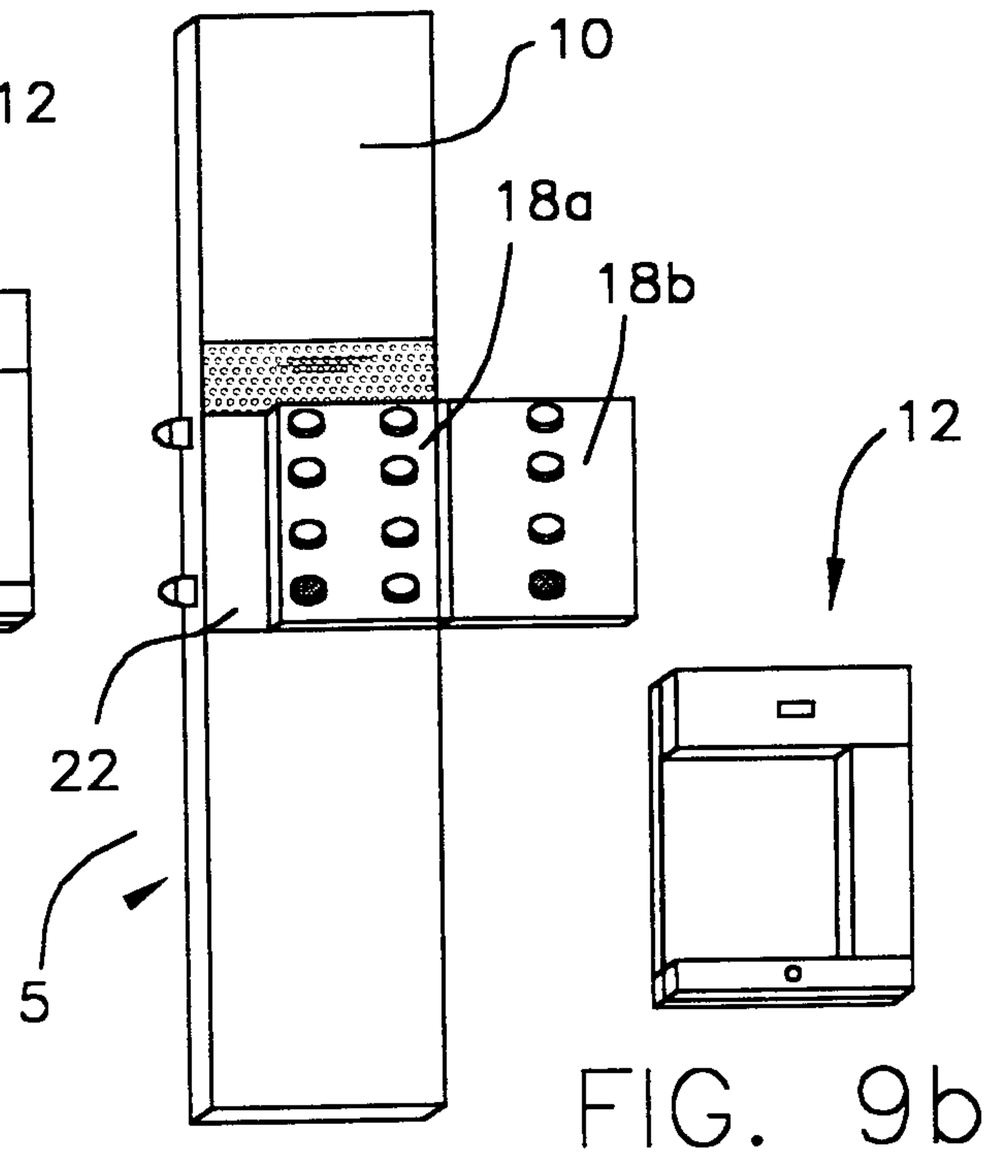

FIG. 9d

FIG. 9b

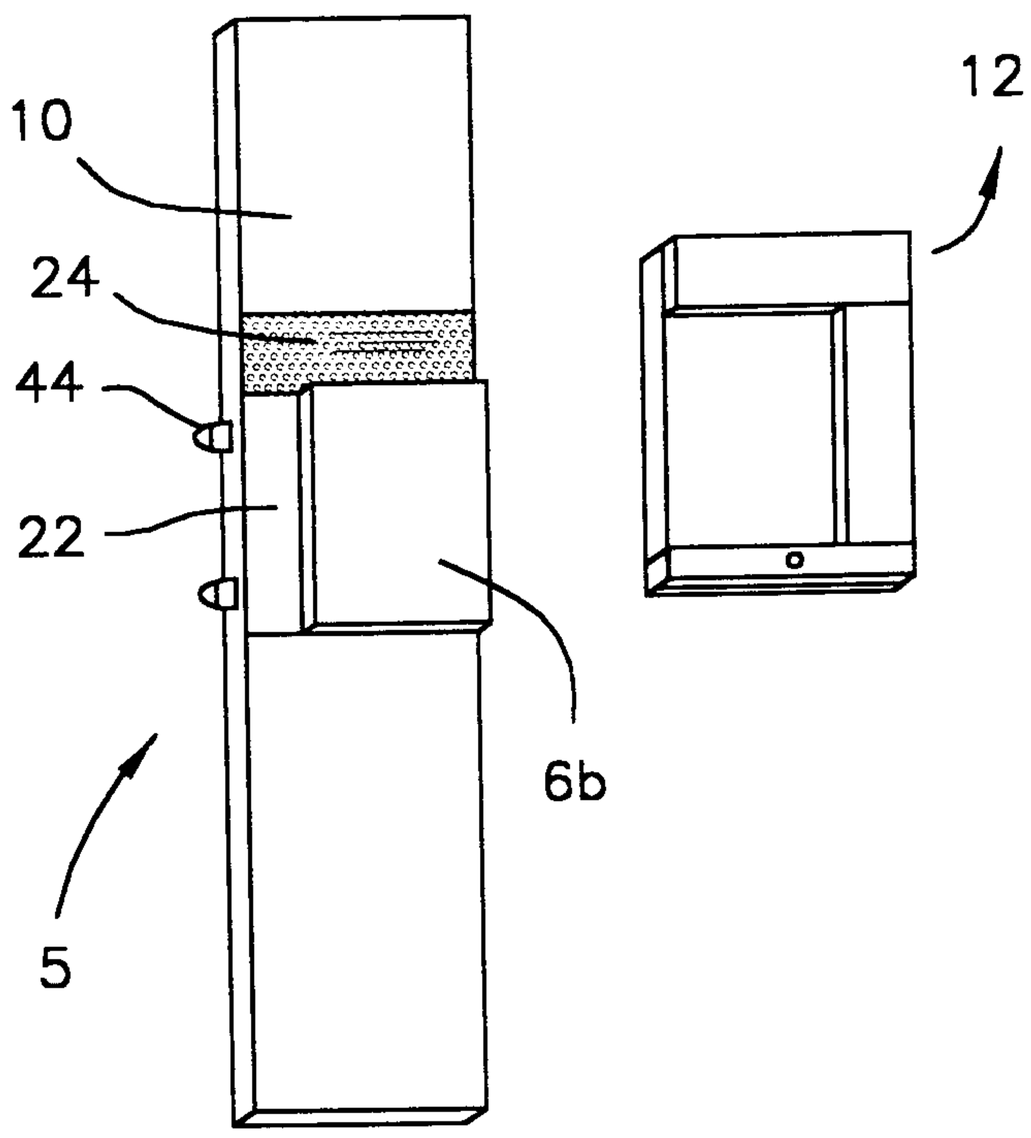

FIG. 9c

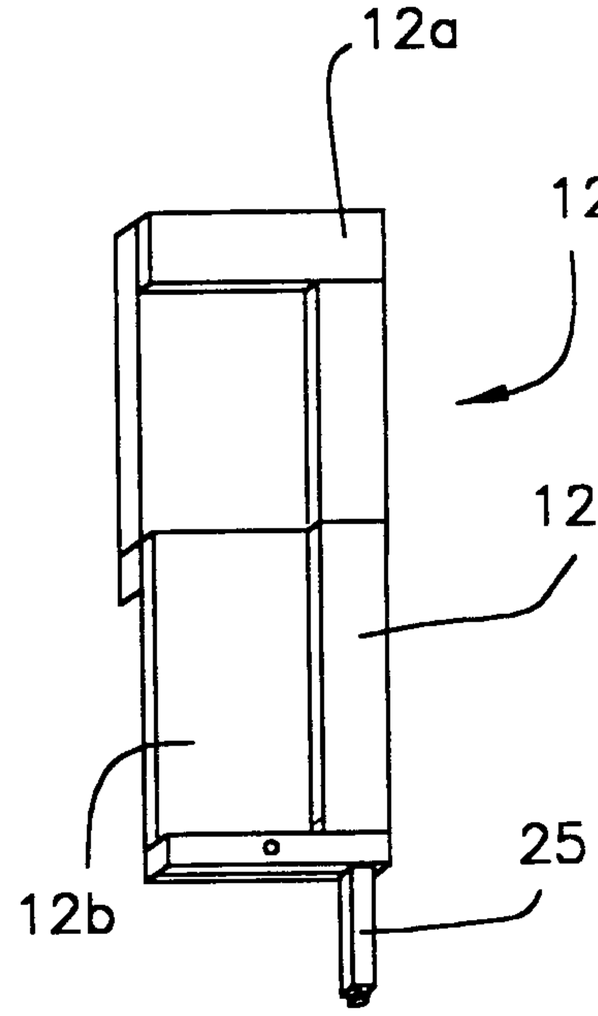

FIG. 9e

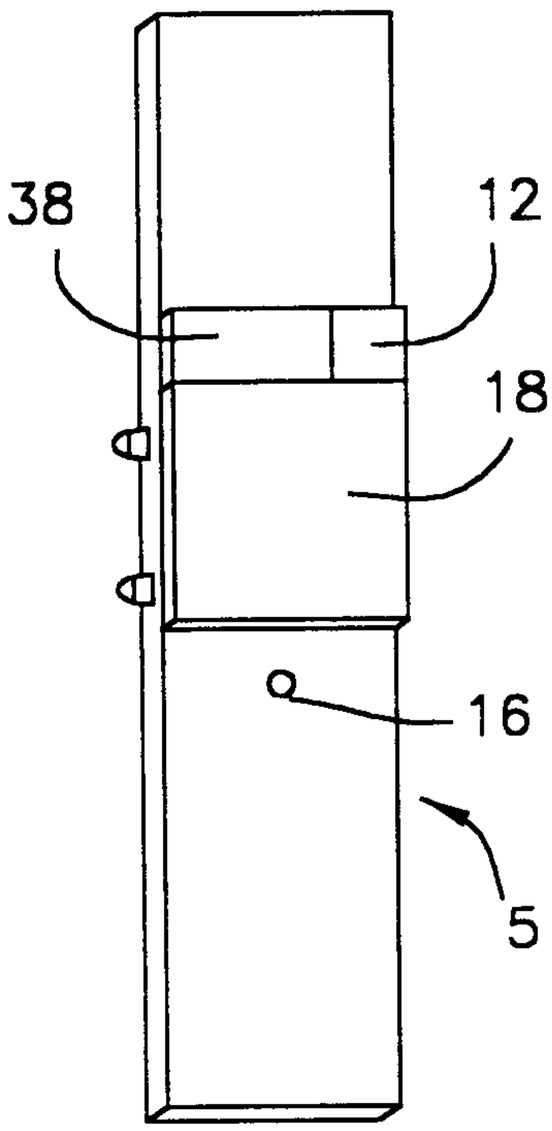

FIG. 10a

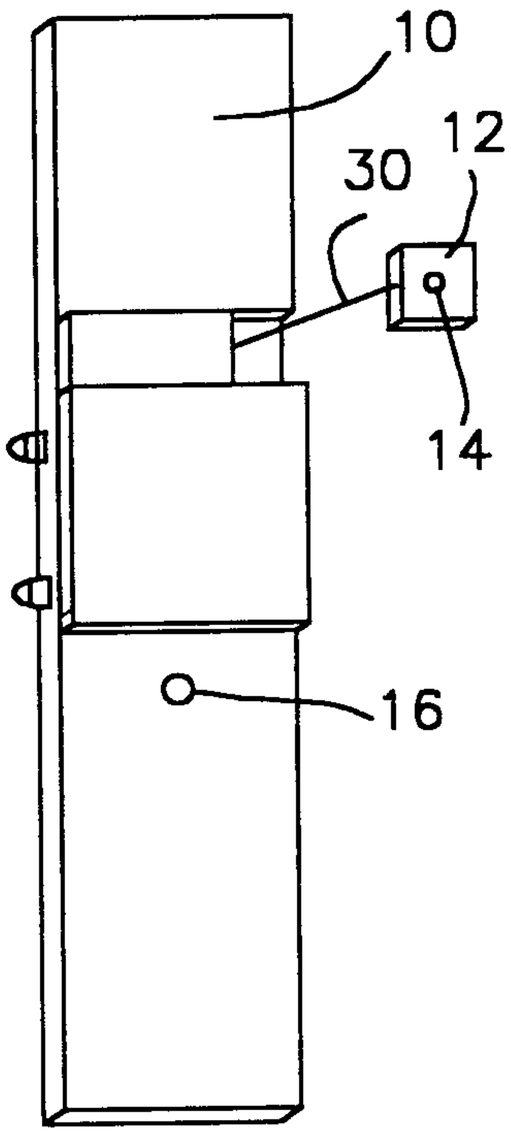

FIG. 10b

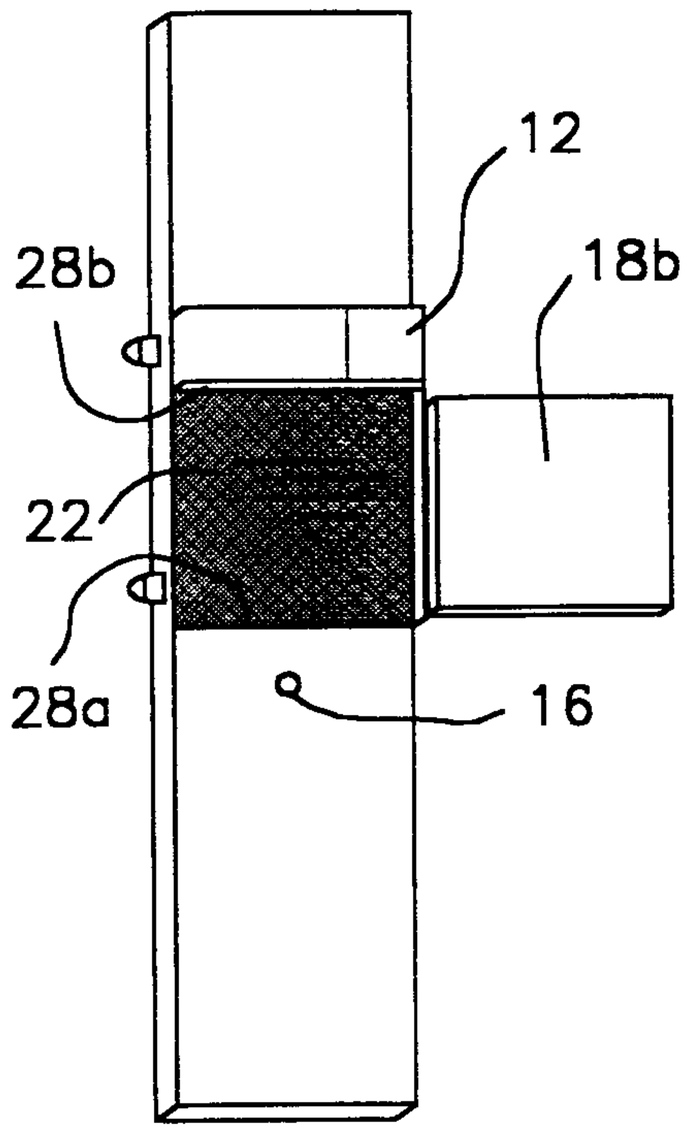

FIG. 10d

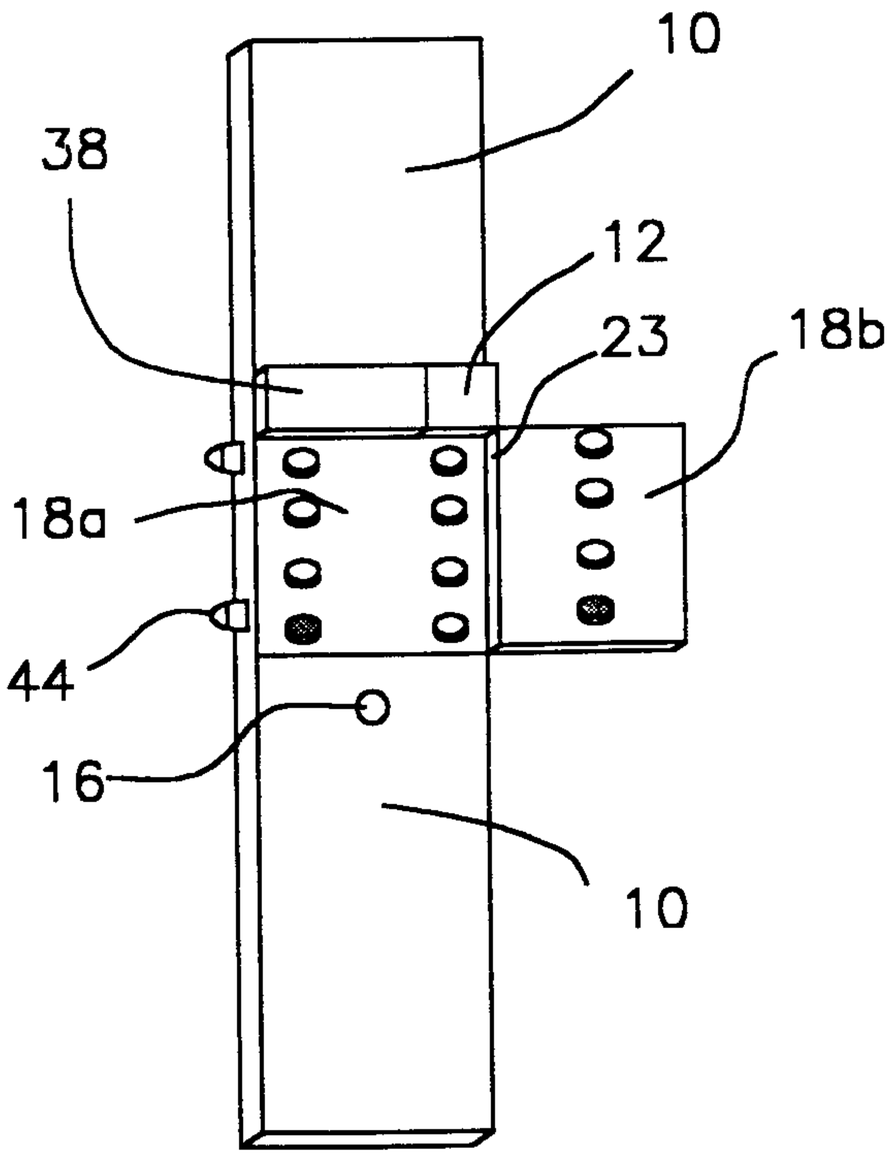

FIG. 10c

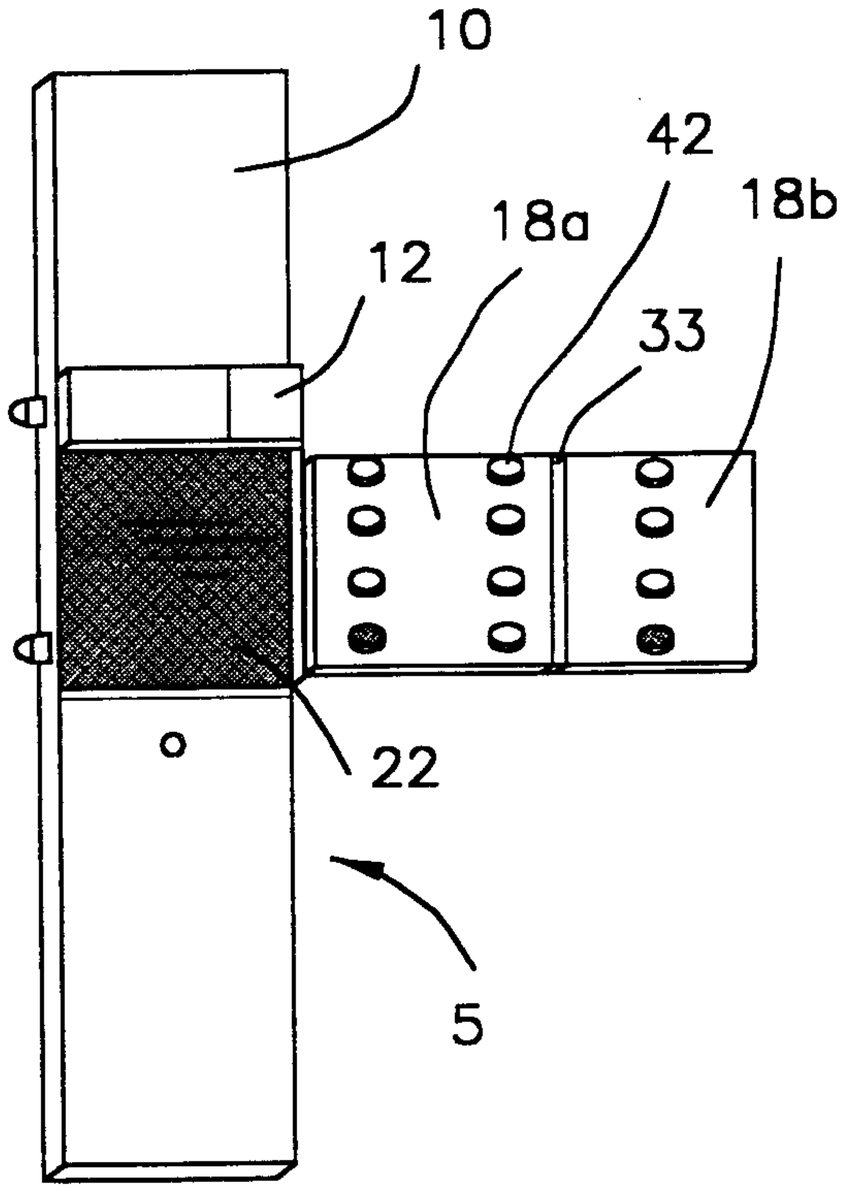

FIG. 10e

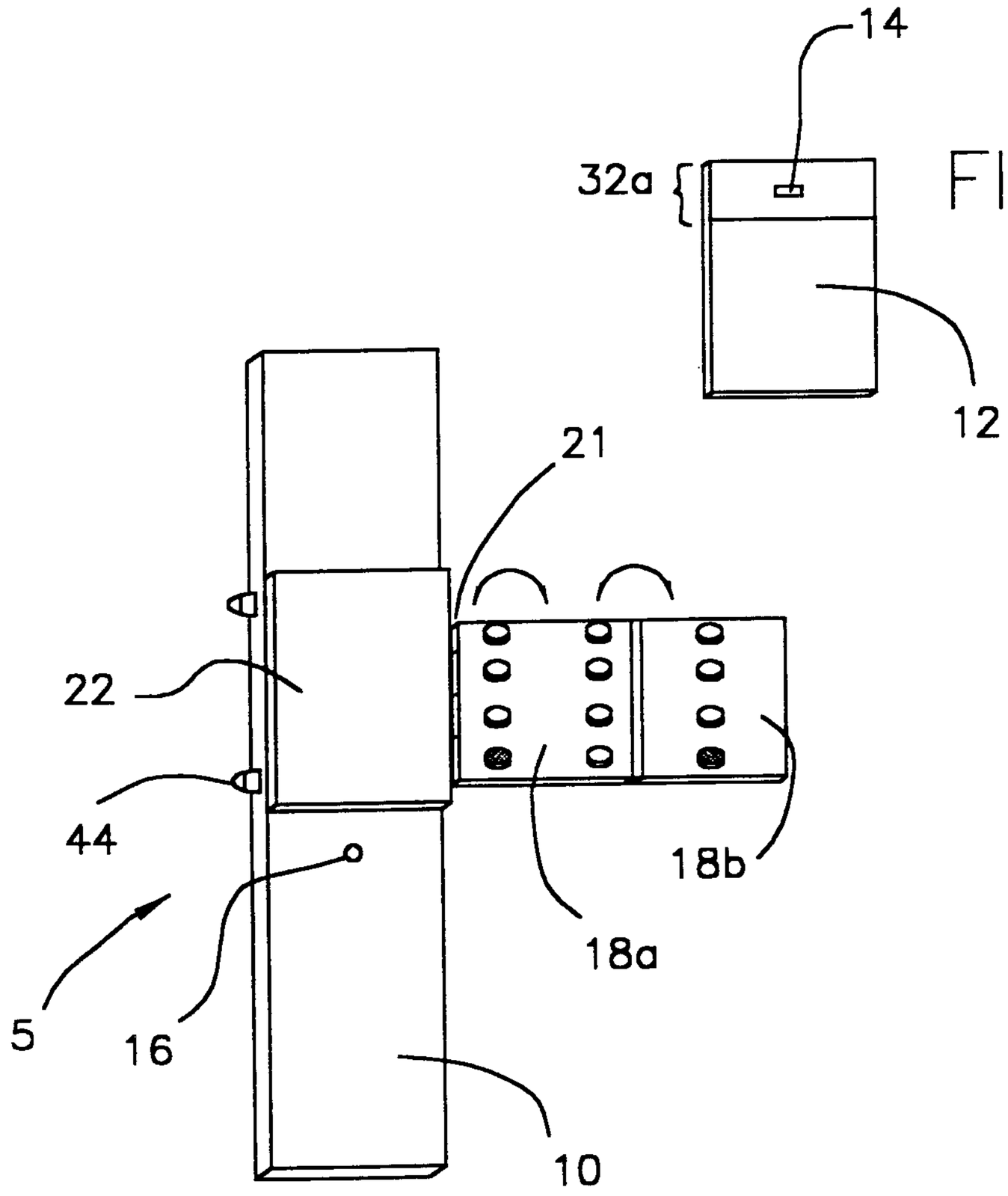

FIG. 11a

FIG. 11b

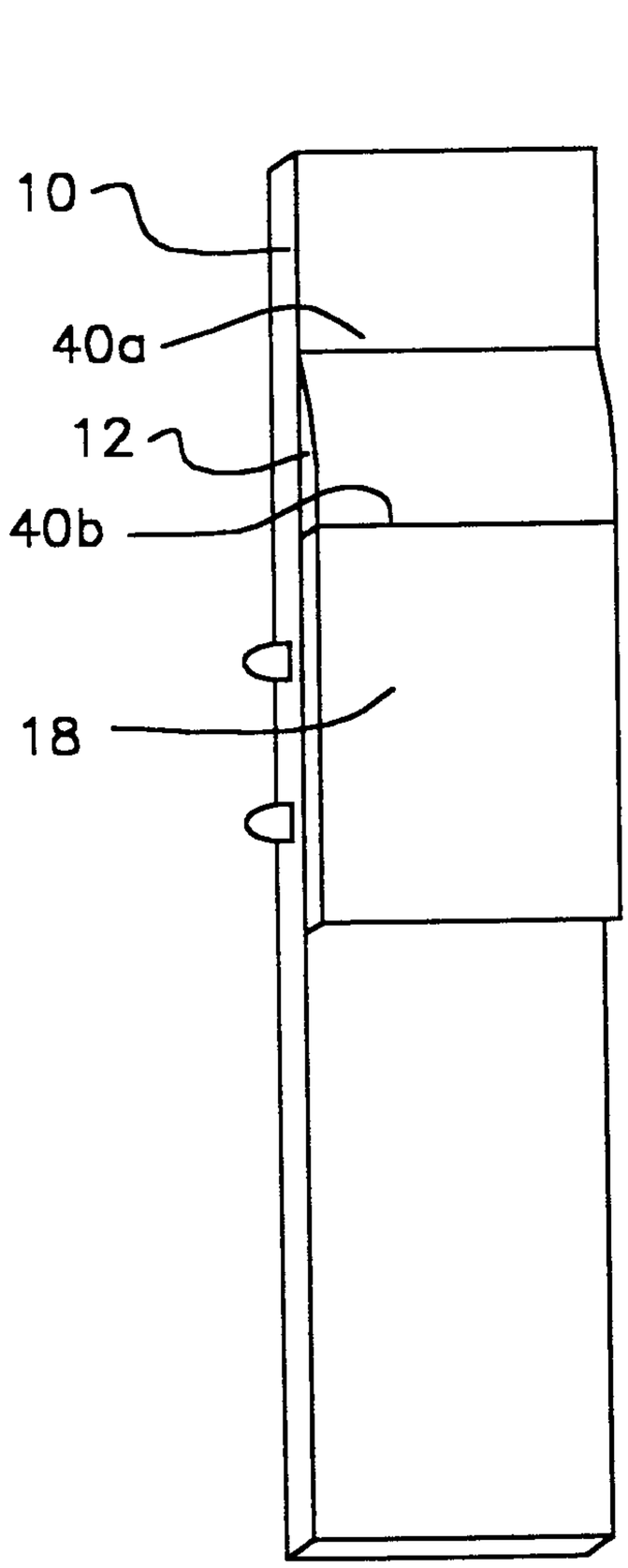

FIG. 12a

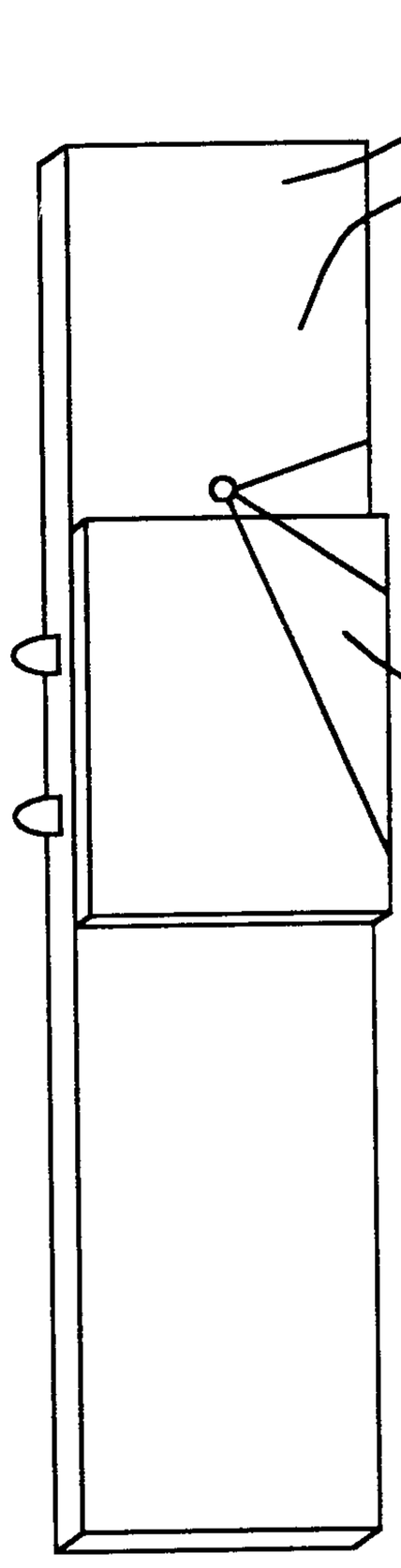

FIG. 12b

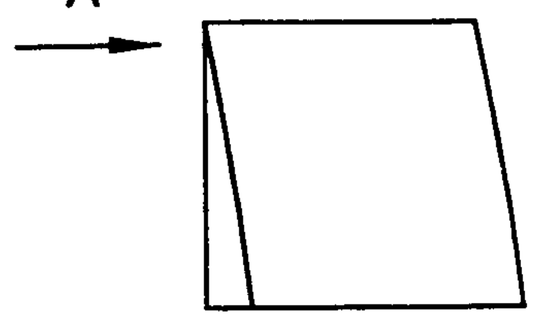

FIG. 12d

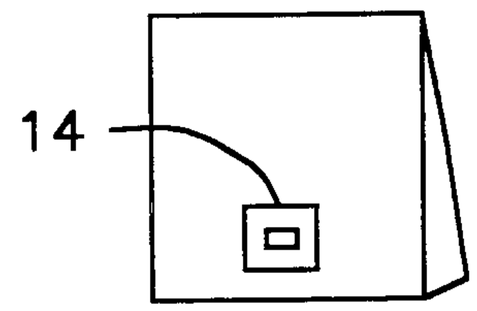

FIG. 12e

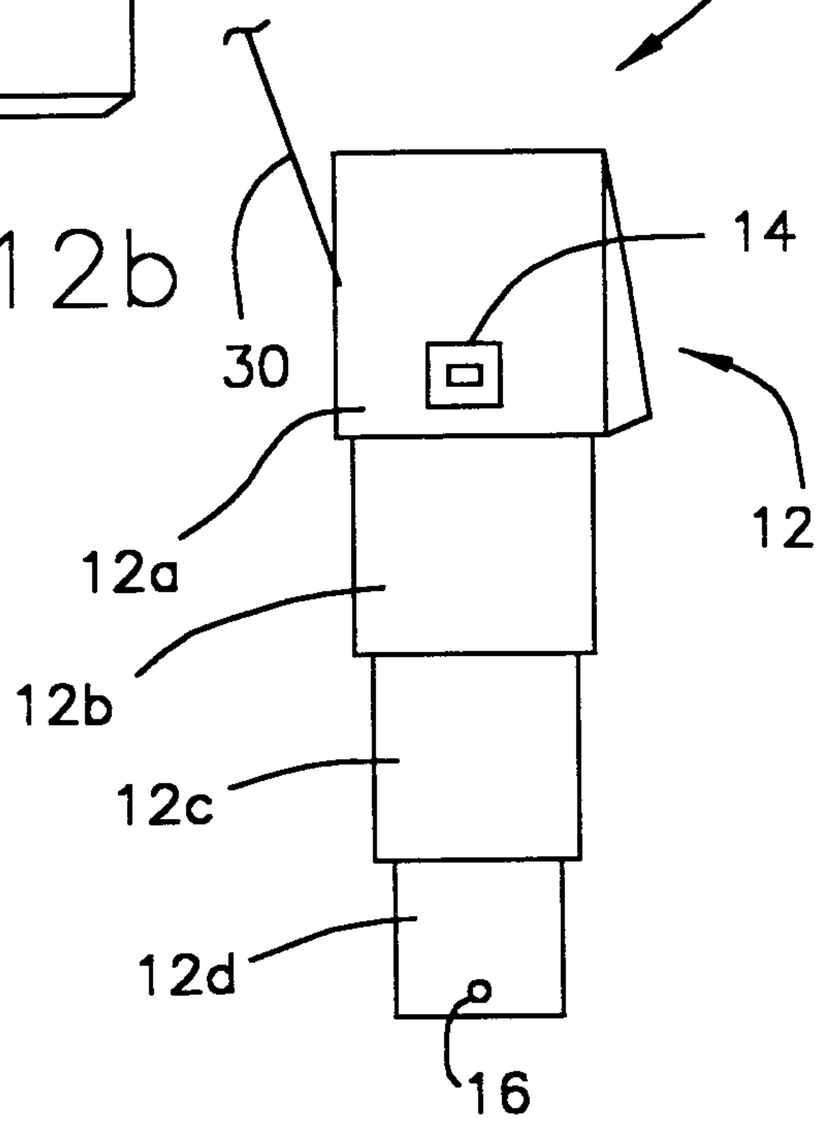

FIG. 12c

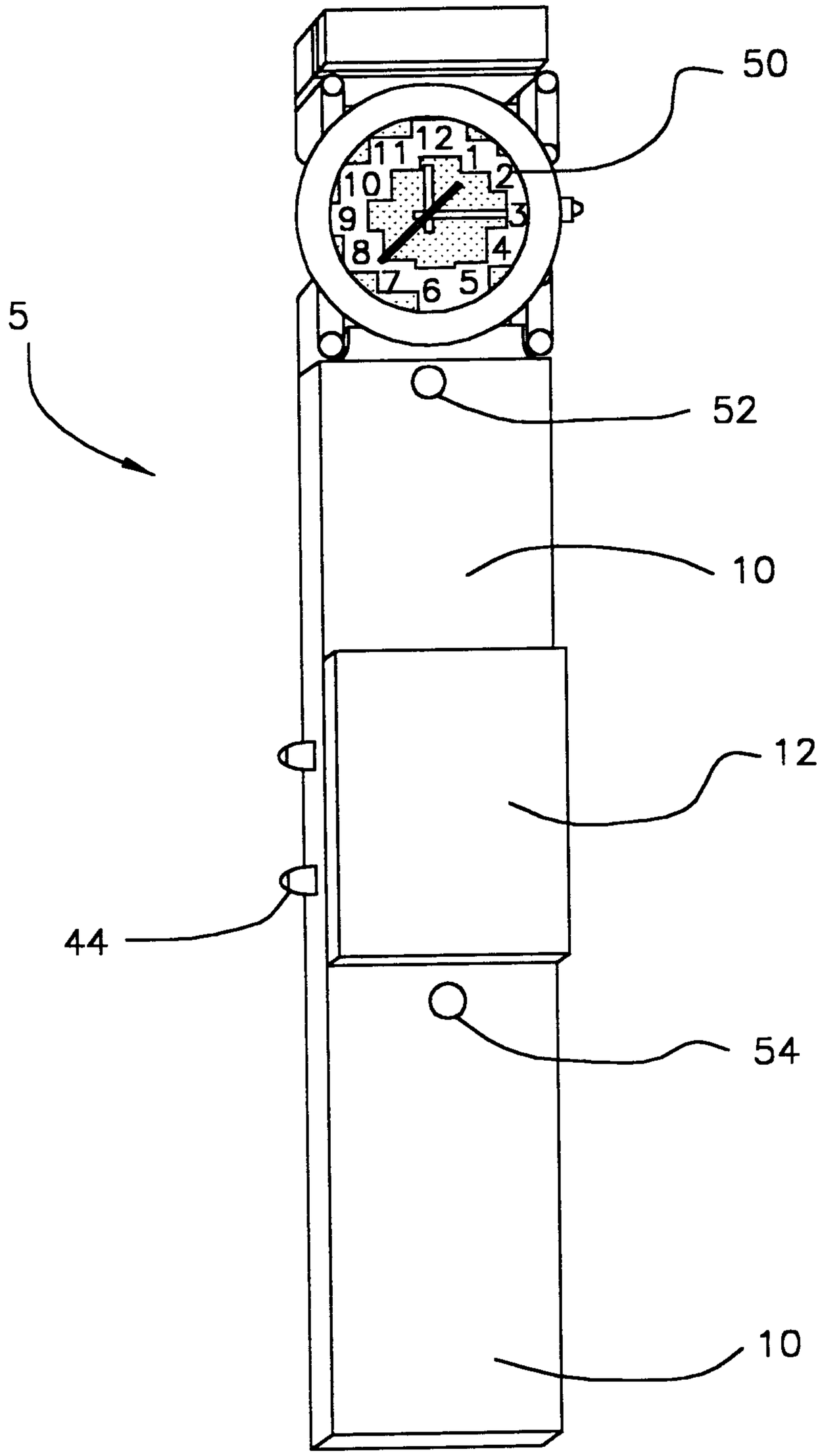

FIG. 13

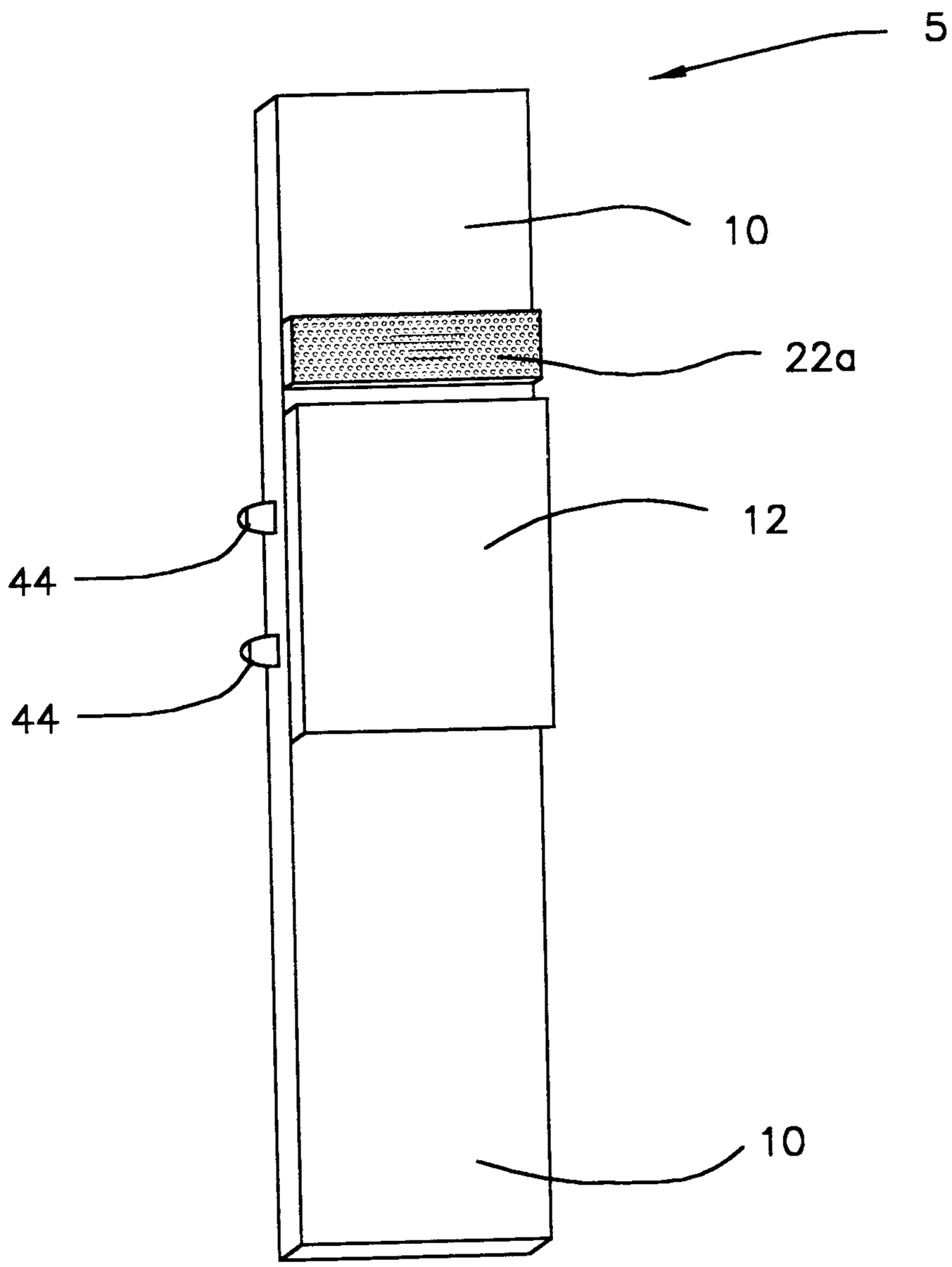

FIG. 14

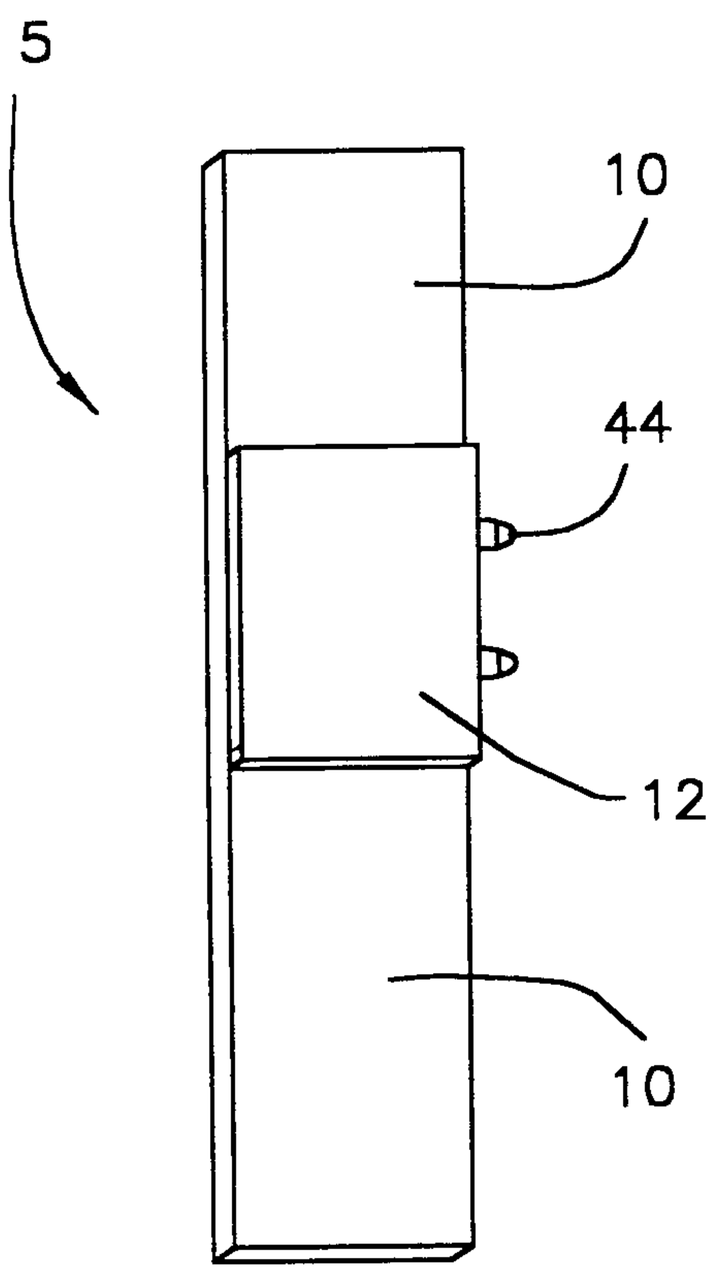

FIG. 15a

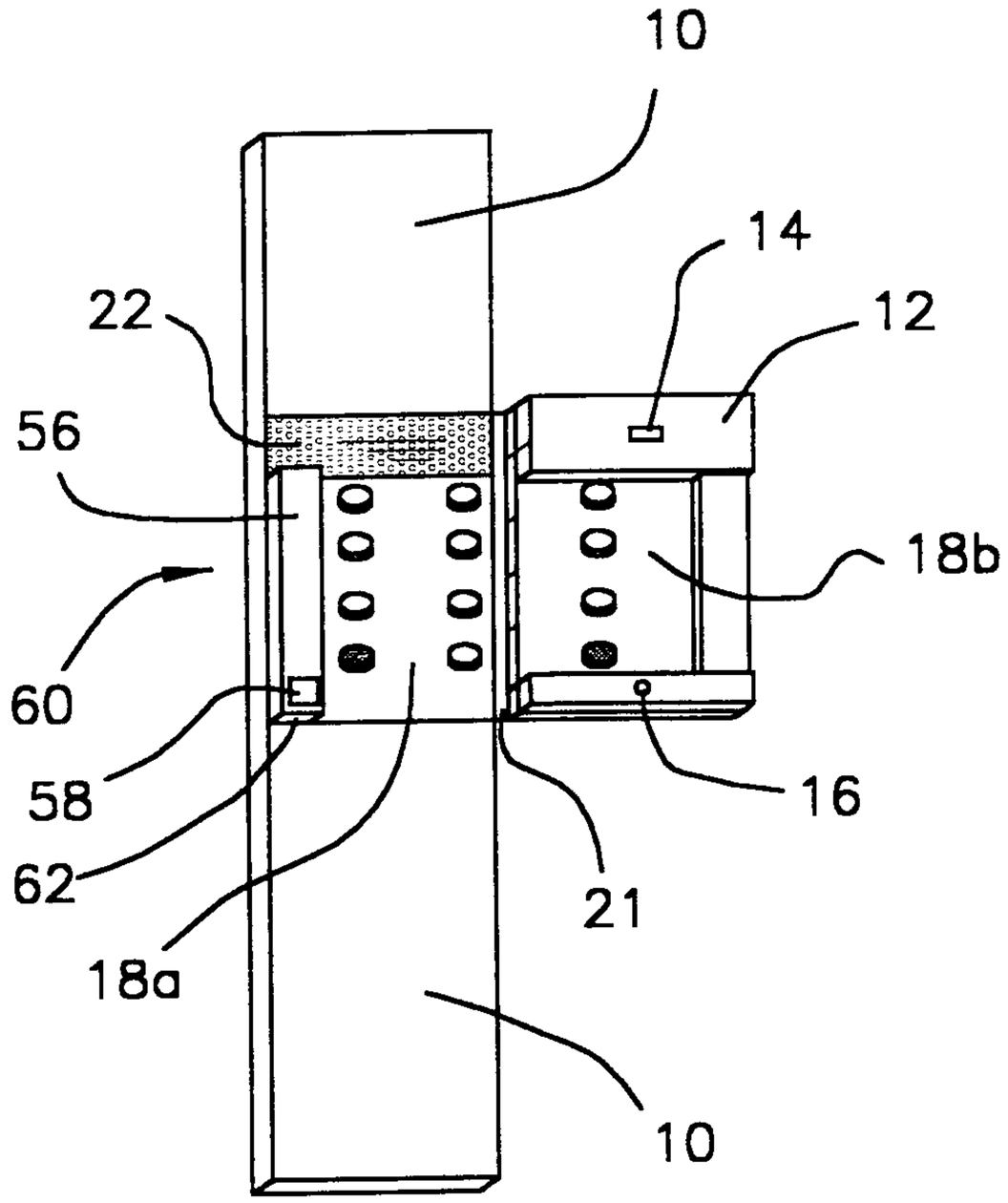

FIG. 15b

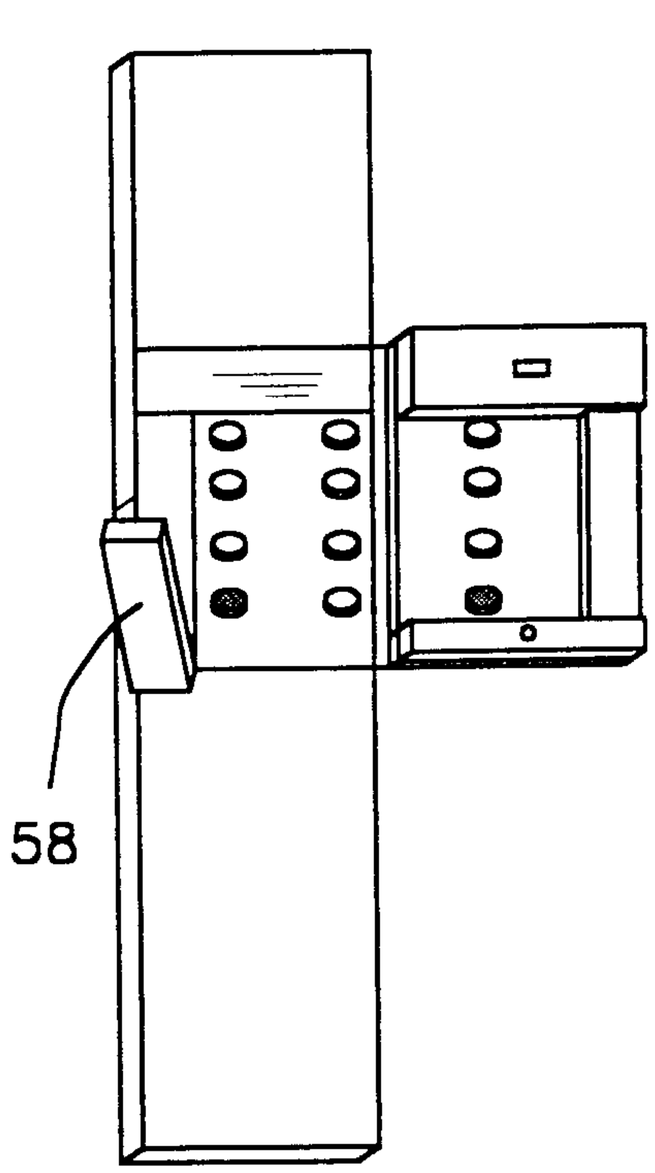

FIG. 15c

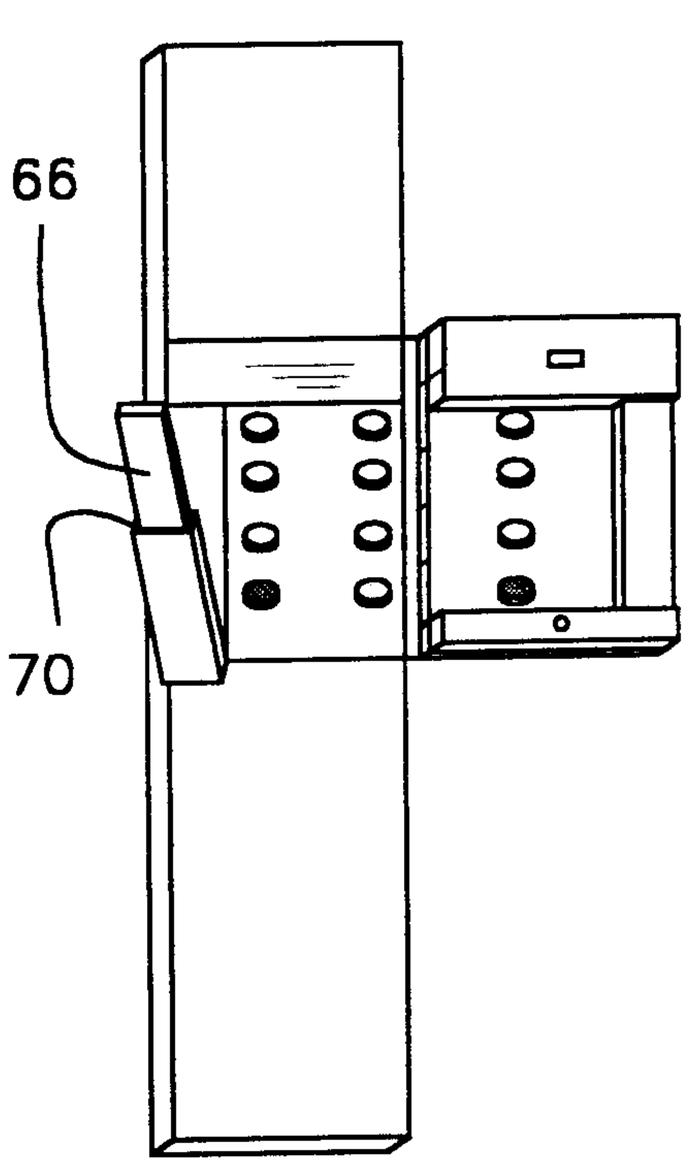

FIG. 15d

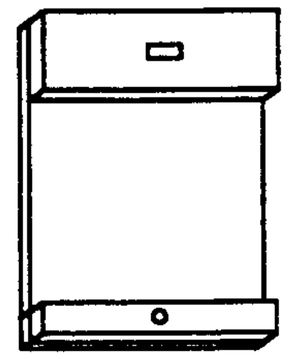

FIG. 15e

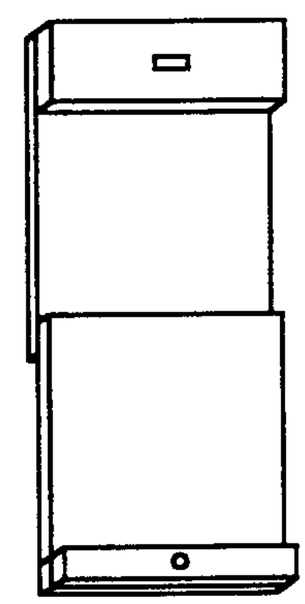

FIG. 15f

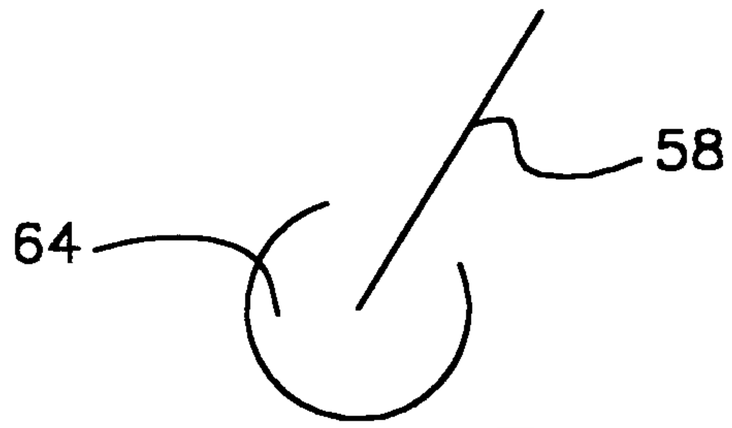

FIG. 15g

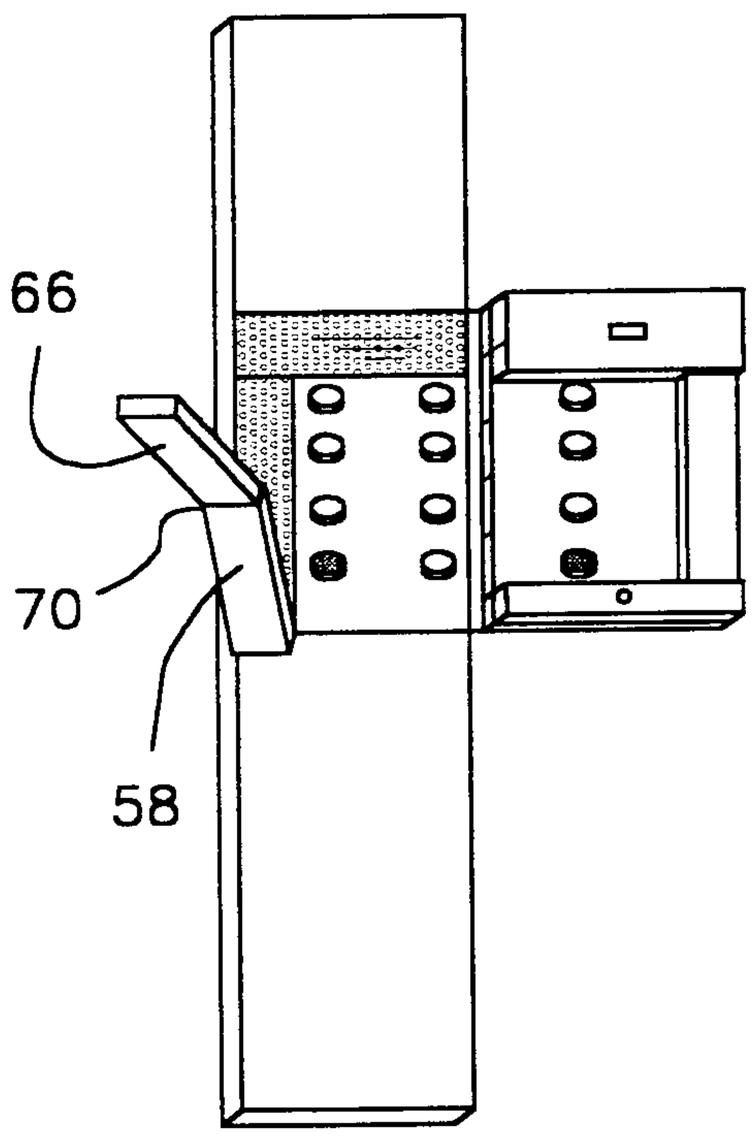

FIG. 16a

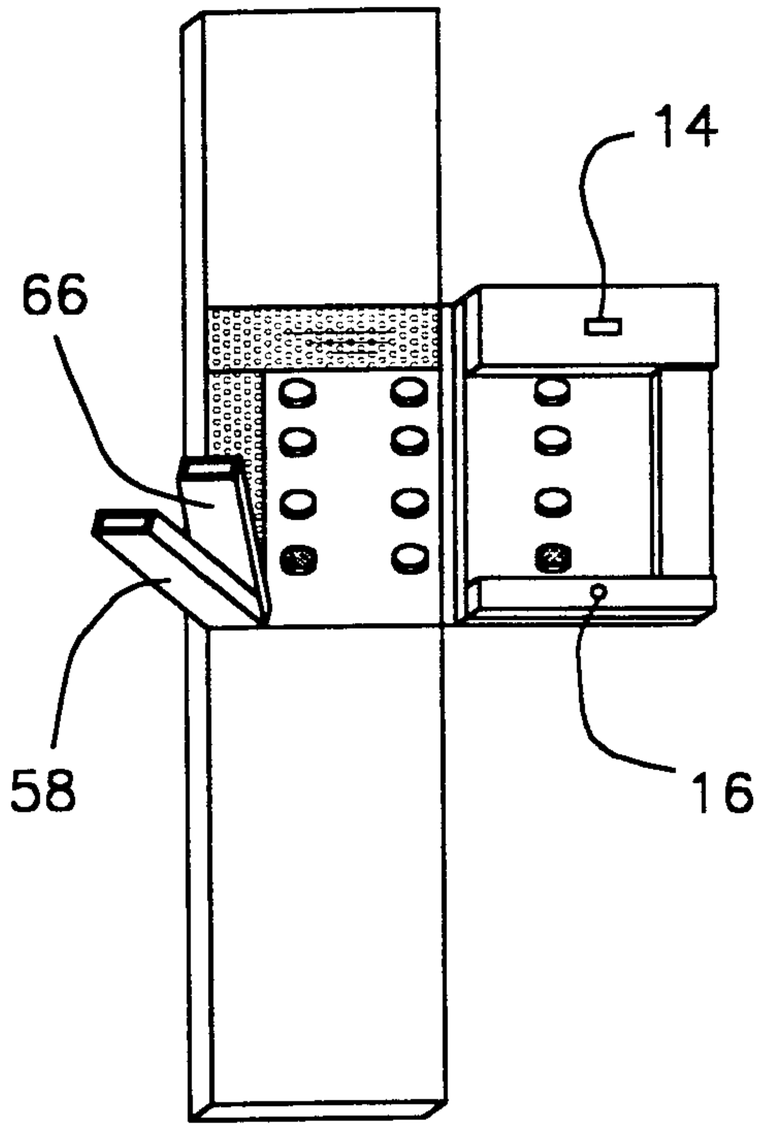

FIG. 16b

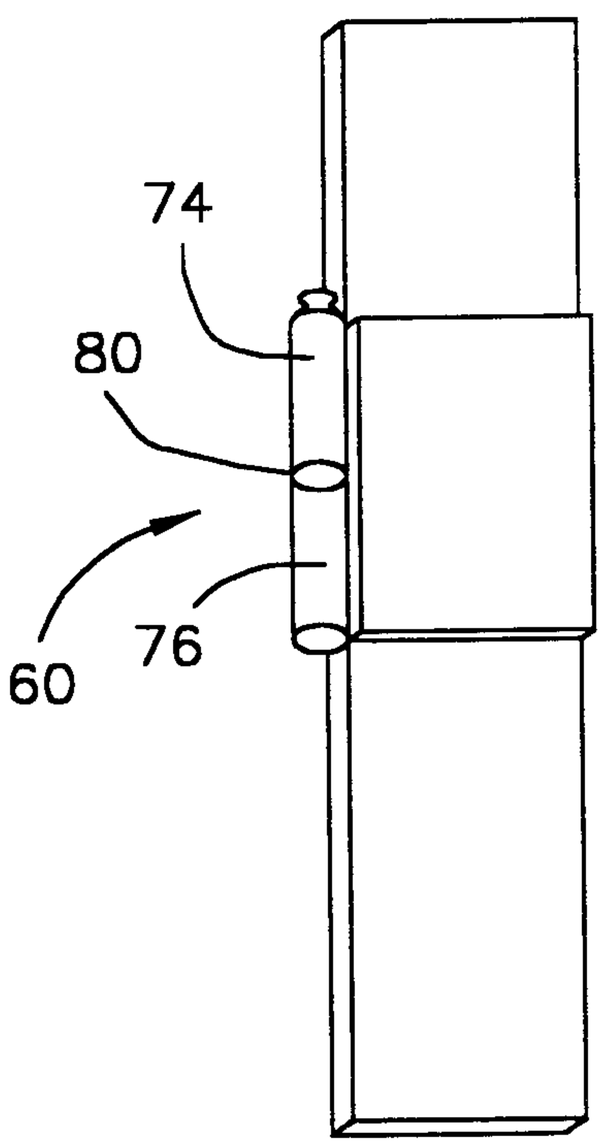

FIG. 17a

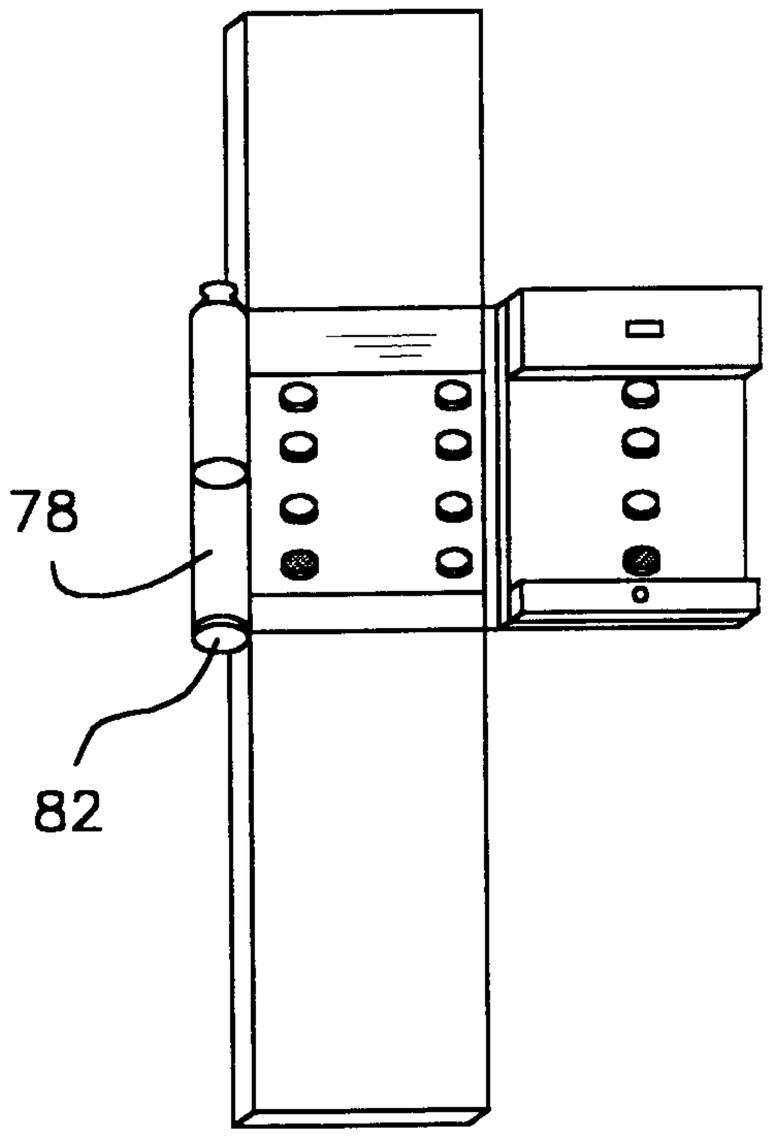

FIG. 17b

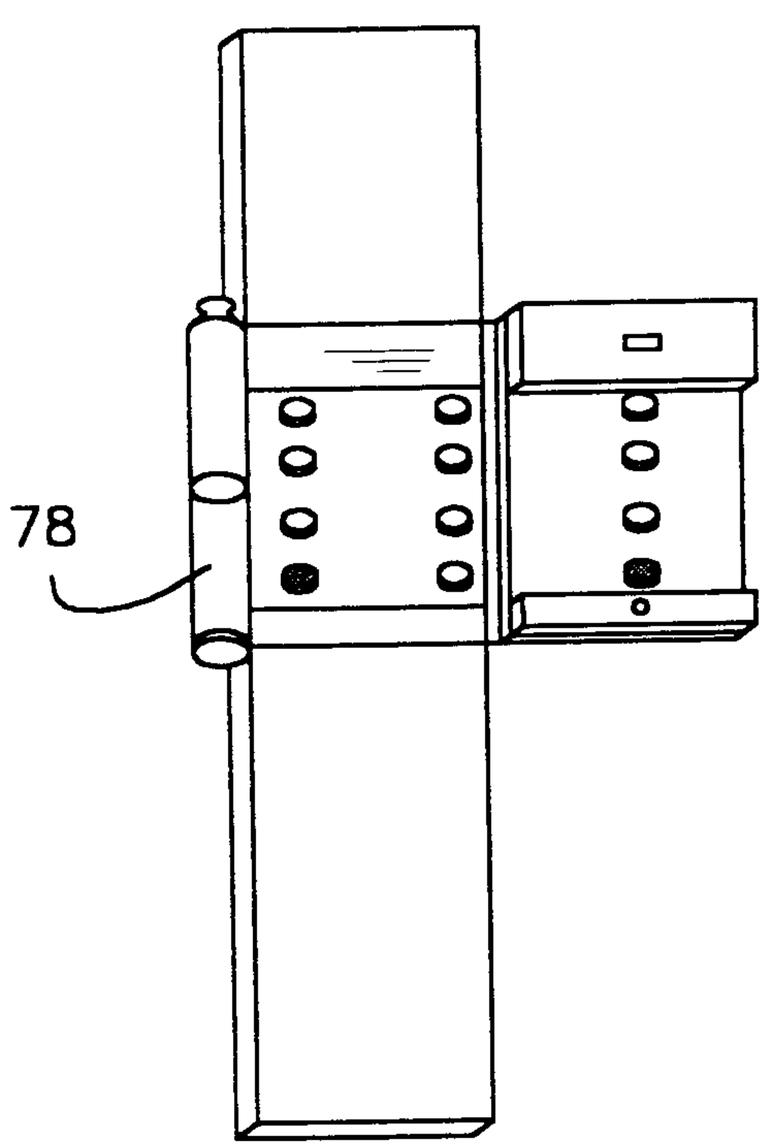

FIG. 18a

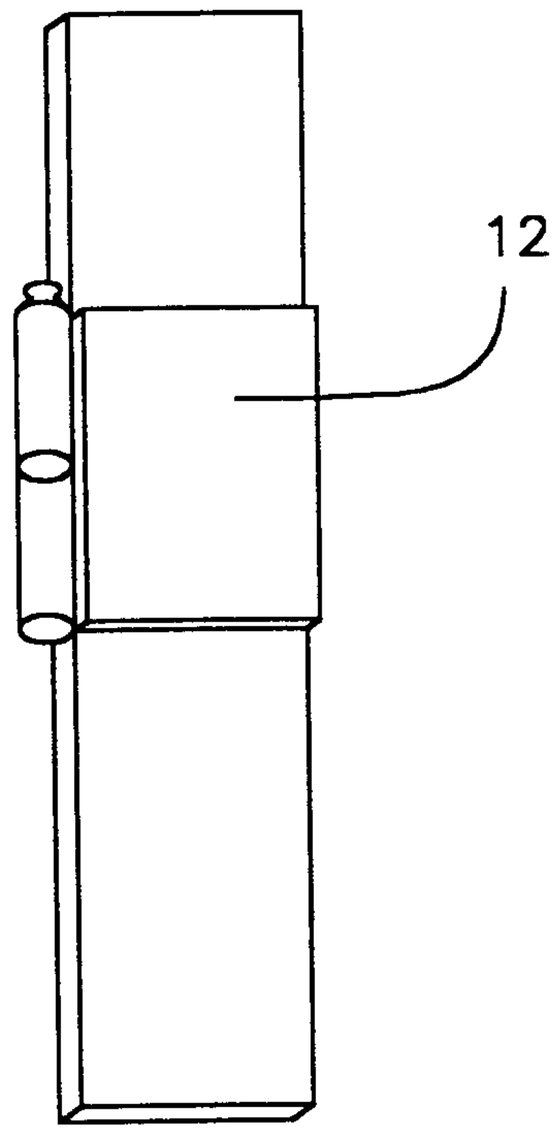

FIG. 18b

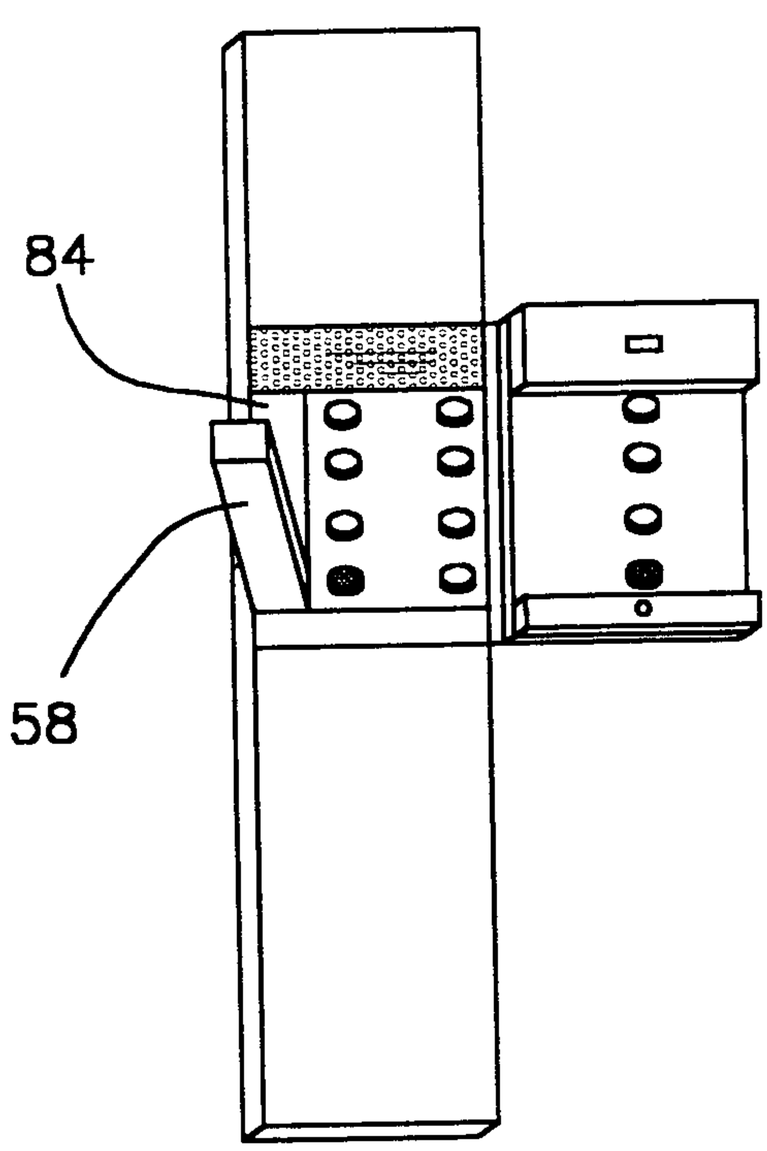

FIG. 19

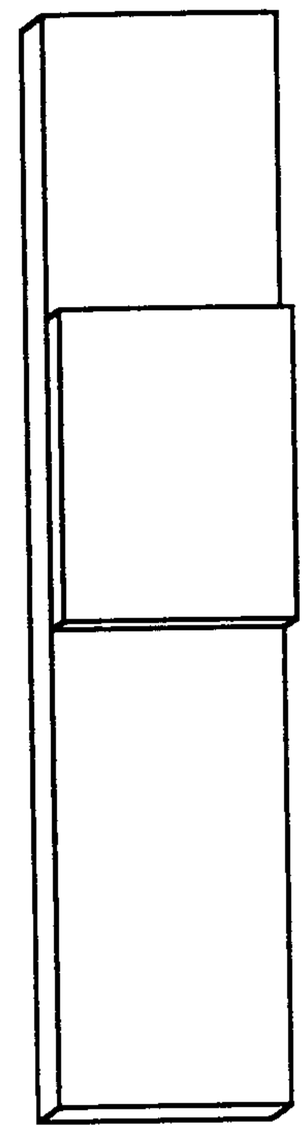

FIG. 20

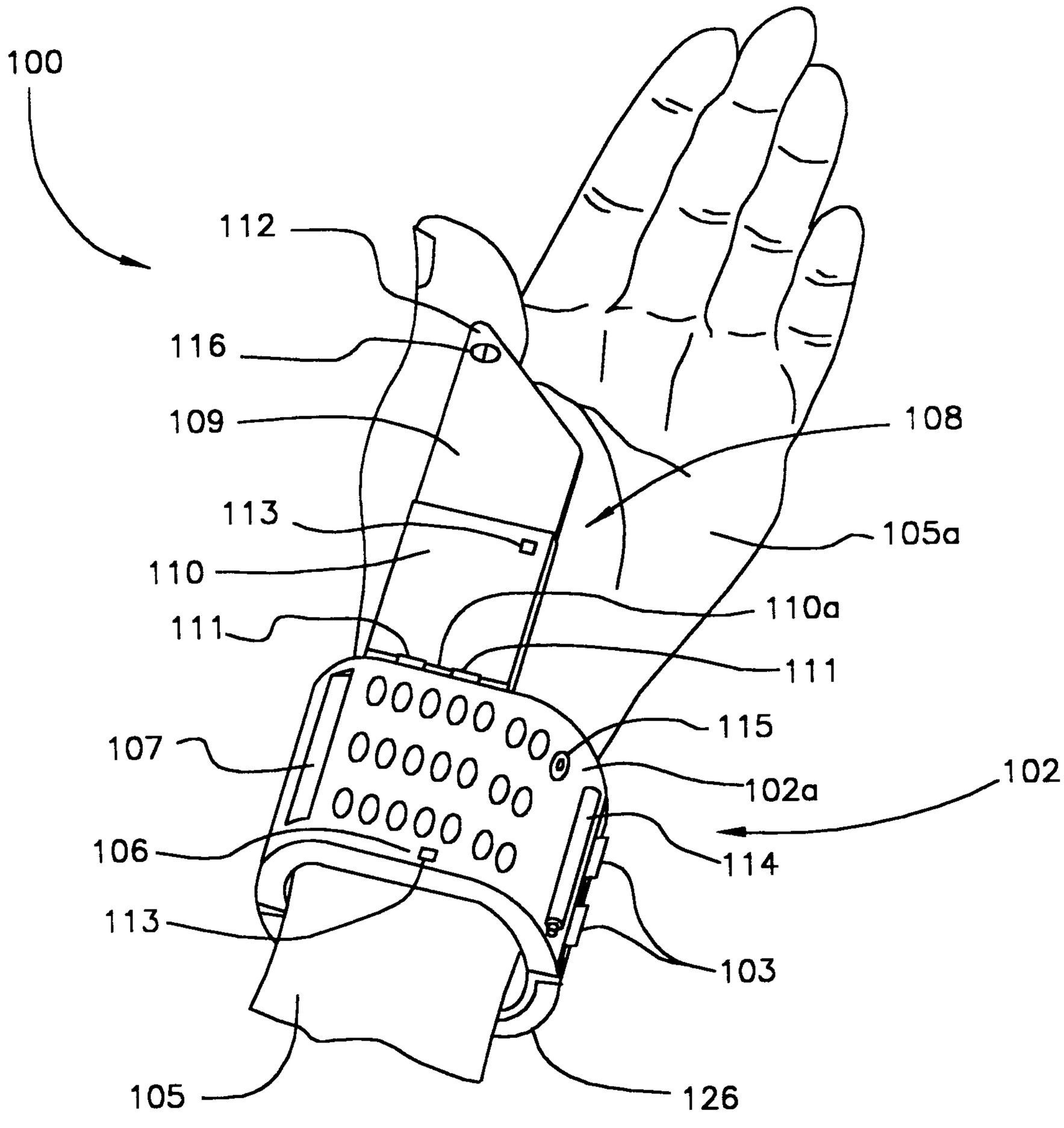
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FIG. 21

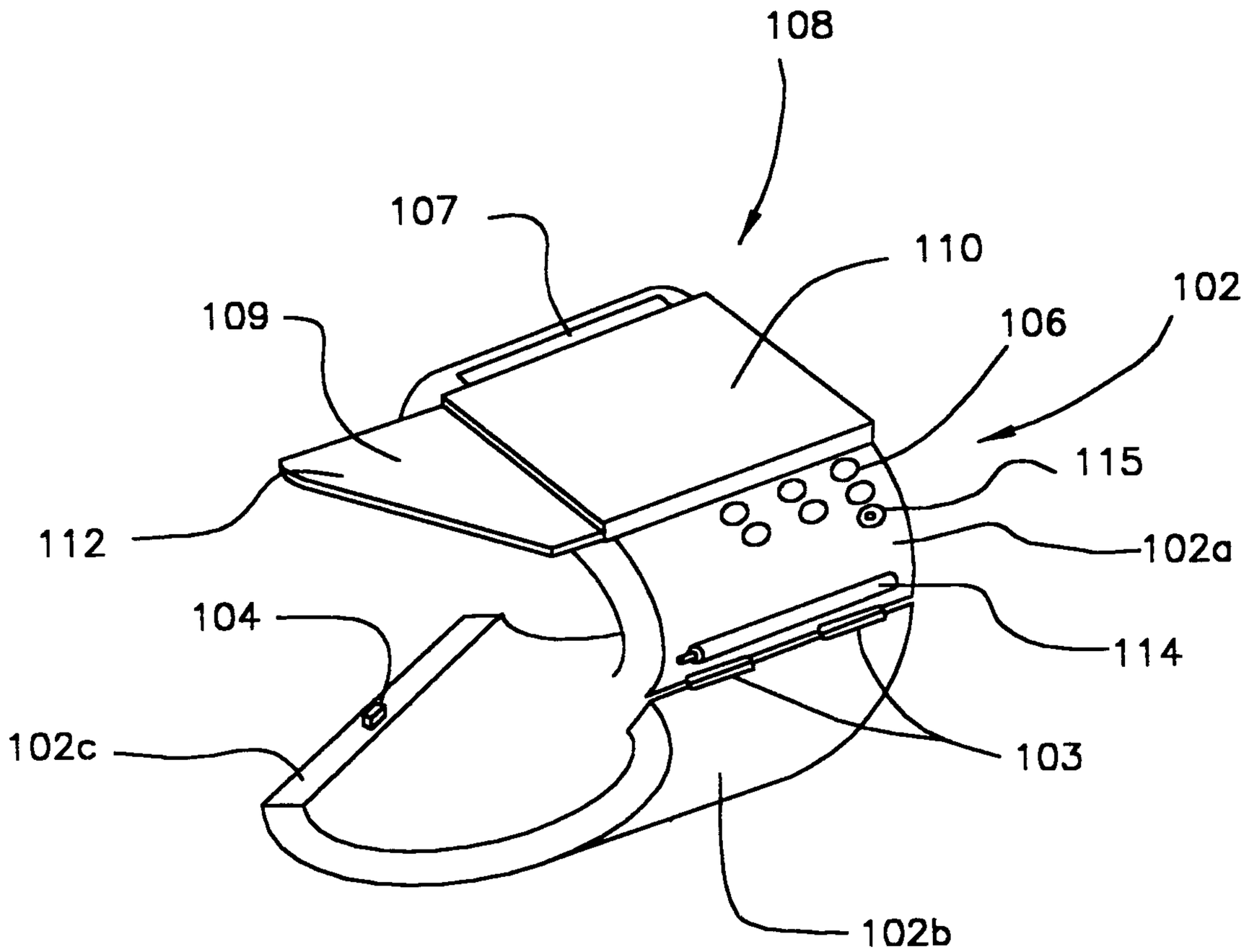


FIG. 22

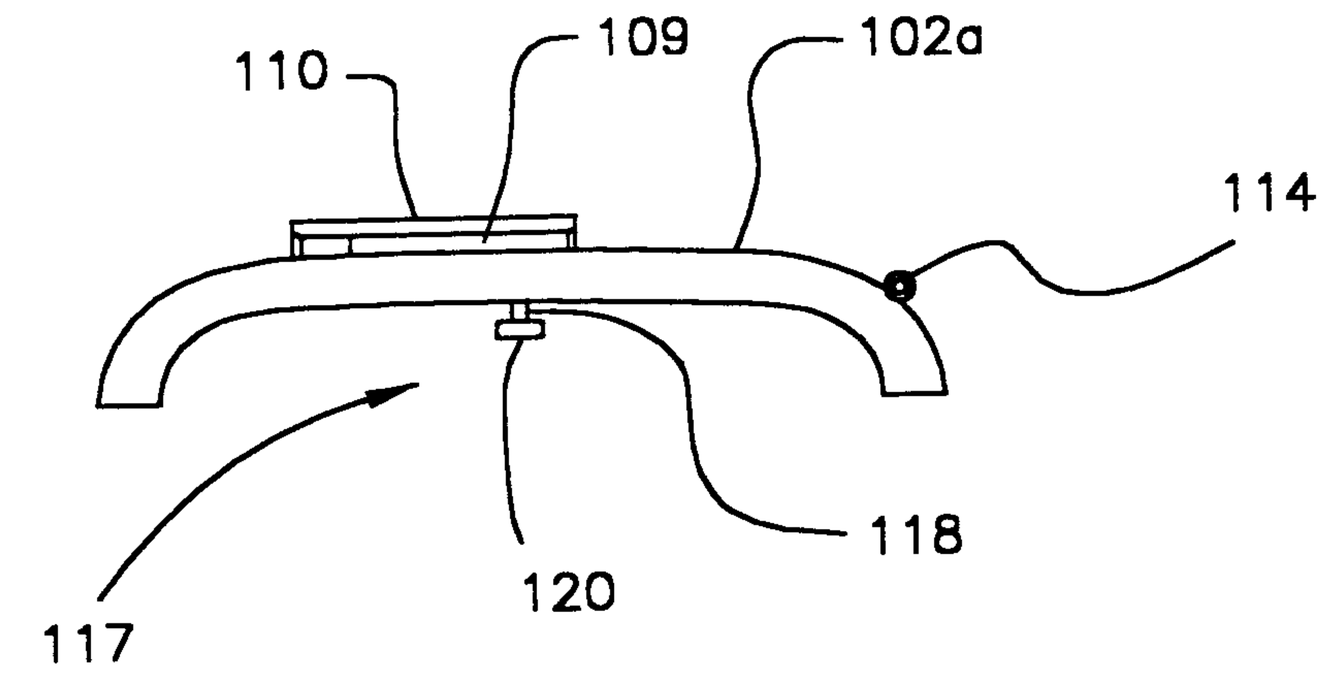


FIG. 23a

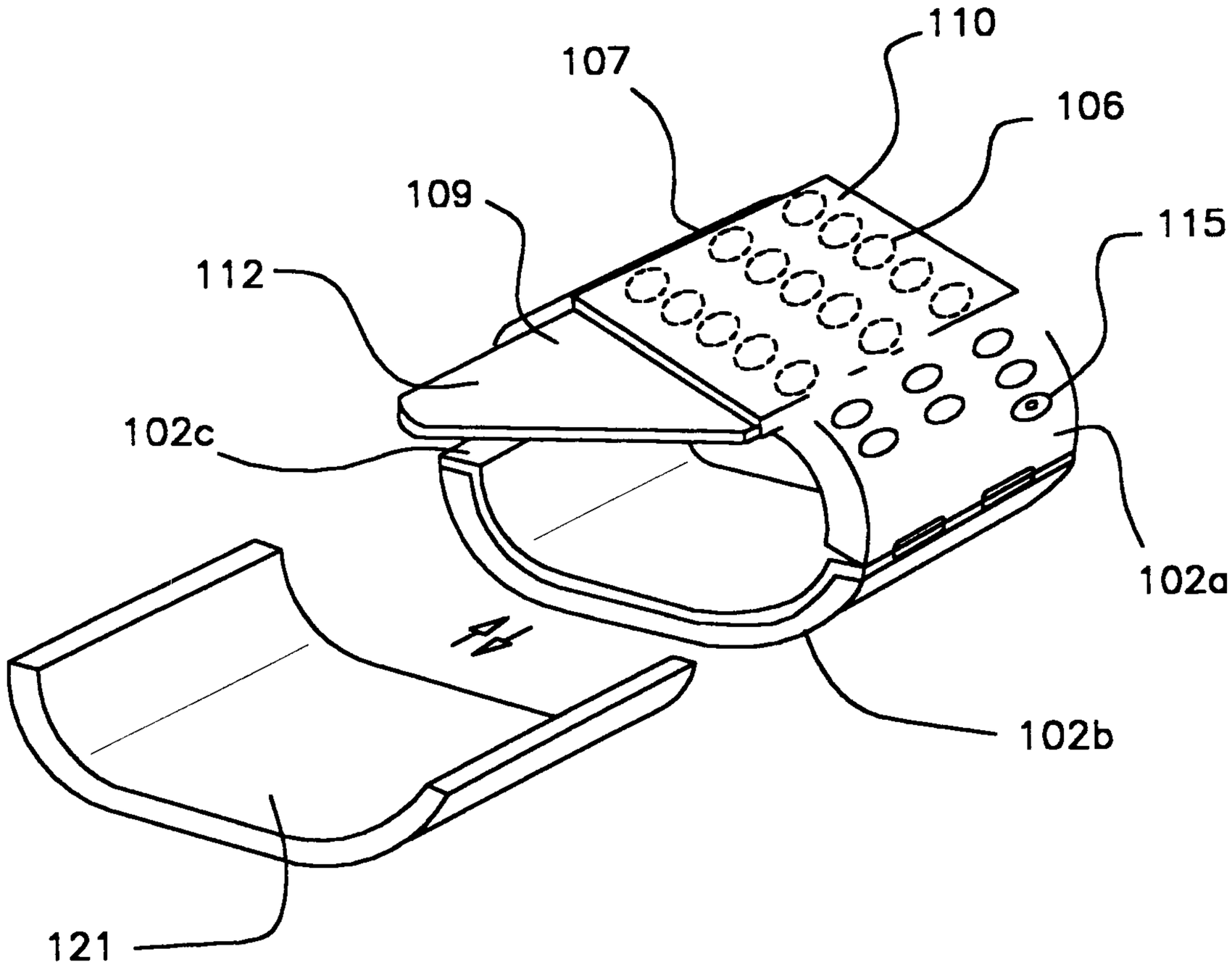


FIG. 23b

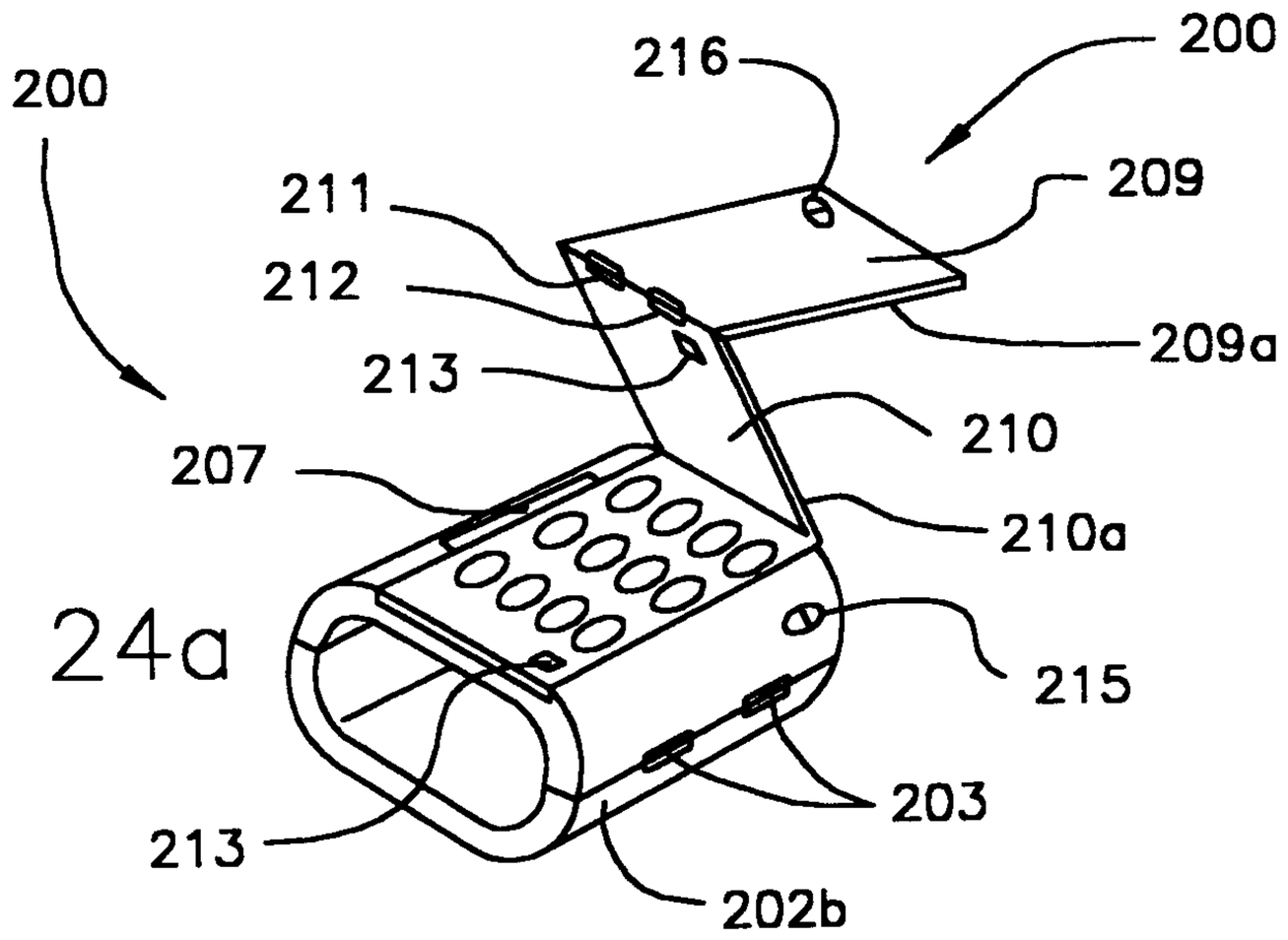


FIG. 24a

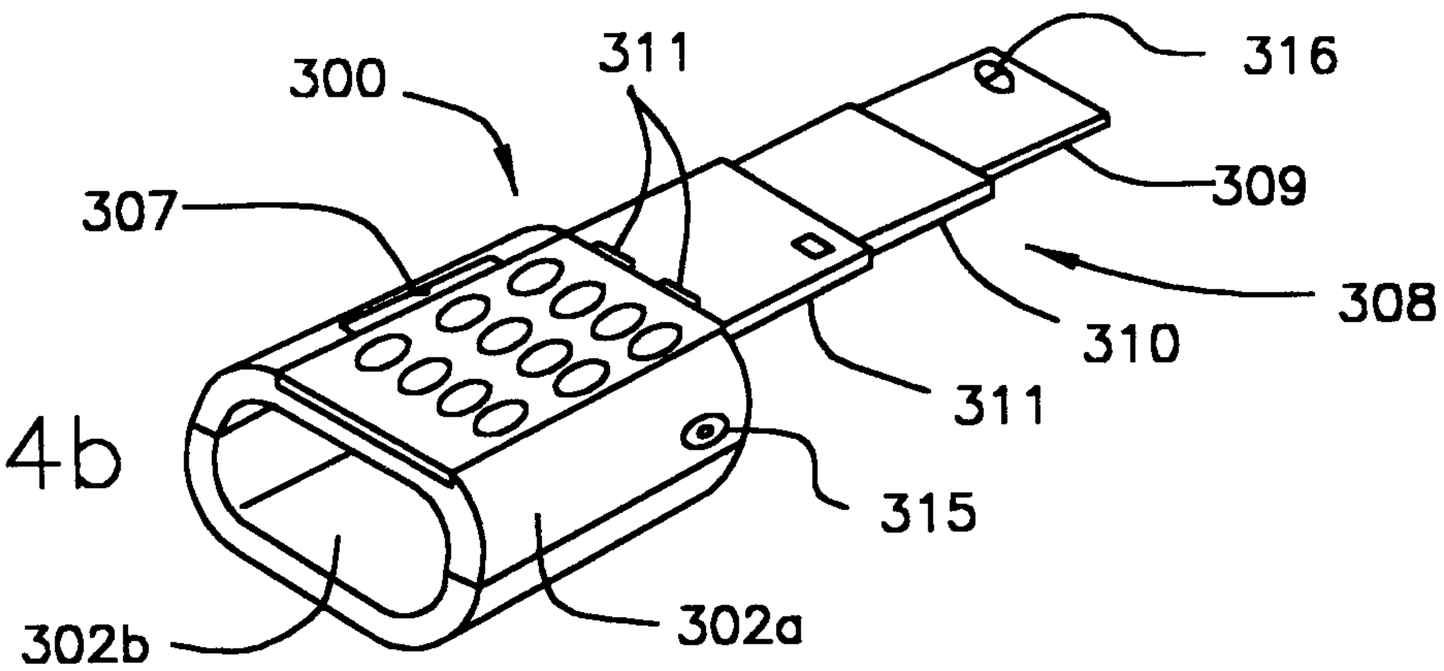


FIG. 24b

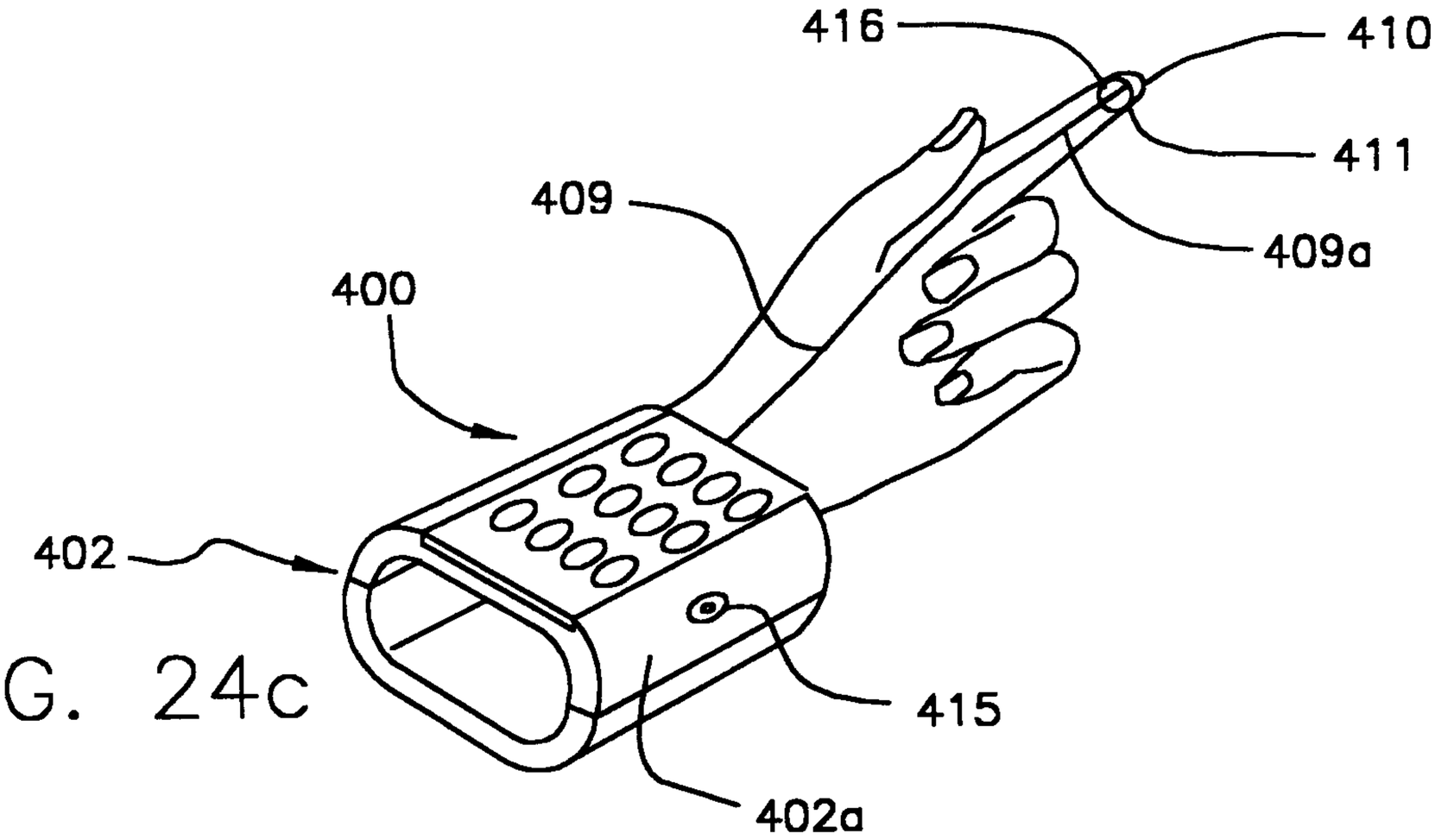


FIG. 24c

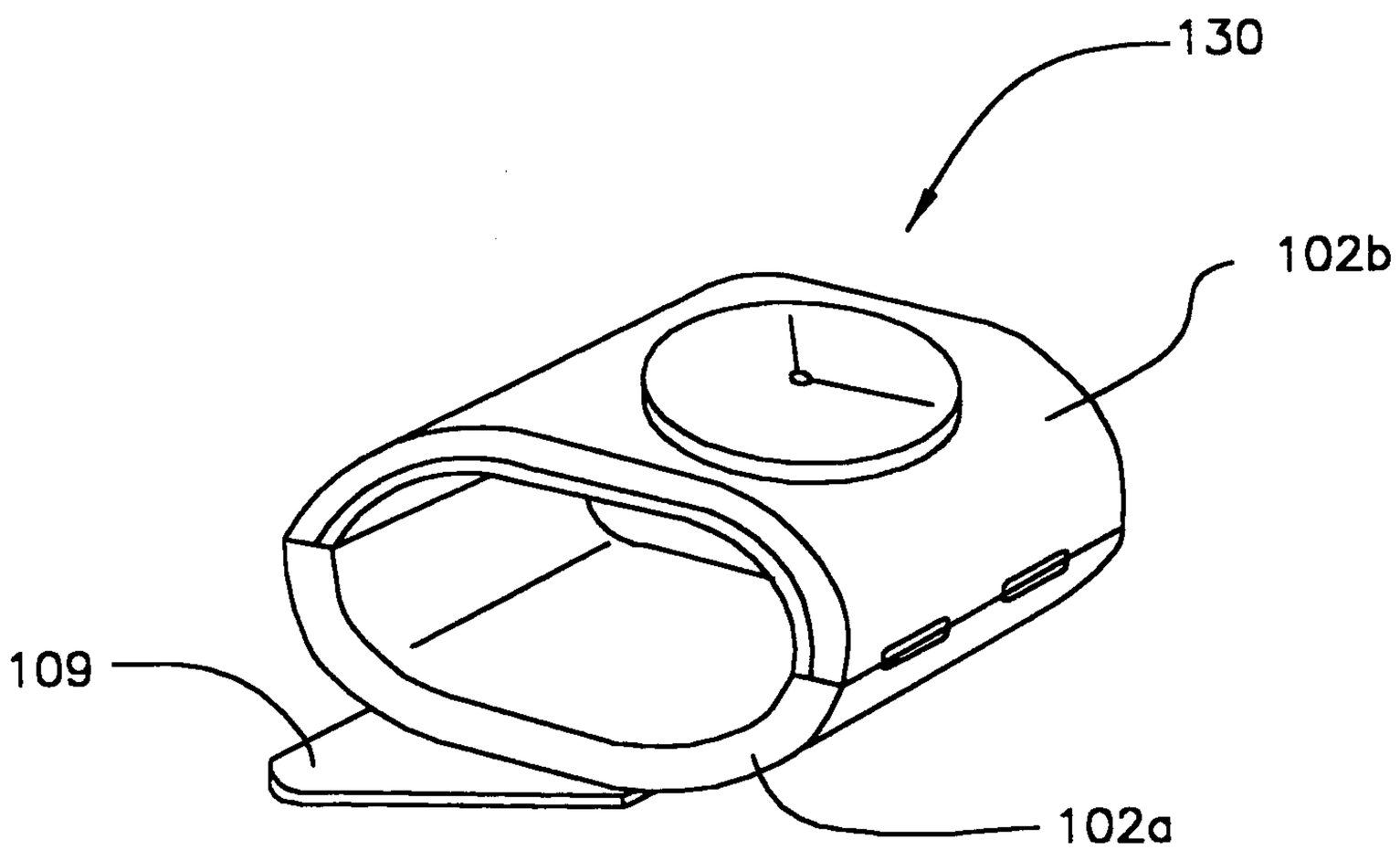


FIG. 25a

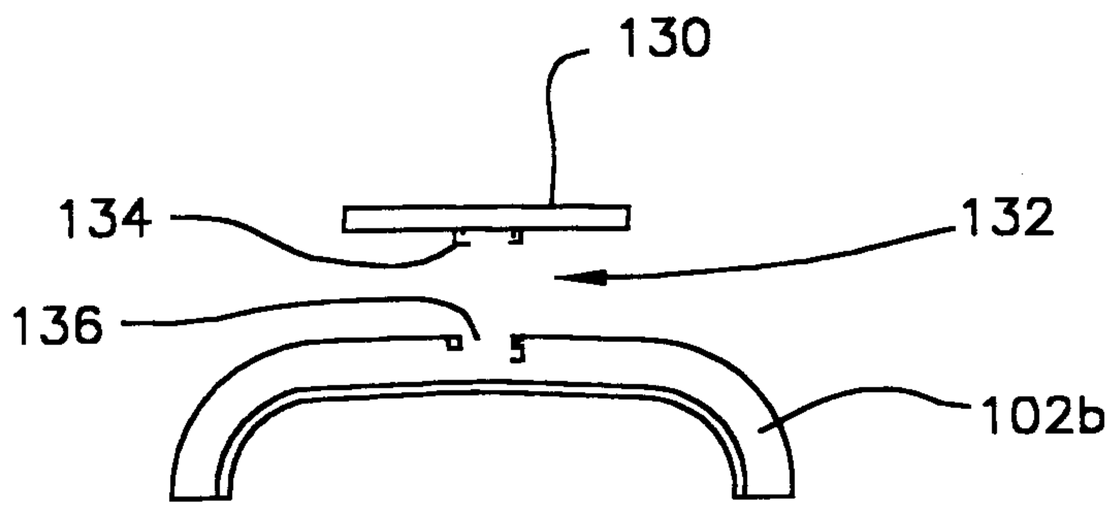


FIG. 25b

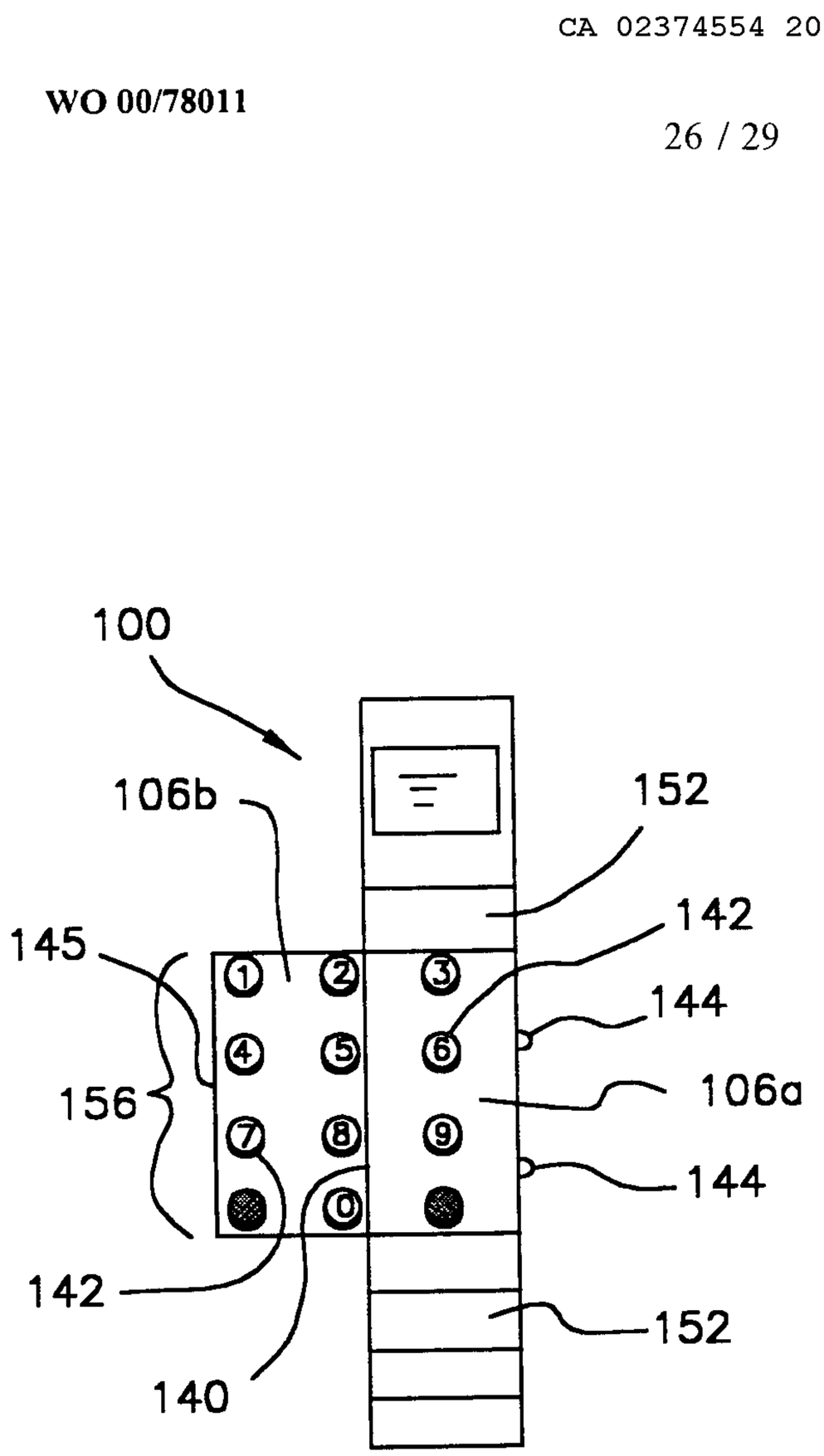


FIG. 26a

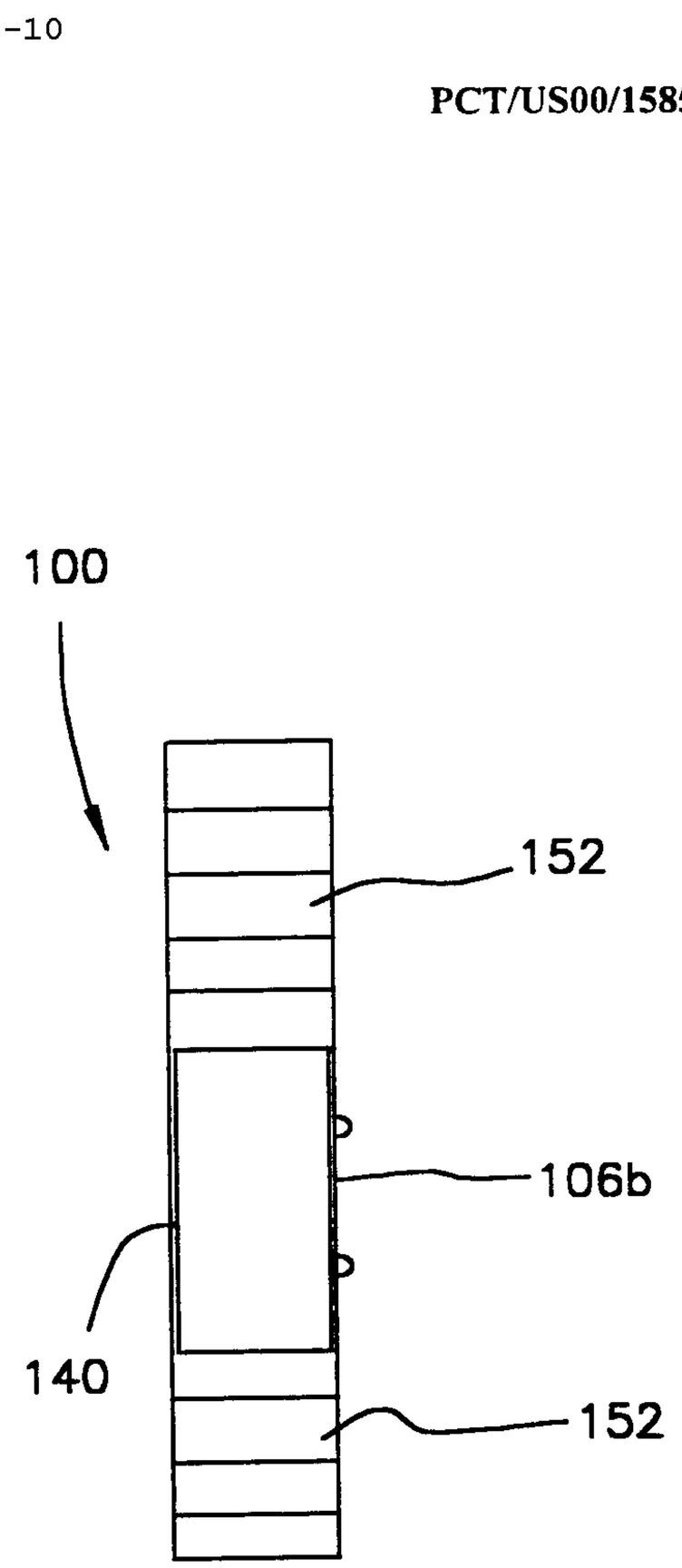
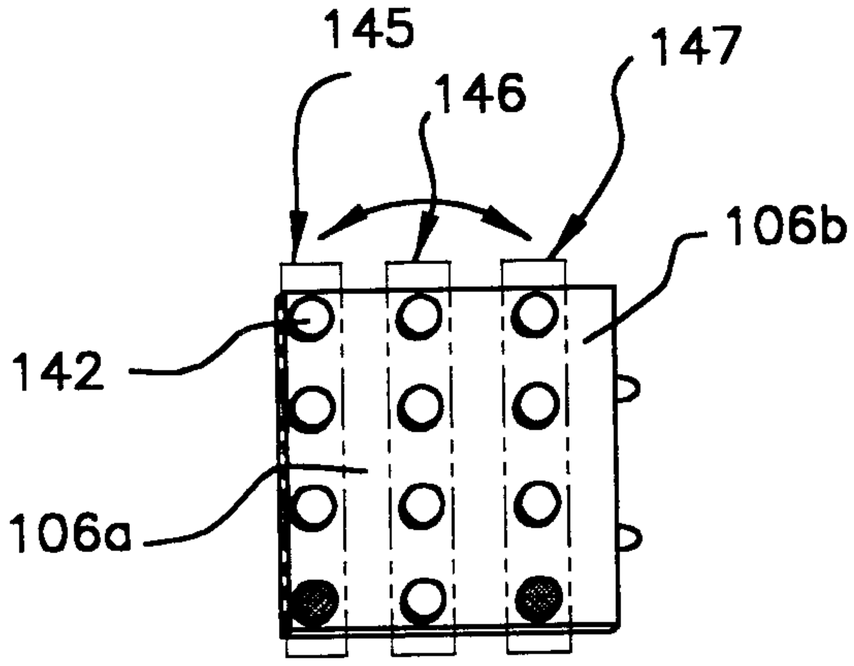
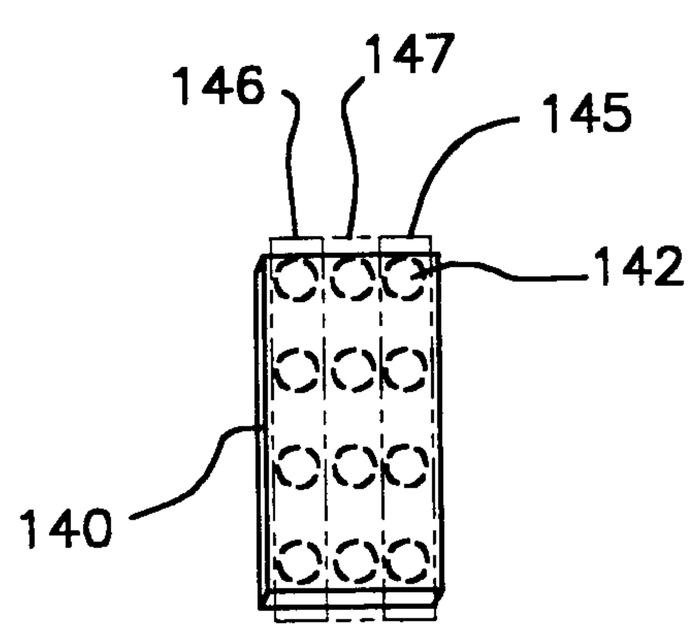


FIG. 26b



OPEN POSITION

FIG. 27a



CLOSED POSITION
VIEW OF INSIDE

FIG. 27b

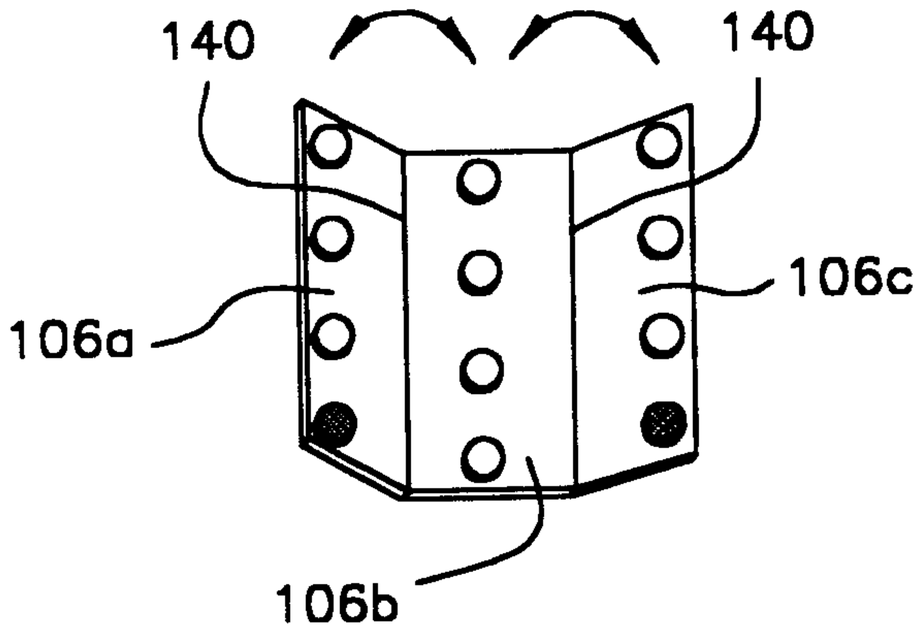


FIG. 28a

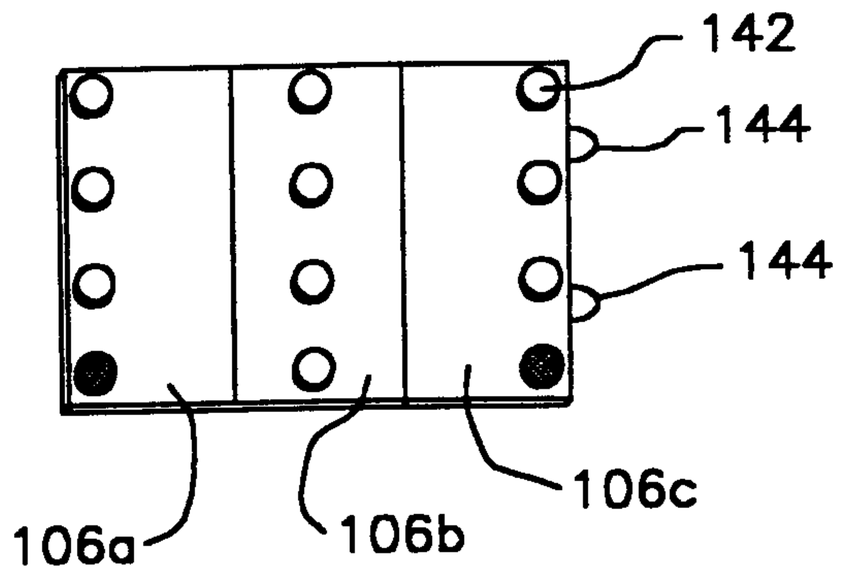


FIG. 28b

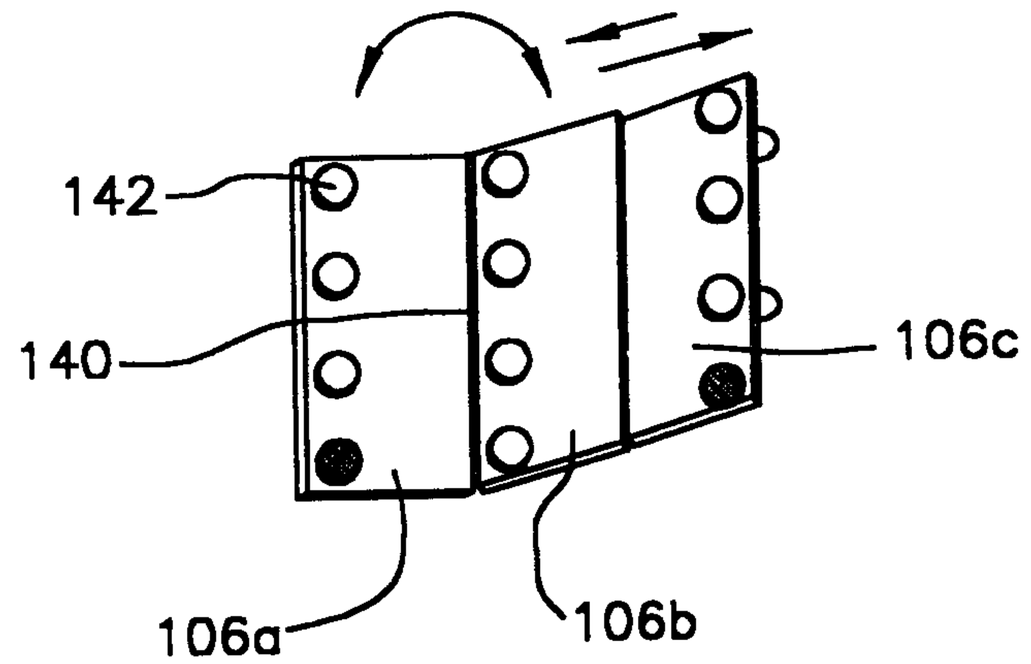


FIG. 28c

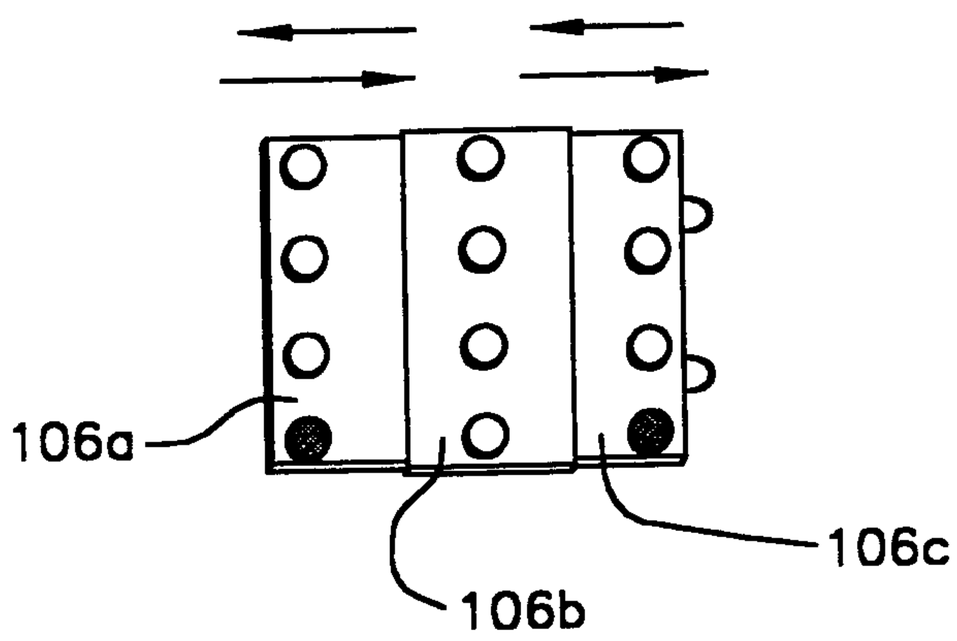


FIG. 28d

FIG. 29a

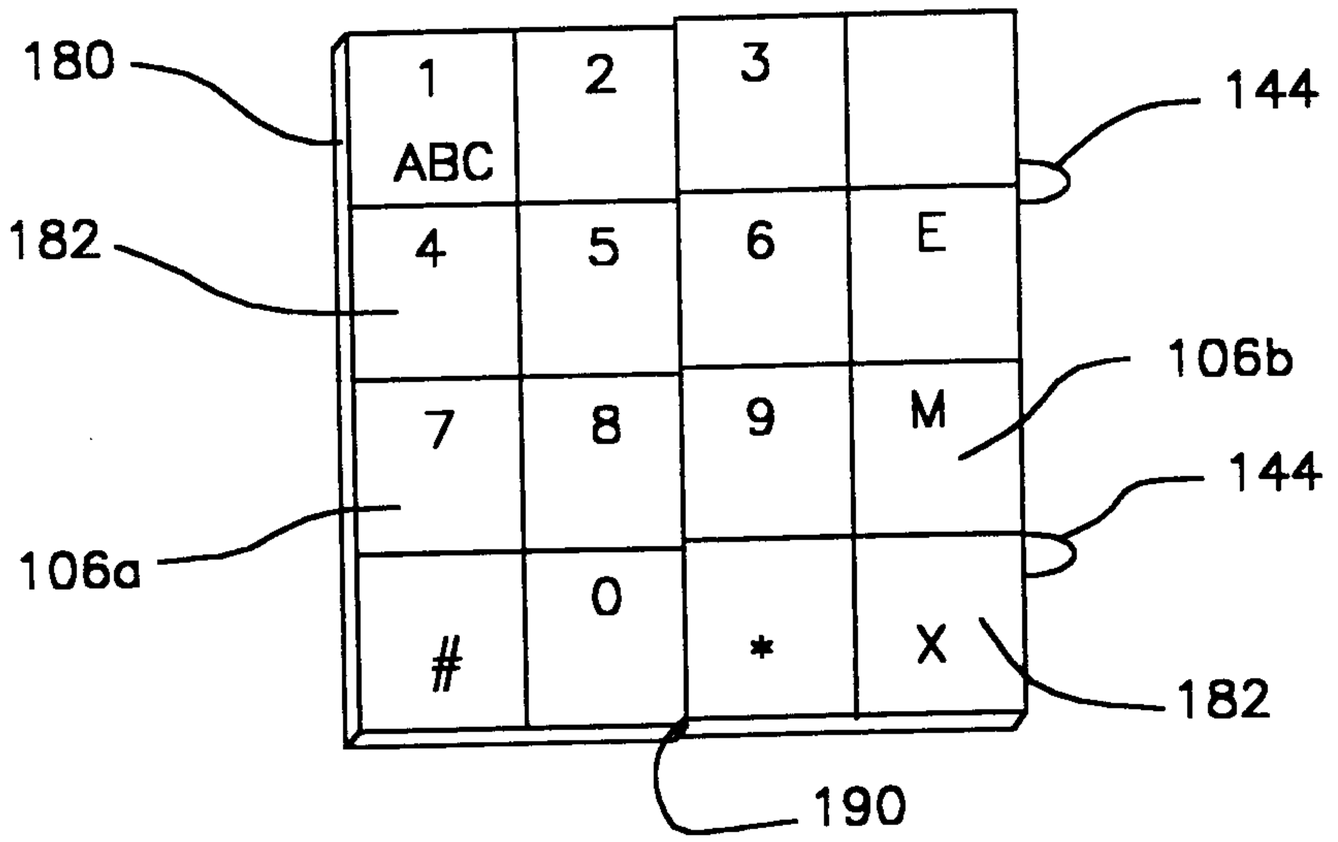


FIG. 29b

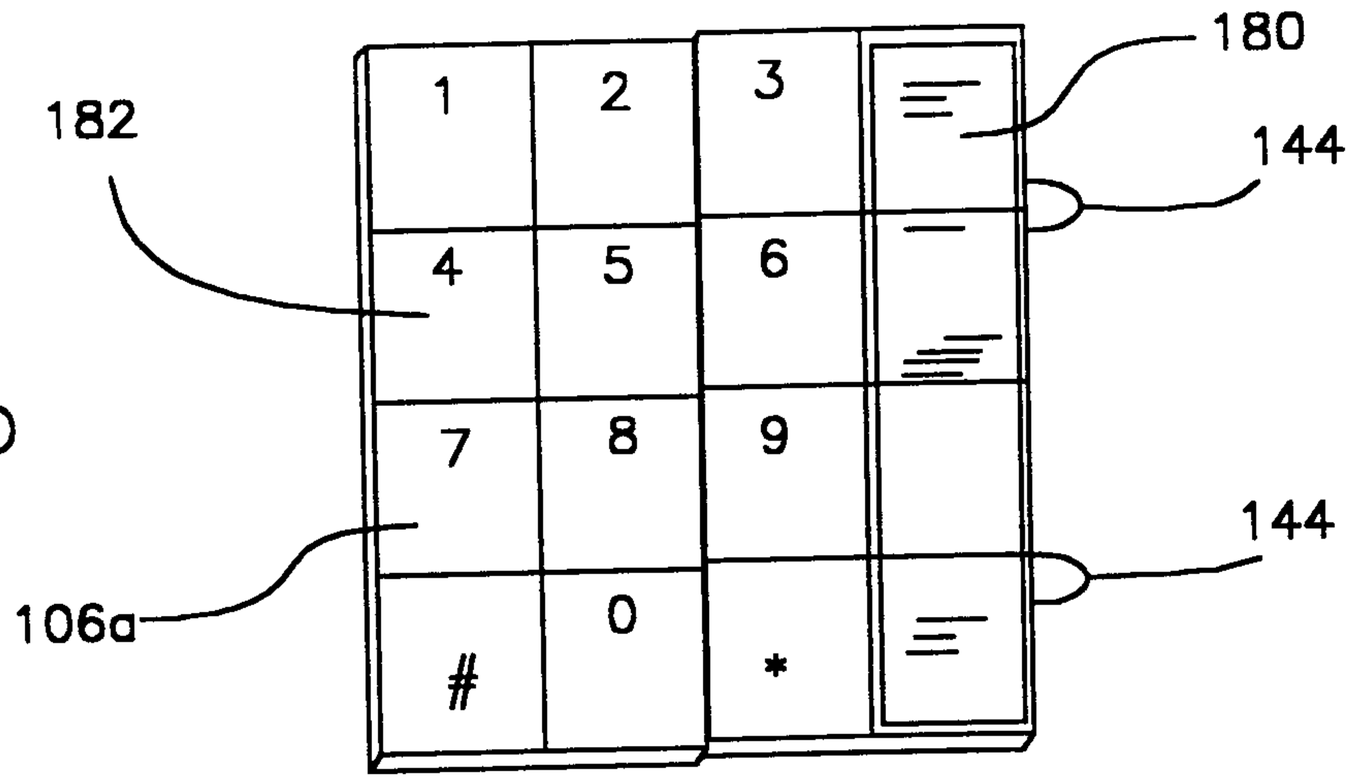
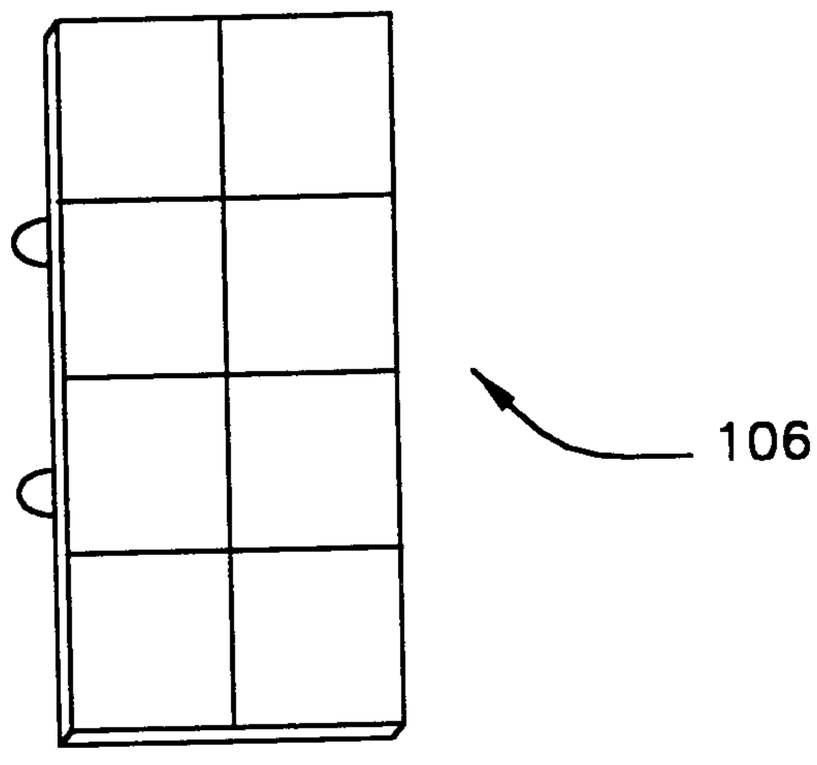
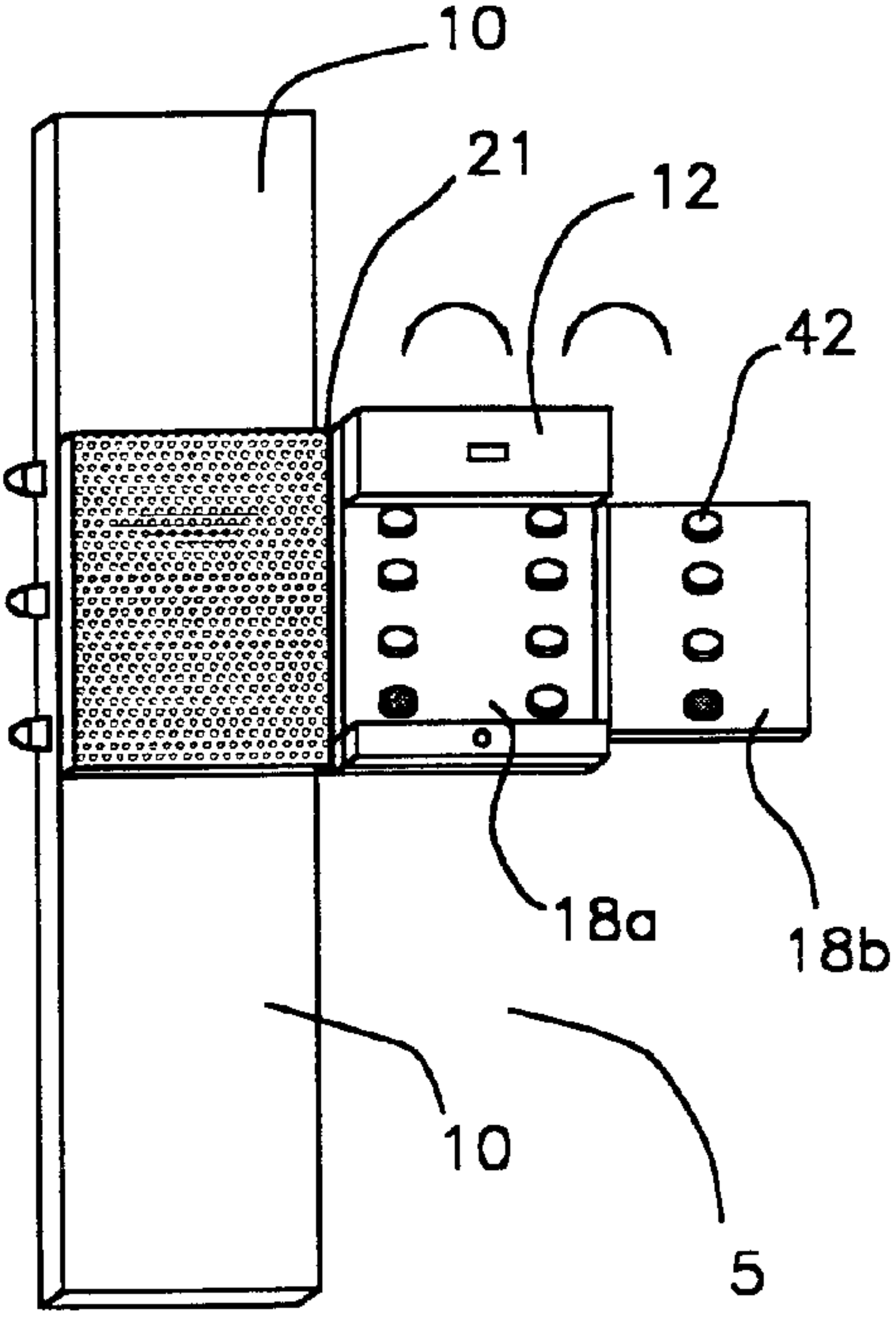


FIG. 29c

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