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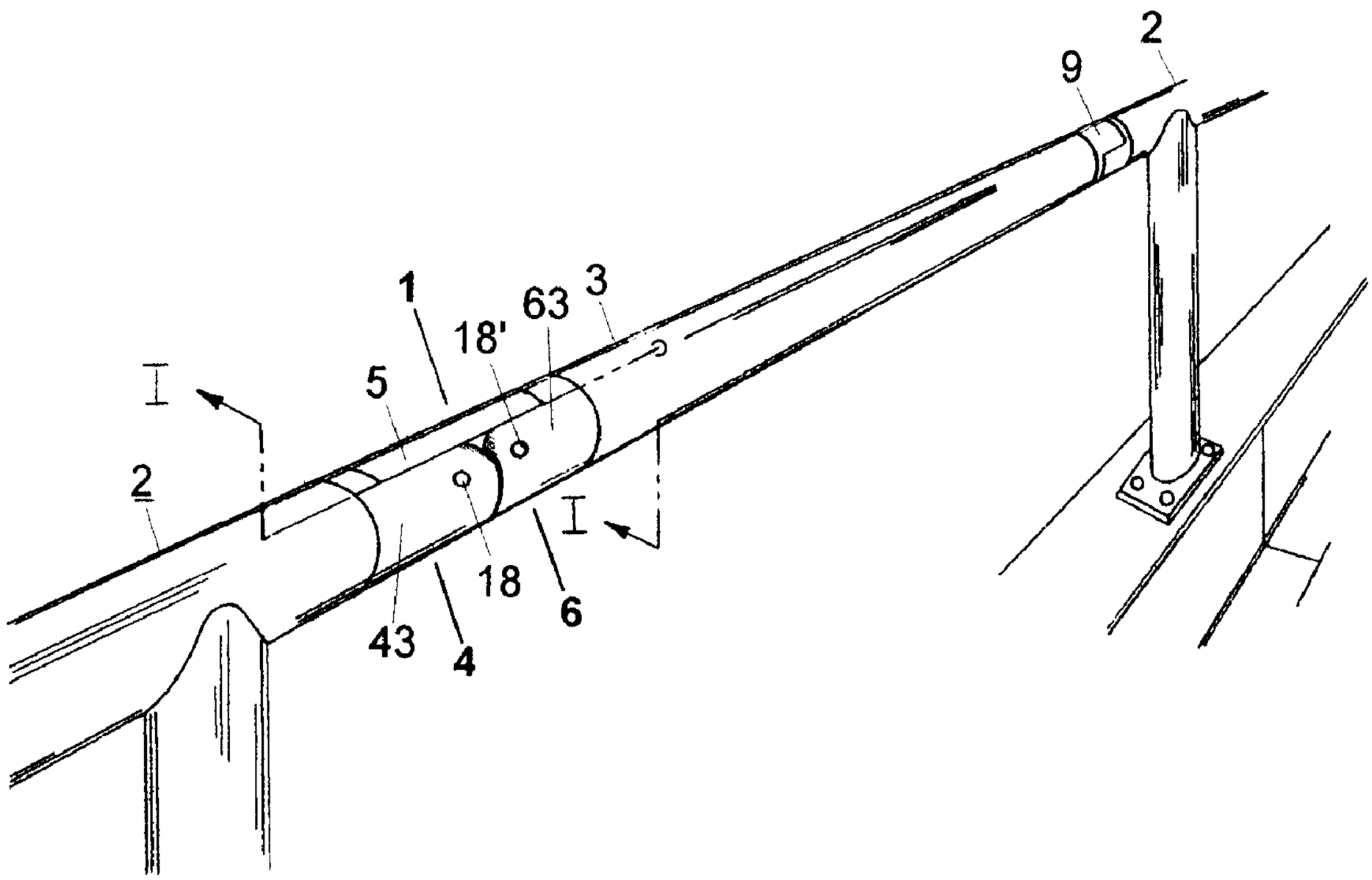

(57) Abrégé/Abstract:
A gate having a gate arm; lock and hinge, for use with a handrail is disclosed. The gate in closed position retains the structural integrity and peripheral profile of the handrail. The hinge consist of two connectors, both pivotally connected to a link by pins. The connectors pivot about the pins, enabling the gate arm to pivot through 180°. The lock includes two mating components, one component having a plug and the other having a socket for receiving the plug. A depressable button secures the plug within the socket. For use with handrails made from tubing, the hinge and lock components includes stubs insertable into the tubing. All components in the closed position of the gate compactly fit together and are shaped to provide peripheral continuity.

ABSTRACT

A gate having a gate arm; lock and hinge, for use with a handrail is disclosed. The gate in closed position retains the structural integrity and peripheral profile of the handrail. The hinge consist of two connectors, both pivotally connected to a link by pins. The connectors pivot about the pins, enabling the gate arm to pivot through 180°. The lock includes two mating components, one component having a plug and the other having a socket for receiving the plug. A depressable button secures the plug within the socket. For use with handrails made from tubing, the hinge and lock components includes stubs insertable into the tubing. All components in the closed position of the gate compactly fit together and are shaped to provide peripheral continuity.

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HANDRAIL GATE, HINGE AND LOCK

FIELD OF THE INVENTION

This invention relates to connections for tubular structures suitable for use as handrails, and more particularly to a hinge and lock that can be attached to a standard handrail to form, together with an arm in the form of a short tubular rail component, a pivotally openable gate that opens and closes the handrail where it is necessary to have a closeable access through the handrail.

BACKGROUND OF THE INVENTION

Usually, handrails consist of horizontally and vertically arranged and connected metal hollow tubes of a selected cross-section, frequently circular. The handrails may be supported on a wall by horizontal mounting posts or may be supported from a floor by posts or stanchions, which are spaced from one another. The stanchions and wall mounting posts are interconnected by lengths of generally horizontal hollow tubing constituting the handrail, but the handrail may also be inclined or vertical along staircases or ladders. Handrails are installed to improve the safety of a specific site and to serve as a support in walking and climbing. In many industrial and civil buildings, handrails are an indispensable installation required by safety regulations.

In some places, it is necessary to make available an opening in the handrail to enable access to an area on the other side of the handrail. In many cases, those openings are simply left free as they do not need to be further secured (for example, when a handrail along a sidewalk is discontinued and restarted again to create an opening for accessing a crosswalk). In other sites, however, such openings reduce the safety of the installation, particularly where a handrail separates two areas situated at different levels. In those cases, it is desirable to secure the opening by creating some barrier or gate so the handrail constantly serves its safety purpose in

its full length, but can be opened when needed.

Such gates within handrails can be commonly found in many manufacturing buildings, in the construction industry and in the marine industry, of which the field of recreational yachting is important. When an opening in the handrail is essential for a staircase, construction elevator, permanent ladder, or for boarding a vessel, some previous rather unsatisfactory designs for an openable section of the handrail that would maintain the structural integrity of the handrail have been proposed. It is desirable that any gate when closed, form an essentially uninterrupted continuum with the adjoining portions of the handrail, so that one's hand can pass along the gate and adjoining railing without impediment, and so that little or no risk of catching a glove or a sleeve occurs when gripping the railing in the gate portion or adjoining portions. It is further desirable that the gate be secure when closed. It is further desirable that all connecting parts, such as hinges, clasps and locks, be simple, reliable, easily manufactured, and strong enough for the purpose. Unfortunately, previously known gate arrangements have fallen short of one or more of these objectives.

In the industry, closing of a gate providing a temporarily open section of a handrail is typically achieved by mounting a simple hinge at one side of the gate bar or tube. The hinge connects one end of the stationary handrail with a sectional pivoting arm constituting the gate bar or tube, usually moving in a ninety degree angle. The arm is long enough to reach the other side of the temporary opening in the handrail, where it is usually received by a mating saddle-type receptacle attached to a horizontal part of the adjoining stationary handrail. Because the closed pivoting arm is not secured or locked by any means, but simply rests in the saddle and can be accidentally opened by bumping into it from the bottom, the gate constitutes a potentially hazardous section of the handrail. In addition, the hinge attachment, which represents the only means of permanent connection of the arm, can be easily damaged when a force is applied to the closed pivoting arm from its side.

To prevent accidental opening of such a conventional gate, holes are often drilled through the pivoting arm and through the handrail saddle, and removable bolts

or pins are inserted into the holes to ensure that the closed arm does not open by accident nor move when a generally horizontal force is applied to it. However, obtrusive elements, such as exposed bolt heads and pins, reduce the overall safety of the handrail, as they can cause hand injuries when a person suddenly grips the handrail. Accordingly, although the conventional design of the mountable pivoting arm is advantageous to a limited extent, the methods of attachment and locking of the arm to the stationary handrail present potential opportunities for improvement.

For marine use, and typically in the construction of handrails for recreational yachts and the like, openings in the handrails, if secured at all, are commonly secured by mounting a stainless steel chain and hook, or a plastic coated stainless steel wire cable and hook, to stanchions or posts or terminating stationary rail elements at the ends of the opening. Alternatively, movable wooden handrail gates with protruding conventional hinges and expensive hardware may span the opening. Devices such as cables or chains do not retain the structural integrity of the boat handrail and are not safe in harsh weather conditions. Additionally, for yachting use, the overall aesthetic appearance of the handrail structure is an important issue, and current designs of hook and cable do not entirely satisfy the expected demands of boat owners for aesthetically pleasing designs.

Therefore, despite the obvious need for a safe and convenient handrail gate design, there has not heretofore been any completely satisfactory solution to the problem of providing a simple gate section in the handrail that would retain the structural integrity of the original handrail and at the same time be both aesthetically pleasing and safe.

It is apparent that the objectives of structural integrity and aesthetic appeal can be met by providing a handrail gate having the same cross-section as the stationary portion of the handrail. The problem is to provide a hinge on one end of the gate and a lock at the other end of the gate that maintain a uniform cross-section throughout the handrail when the gate is closed, even at points of connection. Such hinge and lock should be inexpensive, safe, easy to manufacture, install and use, aesthetically pleasing, durable and solid enough to resist occasional impacts

accidentally caused by users without being displaced or sufficiently damaged to interfere with satisfactory operation.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a combination of a hinge and lock for interconnecting a standard tubular handrail (typically but not necessarily made of round tubing) with a pivoting arm to form a gate within the handrail that retains the structural integrity of the original handrail, and is safe and aesthetically pleasing.

Another object of the present invention is to provide a hinge and lock mountable on or connectable to a standard tubular handrail and on or to a mating pivotable gate arm, that are easy to manufacture, install and use, and that are at the same time durable and reliable.

Another object of the present invention is to provide a hinge as aforesaid that enables pivoting of the gate arm through an angle up to about 180°.

Another object of the present invention is to provide a gate lock as aforesaid that when in the closed position resists longitudinal tensional forces across the gate opening.

The hinge and the lock of the present invention can be used independently of one another.

The hinge and the lock of the present invention are substitutes for the hinge and lock described in Applicant's previously filed Canadian patent application Ser. No. 2,314,839 , filed on 2 August 2000. For convenience of description, some of the content of Applicant's previously filed Canadian patent application is repeated in this application.

The hinge and lock may be installed and used in various orientations, but for ease of explanation in this specification, including the claims, the hinge and lock are referred to as if they are in the closed position when installed on a horizontal handrail. More particularly, the following words have the following meanings:

1. "longitudinal" refers to movement and directions substantially parallel to the longitudinal axis of the handrail and gate arm when the gate arm is in the closed position; and

2. "lateral" refers to side-to-side movement and directions, that is, those that are substantially horizontal and substantially perpendicular to the longitudinal axis of the handrails and gate arm when the gate arm is in the closed position.

The gate according to the invention is particularly suitable for use with an elongate handrail or the like that has one or more open gateways that need to be locked (latched) closed from time to time. Each gateway exists between two spaced terminals of the handrail, one terminal on either side of the gateway.

Preferably, the gate includes a pivotable gate arm, preferably having the same profile in cross-section as the handrail, and pivotally movable from a closed locked position to a fully open position at which the gate arm lies next to the adjoining stationary handrail. Even though the gate arm itself may be substantially uniform along its length or at least longitudinally symmetrical, the two ends of the gate arm may conveniently be referred to as the gate hinge end and the gate lock end, since one end of the gate arm is fastened to a hinge for hingedly connecting the hinge end of the gate arm to one terminal, conveniently referred to as the handrail hinge terminal, and the other end of the gate arm is fastened to one component of a two-component lock. The other lock component is fastened to the other terminal of the handrail, conveniently referred to as the handrail lock terminal. The two lock components matingly engage one another as the lock end of the gate arm moves into alignment with the lock terminal of the handrail.

The two lock components are respectively provided with mating components

of a lock that is operative to releasably secure the gate arm to the handrail when the lock end of the gate arm is aligned with the neighbouring lock terminal of the handrail, and the mating lock components have come into engagement with one another. A release means such as a depressable projecting button is provided for releasing the two lock components from one another after they have locked together.

The lengths of the gate arm and of the hinge and lock components are selected so as to provide a substantially uninterrupted continuum of the entire handrail structure (including the gate arm), when the gate arm is in the closed position. To optimize the structural continuity, the peripheral profile of the hinge and of the lock components are selected to be identical to or at least to merge with the peripheral profile of the gate arm and the handrail.

Handrails are typically made of hollow tubing. Round tubing is the most common and generally the least expensive to manufacture. According to the preferred embodiment of the invention, the hinge and lock components are provided with stubs insertable into the tubing, preferably in a tight fit or at least a snug fit. Auxiliary securing means are also preferably provided to fasten the hinge and lock elements in place during normal use.

In accordance with the present invention, there is also provided a lock having two mating elements referred to herein as the active lock component and the passive lock component. The active lock component has a plug that projects substantially perpendicular to the longitudinal axis of the handrail or gate arm, as the case may be, to which it is attached when the active lock component is installed. The passive lock component has a socket sized and shaped for receiving the plug. The socket has longitudinally-extending side walls so as to impede lateral movement of the active lock component relative to the passive lock component when the plug is in the socket; and a laterally-extending end wall so as to impede longitudinal movement of the active lock component relative to the passive lock component when the plug is seated in the socket.

The lock includes means for releasably securing the plug within the socket so

as to releasably secure the passive and active lock components one to the other. Preferably, the means for releasably securing the plug within the socket comprises a depressable button projecting from the plug and a hole in the socket through which the button projects when the plug is seated within the socket and the active and passive lock components are in the closed position.

Accordingly, the plug and socket, and button and socket, interlock so as to resist any motion of the active lock component relative to the passive lock component when the lock components are in the closed position.

Preferably, the active and passive lock components include surfaces on one or both lock components configured to guide the plug and socket into proper alignment during movement of the lock components to the closed position. Preferably, these guiding surfaces include surfaces that tend to guide the lock components longitudinally such as where the disengaged lock components longitudinally overlap too much, or not enough, for proper interlocking of the plug and socket. Further, these guiding surfaces also preferably include a surface or surfaces tending to guide the lock components laterally, so as to laterally align the lock components during closing. Laterally-guiding surfaces may be desirable when there is sufficient lateral play in the gate arm to permit lateral misalignment of the lock components.

Further, the laterally-guiding surfaces also preferably include a surface on the plug, or within the socket, that guides the plug within the socket during closing such that the button is pushed against a side wall of the socket so as to depress the button. This button-depressing laterally-guiding surface preferably comprises a planar surface on the side of the socket opposite the hole The planar surface is inclined relative to the plane defined by the opening and closing pivotal movement of the gate arm such that when the plug contacts the planar surface during closing the planar surface guides the plug to move simultaneously laterally towards the hole and downward, so as to depress the button and move it towards alignment with the hole.

The peripheral profile of the lock components are preferably selected to be identical to, or at least to merge with, the peripheral profile of the gate arm and the handrail, when the lock components are in the closed position. When the gate arm and handrail are made from round tubing, the visible portions of the closed lock components are configured so as to combine to form a cylindrical peripheral profile of substantially the same diameter as the gate arm and handrail. Preferably the overlapping visible portions of the lock components are each semi-cylindrical. The semi-cylindrical portion of the passive lock component contains the socket and hole. The plug projects from the semi-cylindrical portion of the active lock component. The visible portions of the lock components may also each comprise a cylindrical collar, integral with the respective semi-cylindrical portion and adjoining the relevant handrail or gate arm when the relevant lock component is installed.

For use with handrails and gate arms made from hollow tubing, the lock components preferably each have a stub portion for insertion into the gate lock end or the handrail lock terminal, as the case may be, preferably in a snug or tight fit, so as to attach the lock components to the handrail and gate arm.

For use with handrails and gate arms made from round hollow tubing, each stub preferably is substantially cylindrical and has an external diameter the same as or slightly smaller than the internal diameter of the tubing. Preferably, each stub is hollow and is provided with circumferentially-spaced longitudinally-extending slits to permit the stub to be slightly compressed to facilitate insertion. Preferably the stub has one or more retainer wedges, each having a relatively-long gently-inclined top surface that permits easy insertion of the stub and a short end surface that forms a sharp corner with the gently-inclined surface, which sharp corner engages the inner wall of the tubing so as to resist removal of the stub. Preferably each stub is provided with bevelled or chamfered distal edges to facilitate the initial insertion of the stub into the tubing.

Each stub is also preferably additionally secured within the relevant handrail or gate arm by a fastener such as a headless screw. The fastener is preferably installed by drilling a hole through the handrail or gate arm, and the relevant stub

after the stub has been inserted into the handrail or gate arm. If required for the particular fastener, the hole may then be tapped with the appropriate threads and the fastener, such as a headless screw or other screw, is then screwed into position. The fastener need not be a headless screw and may be a regular machine screw with a head, a rivet or a variety of other fasteners.

In accordance with the foregoing objectives, there is provided an improved hinge for hingedly connecting the handrail hinge terminal to the gate hinge end. The hinge includes two connectors and a link, each connector being separately pivotally attached to the link. Each connector is attached to the link such that each connector may pivot roughly 90° relative to the link, such that the connectors can pivot through roughly 180° relative to each other.

Preferably, the link and connectors are configured such that a portion of each connector abuts the link when the gate arm to which the hinge is attached is in the closed position so as to impede pivotal movement of the gate arm in the direction opposite the opening direction. As well, a portion of each connector abuts the link when the gate arm to which the hinge is attached is pivoted to a fully open position roughly 180° from the closed position, such that the gate arm is substantially parallel to the adjoining handrail. In this way the hinge impedes pivotal movement of the gate arm beyond roughly 180° between the closed position and the fully open position. This structural arrangement lends to the hinge a motion-limiting characteristic permitting the gate arm to pivot from the closed position to the fully open position only in one general direction, usually upward. Accordingly, in the closed position, the gate arm will tend to remain coaxial with the stationary handrail, and will tend not to collapse or pivot downwardly even if it is not supported at its distal end.

Preferably, the connectors are essentially identical one to the other and each comprises a clevis having two spaced-apart fingers and a web spanning the fingers at the base of the fingers, the clevis fingers defining a clevis gap, with the clevis gaps being of substantially identical widths. Preferably, the link is a generally-rectangular parallelepiped interposed between the clevis fingers of each connector

and pivotally connected to each connector by a pin through aligned holes in the link and the relevant connector. The link is sized for insertion into the clevis gaps such that the width of the link is selected to be slightly less than the width of the clevis gap. Preferably, a portion of the web of each connector abuts a portion of the adjoining end of the link when the gate arm is in the closed position so as to impede pivotal movement of the gate arm in the direction opposite the opening direction. Preferably, a portion of the web of each connector abuts the upper surface of the link when the gate arm is in the fully open position so as to impede pivotal movement of the gate arm beyond roughly 180° from the closed position. Preferably, the portions of the webs and link that abut when the gate arm is in the closed position are substantially planar surfaces that are substantially perpendicular to the longitudinal axis of the gate arm and handrail. Alternatively, the link ends and webs may be configured such that the abutting surfaces are substantially parallel to, or inclined relative to, the longitudinal axis of the gate arm and handrail.

Alternatively, the link may include two link clevises and each connector may include a projection inserted into, and pivotally attached to, a link clevis, such that the connector projection pivots within the link clevis. Alternatively, neither the link nor the connectors may have a clevis, and the link and connectors may merely overlap side-by-side rather than a portion of one being interposed between fingers projecting from the other.

The peripheral profile of the hinge is preferably selected to be identical to, or at least to merge with, the peripheral profile of the gate arm and the handrail, when the gate arm is in the closed position. Preferably the link and connectors are configured such that when the gate arm is closed, the distal ends of the clevises abut each other and the top and bottom surfaces the link span the gaps defined by the fingers and the web such that the connectors and link form, to the casual observer, one seemingly-solid piece. When the gate arm and handrail are made from round tubing, the outer surfaces of the clevis fingers, and the top and bottom surfaces of the link, are curved and combine, in the closed position, to form a cylindrical peripheral profile of substantially the same diameter as the gate arm and handrail..

For use with handrails and gate arms made from hollow tubing, the connectors preferably each have a stub portion, essentially identical to the lock component stub portions, for insertion into the gate hinge end or the handrail hinge terminal, as the case may be, so as to attach the connectors to the handrail and gate arm.

The hinge and lock components can be conveniently manufactured so as not to have any sharp nor obtrusive parts or edges, thus permitting them to constitute an integral part of the hand railing. In order to merge visually and structurally with the rest of the handrail, the hinge and lock may be fabricated out of the same material as the handrail. For visual continuity, they may have the same surface finishing as the handrail. The hinge and lock may be made from diverse materials, such as stainless steel and aluminum.

A longitudinal series of gate arms, hinges and locks can be arranged together, thereby creating the possibility of opening large handrail sections. A preferred such combination makes use of a central stanchion that is itself hinge-coupled, or otherwise releasably attached, to a bottom pedestal, permitting the entire stanchion, apart from the pedestal, to be: collapsed pivotally downwardly so as to assume a horizontal orientation, or to be removed. The stanchion receives two individually operable gates, themselves coupled by the hinge connections to tubular railings on either side of the stanchion, and locking to the stanchion. By opening both gates and collapsing the stanchion downwardly or removing the stanchion, it would be possible to create a relatively large opening in the handrail. Further, the stanchion and gate arms may be configured such that with the stanchion in its normal upright position, one gate arm may be opened, leaving the other gate arm closed.

It will be clear that the gate arm need not open only vertically. The hinge and lock may be installed in a variety of orientations as desired.

The present invention provides many advantages over previously known designs. It offers a simple and ingenious solution to the problem of securing handrail openings (gates). To a great extent, it retains the structural and peripheral integrity

of the original handrail, it is durable and strong, and it presents few protrusions or obstructions that can cause injuries. The preferred embodiments provide constraints that prevent or limit motion of the gate arm in undesired directions.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a hinge and lock according to a preferred embodiment of the present invention mounted on a standard handrail shown in a closed position.

Figure 2 is a partly cross-sectional view along the line I-I in Figure 1 of a hinge of the type illustrated in Figure 1, in the closed position.

Figure 3A is a perspective view of the handrail hinge of Figure 1, shown in a fully opened position.

Figure 3B is a perspective view of the passive component of a lock according to a preferred embodiment of the invention mounted onto the end of the handrail opposite that shown in Figure 3A and separated from the end of the handrail shown in Figure 3A by the width of the gate arm. Viewing Figures 3A and 3B together, one perceives an open gateway, the gate arm being folded over onto the handrail portion to which it is connected.

Figure 4 is a view partly in cross-section along the line II-II in Figure 3A of a fully opened hinge.

Figure 5 is a perspective view showing an embodiment of the active lock component of the present invention.

Figure 6 is a perspective exploded view showing the active lock component of Figure 6 with the parts of the depressable button.

Figure 7 is a perspective view showing an embodiment of the passive lock

component of the present invention.

Figure 8 is an alternative perspective view showing the passive lock component of Figure 7.

Figure 9 is a partly sectional view of the active lock component showing the parts of the depressable button.

Figure 10A is a longitudinal sectional view of an embodiment of the passive and active lock components of the present invention showing first contact between the lock components during closing when the lock components are longitudinally misaligned so as to overlap more than required for full closure.

Figure 10B is a lateral sectional view of the passive and active lock components shown in Figure 10A.

Figure 11A is a longitudinal sectional view of the passive and active lock components shown in Figure 10A, showing first contact between the lock components during closing when the lock components are longitudinally misaligned so as to overlap less than required for full closure.

Figure 11B is a lateral sectional view of the passive and active lock components shown in Figure 11A.

Figure 12A is a longitudinal sectional view of the passive and active lock components shown in Figures 10A and 11A, showing a position of the lock components during closing, between first contact and the fully closed position.

Figure 12B is a lateral sectional view of the passive and active lock components shown in Figure 12A.

Figure 13A is a longitudinal sectional view of the passive and active lock components shown in Figures 10A, 11A and 12A, showing the lock components in

the fully closed position.

Figure 13B is a lateral sectional view of the passive and active lock components shown in Figure 13A.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figures 1 through 13B show a preferred embodiment of the present invention for use with handrails made of round tubing. Figure 1 shows the hinge 1, handrail 2, gate arm 3 and lock 9 in the closed position.

As shown in Figures 1, 2, 3A and 4, the hinge includes a link 5 and two connectors 4, 6. The two connectors are substantially identical to each other and are interchangeable. For ease of description, they are named herein according to how they are shown installed in Figures 1, 3A and 4, being , a fixed connector 4 attached to the handrail 2 and a mobile connector 6 attached to the gate arm 3. Each connector 4, 6 has a clevis 41, 61 (respectively) and a stub 42, 62 (respectively). The fixed connector clevis 41 includes two spaced-apart fingers, a first fixed finger 43 and a second fixed finger 44, having opposed substantially-parallel planar surfaces, and a web, the fixed web 45, spanning the fixed fingers 43, 44 at their bases. Likewise, the mobile connector clevis 61 includes two spaced-apart opposed fingers, a first mobile finger 63 and a second mobile finger 64, having opposed substantially-parallel planar surfaces, and a web, the mobile web 65, spanning the mobile fingers 43, 44 at their bases.

The link 5 is a generally rectangular parallelepiped (with curved upper and lower surfaces, as described below). The link 5 is interposed between the fixed fingers 43, 44 and pivotally attached to the fixed connector clevis 41 by a pin 18 passing through aligned holes in the fixed fingers 43, 44 and the link 5. Likewise, the link is interposed between the mobile fingers 63, 64 and pivotally attached to the mobile connector clevis 61 by a pin 18' passing through aligned holes in the mobile fingers 63, 64 and the link 5. The gap between the fixed fingers 43, 44 is substantially the same as the gap between the mobile fingers 63, 64.

The link 5 is sized and shaped such that, when the gate arm 3 to which the link 5 is attached is in the closed position, the link 5 substantially fills the space defined by the fingers 43, 44, 63, 64 and the webs 45, 65, such that the upper link surface 53 and the lower link surface 54 (as shown in Figure 2) substantially visually blend with the clevises 41, 61. In the embodiment shown in the drawings the handrail 2 and the gate arm 3 are made of cylindrical tubing; and the clevises 41, 61 have curved outer surfaces that closely match the external profile of the handrail 2 and the gate arm 3, and the upper link surface 53 and lower link surface 54 are similarly curved.

The link 5 and webs 45, 65 are configured to limit the range of pivotal movement of the hinge 1 to roughly 180°, being between the closed position in which the gate arm 3 and adjoining handrails 2 are aligned and substantially coaxial as shown in Figure 1, and the fully open position in which the gate arm 3 is positioned alongside and substantially parallel to the handrail 2 as shown in Figure 3A. In the closed position, as shown in Figure 2, a first portion of each web 45, 65 abuts the ends of the link 5 so as to impede downward pivoting of any of the connectors 4, 6 or link 5 relative to each other. In the open position, a second portion of each web 45, 65 abuts the upper link surface 53 so as to impede pivoting movement of the hinge 1 beyond roughly 180° from the closed position. In this way, each connector 4, 6 is limited to roughly 90° of pivoting movement relative to the link 5. As shown in Figures 1 and 3A, the fingers 43, 44, 63, 64 have bevelled or partially curved ends so as to permit the connectors 4, 6 to pivot past each other during the opening and closing of the gate arm 3.

The stubs 42, 62 are for attaching the relevant connectors 4, 6 to the associated handrail 2 and gate arm 3. In the embodiment shown in the drawings, the handrail 2 and gate arm 3 are made of cylindrical tubing. The stubs 42, 62 are configured for insertion into the handrail 2 and gate arm 3. The stubs 42, 62 each comprise a hollow cylindrical body with an external diameter substantially the same as, or slightly less than, the internal diameter of the handrail 2 and gate arm 3. In the embodiment shown in the drawings, each stub 42, 62 has four longitudinally extending slits 11 and two retainer wedges 12. The slits 11 permit the stubs 42, 62

to be slightly compressed for insertion into the handrail 2 and gate arm 3. The retainer wedges 12 have a relatively-long gently-inclined top surface that permits easy insertion of the stubs 42, 62, and a short end surface that forms a sharp corner with the gently-inclined surface, which sharp corner engages the inner wall of the hand rail 2 and gate arm 3, as the case may be, so as to resist removal of the relevant stub 42, 62.

Each stub 42, 62 is also preferably additionally secured within the relevant handrail 2 or gate arm 3 by a fastener such as a headless screw 13, as shown in Figure 4. The headless screw 13 is installed by drilling a hole through the handrail 2 or gate arm 3, and the relevant stub 42, 62, after the stub 42, 62 has been inserted into the handrail 2 or gate arm 3. The hole is then tapped with the appropriate threads and the headless screw 13 is screwed into position. The headless screw 13 is preferably screwed into one of those sections of the relevant stub 42, 62 bounded by two slits 11 that does not have a retainer wedge 12, so that the section of the relevant stub 42, 62 through which the headless screw 13 is screwed is not held away from the inner wall of the handrail 2 or gate arm 3 by a retainer wedge 12. Generally, it is preferable for aesthetic reasons that the headless screws 13 be located on the underside of the handrail 2 and the underside of the gate arm 3, when the gate arm 3 is in the closed position, so that the headless screws 13 are not normally visible. The fastener need not be a headless screw 13 and may be a regular machine screw with a head, a rivet or a variety of other fasteners. Alternatively, the stub may be secured within the tubing by welding, such as by spot welding at a hole drilled in the tubing.

It will be clear that the connectors 4, 6 could be attached to the handrail 2 and gate 3 by means other than insertable stubs 42, 62, such as by welding.

As shown in Figures 5 through 13 B, the lock 9 includes a passive lock component 7 and an active lock component 8. The passive lock component 7 has a socket 70. The active lock component 8 has a plug 72 for matingly engaging the socket 70, and a radially-projecting depressable latching button 74 that engages a button hole 76 in the passive lock component 7 for securing the plug 72 within the

socket 70 so as to secure the lock components 7, 8 one to the other. The button 74 and socket 70 should of course have mating cross-sectional configurations and dimensions, but these need not be circular. The preferred circular cross-section of each is illustrated.

Each lock component 7, 8 includes a stub, the passive lock component stub 78 and the active lock component stub 80 as the case may be, that is in all relevant details substantially identical to the connector stubs 42, 62 previously described, and that may be installed in the same manner as the connector stubs 42, 62.

The embodiment of the lock 9 shown in the drawings is for use with handrails 2 and gate arms 3 made of round tubing; and the portions of the lock components 7, 8 that are visible when installed and when the gate arm 3 is in the closed position, have surfaces that closely match the external profile of the handrail 2 and gate arm 3.

In the embodiment shown in the drawings, the socket 70 is defined by an inner end wall 82, an outer end wall 84, a curved side wall 86, a straight side wall 88 and a guide side wall 90. The inner end wall 82 is substantially perpendicular to the longitudinal axis of the passive lock component 7. The outer end wall 84 has a lower wall lip 92 that is substantially perpendicular to the longitudinal axis of the passive lock component 7, and an upper wall lip 94 that is inclined relative to the lower wall lip 92. The curved side wall 86 contains the button hole 76. The curved side wall 86 adjoins the straight side wall 88.

The plug 72 has an end face 96, an end guide face 98, an inner face 100, a curved side face 102, a straight side face 104 and an inclined side face 106. The end face 96 is substantially perpendicular to the longitudinal axis of the active lock component 8. The end guide face 98 adjoins, and is inclined relative to, the end face 96. The inner face 100 has a lower face lip 108 that is substantially perpendicular to the longitudinal axis of the active lock component 8, and an upper face lip 110 that is inclined relative to the lower face lip 108. The button 74 projects from the curved side face 102. The curved side face 102 adjoins the straight side

face 104.

As shown in Figure 9, the button 74 has a button shoulder 112 contained within the button sleeve 114. The button sleeve 114 is secured within a cavity in the active lock component 8 and is preferably a metal sleeve pressed in a tight fit into a bore in the active lock component 8. A spring 116 within the button sleeve 114 biases the button shoulder 112 against an annular retainer 118 at the outward end of the button sleeve 114, such that the button 74 is spring-biassed to project from the curved side face 102. The spring 116 is selected so that the button 74 may be manually depressed.

Figures 10A through 13B show some of the possible positions of the passive lock component 7 and active lock component 8 relative to each other during closing of the gate arm 3. Figures 10A and 11A show the initial contact between the passive lock component 7 and the active lock component 8 in situations where there is a slight longitudinal misalignment of the lock components 7, 8, such as perhaps might be due to the gate arm 3 being the incorrect length, for example, too long in Figure 10A and too short in Figure 11A. In Figure 10A, the point of first contact is between the top of the inner end wall 82 and the end guide face 98, and as the active lock component 8 moves towards engagement with the passive lock component 7, the incline of the end guide face 98 helps to guide the plug 72 into the correct longitudinal position to engage the socket 70. Alternatively, as shown in Figure 11A, the point of first contact may be between the bottom of the lower face lip 108 and the upper wall lip 94, and as the active lock component 8 moves towards engagement with the passive lock component 7, the incline of the upper wall lip 94 helps to guide the plug 72 into the correct longitudinal position to engage the socket 70.

As shown in Figure 11B, the contact of the button 74 with the top of the curved side wall 86 tends to cause the active lock component 8 to move laterally relative to the active lock component 7, such that further downward movement of the active lock component 8 causes the bottom of the curved side face 102 to contact the guide side wall 90. The incline of the guide side wall 90 combined with a downward force on the active lock component 7 causes the active lock component

to move both downward and laterally so as to: depress the button 74 so as to compress the spring 116 by pushing the button 74 against the curved side wall 86; and bring the straight side face 104 into alignment with the straight side wall 88, as shown in Figure 12B. As shown in Figure 13B, further downward movement of the active lock component 8 brings the button hole 76 into alignment with the button 74 permitting the spring 116 to expand so as to cause the button 74 to project through the button hole 76, thus securing the active lock component 8 to the passive lock component 7 in the closed position.

In the closed position, the presence of the button 74 within the button hole 76 impedes upward movement of the active lock component 8; the abutting of the straight side face 104 with the straight side wall 88 and the abutting of the top of the curved side face 102 with the top of the curved side wall 86 impede lateral movement of the active lock component 8; and the abutting of the lower wall lip 92 with the lower face lip 108 resists longitudinal forces tending to separate the passive and active lock components 7, 8.

The active lock component 8 may be released from the passive lock component 7 by depressing the button 74 and moving the active lock component 8 upwards.

The button 74 may be relatively small and unobtrusive, and therefore the lock 9 is particularly aesthetically appropriate for relatively small tubing, such as 2.5 cm (1") diameter. Further, in this embodiment, the gate arm 3, hinge 1 and lock 9 are configured to tie the handrail 2 portion on one side of the gate opening to the handrail 2 portion on the other side of the gate opening so as to resist longitudinal tensional forces tending to spread the handrails 2 on each side of the gate opening. This tying of the handrails 2 contributes to the overall strength of the handrail 2 installation and tends to cause the gate arm 3 to stay closed even if neighbouring portions of the handrail 2 are bent, such as by heavy objects or persons falling against them, or, in the case of marine applications, due to wave impact in extreme storm conditions.

It will be clear that the lock 9 need not be associated with a hinge permitting the gate arm 3 to pivot through a full 180° and that various other hinges may be used with the lock 9. Further, the gate arm 3 may be designed to telescope into the handrail 2 as long as there is sufficient play at the end of the gate arm 3 to permit the mating portions of the lock components 7, 8 to clear each other as the gate arm 3 is telescoped in or out. As well, the gate arm 3 may be designed to be removable, by having a lock 9 at each end, or a lock 9 at one end and some other means for releasably engaging the handrail 2 at the other end.

The scope of the invention is not to be limited by the specific details described, but is to be given the full scope established by the appended claims. As used in the appended claims, the word "tubing" means a hollow bar of any suitable profile (*e.g.*, round, rectangular, oval).

What is claimed is:

1. For a handrail having an open gateway between two terminals of the handrail, one terminal on either side of the gateway, a gate comprising:

a) a gate arm having a hinge end and a lock end, and pivotable between a closed position and a fully open position;

b) a hinge, attached to the hinge end of the gate arm and a hinge terminal of the handrail, being one of the terminals of the handrail, for pivotally connecting the hinge end of the gate arm to the hinge terminal of the handrail; and

c) a lock having two matingly engageable/disenagageable components, an active lock component and a passive lock component, one of which lock components is attached to the lock end of the gate arm, and the other of which is attached to a lock terminal of the handrail, being the other of the terminals of the handrail, wherein:

i) the active lock component includes a plug projecting substantially perpendicular to the longitudinal axis of the active lock component;

ii) the passive lock component includes a socket configured for receiving the plug when the gate arm is in the closed position, the socket having side walls to impede lateral movement of the plug within the socket and end walls to impede longitudinal movement of the plug within the socket such that interference between the passive and active lock components when they are engaged resists longitudinal decoupling forces; and

iii) the passive lock component and the active lock component include means for releasably securing the plug within the socket;

wherein, when the gate arm is in the closed position and the plug is secured within the socket, the gate arm, hinge and lock components act to connect the hinge terminal and lock terminal so as to resist forces tending to move the gate arm and handrail longitudinally away from each other.

2. A gate as defined in claim 1, wherein the means for releasably securing the plug within the socket comprises;

a) a manually-depressable button, attached to the active lock component and biased to project from the plug; and

b) a hole through a socket side wall through which the button projects when the plug is seated within the socket;

wherein, when the plug is seated in the socket, opening movement of the gate arm is impeded by the button abutting a side of the hole, and the button may be manually depressed to permit opening movement of the gate arm.

3. A gate as defined in claim 2, wherein the button is in a bore within the plug and a spring biases the button to project from the plug.

4. A gate as defined in claim 3, wherein:

a) the button is in a sleeve in the bore;

b) the spring is a coil spring positioned between the button and the bottom of the bore;

c) the button has an annular shoulder proximate to its inner end;

d) the sleeve has an annular retainer proximate to its outer end; and

e) the spring biases the button so as to tend to cause the shoulder to abut the retainer.

5. A gate as defined in claim 1, 2, 3 or 4, wherein the lock components include one or more guiding surfaces for helping to guide the plug and socket during movement of the lock components toward the closed position, into the required alignment for the plug to seat in the socket.

6. A gate as defined in claim 5, wherein the guiding surfaces include a laterally-guiding surface for guiding the plug within the socket during closing such that the button is pushed against a side wall of the socket so as to depress the button.

7. A gate as defined in claim 6, wherein the laterally-guiding surface comprises a planar surface on the side wall of the socket opposite the side wall

containing the hole.

8. A gate as defined in claim 5, 6 or 7, wherein the guiding surfaces include one or more longitudinally-guiding surfaces for helping to guide the plug and socket into the required longitudinal alignment for the plug to seat in the socket.

9. A gate as defined in claim 8, wherein the longitudinally-guiding surfaces include an inclined planar surface on the plug.

10. A gate as defined in claim 8 or 9, wherein the longitudinally-guiding surfaces include an inclined planar end wall in the socket.

11. A gate as defined in any one of claims 1 - 10, wherein the hinge comprises:
a) a link; and
b) two connectors, each connector being pivotally attached to the link.

12. A gate as defined in claim 11, wherein a portion of each connector abuts the link when the gate arm to which the hinge is attached is in the closed position so as to impede pivotal movement of the gate arm in the direction opposite the opening direction.

13. A gate as defined in claim 11 or 12, wherein a portion of each connector abuts the link when the gate arm to which the hinge is attached is pivoted to a fully open position roughly 180° from the closed position, such that the gate arm is substantially parallel to the adjoining handrail , so as to impede pivotal movement of the gate arm beyond roughly 180° between the closed position and the fully open position.

14. A gate as defined in claim 11, 12 or 13, wherein each connector abuts the link when each connector has pivoted roughly 90° from the closed position relative to the link.

15. A gate as defined in claim 11, 12, 13 or 14, wherein the link is pivotally connected to each connector by means of a pin passing through aligned holes in the link and connector.

16. A gate as defined in any one of claims 11 - 15, wherein

a) the connectors each comprise a clevis comprising two opposed clevis fingers attached to a clevis web at the bases of the fingers, the clevis fingers defining a clevis gap; and

b) the link is interposed between, and pivotally attached to the clevis fingers of each clevis.

17. A gate as defined in claim 16, wherein the clevis gaps are of substantially identical widths, the width of the link is slightly less than the width of the clevis gaps and the length of the link is selected to provide substantial peripheral continuity of the hinge between the clevis webs, so that the exposed peripheral surfaces of the clevises and exposed surfaces of the link provide substantially-uninterrupted surface continuity between the gate arm and the handrail to which the hinge is connected.

18. A gate as defined in claim 17, wherein the connectors are substantially identical one to the other and the link is a generally-rectangular parallelepiped.

19. A gate as defined in any one of claims 1 - 18, wherein the handrail and gate arm are tubular, and the hinge includes two hinge stubs, one hinge stub inserted into the handrail and the other hinge stub inserted into the gate arm so as to attach the hinge to the handrail and the gate arm.

20. A gate as defined in any one of claims 1 - 19, wherein the handrail and gate arm are tubing, and each lock component includes a lock stub, one lock stub inserted into the handrail and the other lock stub inserted into the gate arm so as to attach the one lock component to the handrail and the other lock component to the gate arm.

21. A gate as defined in claim 19 or 20, wherein the handrail and gate arm are round tubing and each stub is substantially cylindrical and has an external diameter the same as or slightly smaller than the internal diameter of the tubing.

22. A gate as defined in claim 21, wherein each stub is hollow and is provided with circumferentially-spaced longitudinally-extending slits to permit the stub to be slightly compressed to facilitate insertion.

23. A gate as defined in claim 22, wherein each stub has one or more retainer wedges proximal to the insertion end of the stub, each retainer wedge having a relatively-long gently-inclined top surface that facilitates insertion of the stub and a short end surface that forms a sharp corner with the gently-inclined top surface, which sharp corner engages the inner wall of the tubing so as to resist removal of the stub.

24. A gate as defined in any one of claims 19 -23, wherein each stub is secured within the tubing by a fastener inserted through aligned fastener holes in the tubing and the stub.

25. A gate as defined in claim 24, wherein the fastener is a headless screw screwed into threads in the aligned fastener holes.

26. A gate as defined in any one of claims 1 - 25, wherein the peripheral profile of the hinge and of the lock elements are selected to merge with the peripheral profile of the gate arm and the handrail when the gate arm is in the closed position.

27. A dual gate comprising two individual gates each as defined in claim 1, and additionally comprising a central stanchion between the two gates, the stanchion provided with opposed lock components mating with the lock components of the two gate arms of the two gates, one on either side of the

stanchion, and wherein the gates are hingedly connected to stationary handrail terminals each spaced by its respective gate distance from the stanchion, whereby the two gate arms when fully pivotally opened may each rest proximate to an associated portion of the stationary handrail, and wherein the stanchion comprises a pedestal and a shaft hingedly coupled to the pedestal, the shaft being normally vertical when at least one of the gates is closed and being provided in the vicinity of its upper end with the two opposed lock components for mating with the respective lock components said two gates.

28. For use with a handrail made of tubing, in the areas where it is desirable to have a closeable access through the handrail, a two-component lock for releasably connecting one terminating end of the handrail to a pivoting gate arm made of tubing, the lock comprising in combination:

a) an active lock component having:

i) a plug projecting substantially perpendicular to the longitudinal axis of the active lock component; and

ii) a stub for insertion into the tubing so as to attach the active lock component to the tubing;

b) a passive lock component, matingly engageable/disengageable with the active lock component and having:

i) a socket configured for receiving the plug when the gate arm is in the closed position, the socket having side walls to impede lateral movement of the plug within the socket and end walls to impede longitudinal movement of the plug within the socket such that interference between the passive and active lock components when they are engaged resists longitudinal decoupling forces; and

ii) a stub for insertion into the tubing so as to attach the passive lock component to the tubing;

c) means for releasably securing the plug within the socket;

wherein, the lock acts to connect the gate arm and handrail so as to resist forces tending to move the gate arm and handrail longitudinally away from each other.

29. A lock as defined in claim 28, wherein the means for releasably securing the plug within the socket comprises;

a) a manually-depressable button, attached to the active lock component and biased to project from the plug; and

b) a hole through a socket side wall through which the button projects when the plug is seated within the socket;

wherein, when the plug is seated in the socket, opening movement of the gate arm is impeded by the button abutting a side of the hole, and the button may be manually depressed to permit opening movement of the gate arm.

30. A lock as defined in claim 30, wherein the button is in a bore within the plug and a spring biases the button to project from the plug.

31. A lock as defined in claim 31, wherein:

a) the button is in a sleeve in the bore;

b) the spring is a coil spring positioned between the button and the bottom of the bore;

c) the button has an annular shoulder proximate to its inner end;

d) the sleeve has an annular retainer proximate to its outer end; and

e) the spring biases the button so as to tend to cause the shoulder to abut the retainer.

32. A lock as defined in claim 28, 29, 30 or 31, wherein the lock components include one or more guiding surfaces to help guide the plug and socket during movement of the lock components toward the closed position, into the required alignment for the plug to seat in the socket.

33. A lock as defined in claim 32, wherein the guiding surfaces include a laterally-guiding surface for guiding the plug within the socket during closing such that the button is pushed against a side wall of the socket so as to depress the button.

34. A lock as defined in claim 33, wherein the laterally-guiding surface comprises a planar surface on the side wall of the socket opposite the side wall containing the hole.

35. A lock as defined in claim 32, 33 or 34, wherein the guiding surfaces include one or more longitudinally-guiding surfaces for helping to guide the plug and socket into the required longitudinal alignment for the plug to seat in the socket.

36. A lock as defined in claim 35, wherein the longitudinally-guiding surfaces include an inclined planar surface on the plug.

37. A lock as defined in claim 36, wherein the longitudinally-guiding surfaces include an inclined planar end wall in the socket.

38. For use with a handrail made of tubing, in the areas where it is desirable to have a closeable access through the handrail, a hinge for connecting one terminating end of the handrail to a pivoting gate arm made of tubing, the hinge comprising in combination:

a) two connectors, each connector comprising:

i) a clevis having two opposed clevis fingers, and a clevis web spanning the base of the clevis fingers, the clevis fingers defining a clevis gap; and

ii) a stub for insertion into the tubing so as to attach the relevant connector to the tubing;

b) a generally-rectangular parallelepiped link, interposed between the clevis fingers of each clevis and pivotally attached to each clevis by a pin through aligned holes in the clevis and the link;

wherein the combined pivoting of each of the connectors relative to the link is such that, when the hinge is installed, the gate arm may pivot relative to the handrail through 180°.

39. A hinge as defined in claim 38, wherein, when the hinge is installed and the gate arm to which it is installed is in the closed position, a portion of the clevis web of each connector abuts the adjoining end of the link so as to impede pivotal movement of the gate arm in the direction opposite the opening direction.

40. A hinge as defined in claim 38 or 39, wherein, when the hinge is installed and the gate arm to which it is installed is in the closed position, the clevis fingers of one connector abut the clevis fingers of the other connector so as to impede pivotal movement of the gate arm in the direction opposite the opening direction.

41. A gate as defined in claim 38, 39 or 40, wherein each connector abuts the link when each connector has pivoted roughly 90° from the closed position relative to the link.

42. A gate as defined in claim 38, 39, 40 or 41, wherein, when the hinge is installed, a portion of each connector abuts the link when the gate arm to which the hinge is attached is pivoted to a fully open position roughly 180° from the closed position, such that the gate arm is substantially parallel to the adjoining handrail , so as to impede pivotal movement of the gate arm beyond roughly 180° between the closed position and the fully open position.

43. A hinge as defined in any one of claims 38 - 42, wherein the clevis gaps are of substantially identical widths and the width of the link is slightly less than the width of the clevis gaps and the length of the link is selected to provide substantial peripheral continuity of the hinge between the clevis webs, so that the exposed peripheral surfaces of the clevises and exposed surfaces of the link provide substantially-uninterrupted surface continuity between the gate arm and the handrail when the hinge is installed.

44. A hinge as defined in any one of claims 38 - 43, wherein the connectors are

substantially identical one to the other.

45. A hinge as defined in any one of claims 38 - 44, wherein the handrail and gate arm are round tubing and each stub is substantially cylindrical and has an external diameter the same as, or slightly smaller than, the internal diameter of the tubing.

46. A hinge as defined in claim 45, wherein each stub is hollow and is provided with circumferentially-spaced longitudinally-extending slits to permit the stub to be slightly compressed to facilitate insertion.

47. A hinge as defined in claim 45 or 46, wherein each stub has one or more retainer wedges proximal to the insertion end of the stub, each retainer wedge having a relatively-long gently-inclined top surface that facilitates insertion of the stub and a short end surface that forms a sharp corner with the gently-inclined top surface, which sharp corner engages the inner wall of the tubing so as to resist removal of the stub.

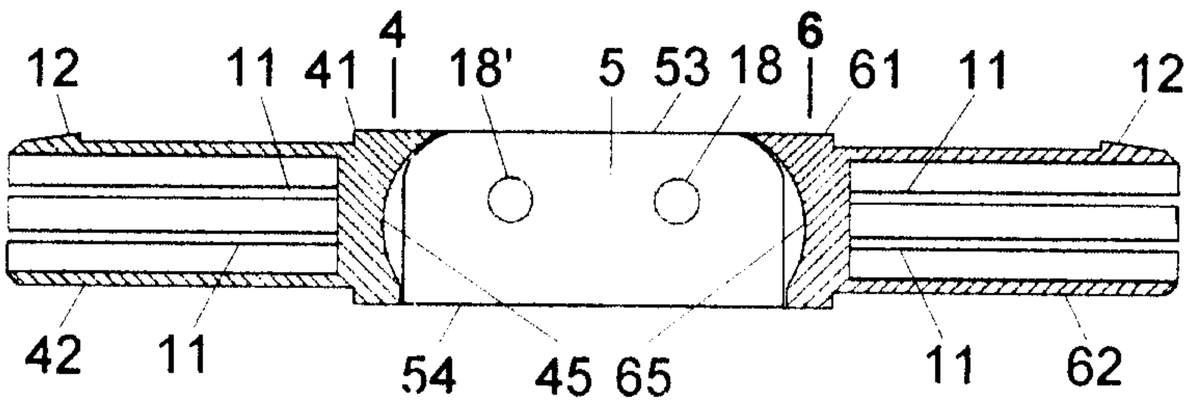


FIG. 2

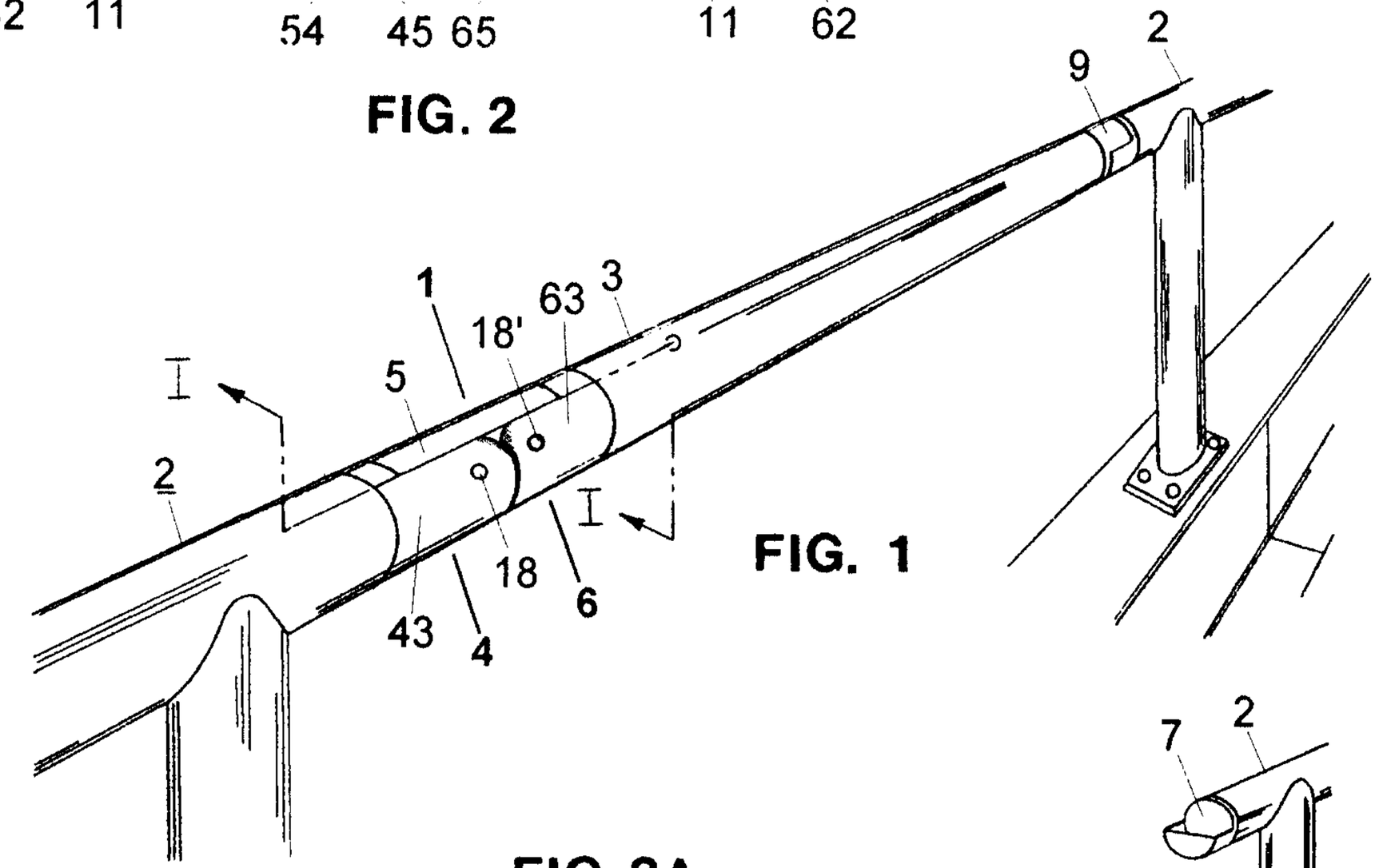


FIG. 1

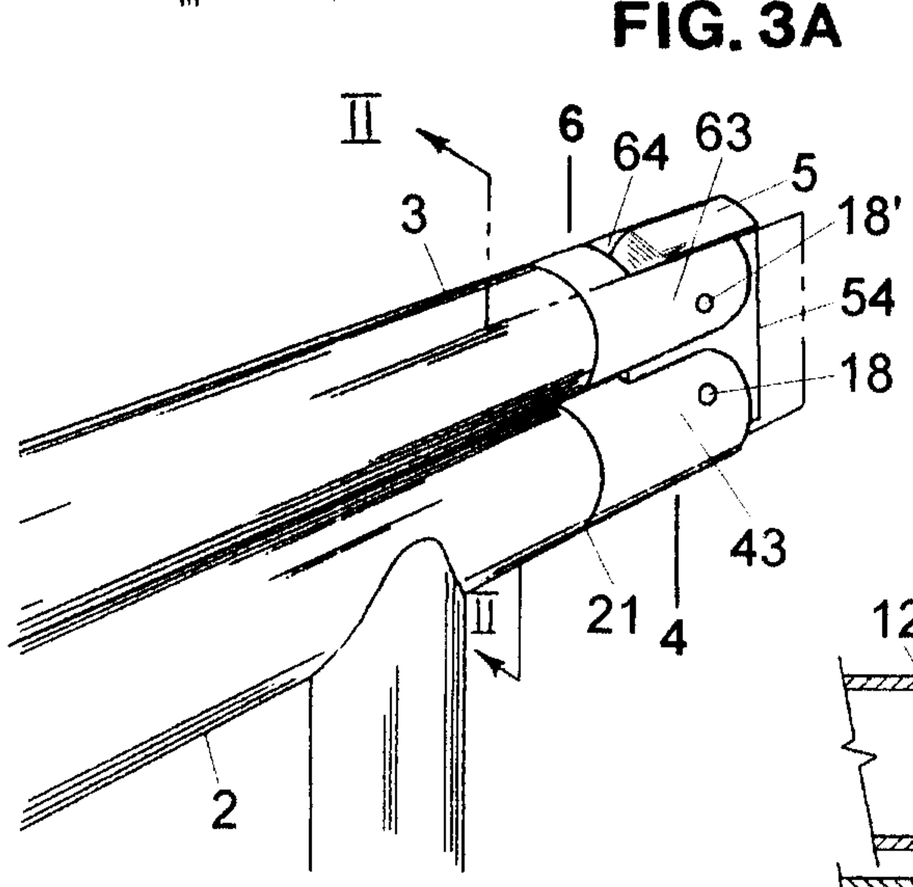


FIG. 3A

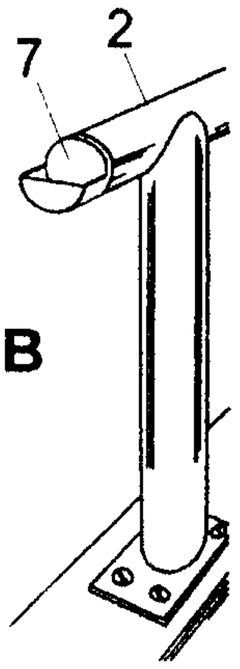


FIG. 3B

FIG. 4

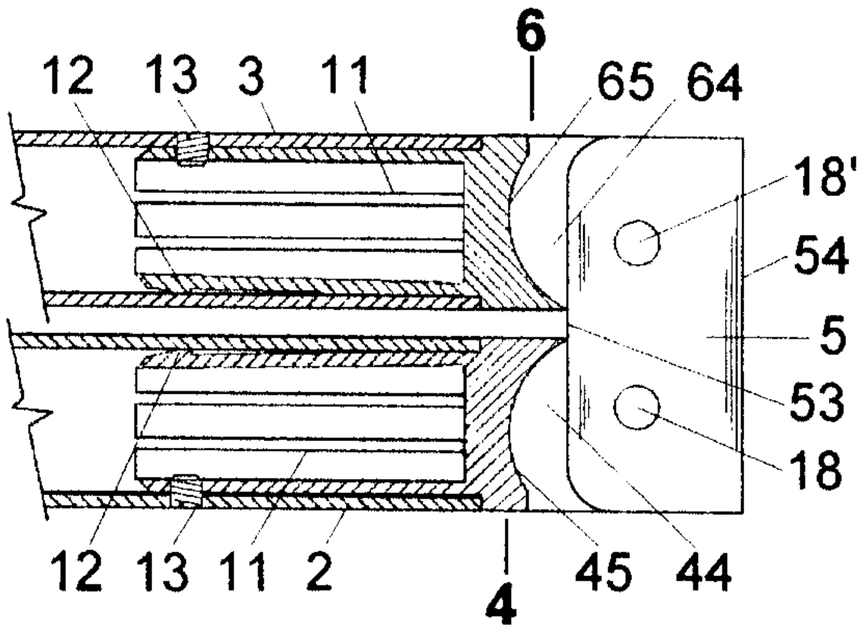


FIG. 5

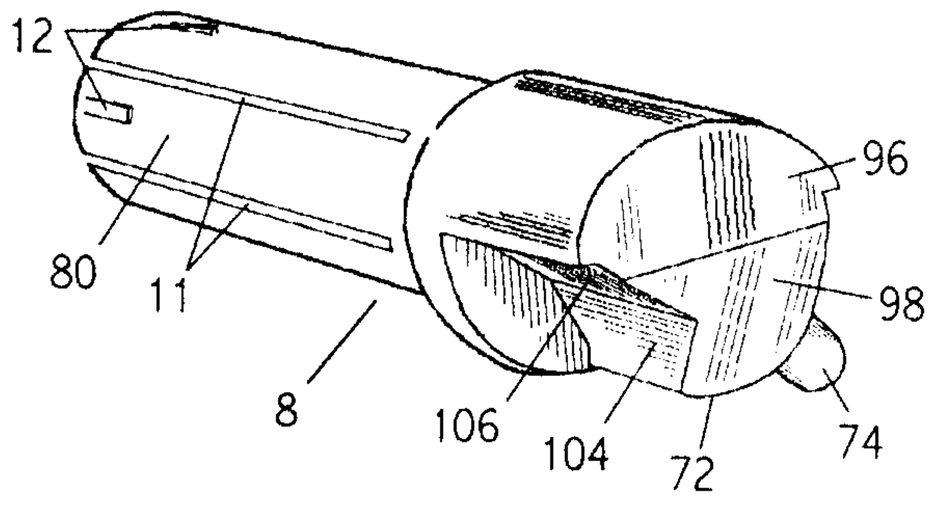


FIG. 6

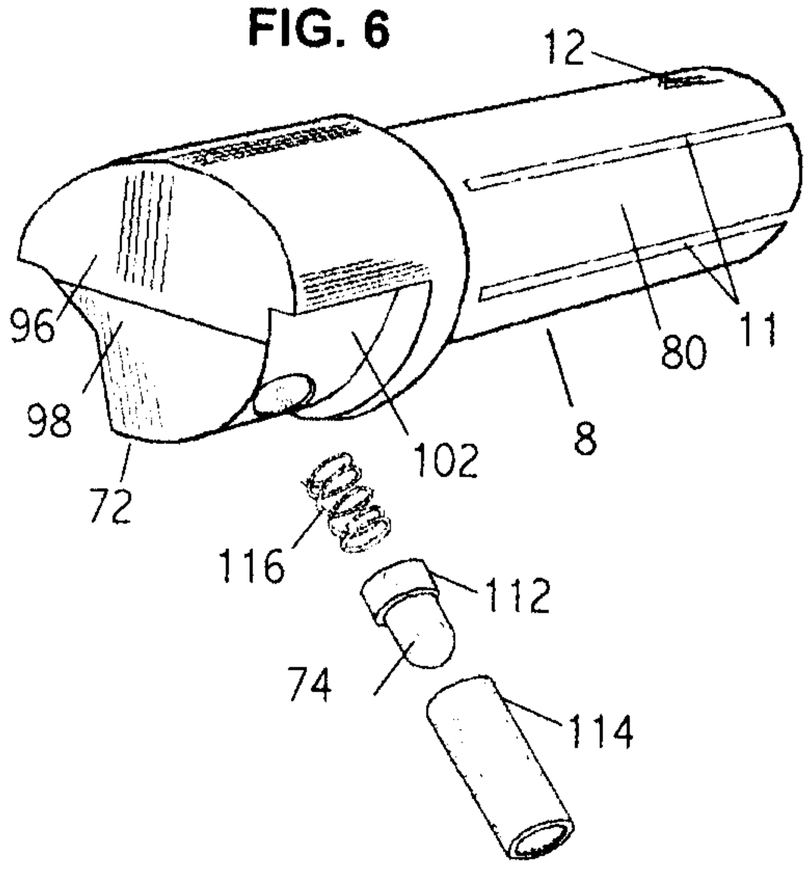


FIG. 7

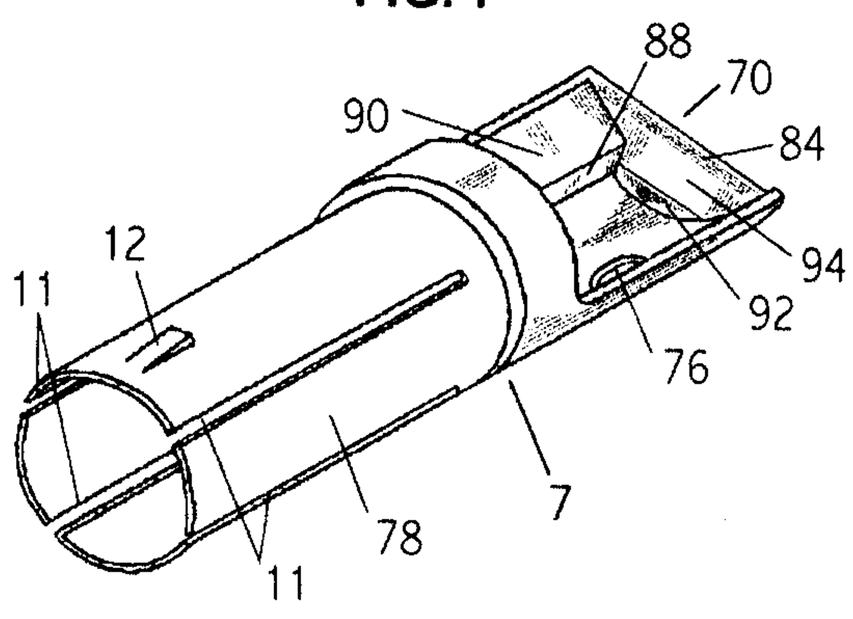


FIG. 8

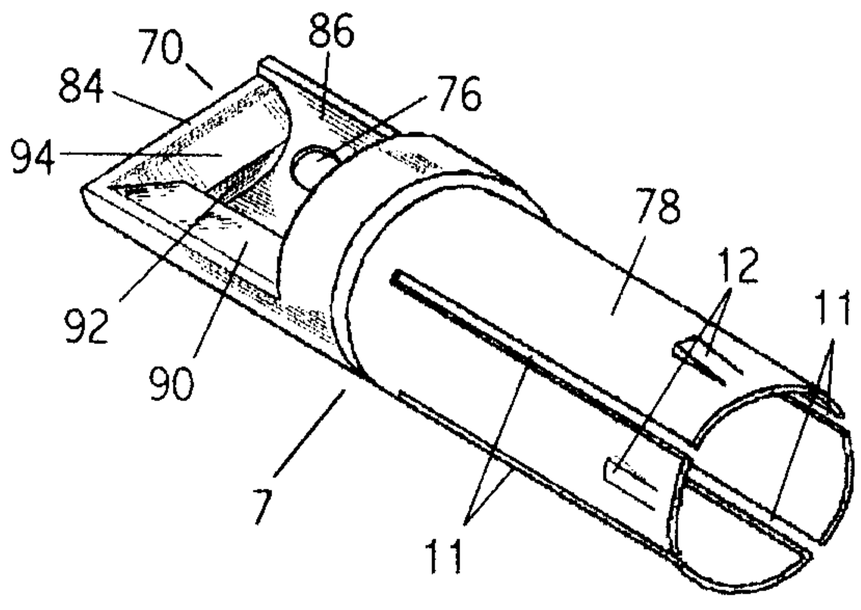


FIG. 9

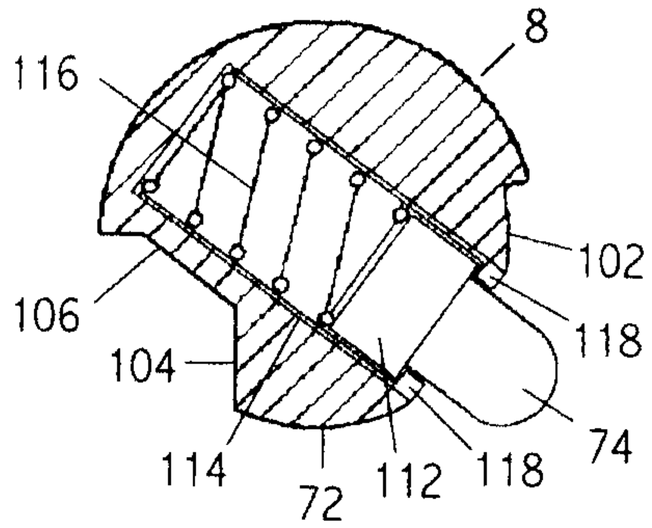


FIG. 10 A

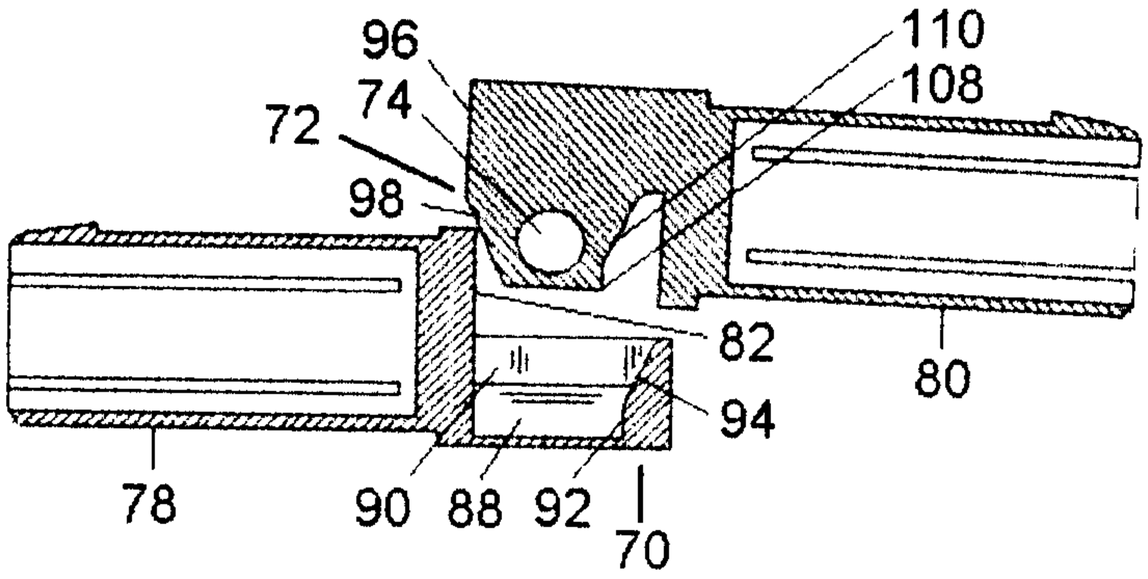


FIG. 10 B

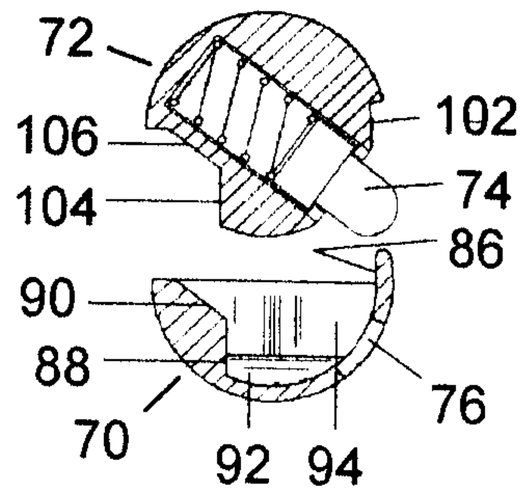


FIG. 11 A

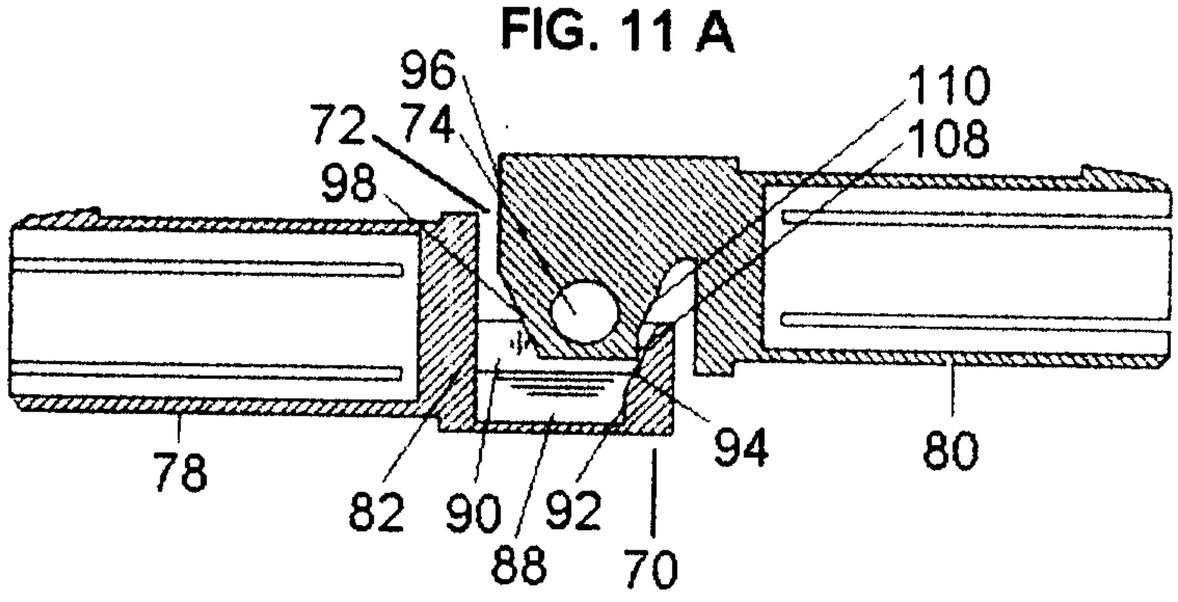


FIG. 11 B

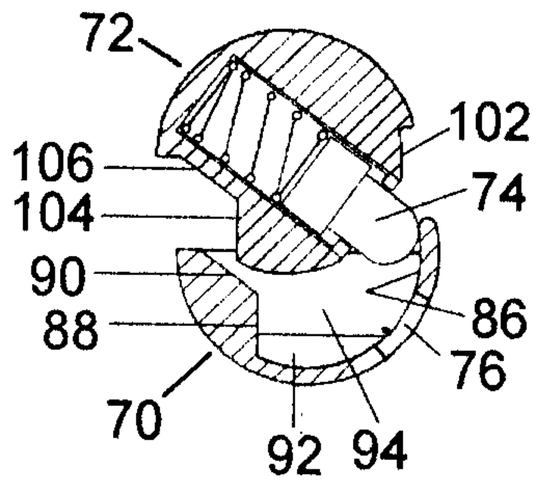


FIG. 12 A

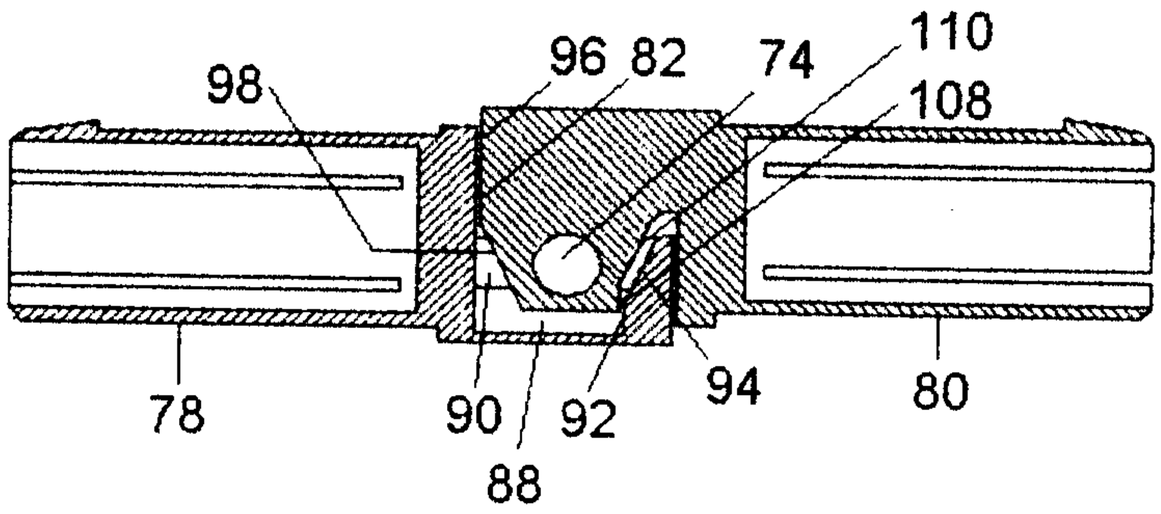


FIG. 12 B

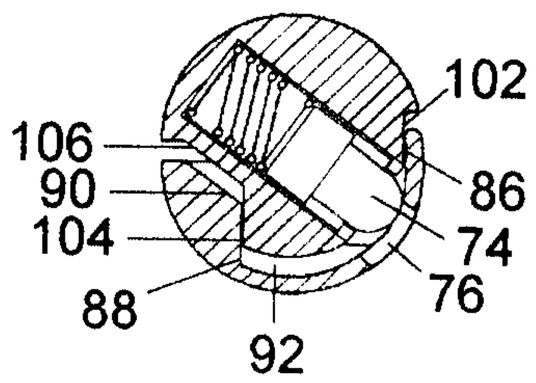


FIG. 13 A

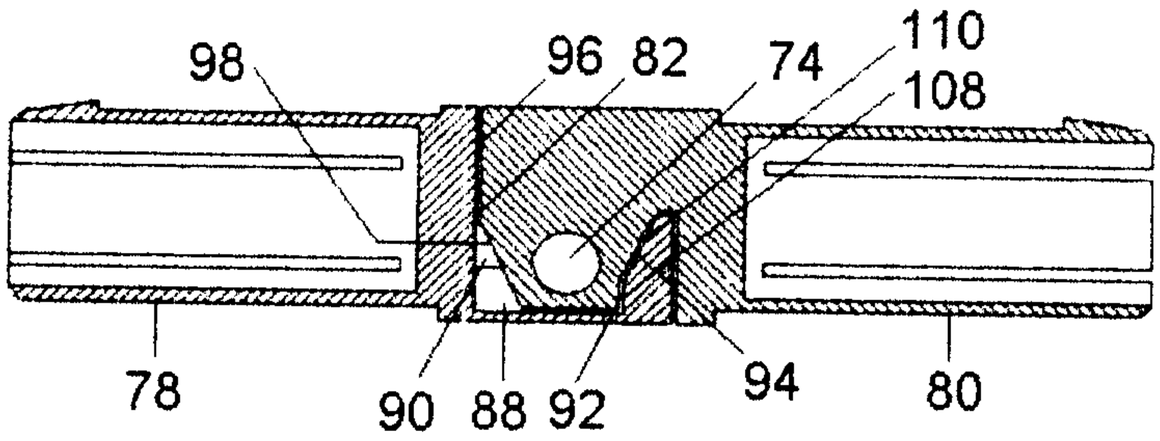
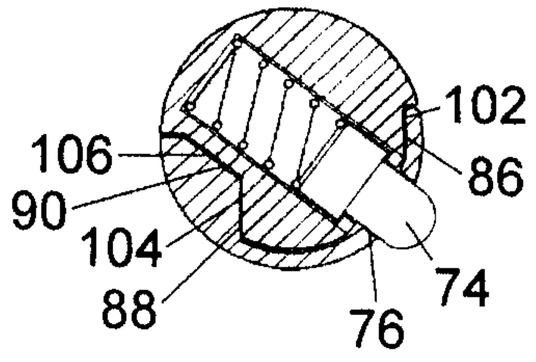
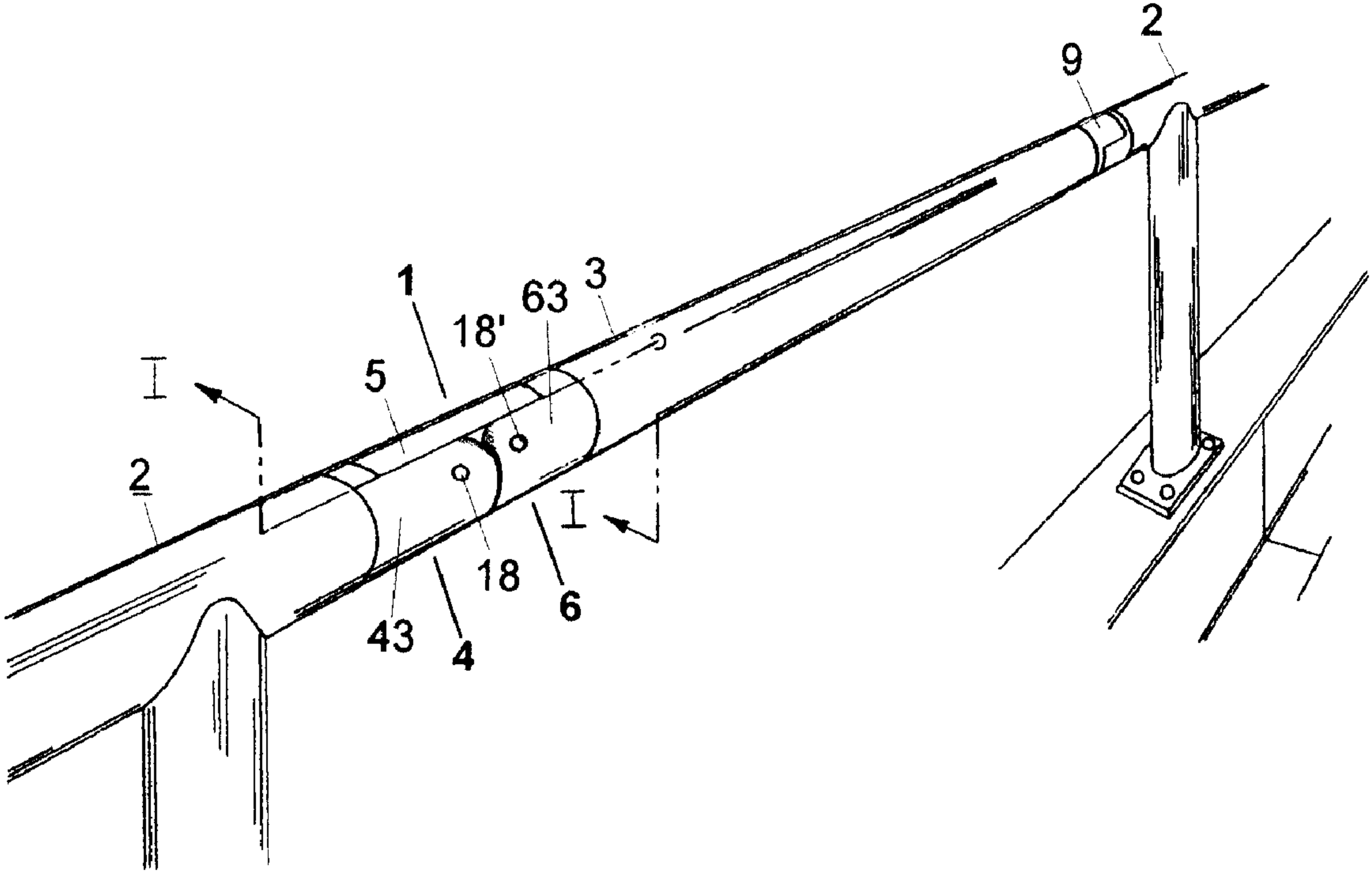


FIG. 13 B

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