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54 **Non-pinching hinge apparatus and method of use.**

57 A non-pinching hinge apparatus (10) having a constant radius hinge bulb (12) integrally connected to a door structure (14) with the hinge bulb (12) rotating about a hinge pivot (16) located at the center of the hinge bulb (12) when the door is operated, the hinge apparatus (10) including at least a single wiper (18) removably affixed to a door jamb structure (20) with the hinge bulb (12) passing the wiper (18) within a very close tolerance for eliminating pinch points and preventing the insertion of body parts into the hinge apparatus (10). A first alternative embodiment replaces the wiper construction with a close fitting socket while a second alternative embodiment provides a spring loaded wiper for use with a non-constant radius hinge bulb having an eccentric surface.

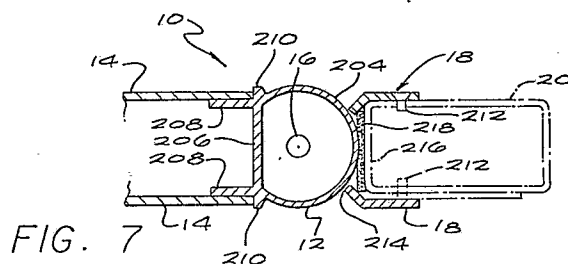


FIG. 7

Description

NON-PINCHING HINGE APPARATUS AND METHOD OF USE

BACKGROUND OF THE INVENTION

This invention relates to mechanical hinge devices for use in doorways, and more particularly, to mechanical hinge devices of the type having a non-pinching structural design for eliminating injury to personnel.

In the field of residential, commercial and industrial construction, the use of mechanical hinge devices for supporting and operating doors has long been known as a method for effecting the entrance to and egress from rooms and compartments. Typically, the hinge device is connected as by fasteners to the door and a door jamb. The door jamb is normally integrally connected to the building structure such as a door frame which may be comprised of wood, metal or any suitable material.

A major problem that exists in mechanical door hinges is the inherent danger of catching a body part such as a finger between the door and the door jamb when the door is operated from one extreme position to the next. The space between the door and the jamb which permits entry of a body part is called a pinch point and is most dangerous to small children. The crushing force exerted between the swinging door and the jamb at the pinch point is sufficient to seriously damage or maim a child.

Several attempts in the past have been made to improve hinge design and each of these designs can be classified in a particular category. A first category includes hooded or covered hinges which are designed to prevent the direction insertion of a body part into the knuckles of the mechanical hinge, but does not eliminate the pinch point which often exists between the two leaves employed for connecting to the door and the structure. A second category includes hinge devices which prevent insertion of a body part into the hinge by employing a tubular member or guard which generally are not structural members necessary for the proper operation of the hinge. Thus, the tubular member or guard often proves to be space consuming and complex in design. A third category of hinges is a miscellaneous category which generally fails to address the pinch point problem. Examples of mechanical hinges from each of these categories will assist the reader in identifying the problem.

Several of the covered hinge devices will now be briefly discussed to further illustrate the problem. One example includes a covered joint hinge which is comprised of a single piece of sheet metal having a central portion of which is apertured and folded or fashioned to form a pintel bearing portion of the hinge butt and a hood partially encircling the pintel bearing portion to conceal the joint of the hinge. A second hinge design employed a hinge base enclosed by a sheet metal U-shaped cover which was shaped to fit and clasp the base. The tubular pivot parts of the door leaf were enclosed

and concealed by hinge tips in the form of caps of sheet metal for providing a more aesthetic appearance. A third design included a hinge having one-piece leaves which included a tubular portion which surrounded and engaged the operating portion of the hinge sleeves.

A fourth example of the covered hinge device included a cover for the hinge and the hinge knuckles which was capable of displacement with a moving leaf of the hinge and was adapted to return to its original position together with the moving leaf. The cover included end portions of rubber or plastic material having resilient characteristics. A fifth example included a hinge for small offset doors such as kitchen cabinets which included a covering plate for snapping over the hinge with a plurality of lips yieldingly engaging against the inner edges of a structural tongue. The contour of a curved portion of the cover substantially conformed to the rounded edge of a projecting border portion of the cabinet door. A sixth example included a device for fitting over a door hinge which additionally limited the angular degree displacement of the door hinge. This limitation was accomplished by combining an inside member which telescoped into an outside member formed into rounded or semi-circular channels. The channels were sized to limit the maximum allowable degree of swing of the hinge and were fitted over the back of the hinge.

A seventh example of a hinge cover was employed on the exterior side doors of an automobile. The cover member included a main panel which covered the front face of a forward hinge arm with the inner edge of the main panel being contoured to conform to the exterior of the vehicle body over the height of the hinge cover member. The hinge cover member included top and bottom panels integral with the main panel and at right angles thereto and further included a rearwardly extending bend-over fastener spring clip on each of the top and bottom panels for detachably fastening the hinge cover member to the forward hinge arm.

An eighth example included a door edge and hinge guard for protecting the hinged edge of a door from damage. The guard was comprised of a U-shaped member and was secured to a door frame longitudinally thereto for protecting the edge of an open door and the hinge therein from resiliently deflecting objects such as shopping carts and the like. A final example of a hinge cover included a cover for butt hinges which was comprised of a decorative cover for mounting to a butt hinge for concealing the exposed portions thereof for improving the aesthetic appearance and which was formed from an elastomeric material for allowing the cover to conformingly move with the hinge.

In each of these examples of hooded or covered hinges, the hood, cover or guard device was employed to prevent direct interference with the mechanical hinge by preventing the insertion of a body part into the knuckles of the hinge. Inspection

of each of the examples discloses that a pinch point continued to exist at some location of the hinge device. Therefore, a continuing danger exists from accidentally inserting a body part into the pinch point.

The second category of devices designed to advance the mechanical hinge art included a finger guard for swinging doors. The finger guard was comprised of an elongated strip of material such as sheet metal, extruded plastic, or the like and which preferably was L-shaped in cross-section. The cross-section comprised a short leg and a long leg in which the long leg was approximately the width of the door jamb to which the finger guard was applied, while the shorter leg approximated the depth of the jamb or recess. The protective element was a tubular member which was outwardly offset relative to the short leg. Thus, when the door was opened, the tubular member prevented a body part such as a finger from being inserted far enough into the jamb to be caught if the door were suddenly closed. The tubular member was comprised of a flexible material and was circular in shape consuming excessive space and was generally unsuitable for fitting to automatically operated doors employed in a high traffic space. Close inspection of the finger guard revealed that a pinch point conceivably continued to exist.

Another example of a protective-type structure included a safety device for use with swinging doors. The safety device in theory eliminated the pinch point, but was very complex in design. Normally, a gap existed between the hinge edge of a swinging door and an adjacent door jamb. A generally rectangular finger excluding strip was provided at each of a pair of vertical edges of hollow collapsible beads. The finger excluding strip was adapted to be pushed past an anchor lip in face-to-face contact with the surface of the door or door jamb until an outward projection upon the bead snaps into place behind the lip. This construction inhibited withdrawal of the bead from the anchor strip. The finger excluding strip was comprised of a plastic polyvinyl chloride extrusion which was fluted along the outer surface for improving flexibility. Generally, the finger excluding strip was also applicable to offset swinging doors. However, the excessive number of assembly pieces proved to be too complex and further was aesthetically unacceptable due to excessive space consumption encroaching upon useable space within the room or compartment.

Finally, the miscellaneous category of hinges included devices which generally failed to address the pinch point problem. A first example included a refrigerator cabinet lid for rotating about a hinge which acted as the pivot point for two cabinet lids which included a pinch point where the lids separated from the structure. A second example included a trailer or container post construction which described a trailer hinge pin and socket construction which failed to provide any protection from exposed pinch points.

A third example included a protective device for preventing the splitting of a door frame by force and was comprised of a plate adapted for attachment to

the hidden outer face of an upstanding frame side member and a flange adapted for engagement with the inside edge of the frame side member. Improved hinge safety features were not disclosed. A final example included a swing control hinge designed for controlling the rotational speed of a door tending to accelerate towards a door strike due to a spring loaded hinge. This construction was designed to address the problem of a spring loaded hinge causing door to slam while allowing enough speed to ensure latching. The problems of personal safety and the elimination of pinch points were not considered.

Hence, those concerned with the development and use of mechanical door hinges in the construction field have long recognised the need for improved mechanical hinges of the type having a non-pinchng structural design for eliminating injury to personnel by eliminating pinch points in the hinge design. In addition to solving this continuing problem, the mechanical hinge must be decorative and attractive, simple in construction and have a minimum of operating parts. Further, there is a need for a mechanical hinge which is space-economical and is structurally reliable and capable of continuous duty for resisting damage to the door when pushed upon during high traffic conditions. The present invention fulfills all of these needs.

SUMMARY OF THE INVENTION

Briefly, and in generally terms, the present invention provides a new and improved door hinge construction which eliminates any hinge pinch points for substantially eliminating any potential hazard to body parts, and which significantly reduces hinge space consumption over similar types of prior art hinges. Moreover, the hinge construction of the present invention is simplified having a minimum of operating parts, is trouble free and structurally reliable in use, is attractive and lightweight, and does not require a hood or cover to attain its improved results.

Basically, the present invention is directed to an improved mechanical door hinge and method of use for eliminating pinch points within the structure of the hinge. This is accomplished by incorporating a rounded bulb and wiper construction within the hinged portion of the door.

In accordance with the invention, the back edge of the door is fashioned in a rounded bulb geometry which interfaces with at least a single wiper mounted on the door jamb or supporting structure.

In accordance with the improved method of the present invention, as a force is applied swinging the door through an arc, the rounded bulb geometry at the hinged portion of the door rotates about a hinge pivot. The outer circumference of the rounded bulb is a smooth constant radial surface which interfaces with the wiper. An insignificant gap exists between the bulb and the wiper which provides sufficient clearance for reducing frictional wear of the structure but inadequate clearance for passing a body part.

The new and improved mechanical door hinge and method of use of the present invention provides a hinge construction which eliminates any hinge pinch points for substantially eliminating any potential hazard to body parts and significantly reduces hinged space consumption. Further, the hinge of the present invention is simple in construction having a minimum of operating parts, is trouble free and structurally reliable in use, is attractive and lightweight, and does not require a hood or cover to attain its improved results.

These and other features and advantages of the invention will become apparent from the following more detailed description, when taken in conjunction with the accompanying drawings, which illustrate, by way of example, the features of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a planar edge view of a covered hinge of the prior art;

FIG. 1B is a perspective view of a hinge tip of the covered hinge of FIG. 1A;

FIG. 1C is a partially exploded view of the covered hinge of FIG. 1A;

FIG. 2 is a planar edge view of a swinging door finger guard apparatus of the prior art;

FIG. 3 is a cross-sectional view of a swinging door safety device of the prior art;

FIG. 4 is a front elevational view of a non-pinching hinge apparatus in accordance with the present invention;

FIG. 5 is a perspective view of a door illustrating a bulb of the non-pinching hinge apparatus of FIG. 4;

FIG. 6 is a planar edge view of a door illustrating a hinge bulb, of the non-pinching hinge apparatus of FIG. 4;

FIG. 7 is a cross-sectional view of the non-pinching hinge apparatus taken along the line 7-7 of FIG. 4;

FIG. 8 is a planar edge view of a first alternative embodiment of a non-pinching hinge apparatus of the present invention; and

FIG. 9 is a planar view of a second alternative embodiment of a non-pinching hinge apparatus of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

As shown in the drawings for purposes of illustration, the invention is embodied in a non-pinching hinge apparatus 10 of the type having a hinge bulb 13 for mechanically communicating with a door 14 and for rotating about a hinge pivot 16 and at least one wiper 18 mounted on a door jamb or structure 20 for preventing body parts from being trapped between the bulb and the jamb.

The space between the door 14 and the jamb 20 which permits entry of a body part is referred to as the pinch point and is most dangerous to small

children. The crushing force exerted between the swinging door and the jamb at the pinch point is sufficient to seriously damage or maim a child. Therefore, several attempts in the past have been made to improve hinge design and each of these designs can be classified in a particular category.

A first of these categories includes hooded or covered hinges which are designed to prevent the direct insertion of a body part into the knuckles of the mechanical hinge but does not eliminate the pinch point which often exists between the two leaves employed for connecting the door and the structure together. A second category includes a hinged device which prevents insertion of a body part into the hinge by employing a tubular member or guard which is not a necessary structural member for the proper operation of the hinge. Therefore, the tubular member or guard often proves to be space consuming and complex in design. A third category of hinges is a miscellaneous category which generally fails to address the pinch point problem.

An example of the first category is illustrated in a hinge generally designated by the reference numeral 30 as illustrated in Figs. 1A, 1B and 1C. A cabinet jamb 32 is hinged to a refrigerator door 34 having the part 36 enclosed by the door frame portion of the cabinet and a sealing strip 38 which is compressed between the door and the front side of the cabinet when the door is closed and latched. The hinge includes a base 40 which is secured to the door jamb 32 by a screw fastener 42 through several holes 44 as illustrated in Fig. 1C. A door leaf 46 is formed with projecting tubular pivot portions 48 which are in alignment with pivot holes in the top and the bottom of the hinge base 40 and pivotally connected therewith with a plurality of pins 50 having heads 52 fitted into the tubular pivot portion 48.

The tubular pivot portions 48 of the door leaf 46 are enclosed and concealed in a pair of hinged tips 54 in the form of caps of sheet metal which are slipped over the tubular projecting parts and united with the pivot pins 50. The hinge tips or cap 54 include vertical slots 56 for accommodating the flat portions of the door leaf adjacent to the tubular portions 48. The tips 54 fit the tubular parts while the open ends of the tips have their edges slightly sprung inwardly as is indicated at 58 so that the tips clasp the tubular portions.

The hinge base 40 is enclosed by a sheet metal U-shaped cover 60 which is shaped to fit and clasp the base. The cover 60 has a pair of edges 62 which are slightly sprung inwardly for retaining the cover in place. The primary purpose of the hinge 30 is for connecting the door 34 to the jamb 32 while the mechanism is enclosed with the hinge tips 54 and the cover 60 for providing a more pleasing aesthetic appearance. It should be noted that a pinch point continues to exist at the point designated 64 clearly shown in Fig. 1A.

An example of the second category of hinge designs includes a finger guard for swinging doors generally designated by the reference character 70 as is shown in Fig. 2. The swing guard 70 comprises an elongated strip 72 (not shown) of materials such as sheet metal, extruded plastic or the like. The

elongated strip 72 preferably is of an L-shaped cross section and having a shorter leg 74 and a longer leg 76 with the shorter leg 74 being integral with a narrow resilient hinge section 78 which bends outwardly a slight amount. The hinge section 78 is integral with a relatively resilient scroll 80, the diameter of which is preferably approximately the thickness of the door with which it is to be used.

The center of the scroll 80 is outwardly off-set relative to the shorter leg 74 so that its inner surface is preferably approximately tangential to the arc defined by the swing of the door. The edge of the longer leg 76 is also integral with the narrow resilient hinge section 82 which bends rearwardly slightly and this section is integral with a tubular member 84 preferably having a diameter much smaller than the resilient scroll 80.

A door 86 is hinged on the left hand edge and opens outwardly so that when the door is opened, the scroll 80 normally prevents any of a plurality of fingers 90 from being inserted far enough into a door jamb 88 to be caught if the door were closed suddenly. Further, the tubular member 84 is sufficiently large to block a gap located at a hinged edge 92 of the door. When the door is being closed, its edge first contacts the fingers 90 and the time element is such as to permit the fingers to be withdrawn due to the natural reflex action which could not be depended upon without the scroll 80. Even if the fingers were not immediately withdrawn upon contact with the door, the resiliency of hinge section 78 and the scroll 80 would prevent the application of injurious squeezing or crushing force. Likewise, the same is true for the smaller tubular member 84 which substantially blocks the gap between the hinge edge 92 of the door 86 and the jamb surface 88. Note that it is possible for the fingers 90 to be caught in the hinge at a pinch point 94.

A final example of the second category of hinge designs includes a safety device for swinging doors generally designated by the reference character 100 and shown in Fig. 3. The safety device is employed in a swinging door assembly for providing protection against the insertion of fingers into a gap between the hinge edge of the swinging door and an adjacent door jamb. A center pivoted door 102 includes a pivoting axes located at 104. The door is of the conventional metal type and is associated with a jamb 106. When the door is pivoted about the axis 104 to the open position, a considerable gap will be opened between the rearward edge of the door 108 and the face or edge of the jamb 106. The gap is sufficiently wide to permit the easy inadvertent insertion of a hand or portion thereof, so that serious injury could result when the door is subsequently closed.

To afford protection against this type of injury, a vertically extending anchored channel member 110 is applied in a position near the rearward edge of the front and back face of the door. The channel member 110 may be most conveniently formed by extruding aluminum and includes a flat portion 112 which is secured against the face of the door by self tapping or sheet metal screws 114. Any suitable type

of fastener may be employed depending upon the door structure. The channel member 110 is so formed as to have a overhanging lip portion 116 terminating in a rib 119 which extends inwardly towards the face of the door a short distance. The overhanging lip 116 extends away from the rearward edge of the door as is shown in Fig. 3.

A generally rectangular, finger excluding strip 120 is provided with a hollow collapsible bead 122 at each of the vertical edges of the strip 120. The hollow collapsible beads are adapted to be pushed passed the rib 118 in face-to-face contact with the surface of the door 102 or the door jamb 106 until an outward projection upon the beads snaps into place behind the rib 118. This construction inhibits withdrawal of the bead from the anchor strip 110. The finger excluding strip 120 extends from the top to the bottom of the door and thus as the door swings, the strip 120 will distort so as to accommodate this movement. Ordinarily when the door is closed, the strip 120 will have a substantially cylindrical contour as viewed from the outer surface. The finger excluding strip 120 may be comprised of plastic polyvinyl chloride extrusion and may include a plurality of fluted portions 124 for providing an attractive appearance and contributing to the flexibility of the finger excluding strip.

Although the safety device 100 appears to eliminate pinch points, the construction includes a plurality of pieces leading to an unreasonably complex design which encroaches upon both internal and external cabin space in high density travelled areas. Further, the finger excluding strip is generally aesthetically unacceptable and is subject to wear and thus, must be periodically replaced.

In accordance with the present invention, the hinge bulb 12 and the wipers 18 cooperate to eliminate hinge pinch points for substantially eliminating any potential hazard to body parts and for significantly reducing the space consumed by the non-pinching hinge apparatus 10. Further, the hinge employs a simplified construction having a minimum of operating parts, is trouble free and structural reliable in use, is attractive and lightweight, and does not require a hood or cover to obtain its improved results.

The non-pinching hinge apparatus 10 may be employed in the operation of a plurality of the door 14 mounted adjacent to one another as in, for example, the entrance and exit to a miniature theater cabin 200 as is illustrated in Fig. 4. The non-pinching hinge apparatus 10 particularly is useful in an environment in which high density foot traffic is entering and exiting the miniature theater cabin 200. However, the hinge apparatus 10 is also useful in a cabin or amusement ride which includes a translational and rotational device or simulating the movement of an object such as a spaceship, a seagoing vessel, a train, an automobile, or any other device or system for carrying or transporting personnel. Further, the non-pinching hinge apparatus 10 is useful in any environment in which personnel safety is a main concern, including but not limited to a pedestrian draw bridge normally employed to accommodate foot traffic but periodically lifted to

permit passage of vehicles.

The door 14 may be suspended within the door jamb 20 by any known or suitable method which may include employing a pin structure 202 which may be positioned along the center line of the hinge pivot 16 as is illustrated in Figs. 5 and 6. Note that the hinge bulb 12 is designed to be integrally fitted into the door 14 as is illustrated in Fig. 6 and more clearly in Fig. 7. The hinge bulb 12 includes a rounded back edge 204 which is shaved on one edge forming a flat surface 206 and including a pair of connection rods 208 extending therefrom. The pair of connection rods 208 slide into the internal section of the door 14 with the external surfaces of the door abutting against a pair of stops 210. The pair of stops extend from the outer surface of the hinge bulb 12 at the interface of the rounded back edge 204 and the flat surface 206 as is illustrated in Fig. 7. It should be noted that the method of connection of the hinged bulb to the door may be by any suitable means known in the art.

The hinge bulb 12 is designed to be of constant radius of which measures, for example, one inch. The hinge bulb provides a smooth constant radial surface along the rounded back edge 204 for interfacing with the wiper 18. The hinge bulb may be visualized as a continuous knuckle extending along the vertical lengths of the door edge. However, the bulb may be divided into integral pieces for accommodating a design that employs a series of knuckles for interfacing with the door jamb 20 as is illustrated in Fig. 5. The door jamb or supporting structure may be any suitable structure presently available or known in the art. A single wiper 18 or in the alternative, a pair of wipers are affixed to the door jamb 20 by any suitable fastener 212 as is illustrated in Fig. 7.

The function of the pair of wipers 18 is to prevent body parts such as hands and fingers from being caught between the rounded back edge 204 of the hinge bulb 12 and the door jamb 20 during the operation of the door 14. Although modern door construction employs a plurality of materials for fabricating the door 14, the hinge bulb 12 and the wipers 18 may be comprised of any suitable material such as high strength plastics, synthetic materials or wood.

In the case of hinge bulbs of metallic construction, the wipers 18 would be rapidly worn away by the rotary grinding action of the rounded back edge 204 if the wipers physically contacted the hinge bulb. For this reason, the wipers 18 do not physically ride on the rounded back edge 204 but are separated from the hinge bulb by a distance sufficient to eliminate interference with rotation of the door 14 but sufficiently close to prevent the insertion of a body part. The distance or gap 214 may be, for example, twenty to thirty thousandths of an inch but is not limited to that range. If synthetic materials are employed in the construction of the hinge bulb 12 and the wipers 18, the gap clearance may be insignificant and the wipers may actually ride along the rounded back edge 204 of the hinge bulb.

The hinge pivot 16 is located along the center line of the hinge bulb 12. This construction ensures that

the distance between the rounded back edge 204 of the hinge bulb and the ends of the wipers 18 remains constant providing the fixed gap 214. The constant radius of the hinge bulb provides a smoother operation of the non-pinching hinge apparatus 10. If the hinge pivot was not located at the center of the hinge bulb, the joint surface would be eccentric and the smooth operation of the bulb surface would be less. An eccentric surface would result if the hinge pivot 16 was located behind the center line of the hinge bulb 12. Thus, if the hinge pivot was not located along the center line of the bulb, a non-constant radius would result providing a pinch point which would defeat the objective of the invention.

Mounted adjacent and in front of a forward edge 216 of the door jamb 20 is a weather and light seal 218. The weather and light seal 218 may be secured to the forward edge 216 of the door jamb 20 by any suitable means such as by fasteners or gluing. The seal is further captured behind the curved surface at the ends of the wipers 18. The seal 218 is in physical communication with the hinge bulb 12 as is illustrated in Fig. 7 and is utilized for sealing the hinge apparatus 10 and the door jamb 20 from the external elements and from the passage of visible light.

Based upon the design of the non-pinching hinge apparatus 10 as hereinabove described, pinch points have been eliminated which substantially reduces the risk of personal injury to those persons located adjacent to the door 14. The hinge apparatus is also simple in construction being comprised of a minimum of operating components necessary for attaining the improved results. Further, it is not necessary to incorporate additional devices or structure which consume excessive space. Thus, the non-pinching hinge apparatus 10 was designed with space economy in mind in addition to being decorative and attractive in appearance.

An additional advantage is that the structure of the hinge bulb 12 may be fabricated from an extrusion metal process employing such metals as, for example, aluminum. Therefore, the hinge bulb may be designed to be hollow and is therefor lightweight. However, the hinge bulb may be designed to be solid for heavy duty use in such applications as in the fabrication of a non-pinching hinge for a bank vault door. Notwithstanding the lightweight extrusion fabrication process employed in the production of the hinge bulb and accompanying door jamb, the hinge apparatus 10 is structurally reliable for continuous duty use and is sufficiently strong to withstand damage if the door 14 is simultaneously pushed upon or abused by a plurality of individuals entering or exiting the miniature theater cabin 200 as is illustrated in Fig. 4.

A first alternative embodiment of the non-pinching hinge apparatus designated by the general reference numeral 300 and incorporating the present invention is illustrated in Fig. 8. In this instance, the first alternative embodiment of the non-pinching hinge apparatus 300 of Fig. 8 is of the hinge bulb type somewhat similar to the non-pinching hinge apparatus 18 of Figs. 4 through 7. Parts of the hinge

apparatus 300 of Fig. 8 which find substantial correspondence in structure and function to those parts of Figs. 4 through 7 are designated with corresponding reference numerals of the three-hundred series.

Briefly, the non-pinching hinge apparatus 300 includes a constant radius hinge bulb 312 integrally connected to a door 314 having a hinge pivot 316 with the hinge bulb 312 interfacing with a close fitting socket 322 mounted within a door jamb 320. The construction and operation of the non-pinching hinge apparatus 300 is very similar as described in the preferred embodiment of the hinge apparatus 10.

The constant radius hinge bulb 312 may be mounted within the door frame structure by a pin structure 302 (not shown) with the hinge bulb including a rounded back edge 304 terminating in a flat surface 306. A pair of connection rods 308 extended from a pair of stops 310 integrally connected to the flat surface 306. The connection rods 308 are inserted within the exterior walls of the door 314 for securing the hinge bulb 312 to the door 314. However, note that the hinge bulb 213 can be secured to the door by any suitable means known in the art.

The hinge pivot 316 is located along the center line of the constant radius hinge bulb 312. In the first alternative embodiment 300, the wipers 18 have been replaced by the close fitting socket 322 having a forward concave surface 326 which matches the outer contour of the hinge bulb. A gap 324 exists between the close fitting socket and the hinge bulb for preventing the premature and excessive wear of the hinge apparatus 300. The gap clearance is of the same order of magnitude as described in the preferred embodiment 10. The close fitting socket 322 includes a pair of extension points 328 which prevent the insertion of body parts between the hinge bulb 312 and the close fitting socket 322. This feature closely approximates the function of the pair of wipers 18 of the hinge apparatus 10 and thus eliminates the hazard to personnel perpetuating the objective of the invention.

Finally, located between the outer surface the hinge bulb 312 and the forward curved edge 326 of the door jamb is a weather and light seal 318 mounted to the curved edge 326 by any conventional means. The seal 318 prevents the external elements from passing through the hinge apparatus 300 and additionally prevents the passage of visible light. The remaining operation of the non-pinching hinge apparatus 300 is duplicate to that of the hinge apparatus 10 of the preferred embodiment.

A second alternative embodiment of the non-pinching hinge apparatus designated by the general reference numeral 400 and incorporating the present invention is illustrated in Fig. 9. In this instance, the second alternative embodiment of the non-pinching hinge apparatus 400 of Fig. 9 is of a non-constant radius hinge bulb type similar in operation to the hinge apparatus 10 of the preferred embodiment illustrated in Figs. 4 through 7. Parts of the hinge apparatus 400 of Fig. 9 which find substantial correspondence in structure and function to those

parts of Figs. 4 through 7 are designated with corresponding reference numerals of the four-hundred series.

The non-pinching hinge apparatus 400 is useful for installing in a door 414 (not shown) as was described in the preferred embodiment 10 and may be secured in position within the door frame by a pin structure 402 (also not shown). A major distinction that is evident in the second alternative embodiment is that the hinge bulb 412 includes a non-constant radius with respect to the hinge centerline and has an eccentric back edge 404 as is illustrated in Fig. 9. Note that the second alternative embodiment of the hinge apparatus 400 may include a flat back surface 406, a pair of connection rods 408 and a pair of stops 410 (each of which are not shown) so that the hinge bulb 412 is an integral part of the door 414 as described in Figs. 5-7. In addition to a non-constant radius hinge bulb and eccentric back edge, a hinge pivot 416 is located off center so that for a fixed pair of wipers, the space between the wiper and the hinge bulb would vary.

To avoid this problem, a pair of wipers 418 are mounted within a wiper retainer 430 which includes a pair of retained arms 432. A spring cavity 434 is mounted between the retained arms for securing a spring 436 which is connected to the inner wall of the wiper retainer and the corresponding wiper 418. As the door 414 is operated, the non-constant radius hinge bulb 412 rotates about the off center hinge pivot 416. The wiper 418 has been spring loaded by employing the spring 436 within the wiper retainer 430 so that during the operation of the door 414, a gap does not exist between the eccentric back edge 404 of the hinge bulb 412 and each of the wipers 418. The wiper retainer is removably affixed to the door jamb 420 by a plurality of wiper retainer fasteners 438 while each of the respective wipers 418 are position adjustable by riding along the eccentric back edge 404 as the non-constant radius hinge apparatus 400 moves during the operation of the door 414.

Under these conditions, the spring 436 mounted in the spring cavity 434 of the wiper retainer 430 causes the wiper 418 to be in physical communication with the eccentric back edge 404 of the hinge bulb 412. This construction prevents the insertion of body parts between the hinge bulb 412 and the door jamb 420. Since each of the wipers 418 must necessarily ride along the eccentric back edge 404, it follows that a contact surface tip 440 of the wipers 418 must be fabricated from a synthetic material having a low coefficient of friction. Therefore, the high quality bearing surface of the surface tip 440 permits excessive wear of the hinge apparatus 400 to be avoided. In addition, a weather and light seal 442 is provided for blocking the elements and visible light from passing through the hinge apparatus. The remainder of the operation of the non-pinching hinge apparatus 400 is similar to that described in the preferred embodiment 10.

From the foregoing, it will be appreciated that the non-pinching hinge apparatus of the present invention eliminates any hinge pinch points for substantially eliminating any potential hazard to personnel in contact with the door 14, and that the hinge space

consumption is reduced thereby improving space economy. Further, the hinge exhibits a simplified construction having a minimum of operating parts, is trouble free and reliable in use, is lightweight and attractive in appearance, and attains its improved results without using a hooded or covered portion.

While several particular forms of the invention have been illustrated and described, it will also be apparent that various modifications can be made without departing from the spirit and scope of the invention. Accordingly, it is not intended that the invention be limited, except as by the appended claims.

Claims

1. A non-pinching hinge apparatus comprising, in combination:

a door mounted within a structural frame for providing an entrance and an exit;

bulb means in mechanical communication with said door, said bulb means having a hinge pivot located at the center of said bulb means for providing a constant radius axis of rotation when said door is rotated about said hinge pivot;

wiping means mounted adjacent to and separated from said bulb means, said wiping means for preventing the insertion of human body parts into said hinge apparatus; and

jamb means in mechanical communication with said structural frame, said jamb means for supporting said wiping means wherein said rotating bulb means and said wiping means provide said non-pinching action of said hinge apparatus.

2. The non-pinching hinge apparatus of claim 1 wherein said bulb means comprises a hinge bulb.

3. The non-pinching hinge apparatus of claim 1 wherein said bulb means further comprises a rounded back edge for rotating past said wiping means at said constant radius.

4. The non-pinching hinge apparatus of claim 1 wherein said door is mounted along said constant radius axis of rotation by a pin structure.

5. The non-pinching hinge apparatus of claim 1 wherein said wiping means comprises a single wiper separated from said bulb means by a minute distance.

6. The non-pinching hinge apparatus of claim 1 wherein said wiping means comprises a plurality of wipers separated from said bulb means by a minute distance.

7. The non-pinching hinge apparatus of claim 1 wherein said jamb means comprises a door jamb.

8. The non-pinching hinge apparatus of claim 1 wherein said bulb means includes a flat surface having a pair of connection rods extending from said flat surface for connecting

said bulb means to said door.

9. The non-pinching hinge apparatus of claim 1 further including a seal mounted to a forward edge of said jamb means for preventing the passage of moisture and visible light through said non-pinching hinge apparatus.

10. A non-pinching hinge comprising, in combination:

a door mounted within a structural frame for providing an entrance and an exit;

a hinge bulb in mechanical communication with said door, said hinge bulb having a hinge pivot located at the center of said hinge bulb for providing a constant radius axis of rotation when said door is rotated about said hinge pivot;

a plurality of wipers mounted adjacent to and separated from said hinge bulb, said plurality of wipers for preventing the insertion of human body parts into said non-pinching hinge; and a door jamb in mechanical communication with said structural frame, said door jamb for supporting said plurality of wipers wherein said rotating hinge bulb and said plurality of wipers provide said non-pinching action of said hinge.

11. A non-pinching hinge comprising, in combination:

a door mounted within a structural frame for providing an entrance and an exit;

a hinge bulb in mechanical communication with said door, said hinge bulb having a hinge pivot located at the center of said hinge bulb for providing a constant radius axis of rotation when said door is rotated about said hinge pivot;

a close fitting socket mounted adjacent to and separated from said hinge bulb, said close fitting socket for preventing the insertion of human body parts into said non-pinching hinge; and

a door jamb in mechanical communication with said structural frame, said door jamb for supporting said close fitting socket wherein said rotating hinge bulb and said close fitting socket provide said non-pinching action of said hinge.

12. The non-pinching hinge of claim 11 wherein said close fitting socket includes a forward concave surface congruent with a rounded back edge of said hinge bulb, said forward concave surface terminating in a pair of extension points for preventing the insertion of human body parts between said hinge bulb and said close fitting socket.

13. A non-pinching hinge apparatus comprising, in combination:

a door mounted within a structural frame for providing an entrance and an exit;

bulb means in mechanical communication with said door, said bulb means having a hinge pivot located off center of said bulb means for providing a non-constant radius axis of rotation when said door is rotated about said off center hinge pivot;

wiping means mounted in mechanical com-

munication with said bulb means, said wiping means for preventing the insertion of human body parts into said hinge apparatus; and jamb means in mechanical communication with said structural frame, said jamb means for supporting said wiping means wherein said rotating bulb means and said wiping means provide said non-pinching action of said hinge apparatus.

14. The non-pinching hinge apparatus of claim 13 wherein said bulb means comprises a hinge bulb and wherein said hinge bulb includes an eccentric back edge for rotating past said wiping means at said non-constant radius.

15. The non-pinching hinge apparatus of claim 13 wherein said wiping means comprises a plurality of wipers with each of said plurality of wipers including a wiper retainer mounted to said jamb means, said wiper retainer having a cavity for housing a spring with said spring forcing said wiper in contact with an eccentric back edge of said hinge bulb.

16. The non-pinching hinge apparatus of claim 13 wherein said wiping means further includes a contact surface tip comprised of a synthetic material having a low coefficient of friction.

17. The non-pinching hinge apparatus of claim 13 further including a seal mounted to a forward edge of said jamb means for preventing the passage of moisture and visible light through said non-pinching hinge apparatus.

18. A non-pinching hinge comprising, in combination:

a door mounted within a structural frame for providing an entrance and an exit;

a hinge bulb in mechanical communication with said door, said hinge bulb having a hinge pivot located off-center of said hinge bulb for providing a non-constant radius axis of rotation when said door is rotated about said off-center hinge pivot;

a plurality of wipers mounted in mechanical communication with said hinge bulb, each of said plurality of wipers comprising a wiper retainer having a cavity for housing a spring with said spring forcing said wiper in contact with an eccentric back edge of said hinge bulb, each of said wipers further including a contact surface tip comprised of a synthetic material having a low coefficient of friction, said wipers for preventing the insertion of human body parts into said non-pinching hinge; and

a door jamb in mechanical communication with said structural frame, said door jamb for supporting said plurality of wipers wherein said rotating hinge bulb and said plurality of wipers provide said non-pinching action of said hinge.

19. A method for providing a non-pinching hinge, said method comprising the steps of:

providing a door mounted within a structural frame;

providing a constant radius axis of rotation about a hinge pivot located at the center of a hinge bulb when said door is rotated about said hinge pivot;

mounting a plurality of wipers adjacent to and separated from said hinge bulb for preventing the insertion of human body parts into said non-pinching hinge; and

supporting said plurality of wipers with a door jamb in communication with said structural frame wherein said rotating hinge bulb and said plurality of wipers provide said non-pinching action of said hinge.

20. A method of providing a non-pinching hinge, said method comprising the steps of: providing a door mounted within a structural frame;

providing a non-constant radius axis of rotation about a hinge pivot located off-center of a hinge bulb when said door is rotated about said off-center hinge pivot;

mounting a plurality of spring loaded wipers in contact with an eccentric back edge of said hinge bulb for preventing the insertion of human body parts into said non-pinching hinge; and supporting said plurality of spring loaded wipers with a door jamb in communication with said structural frame wherein said rotating hinge bulb and said plurality of spring loaded wipers provide said non-pinching action of said hinge.

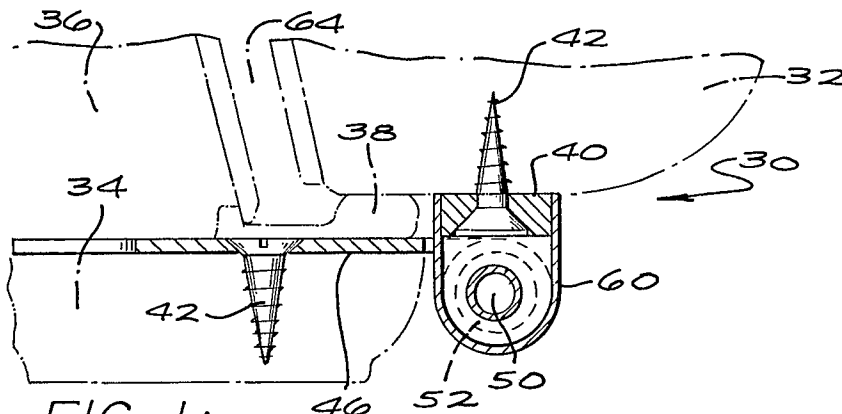
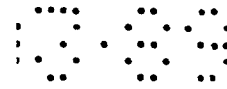


FIG. 1A

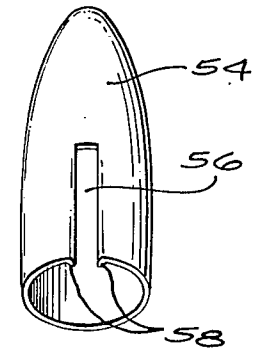


FIG. 1B

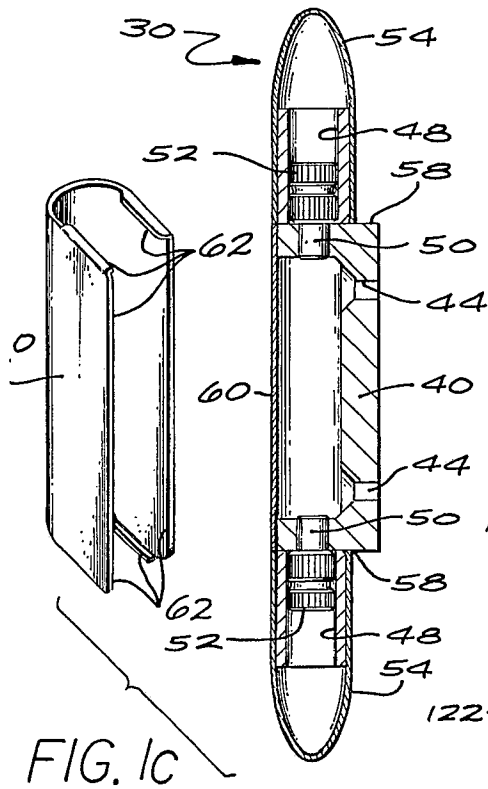


FIG. 1C

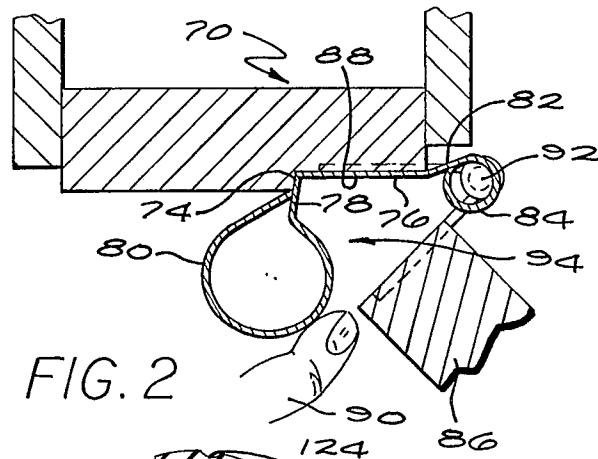


FIG. 2

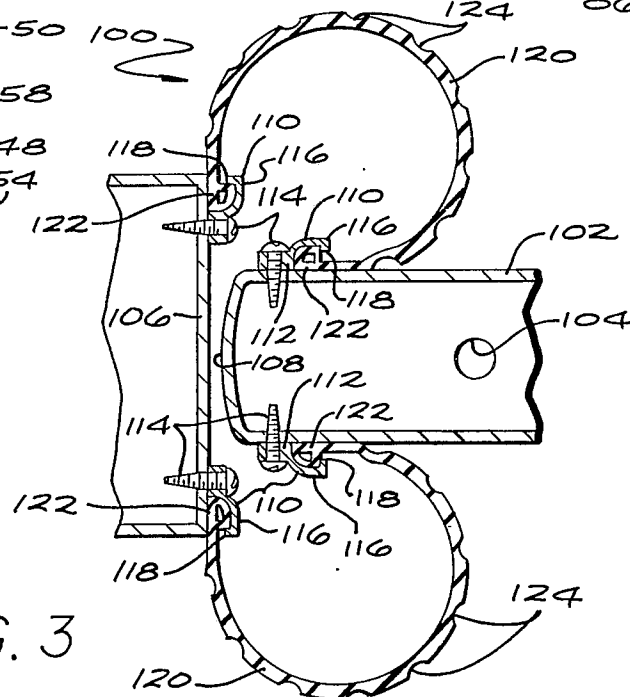
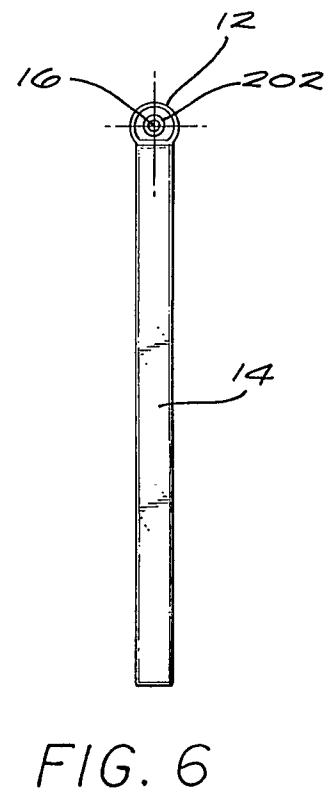
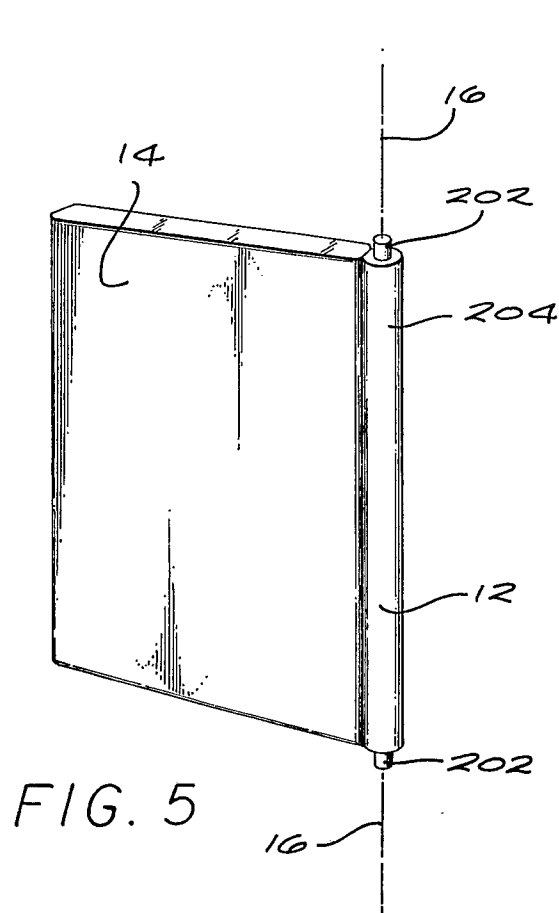
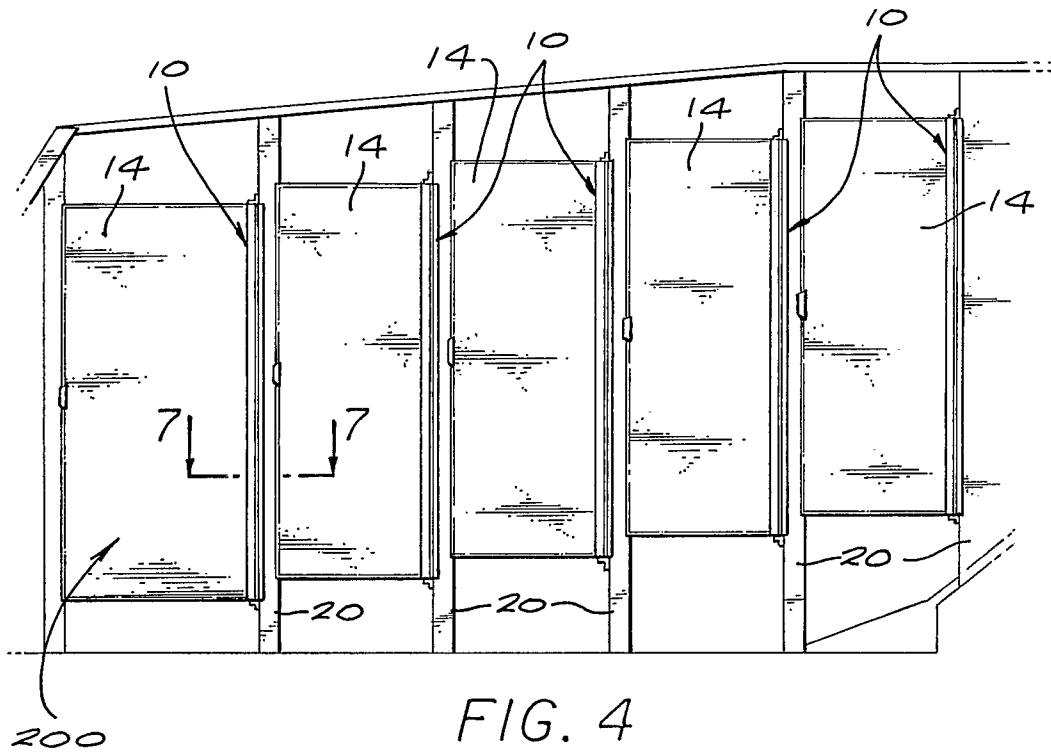
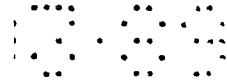
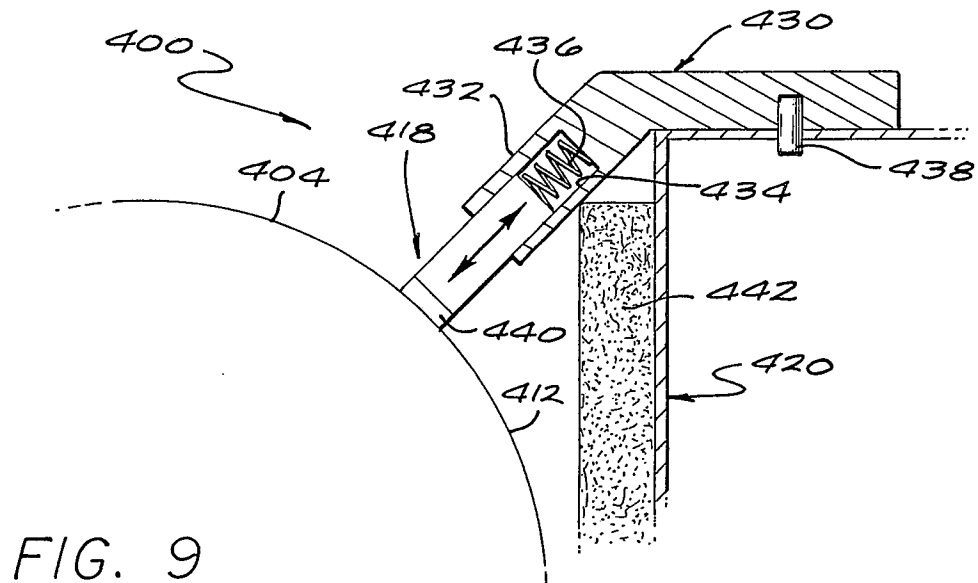
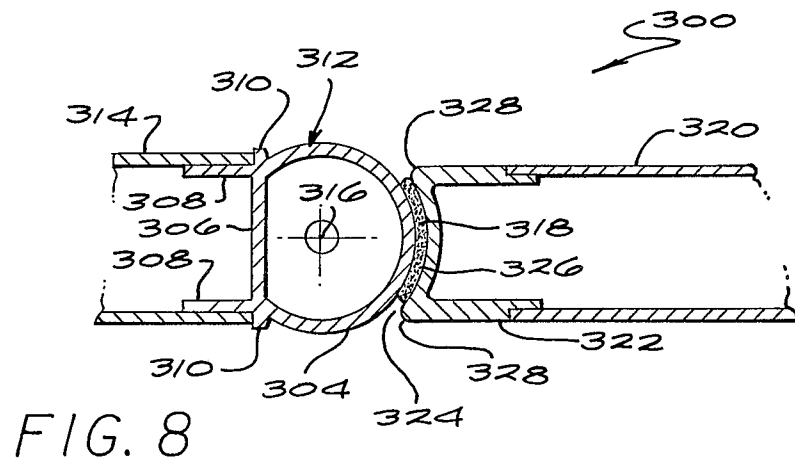
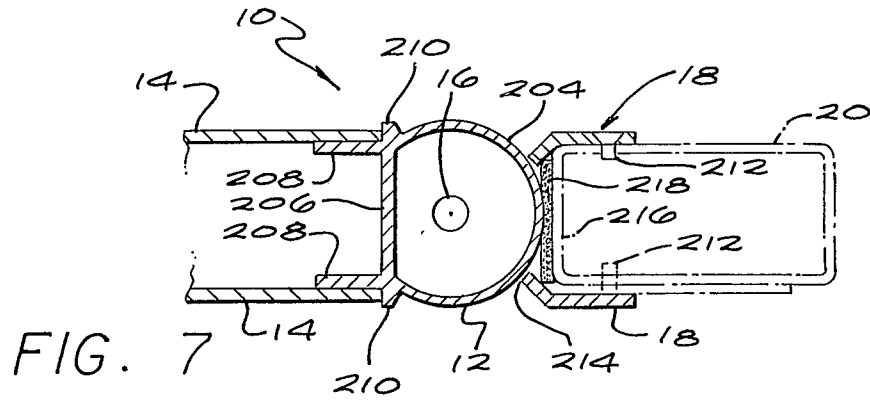


FIG. 3







DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	DE-U-8 709 989 (GROPP) * Page 8, line 12 - page 11, line 28; figures 1-9 *	1-7,10-12,19	E 06 B 3/88
Y	---	13,14,17	
X	CH-A- 641 240 (SCHÜCO) * Column 1, lines 39-44; column 2, lines 28-51; figures 1,2 *	1-7,10-12,19	
X	US-A-3 827 183 (ZIMMERMANN) * Column 3, line 11 - column 4, line 46; column 5, line 54 - column 6, line 10; figures 1-3,6,7 *	1-4,7-9,11,12	
A	---	10,19	
X	US-A-4 290 233 (HUBBARD) * Column 4, line 7 - column 5, line 35; column 7, lines 21-56; figures 2,3,5,7 *	1,2,5,7,8	
A	---	10,13,14,15,18,19,20	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
Y	GB-A- 443 887 (FOCQUE) * Page 1, line 63 - page 2, line 39; figures 1-21 *	13,14,17	E 06 B
A	---	11,12,18,20	
A	FR-A- 736 630 (DOHY) * Page 2, lines 6-18; figure 5 * --- -/-	15,18,20	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 07-04-1989	Examiner DEPOORTER F.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

