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(54) **WATER-BALLASTED PROTECTION BARRIER**

WASSERBALLASTIERTE SCHUTZBARRIERE

BARRIERE DE PROTECTION A BALLAST REMPLI D'EAU

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Description

Background of the Invention

[0001] The present invention relates generally to vehicle protection barriers, and more particularly to movable water ballasted vehicle traffic protection barriers for applications such as pedestrian protection, traffic work zone separation, airport runway divisions, and industrial commercial uses.

[0002] Water ballasted vehicle traffic protection barriers of the type described herein are known in the prior art. Generally, such barriers are comprised of molded, lightweight plastic, and are hollow, having a fill port for filling them with water to ballast them in place such as that disclosed in US4681302. The barriers are fabricated to be sectional and modular, so that, once placed in a desired location, they can be attached together lengthwise to create a barrier of any desired length.

[0003] Prior art water ballasted barriers of this type have a certain utility, but have been plagued with durability problems, and have difficulty meeting current federal highway safety standards, specifically the Federal Highway Administration Standards of Report NCHRP 350. Failure of a barrier to meet these standards excludes the barrier from use on any highway project which is funded in whole or in part by federal highway funds, and thus severely limits that barrier=s usefulness. Typically, failures occur because the barrier cannot pass vehicle impact tests required under NCHRP 350 standards. Test level 1 (TL-1) standards requires an 820 kg vehicle to impact the water wall barrier at 50 kilometers per hour (kph) at an impact angle of 20 degrees, and a 2000 kg vehicle to impact the water wall barrier at 50 kph at an impact angle of 25 degrees. Test level 2 (TL-2) standards require an impact velocity of 70 kph, with the same vehicle weights and impact angles as for TL-1 tests. Test level 3 (TL-3) standards require an impact velocity of 100 kph, again with the same vehicle weights and impact angles as for TL-1 and TL-2 tests. To pass these impact tests, the barrier must keep the impact vehicle from penetrating and driving over the water wall, as well as keeping the impact vehicle from rolling over on its side or roof Additionally, occupant velocity must not exceed 12 m/s, and the ride-down acceleration must not exceed 20g.

[0004] What is needed, therefore, is an improved water ballasted protection barrier system which can successfully meet the TL-1, TL-2, and TL-3 test standards described above.

Summary of the Invention

[0005] Accordingly, there are disclosed herein two embodiments of a water ballasted protection barrier system which are together capable of meeting all three test standards discussed above. Furthermore, there is also provided a water ballasted protection barrier system which is capable of downwardly deflecting vehicles impacting the barrier.

[0006] More particularly, there is provided a barrier segment which is hollow and adapted to be filled with a fluent material for ballast. The barrier segment comprises:

a molded plastic container having outer walls defining an interior volume and having a first end and a second end;
a plurality of connecting lugs disposed on each of said first and second ends, so that a plurality of barrier segments may be joined together;
a drain aperture in one of said outer walls of said barrier segment;
a closure for closing and sealing said drain aperture;
buttress threads disposed on an interior surface of said drain aperture;
threads disposed on an outer surface of said closure, for engaging said buttress threads to secure said closure sealingly relative to said drain aperture;
wherein said buttress threads are coarse and square cut, with flat edges;
a recess disposed on said barrier segment outer wall, surrounding said drain aperture, having a depth sufficient so that when said closure is engaged with said drain aperture to close same, an outer surface of said closure is approximately flush with adjacent non-recessed portions of said outer wall; and
wherein said outer walls having a plurality of sawtooth segments disposed thereon, which are arranged vertically and extend outwardly and downwardly in order to deflect vehicles impacting the barrier segment in a downward direction.

[0007] In embodiments presented as background art there is provided a barrier segment which is hollow and adapted to be filled with a fluent material for ballast. The barrier segment comprises a molded plastic container having outer walls defining an interior volume and having a first end and a second end. A plurality of connecting lugs are disposed on each of the first and second ends, so that a plurality of barrier segments may be joined together. A length of metallic cable, preferably stainless steel wire rope cable, comprising a plurality of 1 x 19 strands, is molded within the molded plastic container, so that most of the length of metallic cable is entirely disposed within the interior volume of the container, along substantially an entire length of the container between the first and second ends thereof.

[0008] Preferably, a loop of cable is disposed at each end of the length of cable, wherein each of the loops are wrapped about a pin hole disposed in one of the lugs. The length of metallic cable is connected between opposing lugs on the first and second ends of the container. In preferred embodiments, additional lengths of metallic cable are provided, wherein there is a length of metallic cable connected between each pair of opposing lugs on the first and second ends of the container.

[0009] A hole is molded into in each of the connecting lugs, for receiving a connecting pin. In some applications, the inventive barrier includes a fence post adapted for disposition over a top end of a connecting pin, for supporting a fence above the barrier segment.

[0010] An important feature of the invention is the inclusion of a drain aperture in one of the outer walls of the barrier segment. A closure is provided for closing and sealing the drain aperture. Advantageously, the drain aperture comprises buttress threads disposed on an interior surface of the drain aperture. Threads are disposed on an outer surface of the closure, for engaging the buttress threads to secure the closure sealingly relative to the drain aperture. The buttress threads are coarse and square cut, with flat edges.

[0011] Another advantageous feature of the invention is the provision of a recess disposed on the barrier segment outer wall, surrounding the drain aperture, having a depth sufficient so that when the closure is engaged with the drain aperture to close same, an outer surface of the closure is approximately flush with adjacent non-recessed portions of the outer wall.

[0012] In another aspect of the invention, there is provided a barrier segment which is hollow and adapted to be filled with a fluent material for ballast. The barrier segment comprises a molded plastic container having outer walls defining an interior volume and having a first end and a second end. The outer walls have a plurality of sawtooth segments disposed thereon, which are arranged vertically and extend outwardly and downwardly in order to deflect vehicles impacting the barrier segment in a downward direction. Preferably, there are three sawtooth segments disposed on each lengthwise outer wall.

[0013] A length of metallic cable is preferably molded within the molded plastic container, so that most of the length of metallic cable is entirely disposed within the interior volume, along substantially an entire length of the container between the first and second ends.

[0014] In still another aspect of the invention, there is provided a barrier segment which is hollow and adapted to be filled with a fluent material for ballast. The barrier segment comprises a molded plastic container having outer walls defining an interior volume and having a first end and a second end. A plurality of connecting lugs are disposed on each of the first and second ends, so that a plurality of barrier segments may be joined together. Each of the connecting lugs comprises a hole for receiving a connecting pin therethrough, and a double-walled reinforcing portion adjacent to the hole on the lug. A recessed section is disposed on an outside of each lug, which creates the double-walled reinforcing portion. A concave female portion on each end of the barrier segment, adjacent to said lugs, provides beneficial effects when a barrier formed by multiple barrier segments, joined end-to-end, is impacted by a vehicle, as described more fully hereinbelow.

[0015] Preferably, each lengthwise outer wall is formed in a vertically oriented concave curved shape. A concave center portion of each lengthwise outer wall has a curve radius of 63 cm (24 ¾ inches).

[0016] In preferred embodiments, a length of metallic cable is molded within the molded plastic container, so that most of the length of metallic cable is entirely disposed within the interior volume, along substantially an entire length of said container between the first and second ends.

[0017] In yet another aspect of the invention, there is disclosed a method of making a barrier segment for use in creating a roadside barrier system. This method comprises steps of disposing at least one wire rope cable within a mold tool, and using the mold tool to mold a plastic hollow container. When the molding step is completed, the wire rope cable is irremovably disposed within the plastic hollow container. The disposing step preferably comprises disposing a plurality of wire rope cables within the mold tool.

[0018] In still another aspect of the invention, there is provided a barrier segment which is hollow and adapted to be filled with a fluent material for ballast. The barrier segment comprises a molded plastic container having outer walls defining an interior volume and having a first end and a second end. A plurality of connecting lugs are disposed on each of the first and second ends, so that a plurality of barrier segments may be joined together. A drain aperture is disposed in one of the outer walls of the barrier segment, and a closure is provided for closing and sealing the drain aperture. Advantageously, buttress threads are disposed on an interior surface of the drain aperture. Threads are disposed on an outer surface of the closure, for engaging the buttress threads to secure the closure sealingly relative to the drain aperture. The buttress threads are coarse and square cut, with flat edges. Another advantageous feature of the invention is that a recess is disposed on the barrier segment outer wall, surrounding the drain aperture, having a depth sufficient so that when the closure is engaged with the drain aperture to close same, an outer surface of the closure is approximately flush with adjacent non-recessed portions of the outer wall.

[0019] The invention, together with additional features and advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying illustrative drawing.

Brief Description of the Drawings

[0020]

Fig. 1 is a plan view showing a configuration of a water barrier segment constructed in accordance with one embodiment of the present invention;

Fig. 2 is a perspective view of a portion of the barrier segment of Fig. 1;

Fig. 3 is a perspective view of the barrier segment

of Figs. 1 and 2;

Fig. 4 is a front plan view of the barrier segment of Fig. 3;

Fig. 5 is a left end view of the barrier segment of Figs. 1-4;

Fig. 6 is a right end view of the barrier segment of Figs. 1-4

Fig. 7 is a front plan view showing two barrier segment such as that shown in Fig. 4, wherein the segments are detached;

Fig. 8 is a front plan view similar to Fig. 7, showing the barrier segments after they have been attached to one another;

Fig. 9 is a perspective view, in isolation, of an interlocking knuckle for use in attaching two barrier segments together;

Fig. 10 is a plan view showing a double wall reinforcement area for a pin lug on the barrier segment;

Fig. 11 is a front plan view similar to Fig. 7 showing a barrier segment;

Fig. 12 is a plan view from the top showing two connected barrier segments rotating with respect to one another upon vehicular impact;

Fig. 13 is a cross-sectional view taken along lines A-A of Fig. 8, after vehicular impact and relative rotation of the two barrier segments;

Fig. 14 is a cross-section view of the detail section C of Fig. 13;

Fig. 15 is a plan view of a barrier segment of the type shown in Fig. 7, showing some of the constructional details of the segment;

Fig. 16 is a top plan view of the barrier segment of Fig. 15;

Fig. 17 is a side plan view of the barrier segment of Fig. 15;

Fig. 18 is a perspective view showing three barrier segments secured together;

Fig. 19 is a perspective view of a second, presently preferred embodiment of a barrier segment constructed in accordance with the principles of the present invention;

Fig. 20 is a front plan view of the barrier segment shown in Fig. 19;

Fig. 21 is a side plan view of the barrier segment shown in Figs. 19-20;

Fig. 22 is a top plan view of the barrier segment shown in Figs. 19-21;

Fig. 23 is a perspective view of the barrier segment shown in Figs. 19-22, taken from an opposing orientation;

Fig. 24 is an end view of the barrier segment of Fig. 23;

Fig. 25 is a perspective view of the barrier segment of Fig. 23, showing internal constructional features of the barrier segment, and in particular a unique cable reinforcement system;

Fig. 26 is a front view of the barrier segment of Fig. 25;

Fig. 27 is a detail view of the portion of Fig. 26 identified as detail A;

Fig. 28 is a perspective view of the barrier segment of Figs. 19-27;

Fig. 29 is a top plan view of the barrier segment of Fig. 28;

Fig. 30 is a detail view of the portion of Fig. 29 identified as detail A;

Fig. 31 is a perspective view showing three barrier segments secured together;

Fig. 32 is a front view of a barrier segment constructed in accordance with the principles of the invention, in which is disposed a drain aperture having an inventive buttress thread configuration;

Fig. 33 is an enlarged view of the drain aperture of Fig. 32; and

Fig. 34 is an enlarged perspective view of the drain aperture of Figs. 32 and 33.

Description of the Preferred Embodiment

[0021] Referring now more particularly to the drawings, there is shown in Figs. 1-3 and 15-17 a water-ballasted barrier segment 10 constructed in accordance with one embodiment of the present invention. The illustrated barrier segment preferably has dimensions of approximately 18 in. W x 32 in. H x 78 in. L, with a material thickness

of about 1/4 in. The material used to fabricate the segment 10 may be a linear medium density polyethylene, and is preferably rotationally molded, although it may also be molded using other methods, such as injection molding or blow molding. The segment 10 preferably has an empty weight of approximately 34-26 kg (75-80 lb.), and a filled weight (when filled with water ballast) of approximately 500 kg (1100 lb).

[0022] Particularly with respect to Figs. 1-2, the barrier segment 10 has been constructed using a unique concave reflective design, wherein outer walls 12 of the barrier segment 10 are configured in a concave manner, as shown. In a preferred configuration, the concave section is approximately 180 cm (71 inches) long, and runs the entire length of the barrier segment. The concave section is designed to prevent the tire of a vehicle, impacting the barrier along the direction of arrow 14, from climbing up the side of the barrier segment, by pocketing the tire in the curved center portion of the barrier wall 12. When the vehicle tire is captured and pocketed inside the curved portion, the reaction force of the impact then diverges the vehicle in a downward direction, as shown by arrow 16 in Fig. 1. The concave diverging design will thus force the vehicle back toward the ground rather than up the side of the water barrier segment 10. In a preferred configuration, as shown in Fig. 1, the concave center portion of the outer wall 12 has a curve radius of approximately 63 cm (24 3/4 in.), and is about 58.5 cm (23 inches) in height.

[0023] Figs. 3-11 illustrate an interlocking knuckle design for securing adjacent barrier segments 10 together. The interlocking knuckle design is a lug pin connection system, comprising four lugs 18 disposed in interweaved fashion on each end of the barrier segment 10. Each lug 18 is preferably about 20 cm (8 inches) in diameter, and approximately 5 cm (2 inches) thick, although various dimensions would be suitable for the inventive purpose. To achieve the interweaved effect, on a first end 20 of the barrier segment 10, the first lug 18 is disposed 10 cm (4 inches) from the top of the segment 10. The remaining three lugs 18 are equally spaced vertically approximately 7.5-5 cm (3-2 inches) apart. On a second end 22 of the barrier segment 10, the first lug 18 is disposed about 17.5 cm (7 inches) from the top of the barrier segment 10, with the remaining three lugs 18 being again equally spaced vertically approximately 7.5-5 cm (3-2 inches) apart. These dimensions are preferred, but again, may be varied within the scope of the present invention.

[0024] When the ends of two adjacent barrier segments 10 are placed together, as shown sequentially in Figs. 7 and 8, the complementary lugs 18 on the mating ends of the adjoined segments 10 slide between one another in interweaved fashion, due to the offset distance of each lug location, as described above, and shown in Figs. 4 and 7. The lugs< dimensional offset permit each segment 10 to be linked together with one lug atop an adjacent lug. This results in a total of eight lugs on each end of the water barrier segment 10 that lock together, as see in Fig. 8. Each lug 18 has a pin receiving hole 24 disposed therein, as best shown in Fig. 10. When the eight lugs 18 are engaged, as discussed above, upon the adjoining of two adjacent barrier segments 10, these pin receiving holes 24, which are preferably approximately 2.5-5 cm (1-2 inches) in diameter, and are disposed through the two inch thick portion of the lug 18, correspond to one another. Thus, a T-pin 26 is slid vertically downwardly through the corresponding pin receiving holes 24 of all eight lugs or knuckles 18, as shown in Fig. 8, in order to lock the two adjoined barrier segments 10 together.

[0025] To reduce the bearing load on the pin lug connection, a double wall reinforcement 28 is included on the backside of the hole 24 on the lug 18, as shown in Fig. 10. The wall is created by making an indentation 30 on an outer curved section 32 of the lug 18, as shown in Fig. 9. The removal of material on the outside curved section 32 of the lug 18 creates a wall on the inside section of the lug. The wall created by the recessed section 30 on the outside of the lug creates a reinforcement section 28 against the vertical hole 24 in the lug 18, as shown in Fig. 10. By creating this double wall reinforcement section 28, the T-pin 26 has two approximately 0.6 cm (1/4 inch) thick surfaces to support the load during vehicular impact. This arrangement will distribute the bearing load over a larger area, with thicker material.

[0026] During impact, the water barrier will rotate at the pin lug connection, resulting in large stresses at the pin lug connection during full rotation of the water wall upon impact. To reduce the stresses at the pin lug connection, a concave inward stress transfer zone is formed between the male protruding lugs 18, as shown in Figs. 12-14. The concave inward section creates a concave female portion 34 at the ends of each water wall segment where the male end of each lug 18 will slide inside when aligned, as illustrated. Before vehicular impact, the male lugs 18 are not in contact with any surface inside the concave female portion 34 of the barrier segment 10. However, when the segment 10 is impacted, and is displaced through its full range of rotation (approximately 30 degrees), as shown in the figures, the external curved surface of the male lugs will come into contact with the external surface of the inside wall of the concave female portion, as shown in Fig. 14. This transfers the load from the pin lug connection to the lug contact point of the male/female portion. By transferring the load of the vehicular impact from the pin lug connection to the female/male contact point, the load is distributed into the male/female surface contact point before the pin connection begins to absorb the load. This significantly reduces the load on the T-pin 26, preventing the pin itself from bending and deforming during the impact.

[0027] To accommodate the ability to dispose a fence 36 or any other type of device to block the view on ones side of the barrier 10, the t-pins 26 are designed to support a square or round tubular fence post 38, as shown in Fig. 18. The tubular post 38 is adapted to slip over the

t-pin, with suitable retaining structure disposed to ensure that the post 38 is firmly retained thereon.

[0028] In a preferred method, each barrier segment 10 is placed at a desired location while empty, and relatively light. This placement may be accomplished using a forklift, for example, utilizing forklift apertures 39. Once the segments are in place, and connected as described above, they can then be filled with water, using fill apertures 39a as shown in Fig. 3. When it is desired to drain a barrier segment, drain apertures, such as aperture 39b in Fig. 15, may be utilized.

[0029] Now referring in particular to Figs. 19-21, a second embodiment of a water-ballasted barrier segment 110 is illustrated, wherein like elements are designated by like reference numerals, preceded by the numeral 1. This barrier segment 110 is preferably constructed to have overall dimensions of approximately 60 cm W x 107 cm H x 200 cm L (24 in. W x 42 in. H x 78 in. L), with a material thickness of about 0.6 cm (1/4 inches). As in the prior embodiment, these dimensions are presently preferred, but not required, and may be varied in accordance with ordinary design considerations. The material of which the barrier segment 110 is fabricated is preferably a high density polyethylene, and the preferred manufacturing process is rotational molding, although other known processes, such as injection molding or blow molding, may be used.

[0030] The illustrated embodiment utilizes a unique configuration to ensure that an impacting vehicle will be prevented from driving up and over the segment 110 upon impact. This configuration comprises a saw tooth profile, as illustrated, which is designed into the top portion of the barrier segment 110, as shown in Figs. 19-24. The design intent of the saw tooth profile is to snag the bumper, wheel, or any portion of a vehicle impacting the barrier 110 from a direction indicated by arrow 114 (Fig. 23) and to deflect the vehicle in a downward direction as indicated by arrow 116 (Fig. 23). The saw tooth profile shape runs the entire length of each section of the barrier segment 110, as shown. A first protruding segment or sawtooth 40, forming the sawtooth profile, begins to protrude approximately 20 inches above the ground, and second and third protruding segments 42, 44, respectively are disposed above the segment 40, as shown. Of course, more or fewer sawtooth segments may be utilized, depending upon particular design considerations. The design intent of using a plurality of sawtooth segments is that, if the first tooth or segment 40 does not succeed in containing the vehicle and re-directing it downwardly to the ground, the second or third teeth 42, 44, respectively, should contain the vehicle before it can successfully climb over the barrier 110.

[0031] The first embodiment of the invention, illustrated in Figs. 1-18, is capable of meeting the earlier described TL-1 and TL-2 crash test, but plastic construction alone has been found to be insufficient for withstanding the impact of a vehicle traveling 100 kph, as required under TL-3 testing regimes. The plastic does not have the physical properties to stay together, pocket, or redirect an impacting vehicle at this velocity. In order to absorb the energy of a vehicle traveling at 100 kph, the inventors have found that steel components need to be incorporated into the water barrier system design. Using steel combined with a large volume of water enables the plastic wall to absorb the necessary energy at such an impact.

[0032] To contain the 100 kph impacting vehicle, the inventors have used the interlocking knuckle design described earlier in connection with the TL-1 and TL-2 water barrier system described and shown in Figs. 1-18 of this application. The same type of design principles are used in connection with this larger TL-3 water barrier system, which includes the same interlocking knuckle attachment system disclosed in connection with the first embodiment.

[0033] The TL-3 barrier system described herein in connection with Figs. 19-31 absorbs energy by plastic deformation, wire rope cable fencing tensioning, water dissipation, and overall displacement of the water barrier itself. Since it is known that plastic alone cannot withstand the vehicular impact, internally molded into the barrier segment 110 is a wire rope cable 46, which is used to create a submerged fence inside the water barrier segment 110 as shown in Figs. 25 and 26. Before the barrier segment 110 is molded, the wire rope cables 46 are placed inside the mold tool. The cables are made with an eyelet or loop 48 (Fig. 30) at each end, and are placed in the mold so that the cable loops 48 wrap around the t-pin hole 124 outside diameter as shown in Fig. 27. Preferably, the wire rope cables 46 are each comprised of stainless steel, to resist corrosion due to their contact with the water ballast, and are formed of 1 X 19 strands. By placing the cables 46 around the t-pin holes 124, dual fence posts are created on each side of the barrier segment 110, with five cable lines 46 disposed in between, thereby forming a cable fence in addition to the water ballast. It is noted that the wire cable is completely covered in plastic during the rotational molding process, to prevent water leakage.

[0034] By placing the wire rope cable 46 to wrap around the t-pin hole 124, a high strength area in the interlocking knuckles is created. When the t-pin 126 is dropped into the hole 124, to connect a series of barrier segments 110, it automatically becomes a steel post by default, since the wire rope cable segments 46 are already molded into the barrier segments. Since the loop of each cable end wraps around the t-pin in each knuckle, the impacting vehicle will have to break the wire rope cable 46, t-pin 126, and knuckle in order to penetrate the barrier. Figs. 28-30 illustrate how the wire rope cables 46 wrap the T-pin holes 124.

[0035] The wire rope cables 46 are part of each barrier segment 110, and cannot be removed once the part has been manufactured. The current design uses up to five wire rope cables 46 per barrier segment 110, as illustrated. This creates a ten piece interlocking knuckle section.

More or fewer knuckles and wire rope cables may be utilized, depending upon whether a lower or taller barrier is desired. The wire rope fence construction disclosed in connection with this second TL-3 embodiment can also be incorporated into the lower height barrier illustrated and described in Figs. 1-17. When large numbers of barrier segments are used to create a longitudinal barrier, a wire rope cable fence is formed, with a t-pin post, with the whole assembly being ballasted by water without seeing the cable fencing. Fig. 31 illustrates such a plurality of segments 110, interlocked together to form a barrier as just described.

[0036] As the barrier illustrated in Fig. 31 is impacted by a vehicle, the plastic begins to deform and break, water ballast is displaced, and the wire rope cables 46 begin to absorb energy by pulling along the knuckles and pulling the wire rope cables in tension. The entire area of impact immediately becomes a wire rope cable fence in tension, holding the impacting vehicle on one side of the water ballasted barrier.

[0037] With reference particularly to Figs. 32-34, an inventive embodiment of the drain aperture 39b will be more particularly described. This particular feature is applicable to any of the above described embodiments of the invention. The aperture 39b is disposed within a recess 50 in a bottom portion of the barrier segment 10. A closure or cap 52 is provided for closing and sealing the aperture 39b to prevent leakage of ballast from the barrier segment 10. The closure 52 is secured in place by means of a series of buttress threads 54 (Figs. 33, 34). The buttress threads 54 are coarse and square cut, with flat edges 55, and advantageously function to create a hydraulic seal through the interference fit between the threads 54 on the aperture 39b and mating threads

[0038] 56 on the closure 52. The closure 52 comprises, in the preferred embodiment, a plastic plug which is threaded into the barrier segment outer wall 12 by means of the interengaging buttress threads 54, 56, as described above. A sealing washer on the plug 52 sits, in a flat profile, on the sealing surface on the barrier wall 12 once the threads are engaged. This flat profile results in a lower chance of leakage, with no need to over-tighten the plug 52. Advantageously, the unique design results in a much reduced chance of cross-threading the plug when threading it into the wall, compared with prior art approaches, and it is much easier to start the thread of the plug into the barrier wall. Because of the recess 50, the plug 52 is flush or even recessed relative to the wall, which reduces the chances of damage to the plug during use.

[0039] The thread 54 is uniquely cast-molded into the wall, which is typically roto-molded. Avoidance of spin-welding, which is a typical prior art technique for fabricating threads of this type in a roto-molded device, surprisingly greatly reduces the chance of damage to the barrier and closure due to cracking and stripping.

[0040] Accordingly, although an exemplary embodiment of the invention has been shown and described, it is to be understood that all the terms used herein are descriptive rather than limiting, and that many changes, modifications, and substitutions may be made by one having ordinary skill in the art without departing from the scope of the appended claims.

Claims

1. A barrier segment (10) which is hollow and adapted to be filled with a fluent material for ballast, comprising:

a molded plastic container having outer walls (12) defining an interior volume and having a first end and a second end;
a plurality of connecting lugs (18) disposed on each of said first and second ends, so that a plurality of barrier segments may be joined together;
a drain aperture (39b) in one of said outer walls of said barrier segment;
a closure (52) for closing and sealing said drain aperture;
buttress threads (54) disposed on an interior surface of said drain aperture;
threads disposed on an outer surface of said closure (56), for engaging said buttress threads to secure said closure sealingly relative to said drain aperture;
characterized in that said buttress threads are coarse and square cut, with flat edges;
a recess (50) disposed on said barrier segment outer wall, surrounding said drain aperture, having a depth sufficient so that when said closure is engaged with said drain aperture to close same, an outer surface of said closure is approximately flush with adjacent non-recessed portions of said outer wall; and **in that**

said outer walls having a plurality of sawtooth segments (12 and/or 40, 42, 44) disposed thereon, which are arranged vertically and extend outwardly and downwardly in order to deflect vehicles impacting the barrier segment in a downward direction.

2. The barrier segment as recited in Claim 1, and further comprising:

a length of metallic cable (46) molded within said molded plastic container, so that most of the length of metallic cable is entirely disposed within said interior volume, along substantially an entire length of said container between said first and second ends; and
a loop of cable (48) at each end of the length of cable, wherein each said loop is wrapped about a pin hole (124) disposed in one of said lugs.

3. The barrier segment as recited in Claim 2, wherein said metallic cable (46) comprises wire rope cable.

4. The barrier segment as recited in Claim 2, wherein said metallic cable (46) comprises stainless steel.

5. The barrier segment as recited in Claim 2, wherein said length of metallic cable (46) is connected between opposing lugs (118) on the first and second ends of the container.

6. The barrier segment as recited in Claim 2, and further comprising additional lengths of metallic cable (46), wherein there is a length of metallic cable connected between each pair of opposing lugs on the first and second ends of the container.

7. The barrier segment as recited in Claim 1, and further comprising:

a hole (24) in each of said connecting lugs, for receiving a connecting pin (26); and
a fence post (38) adapted for disposition over a top end of a connecting pin, for supporting a fence above the barrier segment.

8. The barrier segment as recited in Claim 1, wherein there are three sawtooth segments (40, 42, 44) disposed on each lengthwise outer wall.

9. The barrier segment as recited in Claim 1, and further comprising:

a length of metallic cable (46) molded within said molded plastic container (12), so that most of the length of metallic cable is entirely disposed within said interior volume, along substantially an entire length of said container between said first and second ends.

Patentansprüche

1. Barrieresegment (10), welches hohl ist, und angepasst ist, mit einem flüssigen Material als Ballast gefüllt zu werden, Folgendes umfassend:

einen geformten Kunststoffbehälter mit Außenwänden (12), die ein Innenvolumen definieren, und mit einem ersten und einem zweiten Ende;
mehrere Verbindungselemente (18), angeordnet am ersten und am zweiten Ende, sodass mehrere Barrieresegmente miteinander verbunden werden können;
eine Ablassöffnung (39b) in einer der Außenwände des Barrieresegments;
einen Verschluss (52) zum Verschließen und Abdichten der Ablassöffnung;
Sägegewinde (54), angeordnet an einer Innenoberfläche der Ablassöffnung;
Gewinde, angeordnet an einer Außenoberfläche des Verschlusses (56), zum Eingreifen in das Sägegewinde, um den Verschluss abdichtend in der Ablassöffnung zu sichern;
dadurch gekennzeichnet, dass das Sägegewinde grob und rechtwinklig geschnitten mit flachen Kanten ist;
eine Aussparung (50), angeordnet an der Außenwand des Barrieresegments, die die Ablassöffnung umgibt und eine ausreichende Tiefe aufweist, sodass, wenn der Verschluss derart mit der Ablassöffnung im Eingriff steht, er diese verschließt, eine Außenoberfläche des Verschlusses im Wesentlichen mit den angrenzenden, nicht vertieften Abschnitten bündig abschließt, und dadurch, dass
die Außenwände mehrere darauf angeordnete Sägezahnsegmente (12 und/oder 40, 42, 44) aufweisen, die vertikal angeordnet sind und sich nach außen und nach unten erstrecken, um Fahrzeuge nach unten abzulenken, die auf das Barrieresegment prallen.

2. Barrieresegment nach Anspruch 1, ferner Folgendes umfassend:

eine Länge Metallseil (46), in den geformten Kunststoffbehälter eingeformt, sodass der Großteil der Länge Metallseil im Wesentlichen entlang einer Gesamtlänge des Behälters zwischen dem ersten und dem zweiten Ende gänzlich im Innenvolumen angeordnet ist; und
eine Metallseilschlaufe (48) an jedem Ende der Länge Metallseil, wobei jede Schlaufe um ein in einem der Verbindungselemente angeordnetes Stiftloch (124) herum angeordnet ist.

3. Barrieresegment nach Anspruch 2, wobei das Metallseil (46) ein Drahtseil umfasst.

4. Barrieresegment nach Anspruch 2, wobei das Metallseil (46) Edelstahl umfasst.

5. Barrieresegment nach Anspruch 2, wobei die Länge Metallseil (46) zwischen einander gegenüber angeordneten Verbindungselementen (118) am ersten und zweiten Ende des Behälters angeordnet ist.

6. Barrieresegment nach Anspruch 2, ferner zusätzliche Längen Metallseil (46) umfassend, wobei eine Länge Metallseil zwischen jedem Paar einander gegenüber angeordneter Verbindungselemente am ersten und zweiten Ende des Behälters verbunden ist.

7. Barrieresegment nach Anspruch 1, ferner Folgen-

des umfassend:

ein Loch (24) in jedem der Verbindungselemente zum Aufnehmen eines Verbindungsstifts (26); und
einen Zaunpfahl (38), angepasst, um über dem oberen Ende eines Verbindungsstifts angeordnet zu werden, um einen Zaun über dem Barrieresegment anzuordnen.

8. Barrieresegment nach Anspruch 1, wobei drei Sägezahsegmente (40, 42, 44) auf jeder Längenaußenwand angeordnet sind.

9. Barrieresegment nach Anspruch 1, ferner Folgendes umfassend:

eine Länge Metallseil (46), in den geformten Kunststoffbehälter (12) eingeformt, sodass der Großteil der Länge Metallseil im Wesentlichen entlang einer Gesamtlänge des Behälters zwischen dem ersten und dem zweiten Ende gänzlich im Innenvolumen angeordnet ist.

Revendications

1. Segment de barrière (10) qui est creux et adapté pour être rempli d'un matériau fluide de ballast, comprenant :

un contenant en plastique moulé ayant des parois externes (12) définissant un volume intérieur et ayant une première extrémité et une seconde extrémité ;
une pluralité de languettes de raccordement (18) disposées sur chacune desdites première et seconde extrémités, de sorte qu'une pluralité de segments de barrière peuvent être reliés ensemble ;
une ouverture de drainage (39b) dans l'une desdites parois externes dudit segment de barrière ;
une fermeture (52) destinée à fermer hermétiquement ladite ouverture de drainage ;
des filetages trapézoïdaux (54) disposés sur une surface intérieure de ladite ouverture de drainage ;
des filetages disposés sur une surface externe de ladite fermeture (56), afin d'enclencher lesdits filetages trapézoïdaux pour fixer ladite fermeture hermétiquement par rapport à ladite ouverture de drainage ;
caractérisé en ce que lesdits filetages trapézoïdaux sont grossiers et carrés, avec des bords plats ;
un évidement (50) disposé sur ladite paroi externe de segment de barrière, entourant ladite ouverture de drainage, ayant une profondeur suffisante pour que lorsque ladite fermeture est enclenchée avec ladite ouverture de drainage pour fermer cette dernière, une surface externe de ladite fermeture soit approximativement de niveau avec des parties non évidées adjacentes de ladite paroi externe ; et **en ce que**
une pluralité de segments en dent de scie (12 et/ou 40, 42, 44) sont disposés sur lesdites parois externes, lesquels segments sont agencés verticalement et s'étendent vers l'extérieur et vers le bas afin de dévier des véhicules heurtant le segment de barrière dans une direction vers le bas.

2. Segment de barrière selon la revendication 1, et comprenant en outre :

une longueur de câble métallique (46) moulé au sein dudit contenant en plastique moulé, de sorte que la majeure partie de la longueur de câble métallique est entièrement disposée au sein dudit volume intérieur, sensiblement le long d'une longueur entière dudit contenant entre lesdites première et seconde extrémités ; et
une boucle de câble (48) au niveau de chaque extrémité de la longueur de câble, dans lequel chaque dite boucle est enroulée autour d'un trou de broche (124) disposé dans l'une desdites languettes.

3. Segment de barrière selon la revendication 2, dans lequel ledit câble métallique (46) comprend un câble d'acier.

4. Segment de barrière selon la revendication 2, dans lequel ledit câble métallique (46) comprend de l'acier inoxydable.

5. Segment de barrière selon la revendication 2, dans lequel ladite longueur de câble métallique (46) est raccordée entre des languettes (118) opposées sur les première et seconde extrémités du contenant.

6. Segment de barrière selon la revendication 2, et comprenant en outre des longueurs supplémentaires de câble métallique (46), dans lequel il y a une longueur de câble métallique raccordée entre chaque paire de languettes opposées sur les première et seconde extrémités du contenant.

7. Segment de barrière selon la revendication 1, et comprenant en outre :

un trou (24) dans chacune desdites languettes de raccordement, afin de recevoir une broche de raccordement (26) ; et
un piquet de clôture (38) adapté pour être disposé sur une extrémité supérieure d'une broche

de raccordement, afin de supporter une clôture au-dessus du segment de barrière.

8. Segment de barrière selon la revendication 1, dans lequel il y a trois segments en dent de scie (40, 42, 44) disposés sur chaque paroi externe dans le sens de la longueur.

9. Segment de barrière selon la revendication 1, et comprenant en outre :

une longueur de câble métallique (46) moulée au sein dudit contenant en plastique moulé (12), de sorte que la majeure partie de la longueur de câble métallique est entièrement disposée au sein dudit volume intérieur, sensiblement le long de la longueur entière dudit contenant entre les-dites première et seconde extrémités.

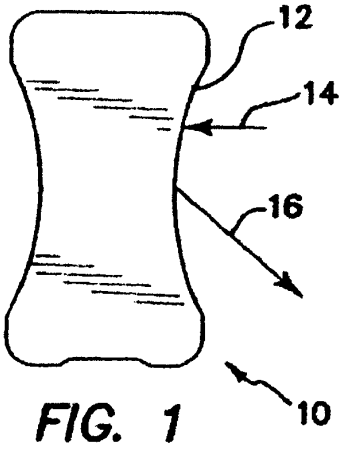


FIG. 1

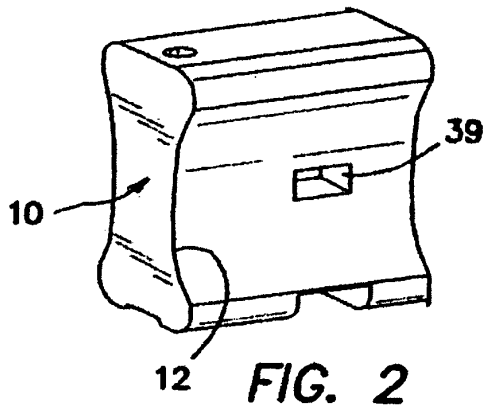


FIG. 2

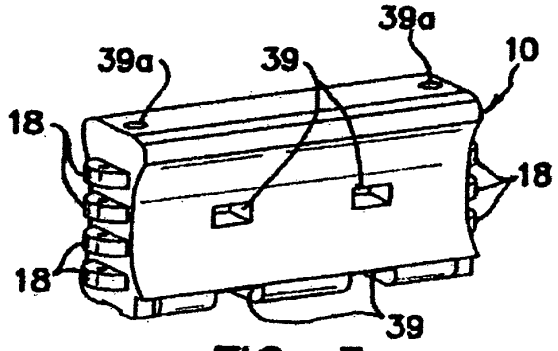


FIG. 3

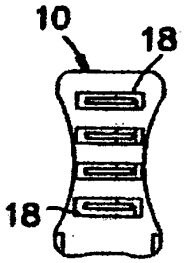
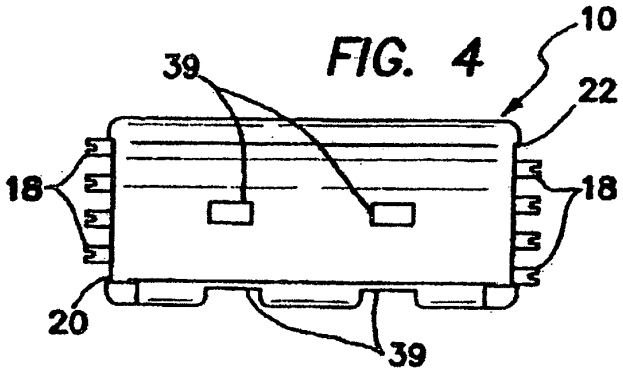


FIG. 5



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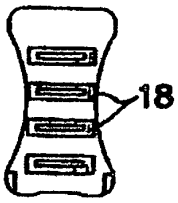

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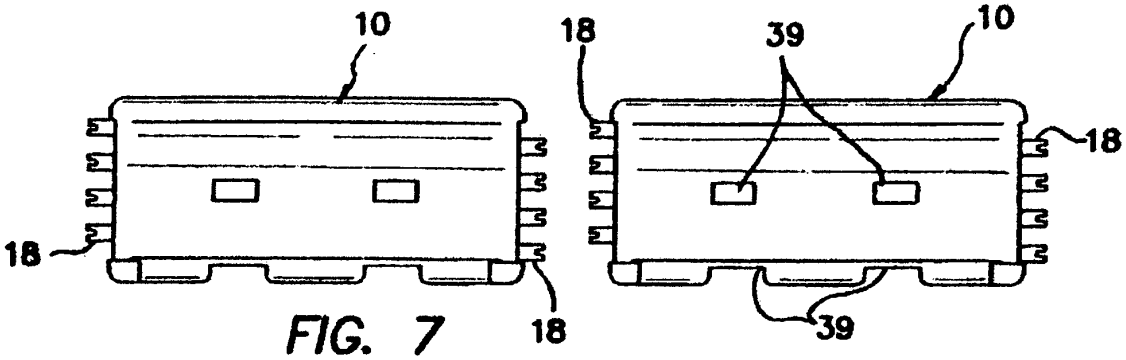


FIG. 7

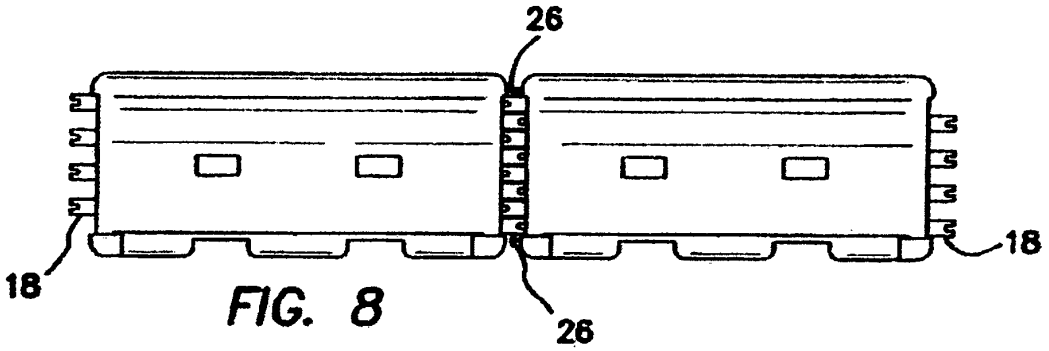


FIG. 8

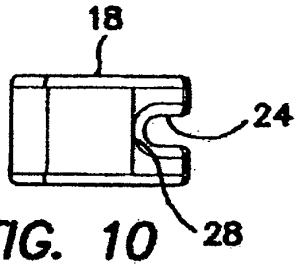


FIG. 10

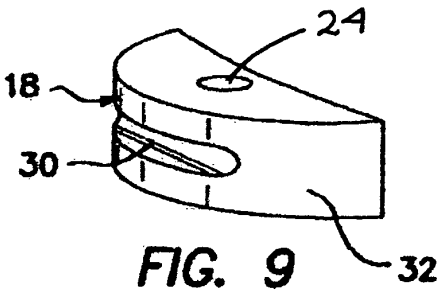


FIG. 9

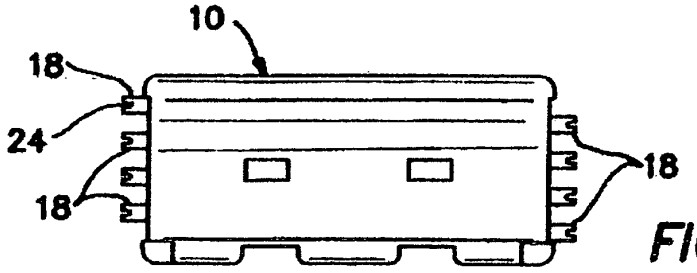


FIG. 11

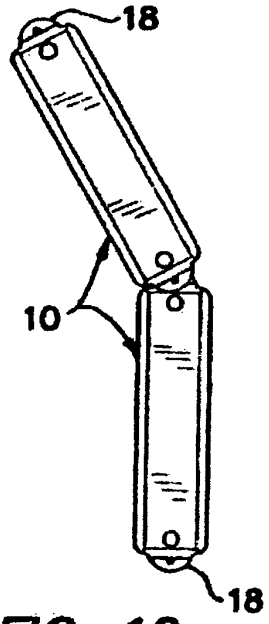


FIG. 12

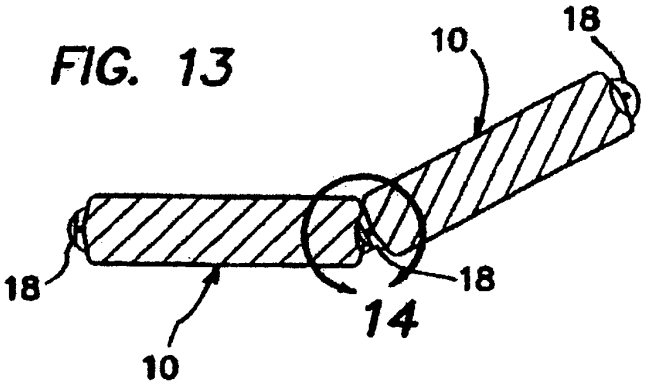


FIG. 13

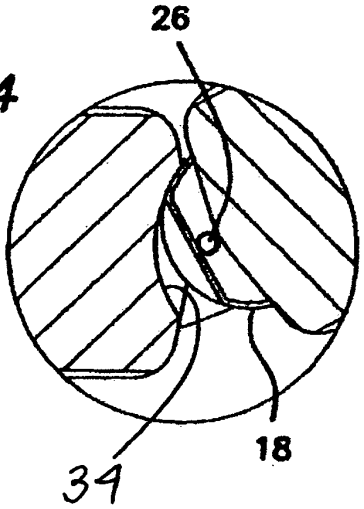
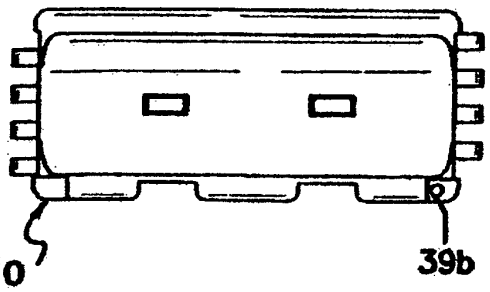


FIG. 14

FIG. 15



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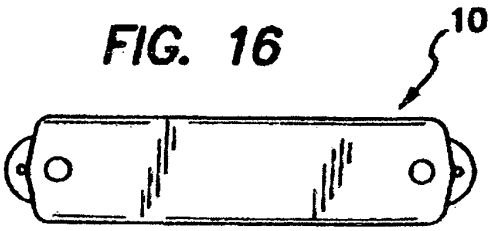
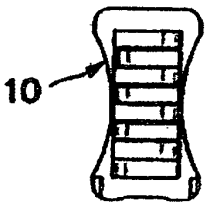


FIG. 17



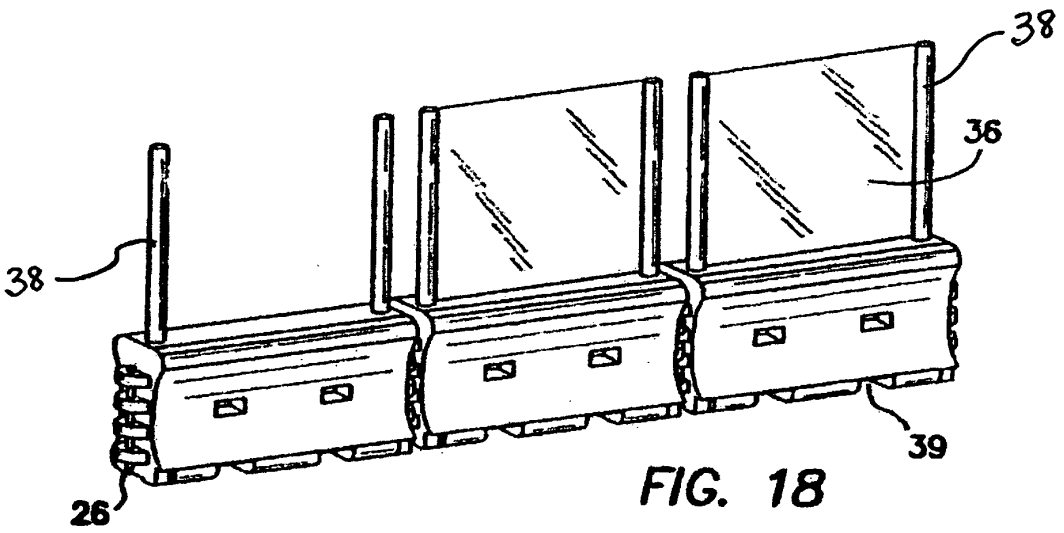


FIG. 18

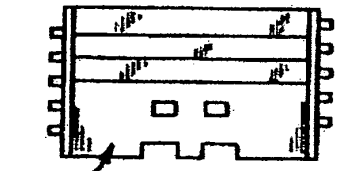


FIG. 20

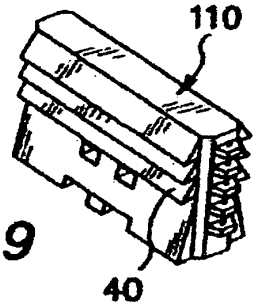


FIG. 19

FIG. 22

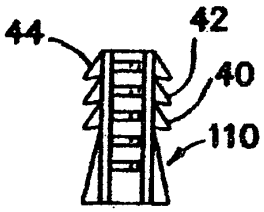


FIG. 21

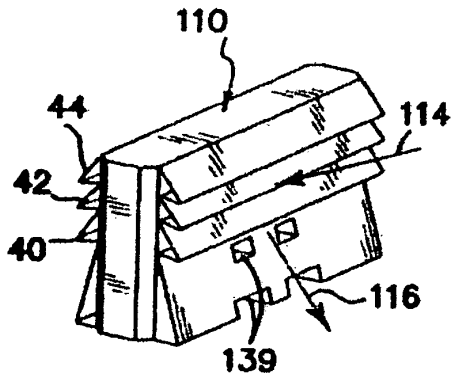


FIG. 23

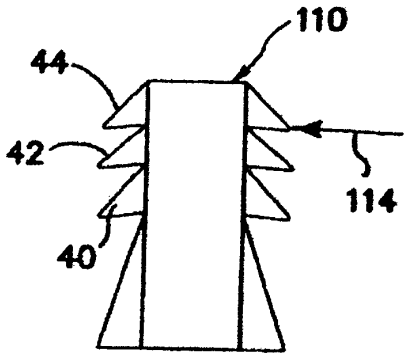


FIG. 24

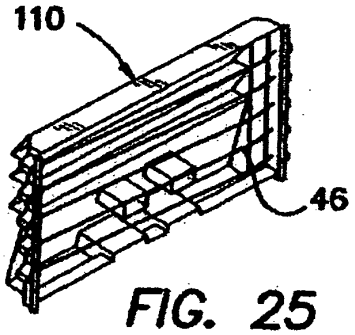
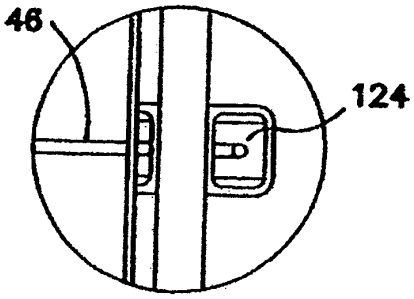


FIG. 25

FIG. 27



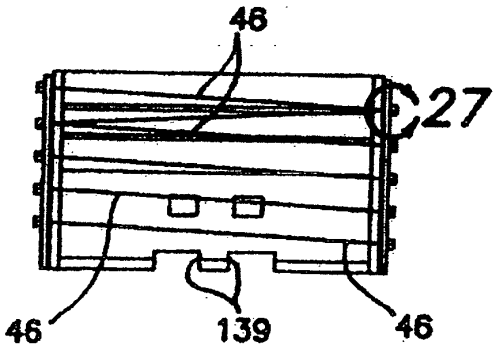


FIG. 26

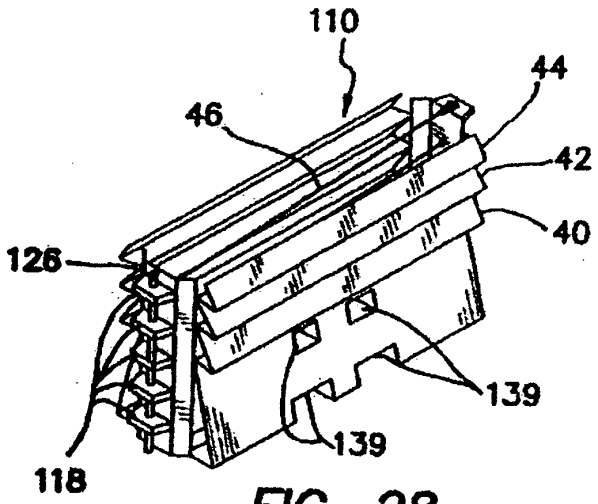


FIG. 28

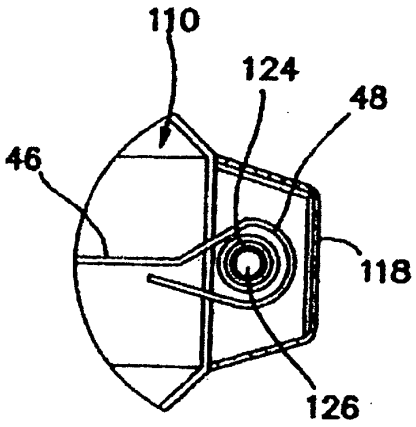


FIG. 30

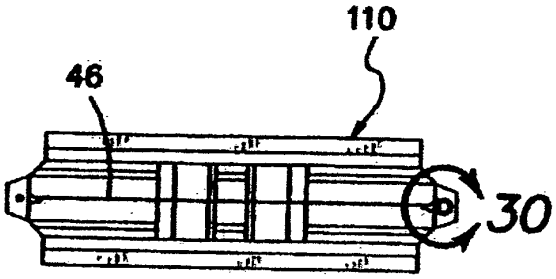
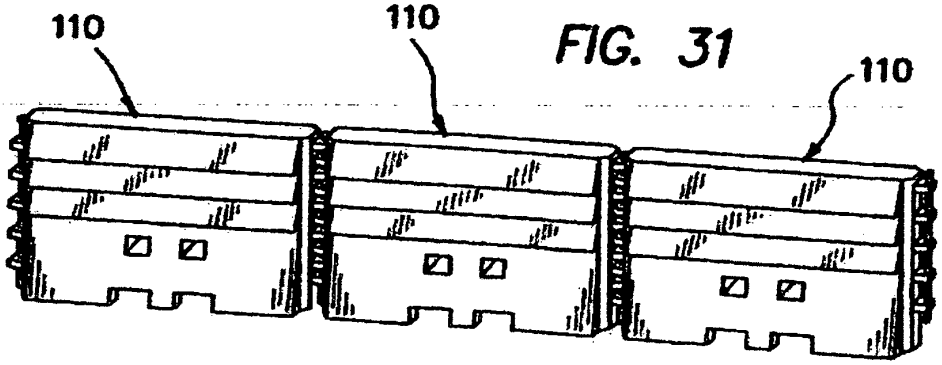


FIG. 29



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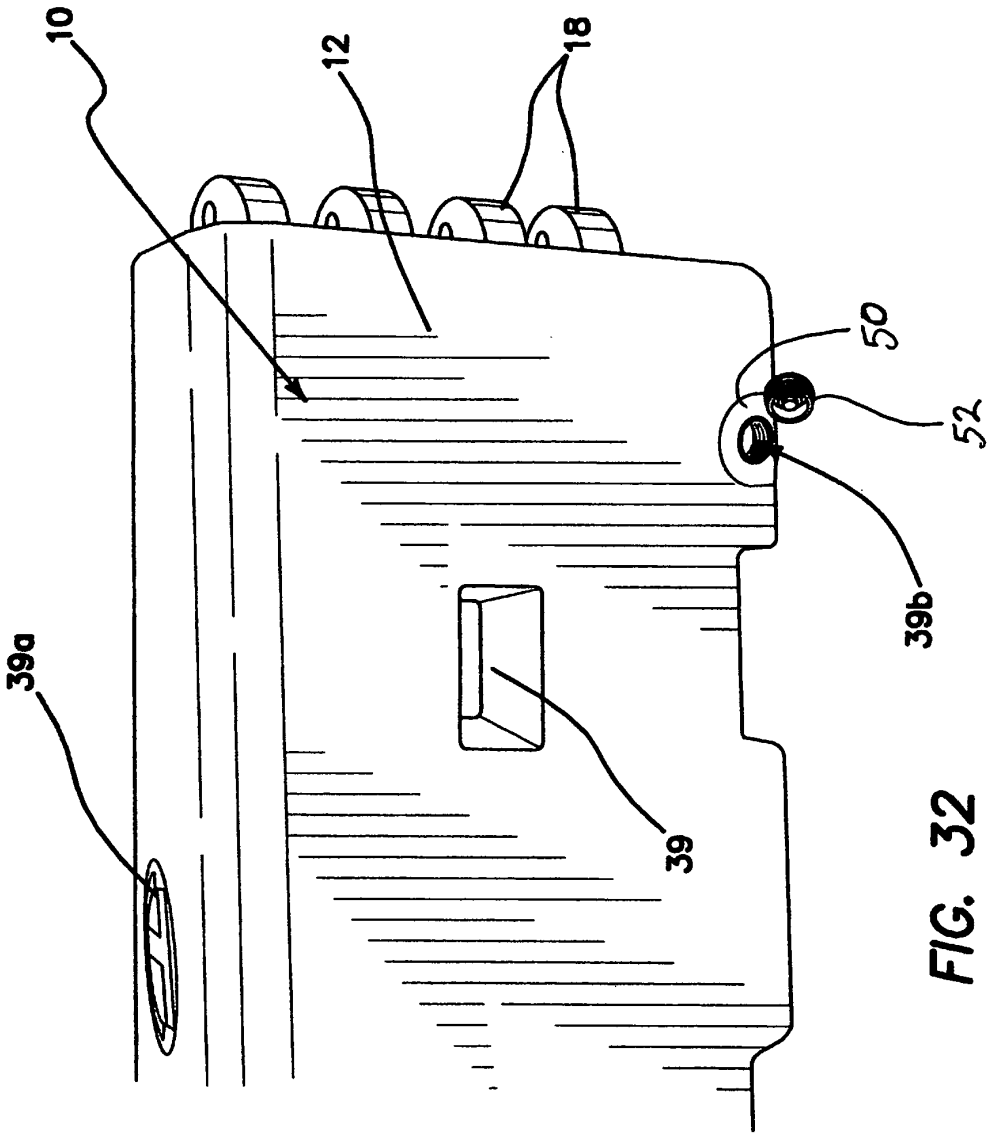

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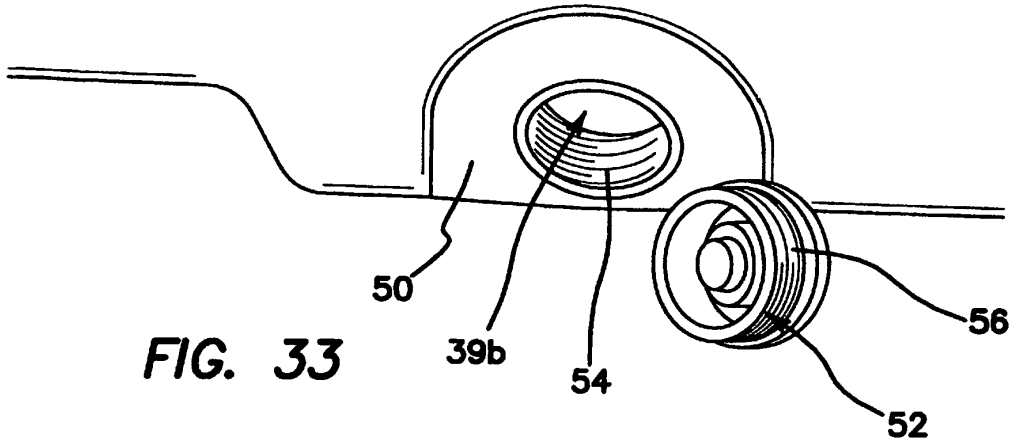

FIG. 33

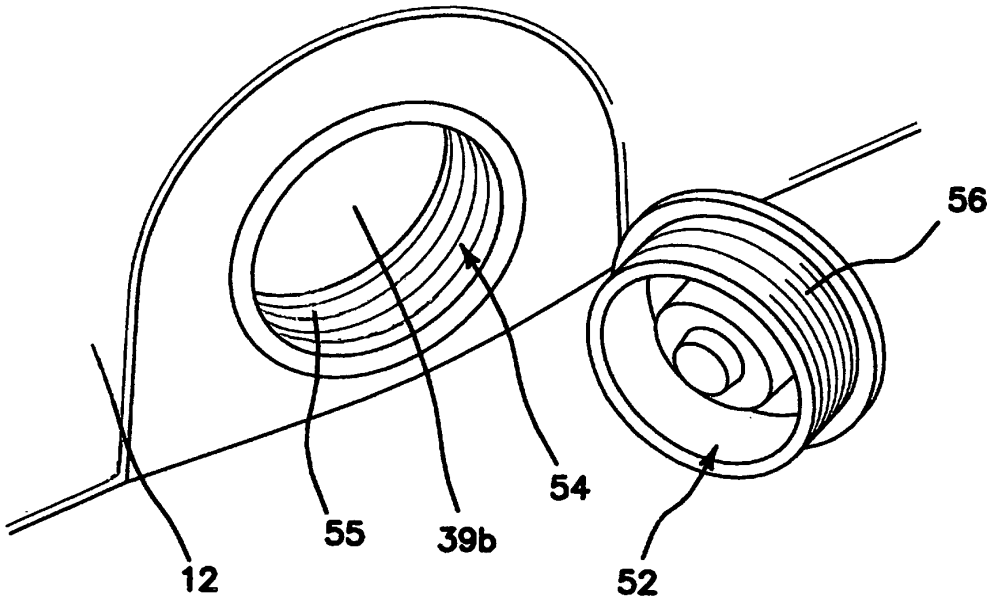

FIG. 34

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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