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(54) **Fast-release shutter for a submarine countermeasure launch device, and relative fabrication method**

Schnellentriegelungsluke für ein Unterwassergerät zur Initiierung von Gegenmaßnahmen und Herstellungsverfahren dafür

Obturbateur à libération rapide pour dispositif de lancement de contre-mesures sous-marines, et procédé de fabrication associé

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Description

[0001] The present invention relates to a shutter for a submarine countermeasure launch system as described in US 6123005 A.

[0002] As is known, submarines are equipped with countermeasure launch systems, which normally comprise a number of launch tubes with compressed-air firing systems, and are housed in an area of the submarine located between the outer hull and the pressure hull. The countermeasures are fired through shutters designed to permit rapid firing and in no way affect the streamline profile of the submarine.

[0003] It is an object of the present invention to provide a perfected countermeasure launch system shutter designed for reliable release and fast release and closure, and which does not affect the launch tube layout.

[0004] Further objects of the present invention are to provide a shutter that in no way affects the original streamline profile of the submarine, and of a mechanical strength in conformance with hull specifications.

[0005] According to the present invention, there is provided a shutter as claimed in Claim 1.

[0006] A preferred, non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a schematic partial view in perspective of a submarine featuring a countermeasure launch system and a number of shutters in accordance with the present invention;

Figure 2 shows a front view of a shutter in accordance with the present invention;

Figure 3 shows a section along line III-III in Figure 2.

[0007] Number 1 in Figure 1 indicates as a whole a submarine equipped with a countermeasure launch system 2.

[0008] Launch system 2 comprises a number of air-powered launch tubes 3 housed in an area 4 located between an inner pressure hull 5 and an outer hull 6 of submarine 1, and which is therefore flooded.

[0009] Launch tubes 3 are arranged, for example, in two sets (only one shown), each sloping rearwards, with respect to the normal travelling direction of submarine 1, towards a respective side 7 of outer hull 6, and each comprising a number of superimposed rows of launch tubes 3.

[0010] Sides 7 of outer hull 6 have respective hatches 8 facing launch systems 2 and having respective openings (not shown) facing respective launch tubes 3 and fitted with respective shutters 9.

[0011] The following is a detailed description of one shutter 9 with reference to Figures 2 and 3.

[0012] Shutter 9 comprises a metal, e.g. stainless steel, supporting frame 11 substantially in the form of a surrounding frame and having an inner opening 12. In the example shown, frame 11 is a flat and rectangular

with two long sides 13 and two short sides 14, and opening 12 is substantially rectangular.

[0013] Opening 12 has outer recesses 15 close to the ends of long sides 13, and each defined by a 90° arc 16 tangent to the inner edge of the adjacent short side 14, and by a sloping side 17, so that the inner edges 18 of long sides 13 of frame 11 are substantially in the form of an isosceles trapezium with the minor base 19 facing inwards of the frame.

[0014] Frame 11 has six fastening holes 20 edged on one side to form respective annular collars 21. Two of holes 20 are located along the centre lines of short sides 14, and the other four holes 20 are located in pairs on long sides 13, close to the ends of minor bases 19 of inner edges 18.

[0015] A cylindrical pin 22 is conveniently fitted, preferably force-fitted, inside a hole 23 located along the centre line of one of the long sides of frame 11.

[0016] Frame 11 also comprises a number of small-diameter holes 36 arranged along sides 13 and 14.

[0017] The shutter also has a cover 24 of elastomeric material, in which frame 11 is embedded.

[0018] More specifically, cover 24 comprises, integrally, a peripheral portion 25 covering frame 11 (with the exception of the inside of holes 20, the end surface of collars 21, and the end portion of pin 22 projecting beyond the axial length of collars 21); and a diaphragm 26 substantially closing opening 12 of frame 11. "Substantially closing" is intended here, not in the sense of sealing, but rather in the sense of restoring the profile of side 7, which would otherwise be interrupted by opening 12.

[0019] The peripheral portion (25) encases substantially the whole of frame 11, with the exception of the inside of holes 20, the end surface of collars 21 (with which the cover is flush), and an end portion of pin 22; and the elastomeric material inside holes 36 of frame 11 "bridges" the opposite sides of peripheral portion 25 to improve grip to frame 11.

[0020] Diaphragm 26 has a thin central portion 27 - more specifically, recessed on the collar 21 side - in the form of an isosceles triangle having a vertex 28 close to the centre line of a short side 14 of the frame, and two base vertices 29 at recesses 15 of opening 12 of the frame. Vertices 28, 29 of thin portion 27 are all rounded.

[0021] Respective small-diameter holes 30, 31 are formed just inside the vertices of the triangle, and a further hole 32 is located along the centre line of the base holes 31.

[0022] Portion 27 has two cuts 33, 34 respectively forming the height and base of an isosceles triangle having holes 30, 31 as the vertices: cut 33 joins hole 30 at vertex 28 to hole 32, and cut 34 joins the two base holes 31.

[0023] Cover 24 has a flat surface 35 facing outwards and flush with the outer profile of the submarine in use, and is conveniently made of a thermoplastic elastomer, preferably a polyurethane-based thermoplastic elastomer, such as that marketed by the trade name ADI-

PRENE® (Uniroyal Chemical Company, Inc. registered trademark). ADIPRENE® L-42, of Shore A hardness 75 or 80, or ADIPRENE® LF-1700A are preferably used.

[0024] The elastomer contains a curing agent selected from the group comprising 1,4-butadiene diol, trimethylolpropane, methylene-dianiline, dioctylphthalate, 4,4'-methylene-bis-(2-chloroaniline), and preferably a 4,4'-methylene-bis-(2-chloroaniline) marketed by the trade name MOCA® (DuPont De Nemours registered trademark).

[0025] To produce shutter 9, frame 11 is placed inside a mold, and the elastomer is poured into the mold by gravity.

[0026] After curing, cuts 33, 34 are conveniently made using a sharp blade, with no material removal, so that the lips of the cuts mate perfectly when diaphragm 26 is not stressed.

[0027] In actual use, shutter 9 is mounted facing a respective launch tube 3. Pin 22 acts as a locator to position the shutter, which is fixed to the side of the submarine by means of screws (not shown) through holes 20.

[0028] Tests conducted by the Applicant show shutter 9 according to the present invention provides for solving all the drawbacks typically associated with the known art.

[0029] In particular, cuts 33, 34 allow substantially instantaneous "release" of diaphragm 26 by the countermeasure as it is launched, and therefore substantially unimpeded passage of the countermeasure.

[0030] Once the countermeasure is launched, diaphragm 26 also closes substantially instantaneously to restore the streamline profile of the submarine; and shutter 9 produces no additional noise.

[0031] Shutter 9 easily complies with specifications governing the mechanical strength of hulls.

[0032] Shutters 9 also allow complete freedom in the layout of the launch tubes, depending on the space available on board.

[0033] Clearly, changes may be made to shutter 9 without, however, departing from the protective scope as defined in the accompanying Claims.

[0034] For example, as opposed to being flat, frame 11 may be shaped to match a curved profile of the outer hull of the submarine; and cover 24 may be designed accordingly, so that outer surface 35 is flush with the outer profile of submarine 1.

[0035] Each shutter may comprise one or more openings, and therefore one or more diaphragms.

[0036] The size and shape of the diaphragm/s may vary, depending on the layout and characteristics of the launch system.

[0037] For example, thin portion 27 of diaphragm 26 may be substantially rectangular; and cuts 33, 34 may differ in number and be replaced, for example, by cuts forming an H, i.e. two close to two opposite sides of portion 27, and a third joining the middle of the first two.

Claims

1. A shutter (9) for a submarine countermeasure launch system having at least one launch device (3), said shutter (9) comprising a metal frame (11) suitable to be fixed to an outer hull (6) of the submarine, facing said launch device (3), and having an inner opening (12) for passage of a countermeasure; and a diaphragm (26) made of elastomeric material and fixed to said frame (11) to substantially close said opening (12); **characterized in that** said diaphragm (26) has at least one cut (33, 34) allowing it to open by elastic deformation under the force of a countermeasure as it is launched; said diaphragm (26) being so configured that, once the countermeasure is launched, it closes substantially instantaneously to restore the streamline profile of said submarine.
2. A shutter as claimed in Claim 1, **characterized by** comprising a cover (24) of elastomeric material forming, integrally, a cover portion (25) covering said frame, and said diaphragm (26).
3. A shutter as claimed in Claim 2, **characterized in that** said frame (11) is embedded in said cover portion (25).
4. A shutter as claimed in one of the foregoing Claims, **characterized in that** said diaphragm (26) comprises a thin portion (27) in which said at least one cut (33, 34) is formed.
5. A shutter as claimed in one of the foregoing Claims, **characterized by** having a surface (35) facing outwards of the submarine (1) in use and designed to be flush with the outer profile of the submarine (1).
6. A shutter as claimed in Claims 4 and 5, **characterized in that** said thin portion (27) is recessed on the side facing inwards of the submarine (1) in use.
7. A shutter as claimed in any one of the foregoing Claims, **characterized in that** said diaphragm (26) comprises holes (30, 31) at the ends of said at least one cut (34).
8. A shutter as claimed in one of the foregoing Claims, **characterized in that** said diaphragm (26) comprises at least two intersecting cuts (33, 34).
9. A shutter as claimed in Claim 8, **characterized in that** said cuts (33, 34) form a T.
10. A shutter as claimed in Claim 8, **characterized in that** said thin portion (27) is substantially in the form of an isosceles triangle; the T cuts extending parallel to the base and along the height of said isosceles triangle.

11. A shutter as claimed in one of Claims 1 to 7, **characterized in that** said diaphragm (26) comprises three cuts forming an H.
12. A shutter as claimed in any one of the foregoing Claims, **characterized in that** said diaphragm (26) is made of a thermoplastic elastomer.
13. A shutter as claimed in Claim 12, **characterized in that** said thermoplastic elastomer is polyurethane-based.
14. A shutter as claimed in Claim 13, **characterized in that** said thermoplastic elastomer contains a curing agent selected from the group comprising 1,4-butanediol, trimethylolpropane, methylene-dianiline, dioctylphthalate, 4,4'-methylene-bis-(2-chloroaniline).
15. A shutter as claimed in Claim 14, **characterized in that** said curing agent is a 4,4'-methylene-bis-(2-chloroaniline).
16. A method of fabricating a shutter as claimed in any one of Claims 2 to 15, **characterized by** comprising the steps of:
- positioning said frame inside a mold; and
 - pouring said elastomeric material into said mold to form said cover.
17. A method as claimed in Claim 16, **characterized by** comprising a step of cutting said elastomeric material with no material removal.

Patentansprüche

1. Verschluss (9) für ein System zum Abschuss von Unterseeboot-Gegenmaßnahmen mit wenigstens einer Abschussvorrichtung (3), wobei der Verschluss umfasst: einen der Abschussvorrichtung (3) gegenüberliegenden Metallrahmen (11), der geeignet ist, um an einer äußeren Hülle (6) des Unterseeboots angebracht zu werden, und der eine innere Öffnung (12) für den Durchgang einer Gegenmaßnahme aufweist; und eine Membran (26) aus einem elastomeren Material, die am Rahmen (11) befestigt ist, um die Öffnung (12) im Wesentlichen zu verschließen, **dadurch gekennzeichnet, dass** die Membran (26) wenigstens einen Schnitt (33, 34) aufweist, sodass sie sich unter der Krafteinwirkung einer Gegenmaßnahme, die abgeschossen wird, durch elastische Deformation öffnen kann, wobei die Membran (26) so ausgelegt ist, dass sie sich nach dem Abschuss der Gegenmaßnahme im Wesentlichen sofort wieder schließt, um das stromlinienförmige Profil des Unterseeboots wieder herzu-

stellen.

2. Verschluss nach Anspruch 1, **gekennzeichnet durch** eine Abdeckung (24) aus elastomerem Material, die integral einen Abdeckungsbereich (25), der den Rahmen abdeckt, und die Membran (26) bildet.
3. Verschluss nach Anspruch 2, **dadurch gekennzeichnet, dass** der Rahmen (11) in den Abdeckungsbereich (25) eingebettet ist.
4. Verschluss nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Membran (26) einen dünnen Bereich (27) umfasst, in dem der wenigstens eine Schnitt (33, 34) ausgebildet ist.
5. Verschluss nach einem der vorstehenden Ansprüche, **gekennzeichnet durch** eine Oberfläche (35), die bei Gebrauch vom Unterseeboot (1) aus nach außen weist und so gestaltet sind, dass sie mit dem äußeren Profil des Unterseeboots (1) fluchtet.
6. Verschluss nach Anspruch 4 oder 5, **dadurch gekennzeichnet, dass** der dünne Bereich (27) auf derjenigen Seite vertieft ist, die bei Gebrauch nach innen zum Unterseeboot hinzeigt.
7. Verschluss nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Membran (26) an den Enden des wenigstens eines Schnittes (34) Löcher (30, 31) aufweist.
8. Verschluss nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Membran (36) wenigstens zwei sich kreuzende Schnitte (33, 34) aufweist.
9. Verschluss nach Anspruch 8, **dadurch gekennzeichnet, dass** die Schnitte (33, 34) ein T bilden.
10. Verschluss nach Anspruch 8, **dadurch gekennzeichnet, dass** der dünne Bereich (27) im Wesentlichen die Form eines gleichschenkligen Dreiecks aufweist, und sich die T Schnitte parallel zur Basis und entlang der Höhe des gleichschenkligen Dreiecks erstrecken.
11. Verschluss nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** die Membran drei Schnitte aufweist, die ein H bilden.
12. Verschluss nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Membran (26) aus einem thermoplastischen Elastomer besteht.
13. Verschluss nach Anspruch 12, **dadurch gekenn-**

zeichnet, dass das thermoplastische Elastomer auf Polyurethan basiert.

14. Verschluss nach Anspruch 13, **dadurch gekennzeichnet, dass** das thermoplastische Elastomer einen Härter enthält, der aus der Gruppe ausgewählt ist, die 1,4-Butadien Diol, Trimethylolpropan, Methylendianilin, Dioctylphthalat und 4,4'-Methylen-bis-(2-Chloroanilin) umfasst.
15. Verschluss nach Anspruch 14, **dadurch gekennzeichnet, dass** der Härter ein 4,4'-Methylen-bis-(2-Chloroanilin) ist.
16. Verfahren zum Herstellen eines Verschlusses nach einem der Ansprüche 2 bis 15, **dadurch gekennzeichnet, dass** das Verfahren die Schritte umfasst: Positionieren des Rahmens in einer Form; und Gießen des elastomeren Materials in die Form, um die Abdeckung auszubilden.
17. Verfahren nach Anspruch 16, **dadurch gekennzeichnet, dass** es einen Schritt des Schneidens des elastomeren Materials umfasst, ohne dass dabei Material entfernt wird.

Revendications

1. Obturateur (9) pour un système de lancement de contre-mesure de sous-marin ayant au moins un dispositif de lancement (3), ledit obturateur (9) comprenant un cadre métallique (11) adapté pour être fixé à une coque extérieure (6) du sous-marin, faisant face audit dispositif de lancement (3), et ayant une ouverture interne (12) pour le passage d'une contre-mesure ; et un diaphragme (26) constitué de matériau élastomère et fixé audit cadre (11) pour fermer sensiblement ladite ouverture (12) ; **caractérisé en ce que** ledit diaphragme (26) a au moins une découpe (33, 34) permettant de l'ouvrir par déformation élastique sous la force d'une contre-mesure lorsqu'elle est lancée; ledit diaphragme (26) étant configuré de sorte que, une fois que la contre-mesure est lancée, elle se ferme de façon sensiblement instantanée pour restaurer le profil dudit sous-marin.
2. Obturateur selon la revendication 1, **caractérisé en ce qu'il** comprend un couvercle (24) de matériau élastomère formant, de façon intégrée, une partie de couvercle (25) couvrant ledit cadre, et ledit diaphragme (26).
3. Obturateur selon la revendication 2, **caractérisé en ce que** ledit cadre (11) est incorporé dans ladite partie de couvercle (25).
4. Obturateur selon une des revendications précédentes,

caractérisé en ce que ledit diaphragme (26) comprend une partie mince (27) dans laquelle ladite au moins une découpe (33, 34) est formée.

5. Obturateur selon une des revendications précédentes, **caractérisé en ce qu'il** a une surface (35) orientée vers l'extérieur du sous-marin (1) en utilisation et conçue pour affleurer avec le profil extérieur du sous-marin (1).
6. Obturateur selon les revendications 4 et 5, **caractérisé en ce que** ladite partie mince (27) est évidée sur le côté faisant face vers l'intérieur du sous-marin (1) en utilisation.
7. Obturateur selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit diaphragme (26) comprend des trous (30, 31) aux extrémités de ladite au moins une découpe (34).
8. Obturateur selon une des revendications précédentes, **caractérisé en ce que** ledit diaphragme (26) comprend au moins deux découpes qui se coupent (33, 34).
9. Obturateur selon la revendication 8, **caractérisé en ce que** lesdites découpes (33, 34) forment un T.
10. Obturateur selon la revendication 8, **caractérisé en ce que** ladite partie mince (27) est sensiblement sous la forme d'un triangle isocèle ; les découpes en T s'étendant parallèlement à la base et le long de la hauteur dudit triangle isocèle.
11. Obturateur selon une des revendications 1 à 7, **caractérisé en ce que** ledit diaphragme (26) comprend trois découpes formant un H.
12. Obturateur selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit diaphragme (26) est constitué d'un élastomère thermoplastique.
13. Obturateur selon la revendication 12, **caractérisé en ce que** ledit élastomère thermoplastique est à base de polyuréthane.
14. Obturateur selon la revendication 13, **caractérisé en ce que** ledit élastomère thermoplastique contient un agent de durcissement choisi dans le groupe constitué des 1,4-butadiènediol, triméthylolpropane, méthylène-dianiline, phtalate de dioctyle, 4,4'-méthylène-bis-(2-chloroaniline).
15. Obturateur selon la revendication 14, **caractérisé en ce que** ledit agent de durcissement est une 4,4'-méthylène-bis-(2-chloroaniline).

16. Procédé de fabrication d'un obturateur selon l'une quelconque des revendications 2 à 15, **caractérisé en ce qu'il** comprend les étapes consistant à:

- placer ledit cadre à l'intérieur d'un moule ; et 5
- verser ledit matériau élastomère dans ledit moule pour former ledit couvercle.

17. Procédé selon la revendication 16, **caractérisé en ce qu'il** comprend une étape de découpe dudit matériau élastomère sans retrait de matériau. 10

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FIG. 1

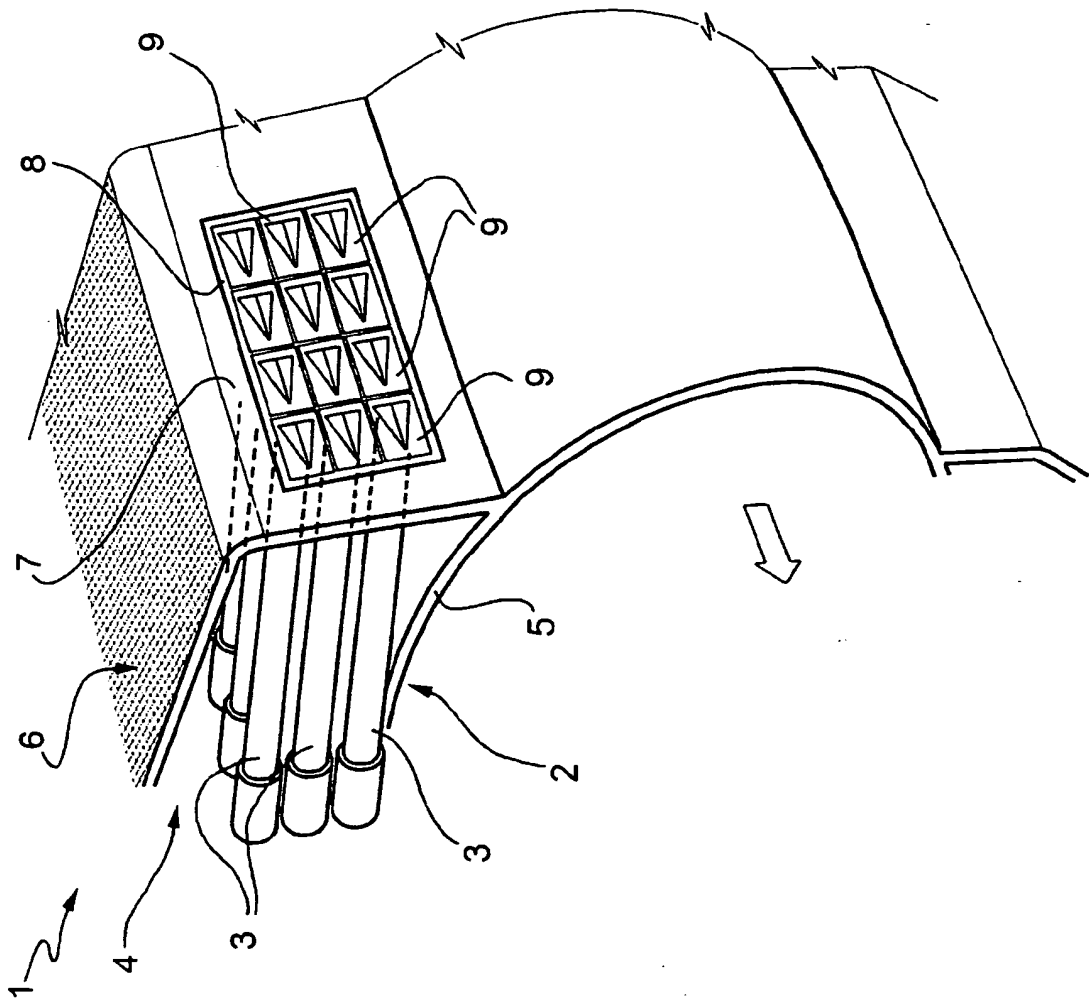


FIG. 3

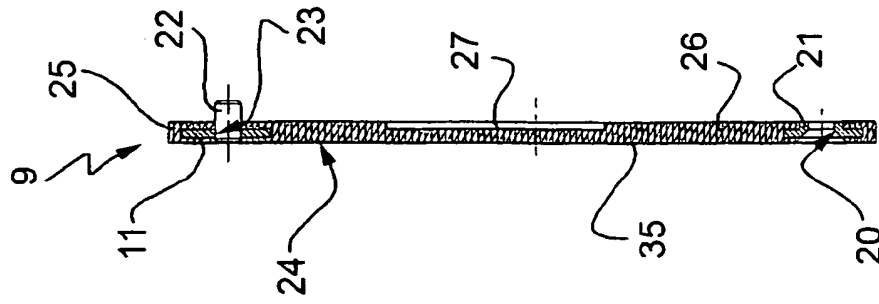
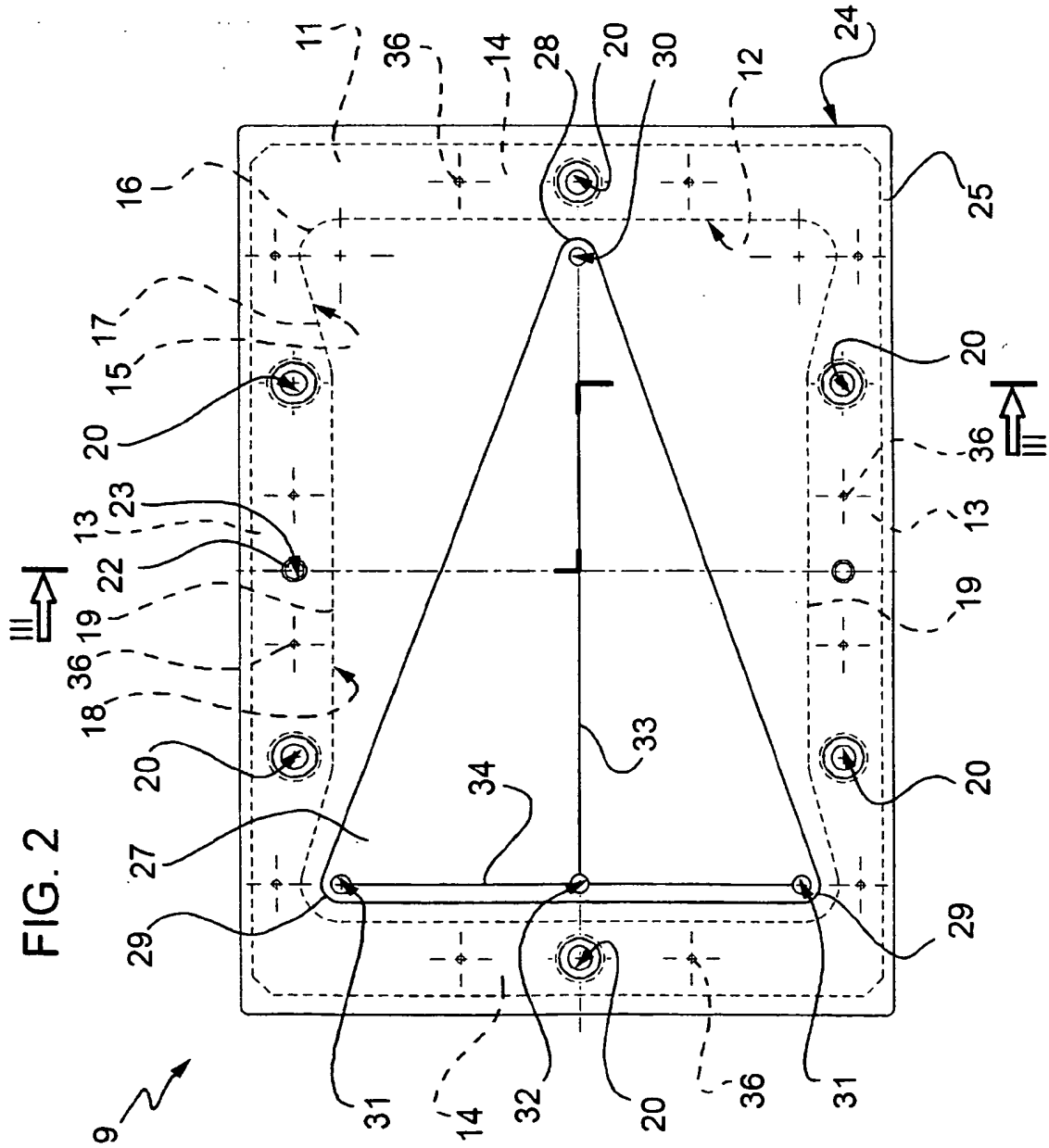


FIG. 2



REFERENCES CITED IN THE DESCRIPTION

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