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(54) **AERIAL TARGET SYSTEM**

IN DER LUFT FLIEGENDES ZIEL

SYSTEME DE CIBLE AERIENNE

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Description

Technical Field

[0001] The present invention relates to a thermal unit for an aerial target system, and to a method of providing a thermal signature in an aerial target.

Background Art

[0002] A typical commercially available aerial target for use with an air defence weapon system, including both gun and missile systems, comprises an unmanned aeroplane which carries a payload of infra-red flares, smoke tracking flares and chaff dispensers. The aircraft is remotely piloted by an operator to simulate a number of different mission profiles. When lit, the infra-red flares carried by the aircraft provide a thermal signature to enable the aircraft to be acquired by an infra-red seeking weapon. The aerial target may simply be used to test the target acquisition and tracking capabilities of the air defence weapon system, in which case the aerial target is recovered, refuelled and a new payload fitted for the next mission. In a live firing test, the aerial target is destroyed by the air defence system.

[0003] One problem with infra-red flares is that they are easily picked up visually and therefore the aerial target does not accurately simulate a normal target. Also, each infra-red flare has a burn time of only around 45 seconds and therefore a number of flares must be lit consecutively to present a target for any length of time. A typical aerial target can carry a payload of up to 16 infra-red flares giving a relatively short total burn time in comparison to an endurance of around 1½ hours for the aerial target itself. A further problem is that infra-red flares are classified as a hazardous material making it difficult and expensive to transport the flares to customers, particularly by air. As the infra-red flares are not reusable a customer will always require replacement stocks of flares.

[0004] The documents GB-A-1,454,893 and GB-A-1,157,999 (basis for the independent claims 1 and 16) disclose aerial target systems which are provided with an aft-mounted thermal unit which heats a mesh surface to provide a thermal signature. The mesh improves the dissipation of heat so that the target can be detected more readily by a heat seeking missile. However, like conventional infra-red flares, such a system is also visible to the naked eye, allowing visual targeting by the operator of a weapons system.

Disclosure of Invention

[0005] The invention is disclosed in claims 1 and 16.

[0006] According to a first aspect of the present invention, a method of providing a thermal signature in an aerial target comprises heating an external continuous thermally conductive surface of the aerial target with a burn-

er.

[0007] According to a second aspect of the present invention, an aerial target system comprises an unmanned aircraft having a thermal unit which includes a burner for heating a continuous thermally conductive surface to provide a thermal signature.

[0008] According to a third aspect of the present invention, a thermal unit for fitting to an aerial target comprises a burner arranged to heat a continuous thermally conductive surface to provide a thermal signature.

[0009] In the present invention, a surface of the aerial target is heated using a burner to a sufficient temperature to provide a thermal signature for acquisition by an infra-red seeking air defence weapon system. The burner generates a flame which is directed against a continuous thermally conductive surface which then radiates an infra-red signature. As the thermal unit of the present invention heats an external continuous surface using an internally mounted burner, the aerial target cannot be tracked and targeted visually by reference to the infra-red source.

[0010] In a preferred embodiment of the present invention, the thermal unit forms the aircraft nose-cone. This is particularly advantageous as such a nose cone does not affect the aerodynamic performance of the aircraft. The thermal unit may also be mounted in the aircraft tail, on the wings or carried under the aircraft fuselage.

[0011] Preferably, the thermal unit comprises a primary chamber which receives ram air from a number of air intakes. The primary chamber provides a source of pressurised air which is used to supply air for the burner. Preferably, the primary chamber is also provided with a number of air outlets through which air is permitted to bleed to atmosphere.

[0012] Preferably, the thermal unit further comprises a secondary chamber through which the burner extends and which receives air from the primary chamber.

[0013] Preferably, the thermal unit further comprises a combustion chamber where a flame from the burner heats a surface of the thermal unit. Preferably, the combustion chamber includes means to spread the flame over the surface of the chamber. Most preferably, the combustion chamber includes guide means to control the flow of hot gasses over the thermally conductive surface.

[0014] Preferably, the combustion chamber includes a number of exhaust outlets located adjacent to and upstream of the air outlets of the primary chamber so that the aircraft fuselage is shielded from the hot exhaust gasses of the combustion chamber by cool air from the primary chamber. This arrangement protects the aircraft fuselage from heat damage.

[0015] Preferably, the system comprises a source of liquid petroleum gas carried by the aircraft which is operatively connected to the burner. Suitable liquid petroleum gas fuels include propane and MAPGAS. Liquid petroleum gas is typically supplied in bottles which are

preferably located within the aircraft fuselage. As an alternative, the fuel used for the burner may be the same as that used to power the aircraft.

[0016] The liquid petroleum gas must be vaporised before it is supplied to the burner and therefore preferably, a path of a fluid line connecting the liquid petroleum gas supply to the burner passes through a heat exchanger. Most conveniently, this is achieved by passing the fluid line through the secondary chamber where the liquid petroleum gas within the fluid line is vaporised by the exchange of heat generated within the combustion chamber. Preferably, the gas subsequently passes through a pressure regulator before being fed to the burner.

[0017] The burner may be ignited by hand before the aerial target gets airborne. Alternatively, an electrical ignition system may be provided which may be remotely operated.

[0018] In the present invention, an external surface of an aerial target is heated to provide a thermal signature. Accordingly, infra-red flares are no longer required. Using a thermal unit including a burner means that the aerial target may be re-used many times over and at a fraction of the cost of operating a conventional infra-red flare system. Furthermore, the thermal signature is not visible to the naked eye so that the aerial target system more accurately simulates a real aircraft.

Brief Description of Drawings

[0019] An example of the present invention will now be described in detail with reference to the accompanying drawings, in which:

Figure 1 shows a simplified view of a remotely piloted aerial target fitted with a thermal unit in accordance with the present invention;

Figures 2 to 4 show a thermal unit in the form of a nose-cone;

Figure 5 shows a split cross-section of the thermal unit of Figures 2 to 4 taken along the lines A-A and B-B in Figure 3; and,

Figure 6 shows a modification to the thermal unit of Figure 5 to include a burner fan.

Detailed Description

[0020] Figure 1 shows a remotely piloted aerial target 1 of the type sold by the applicant under the trade name BTT-3 Banshee which is powered by a rear mounted engine 2. The nose-cone of the aerial target has been replaced with a thermal unit 3 which provides a thermal signature for acquisition by an infra-red seeking weapon. The thermal unit 3 replaces the conventional infra-red flares typically used with such an aerial target system.

[0021] The thermal unit 3 which forms the nose-cone for the aerial target 1 is shown in Figures 2 to 5. The

thermal unit 3 is constructed from sheets of stainless steel which when heated will radiate thermal energy to provide a thermal signature. The thermal unit 3 comprises two sets of three air intakes 4 which face the intended direction of travel of the aerial target 1 and four outlets 5 each of which combines a cold air outlet 6 and an exhaust outlet 7, as is described in detail below.

[0022] As shown in Figures 4 and 5, to the rear of the thermal unit 3 there is provided a heat exchange inlet 8 which receives liquid petroleum gas from a number of pressurized bottles 27 housed within the fuselage of the aerial target. A manual on/off valve 28 and fail-safe electrical solenoid valve 29 are provided to isolate the pressurized bottles 27. As is described below, the fuel is vaporised by the exchange of heat generated within the thermal unit. The gas then passes through a pressure regulator 9, known as a Bijou regulator, where the gas pressure is reduced to around 2 bar. The gas is then fed along a high pressure fluid line 10, through control and fail-safe electrical solenoid valves 11 and 12, respectively, and then along a further length of high pressure pipe 13 to a gas burner inlet 14.

[0023] Figure 5 shows the interior of the thermal unit 3. As shown by the arrows, ram air from the cold air intakes 4 is received in a primary chamber 15. The cold air is pressurized due to the ram air effect and the majority of this cold air is bled directly out of the cold air outlets 6. The remainder of the cold air passes through a forward bulkhead 16 into a secondary chamber 17 containing a gas burner 18. The gas burner 18 receives gas from the fuel inlet 14 which is mixed with cold air within an air/fuel mixing chamber 19. The cold air is drawn into the air/fuel mixing chamber 19 by a venturi effect.

[0024] The gas burner includes a flame tube 20 where combustion of the air/fuel mix takes place. The flame tube 20 extends into a combustion chamber 21 so that when the gas burner 18 is lit, a flame is directed into the combustion chamber 21 and against a surface 22 which forms an external wall of the thermal unit 3. A mesh 23 is provided to spread the heat from the flame and thereby avoid overheating the surface of the wall 22 directly facing the flame. The combustion chamber 21 is provided with a number of guide vanes 24 which control the flow of hot gasses around the surface of the wall 22 so that a substantial portion of the surface area of the bulbous front end of the thermal unit is heated. Hot gases are exhausted at the exhaust port 7 where they meet a flow of cold air from the cold air outlet 6. This prevents the aircraft fuselage downstream of the flow of hot exhaust gasses from suffering heat damage.

[0025] Liquid petroleum gas passes through the heat exchanger inlet 8 to a heat exchanger 25 comprising a length of high pressure pipe where heat from the combustion chamber 21 radiated by the wall 26 vaporizes the liquid petroleum gas.

[0026] The gas burner 18 is lit using a naked flame before the aerial target is launched. Typically, a supply

of two bottles of liquid petroleum gas will provide a continuous thermal signature for at least one hour.

[0027] In this example, the thermal unit 3 is formed from two separable parts. The first part comprises the primary chamber 15 and gas burner fittings. The second part comprises the secondary chamber 17 and combustion chamber 21. The first part is mounted directly to the front end of the aircraft fuselage whilst the second part is secured to the first part once the gas burner has been lit shortly before the aerial target is launched. During storage and transit the thermal unit is left attached to the aircraft.

[0028] Figure 6 shows a modification in which an electric fan 30 is provided which facilitates ground running of the unit prior to launch. It also assists the regulation of airflow in flight instead of relying solely on ram air.

Claims

1. A thermal unit (3) for fitting to an aerial target (1) comprising a burner (18) mounted internally within the thermal unit and arranged to heat a continuous thermally conductive surface (22) in order to provide, when mounted on an aerial target, a thermal signature for acquisition by an infra-red seeking air defence weapon system, so that a flying aerial target, when carrying such a thermal unit with a continuous thermally conductive surface, cannot be tracked and targeted visually by reference to the thermal signature.
2. A thermal unit according to claim 1, formed as an aircraft nose cone.
3. A thermal unit according to claim 1 or 2, in which the thermal unit (3) comprises a primary chamber (15) which receives ram air from a number of air intakes (4).
4. A thermal unit according to claim 3, in which the primary chamber (15) comprises a number of air outlets (5) through which air is permitted to bleed to atmosphere.
5. A thermal unit according to claim 3 or 4, further comprising a secondary chamber (17) through which the burner (18) extends and which receives air from the primary chamber (15).
6. A thermal unit according to any preceding claim, further comprising a combustion chamber (21) where a flame from the burner (18) heats a surface (22) of the thermal unit.
7. A thermal unit according to claim 6, in which the combustion chamber (21) includes means (23, 24) to spread the flame over the surface of the combustion chamber (21).

8. A thermal unit according to claims 6 or 7, in which the combustion chamber (21) includes guide means (24) to control the flow of hot gases over the thermally conductive surface (22).
9. A thermal unit according to any one of claims 6 to 8, when dependent on claim 4, in which the combustion chamber (21) includes a number of exhaust outlets (7) each of which is located adjacent to and upstream of a corresponding one of the air outlets (5) of the primary chamber.
10. A thermal unit according to any preceding claim, in which the burner (18) is a liquid petroleum gas burner.
11. An aerial target system comprising an unmanned aircraft (1) including a thermal unit (3) according to any preceding claim.
12. An aerial target system according to claim 11, further comprising a source of liquid petroleum gas carried by the aircraft which is operatively connected to the burner (18).
13. An aerial target system according to claim 12, in which a path of a fluid line connecting the source of liquid petroleum gas to the burner (18) passes through a heat exchanger (25).
14. An aerial target system according to any of claims 11 to 13, in which the aircraft (1) is driven by an aft mounted engine unit (2) independent of the thermal unit (3).
15. An aerial target system according to claim 14, in which the engine (2) is a propeller engine.

16. A method of providing a thermal signature in an aerial target comprising heating an external continuous thermally conductive surface of the aerial target with a burner mounted internally within the thermal unit to provide a thermal signature for acquisition by an infra-red seeking air defence weapon system, wherein the aerial target cannot be tracked and targeted visually by reference to the thermal signature.

Patentansprüche

1. Wärmeeinheit (3) zur Anbringung an einem Luftziel (1), die einen Brenner (18) aufweist, der innerhalb der Wärmeeinheit montiert und angeordnet ist, um eine kontinuierlich wärmeleitende Fläche (22) zu erwärmen, damit in dem in das Luftziel eingebauten Zustand eine thermische Signatur zur Erfassung

durch ein infrarotsuchendes Luftabwehrwaffensystem geschaffen wird, so daß ein fliegendes Luftziel, wenn es solch eine Wärmeeinheit mit einer kontinuierlich wärmeleitenden Fläche trägt, nicht visuell durch Bezug auf die thermische Signatur verfolgt und anvisiert werden kann.

2. Wärmeeinheit nach Anspruch 1, dadurch gekennzeichnet, daß sie als eine Flugzeugbugverkleidung ausgebildet ist. 10
3. Wärmeeinheit nach Anspruch 1 oder 2, in der die Wärmeeinheit (3) eine Primärkammer (15) aufweist, die Frischluft durch eine Anzahl von Luftauslässen (4) aufnimmt. 15
4. Wärmeeinheit nach Anspruch 3, in der die Primärkammer (15) eine Anzahl von Luftauslässen (5) aufweist, durch die ein Ausstoßen der Luft in die Umgebung möglich ist. 20
5. Wärmeeinheit nach Anspruch 3 oder 4, dadurch gekennzeichnet, daß zusätzlich eine Sekundärkammer (17) vorgesehen ist, durch die der Brenner (18) sich erstreckt und die Luft von der Primärkammer (15) Luft aufnimmt. 25
6. Wärmeeinheit nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß zusätzlich eine Verbrennungskammer (21) vorgesehen ist, in der eine Flamme von dem Brenner (18) eine Fläche (22) der Wärmeeinheit erwärmt. 30
7. Wärmeeinheit nach Anspruch 6, dadurch gekennzeichnet, daß die Verbrennungskammer (21) Mittel (23, 24) einschließt, um die Flamme über die Fläche der Verbrennungskammer (21) zu verteilen. 35
8. Wärmeeinheit nach Anspruch 6 oder 7, dadurch gekennzeichnet, daß die Verbrennungskammer (21) Führungsmittel (24) einschließt, um den Luftstrom des heißen Gases über die wärmeleitende Fläche (22) zu leiten. 40
9. Wärmeeinheit nach einem der Ansprüche 6 bis 8 rückbezogen auf Anspruch 4, dadurch gekennzeichnet, daß die Verbrennungskammer (21) eine Anzahl von Abgasauslässen (7) aufweist, von denen jeder angrenzend an und stromaufwärts von einem entsprechenden Luftauslaß (5) der Primärkammer liegt. 45
10. Wärmeeinheit nach einem der vorangehenden Ansprüche, in der als Brenner (18) ein Brenner für flüssiges Petroleumgas vorgesehen ist. 50
11. Luftzielsystem mit einem unbemannten Fahrzeug (1), das eine Wärmeeinheit (3) nach einem der vor-

angehenden Ansprüche aufweist.

12. Luftzielsystem nach Anspruch 11, dadurch gekennzeichnet, daß zusätzlich ein Tank für flüssiges Petroleumgas durch das Flugzeug getragen wird, der wirksam mit dem Brenner (18) verbunden ist.
13. Luftzielsystem nach Anspruch 12, dadurch gekennzeichnet, daß der Weg einer Flüssigkeitsleitung, die den Tank für flüssiges Petroleumgas mit dem Brenner (18) verbindet, durch einen Wärmetauscher (25) läuft.
14. Luftzielsystem nach einem der Ansprüche 11 bis 13, dadurch gekennzeichnet, daß das Flugzeug (1) durch eine heckseitige Motoreinheit (2) unabhängig von der Wärmeeinheit (3) angetrieben wird.
15. Luftzielsystem nach Anspruch 14, dadurch gekennzeichnet, daß der Motor ein Propellermotor ist.
16. Verfahren zur Bereitstellung einer thermischen Signatur in einem Luftziel, das Erhitzen einer externen, kontinuierlich wärmeleitenden Fläche des Luftziels mit einem Brenner, der intern innerhalb der Wärmeeinheit befestigt ist, einschließt, um eine thermische Signatur zur Erfassung durch ein infrarotsuchendes Luftabwehrwaffensystem zu schaffen, wobei das Luftziel nicht visuell durch Bezug auf die thermische Signatur verfolgt und anvisiert werden kann.

Revendications

1. Unité thermique (3) destinée à être montée sur une cible aérienne (1), comprenant un brûleur (18) monté à l'intérieur de l'unité thermique et disposé afin qu'il chauffe une surface conductrice thermiquement continue (22) afin que celle-ci donne, lors du montage sur une cible aérienne, une signature thermique permettant l'acquisition par un système d'armes de défense aérienne à recherche infrarouge, si bien qu'une cible aérienne volante, lorsqu'elle porte une unité thermique ayant une surface conductrice thermiquement continue, ne peut pas être suivie et visée visuellement par référence à sa signature thermique.
2. Unité thermique selon la revendication 1, formant un cône de nez d'un aéronef.
3. Unité thermique selon la revendication 1 ou 2, dans laquelle l'unité thermique (3) comporte une chambre primaire (15) qui reçoit de l'air comprimé d'un certain nombre d'entrées d'air (4).
4. Unité thermique selon la revendication 3, dans la-

quelle la chambre primaire (15) comprend un certain nombre de sorties d'air (5) par lesquelles de l'air peut être évacué à l'atmosphère.

5. Unité thermique selon la revendication 3 ou 4, comprenant en outre une chambre secondaire (17) dans laquelle s'étend le brûleur (18) et qui reçoit l'air de la chambre primaire (15). 5
6. Unité thermique selon l'une quelconque des revendications précédentes, comprenant en outre une chambre de combustion (21) à l'emplacement où une flamme du brûleur (18) chauffe une surface (22) de l'unité thermique. 10
7. Unité thermique selon la revendication 6, dans laquelle la chambre de combustion (21) comporte un dispositif (23, 24) destiné à étaler la flamme à la surface de la chambre de combustion (21). 15
8. Unité thermique selon les revendications 6 et 7, dans laquelle la chambre de combustion (21) comprend un dispositif de guidage (24) destiné à régler la circulation des gaz chauds sur la surface thermiquement conductrice (22). 20
9. Unité thermique selon l'une quelconque des revendications 6 à 8 lorsqu'elle dépend de la revendication 4, dans laquelle la chambre de combustion (21) comprend un certain nombre de sorties d'échappement (7) placées chacune près d'une sortie correspondante d'air (5) de la chambre primaire et en amont de cette sortie correspondante. 25
10. Unité thermique selon l'une quelconque des revendications précédentes, dans laquelle le brûleur (18) est un brûleur à gaz de pétrole liquéfié. 30
11. Système à cible aérienne comprenant un aéronef sans pilote (1) comportant une unité thermique (3) selon l'une quelconque des revendications précédentes. 35
12. Système à cible aérienne selon la revendication 11, comprenant en outre une source de gaz de pétrole liquéfié transportée dans l'aéronef et qui est raccordée au brûleur (18) pendant le fonctionnement. 40
13. Système à cible aérienne selon la revendication 12, dans lequel un trajet d'une conduite de fluide raccordant la source de gaz de pétrole liquéfié au brûleur (18) passe dans un échangeur de chaleur (25). 45
14. Système à cible aérienne selon l'une quelconque des revendications 11 à 13, dans lequel l'aéronef (1) est mu par une unité (2) à moteur montée à l'arrière indépendamment de l'unité thermique (3). 50

15. Système à cible aérienne selon la revendication 14, dans lequel le moteur (2) est un moteur à hélice.

16. Procédé de création d'une signature thermique dans une cible aérienne, comprenant le chauffage d'une surface externe thermiquement conductrice et continue de la cible aérienne à l'aide d'un brûleur monté à l'intérieur de l'unité thermique pour la création d'une signature thermique destinée à être acquise par un système d'armes de défense aérienne à recherche infrarouge, dans lequel la cible aérienne ne peut pas être suivie et visée visuellement par référence à sa signature thermique.

Fig.1.

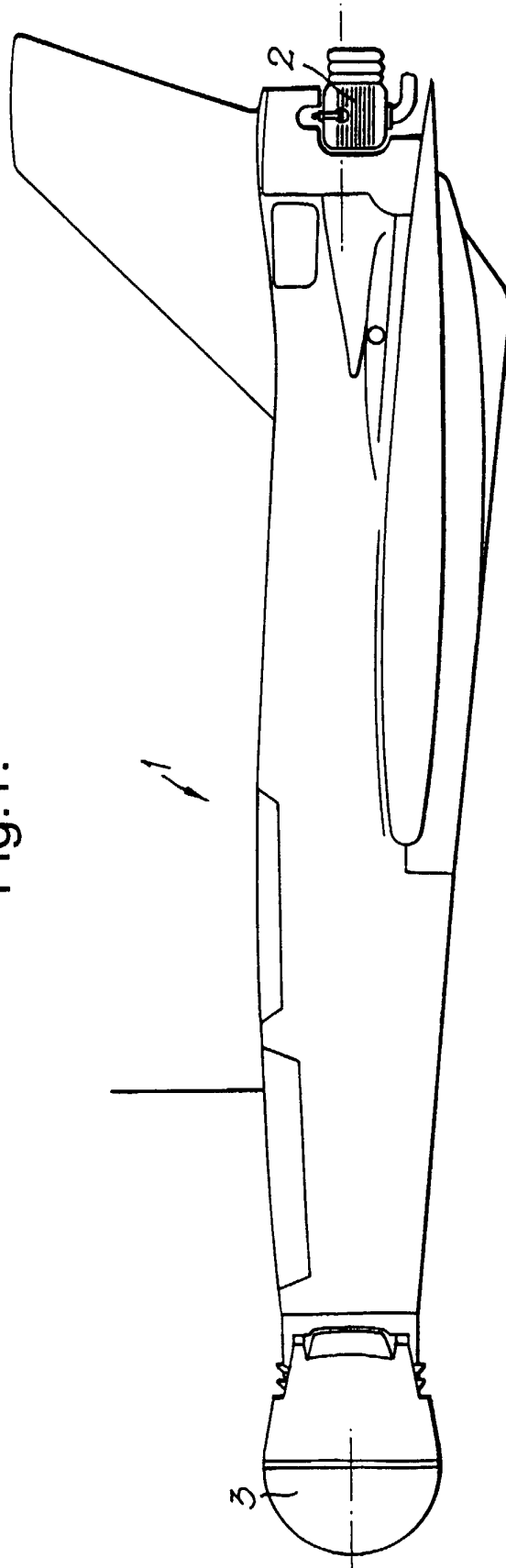


Fig.2.

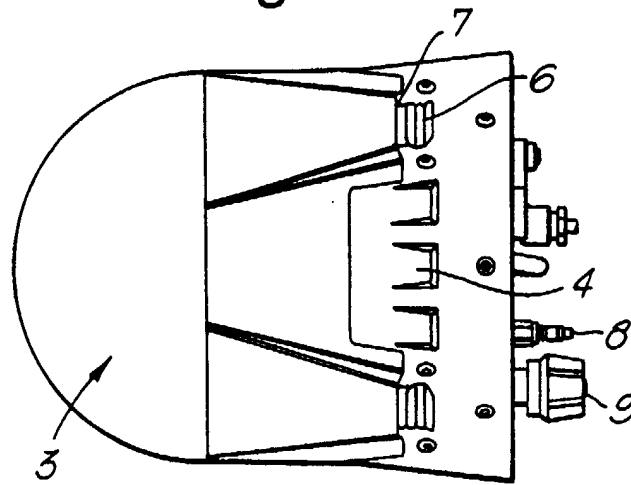


Fig.3.

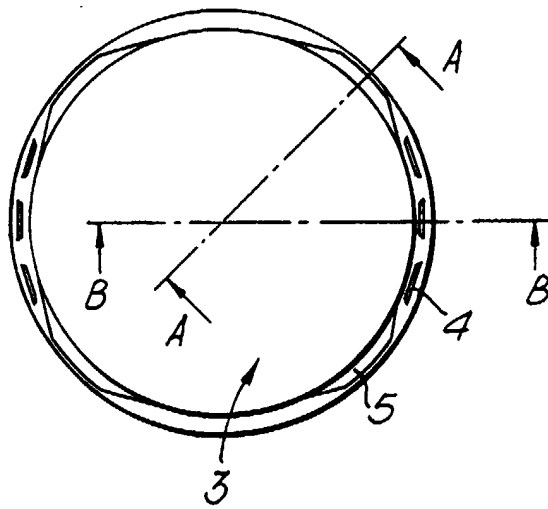


Fig.4.

