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A request for correction of the claims has been filed pursuant to Rule 88 EPC. A decision on the request will be taken during the proceedings before the Examining Division (Guidelines for Examination in the EPO, A-V, 3.).

(54) Non-lethal projectile

(57) The present invention is a projectile comprising a non-lethal payload (50), a frangible composite case (10), an air-bursting fuze (40), and at least one explosive (30). The projectile is adaptable to any medium or large caliber ammunition. After being launched from a gun system towards an intended target, the fuze mechanism triggers a first explosive charge that causes a blast force to disintegrate the composite case into sufficiently small particles so that the particles rapidly decelerate to a non-lethal state. The explosive charge may also create an overpressure wave to disorient or incapacitate the target. Other non-lethal payloads, such as aerosols or rubber pellets, may be included within the walls of the frangible case.

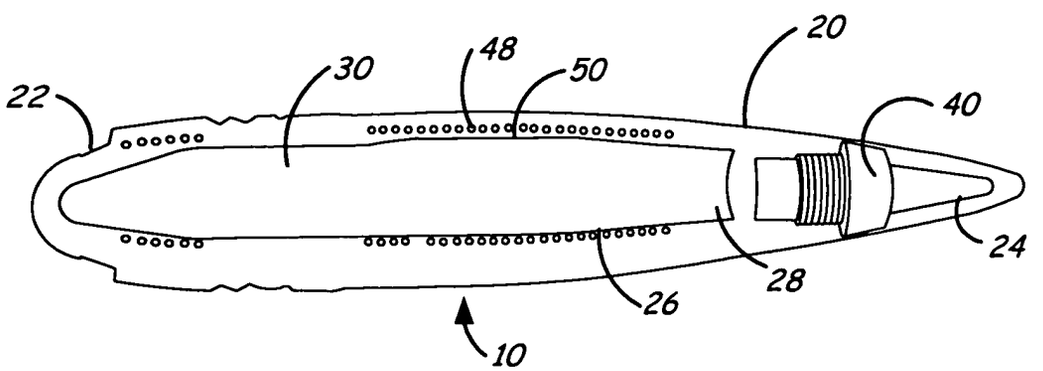

Fig. 1

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Description

Related Applications

[0001] The present invention claims the benefit of U. S. Provisional Application No. 60/475,705 filed June 4, 2003 and entitled "Non-Lethal Percussion Projectile," which is hereby incorporated by reference in its entirety.

Field of the Invention

[0002] The present invention relates to non-lethal munitions and in particular to a non-lethal percussion projectile with a frangible casing so as to effectively deliver a percussion charge above a target area that upon detonation the projectile casing disintegrates into harmless fragments and the other projectile components either disintegrate as well or are directed away from the target area.

Background of the Invention

[0003] The present scope of military operations has increased the need to address certain threats in a non-lethal manner. Military forces frequently find themselves transitioning between traditional combat missions to peacekeeping missions involving police or crowd control activities. For example, in crowd control situations, it is extremely difficult to determine which elements of a crowd are hostile. Thus a field commander cannot use traditional weapons to disperse or attack such a crowd without the risk of injury to innocent bystanders. Likewise, in protecting installation or ships it would be advantageous to have the capability of stopping a questionable vehicle or boat without killing its occupants. In such instances the traditional weapons of the military are not effective in accomplishing the overall mission, as they do not have non-lethal settings.

[0004] It would be advantageous then to provide field commanders with alternative means to handle conflicts when lethal force is to be avoided. Such alternative means include any of the multitude of non-lethal instruments presently available or under development. Non-lethal weapons include low kinetic energy projectiles such as rubber pellets, or skin irritants, odor bombs, electromagnetic pulses or even shock waves. While such non-lethal alternatives increase the effectiveness of the military force, such alternatives frequently involve the use of specialized equipment that creates an additional logistical burden and training requirement.

[0005] , It would be advantageous then if the non-lethal alternative could be applied using traditional weapons. This would eliminate or reduce the logistical problems associated with fielding multiple weapons. Likewise, the personnel would not require any additional training to operate weapons that they were already familiar with.

[0006] Furthermore, there is a need to deliver such alternative non-lethal weapons from a stand-off distance so as to decrease the danger to friendly forces. Traditional standoff weapons include mortars and artillery. These types of weapons deliver a munition by propelling a projectile from a tube. The firing characteristics of this class of weapons require a projectile casing capable of withstanding launch and aerodynamic forces commensurate with ranges up to 10000 meters. Conventional casings and component are made of metal. These metallic casings can easily withstand the launching forces but are a lethal weapon themselves due to their mass and velocity. An internal charge within the shell is triggered at the appropriate point in the trajectory to shatter the external case creating shrapnel. While the shrapnel created in the traditional missions is acceptable, such a lethal byproduct is completely unacceptable for non-lethal missions.

[0007] There is a need for a projectile that can accomplish non-lethal missions from stand-off distances using weapons currently available. The projectile must be able to disintegrate on command when it reaches a target. Furthermore, the casing particles and interior components must have a non-lethal kinetic energy upon impact.

Summary of the Invention

[0008] The present invention meets the aforementioned needs. The present invention is a projectile comprising a non-lethal percussion payload, a frangible composite case, an air-bursting fuze, and at least one explosive. The projectile design is adaptable to any medium or large caliber ammunition. After being launched from a gun system towards an intended target, the fuze mechanism triggers a first explosive charge that causes a blast force to disintegrate the composite case into sufficiently small particles so that the particles rapidly decelerate to a non-lethal state. The explosive charge may also create an overpressure wave to disorient or incapacitate personnel in the target area. Other non-lethal payloads, such as aerosols or rubber pellets, may be delivered by the projectile in addition to or in place of the percussion charge that creates the overpressure wave.

[0009] Preferred embodiments of the non-lethal percussion projectile are sized according to traditional artillery weapons systems thus alleviating the need for new launch mechanisms. The projectile is designed to be fired or launched from presently installed gun weapon systems on naval and coast guard ships or land batteries. In particular, the present invention may be constructed for use with a 5 inch, 76 mm, 57 mm, and 40 mm weapon. Thus, the projectile can be launched and effects delivered at the range of the gun from which it is fired.

[0010] Detonation of at least one explosive contained in the projectile disintegrates the projectile's composite

case into sufficiently small fragments or particles so that they rapidly loose velocity or decelerate to a non-lethal state. The first detonation may trigger subsequent detonation of explosive layers or areas in the casing itself to increase the disintegration.

[0011] The present invention is well suited for non-warfare activities such as drug interdictions, port security, force protection, evacuation operations, and general self-protection. The overpressure wave from the detonation of the explosive payload will disorient or incapacitate personnel in the general area of a target. Other non-lethal effects that are deliverable within the projectile include crystalline or gelatine type skin irritants, rubber pellets, and malodorants

[0012] As an alternate embodiment, an external sabot can be fitted to the projectile. The sabot protects the projectile during launch from gun barrel interfaces and gun launch forces. The addition of the sabot will decrease the stress experienced by the projectile casing. The sabot peels away from the projectile immediately after launch. The composite case may then be made from a limited composite frame or an aerofoam type structure.

[0013] Operation of preferred embodiments of a non-lethal percussion projectile having a frangible composite case comprises launching the projectile; disintegrating the composite case into sufficiently small particles so that the particles rapidly decelerate to a non-lethal state; and delivering at least one non-lethal effect upon the target to disorient or incapacitate the target. In the preferred embodiment, the fuze is also a prefragmented device so as not to produce lethal effects. In the alternative, the fuze could be situated ahead of a fuze guide which would direct the fuze down range of the target area. At least one explosive is contained within the composite case and detonated to disintegrate the composite case and create the overpressure wave and/or deliver other non-lethal effects.

Brief Description of the Drawings

[0014]

Figure 1 is a cross-sectional view of the preferred embodiment of the non-lethal percussion 57mm projectile.

Figure 2 is a cross-sectional view of an alternative embodiment of the non-lethal percussion 76mm projectile.

Figure 3 is a cross-sectional view of an alternative embodiment of the non-lethal percussion projectile.

Figure 4 is cross-sectional view of an alternate embodiment of the non-lethal percussion projectile encased in a sabot.

Detailed Description of the Drawings

[0015] The preferred embodiment relates to a non-lethal percussion projectile in accordance with the present invention. The projectile can be fired or launched from presently installed medium to large artillery pieces. Additionally, it should be apparent to those skilled in the art that the projectile is adaptable to ground or air gun weapon systems as well and gun systems that may be developed in the future. Thus, the projectile can be launched and effects delivered at the range of the gun from which it is fired, for example, up to 5,000 meters for an MK 75 Mod 0 gun mount. The burst height or distance from the target at which the projectile is exploded controls the delivery of the effects contained therein.

[0016] As shown in Figure 1, the preferred embodiment of the percussion projectile 10 comprises a frangible composite case 20, an explosive payload 30, a fuze 40, and a non-lethal payload 50. The composite case 20 is generally an elongated cylinder shape with a blunt tail 22 for bearing the stresses of a gun system firing, a conical front nose 24 for more aerodynamic flight, and a fuselage 26. The nose 24 preferably houses the fuze 40, which contains a number of metal components. The cylindrical fuselage 26 contains the explosive payload 30 within a cylindrical recess 28.

[0017] The composite case 20 is gun hardened to withstand gun weapon system firing. The composite case 20 is preferably fabricated from a fiberglass or Kevlar™ wrap, which is wound like thread and bonded together with a high temperature resin. Changing fiber orientation, manipulating matrix formulations, and controlling the fiber volume fraction are examples of ways to geometrically control the specific structural properties of the composite casing. The use of a unidirectional wrap or unidirectional fibers provides support and strength in the longitudinal direction of the projectile, yet with a tendency to split along the matrix rich areas between the fibers. Matrix fillers can provide a more powder like nature to the resin during failure, hence decreasing the lethal nature of the explosion. Taking advantage of the structural properties of a fiber matrix construction, it is possible to develop casing designs that fail in a desired manner when subjected to an internal blast as compared to the external launch forces. In addition, the case could be wound to include predetermined scoring (not shown) or striations on the inside or outside surface of the composite case 20 to further control the case's non-lethal disintegration. Moreover, the casing itself may contain secondary explosive layers or areas that will further enhance the disintegration of the casing.

[0018] The percussion projectile 10 of the present invention further includes a fuze 40 within the nose section 24. The fuze 40 is preferably a prefragmented, programmable, proximity fuze (3P) for example as manufactured by Bofors Defence AB. The fuze 40 will be programmable for optimized effect and tactical flexibility with air burst capability and immune to electronic counter measures (ECM). If programmed for air burst, the fuze 40 will travel beyond the target area due to its momentum so as not to cause lethal harm. In addition, for a 76 mm projectile, as shown in Figure 3, a cone-shaped fuze

barrier 42 may be installed immediately aft of the fuze 40 to drive the fuze 40 downrange following detonation of the payload 30.

[0019] In a first embodiment, the non-lethal payload 50 may be inserted in a pellet form within the composite case 20. The non-lethal payload 50 may include rubber pellets for direct physical non-lethal contact. In the alternative, the non-lethal payload 50 may be pelletized units of compounds intended to irritate the skin, eyes or nose. The non-lethal payload 50 would be disposed within the composite case 20 during the manufacturing process.

[0020] In a first embodiment the explosive payload 30 contains MIL-STD 2105B Insensitive Munition (IM) compliant explosive therein for delivering desired effects. Presently, the United States Navy requires that all explosives comply with MIL-STD 2105B Insensitive Munition standards. This is so that ammunition is less likely to detonate sympathetically in the event of an explosion or fire in a ship's magazine. Currently accepted IM compliant explosives include, without limitation, plastic bonded explosive (PBX) PBXN-9 and PBX-114. Improvements are continuously being made, so preferably the projectile 10 utilizes the appropriate explosive(s) available at the time of manufacture. The explosive payload 30 is sized to create a concussion or shock wave so as to stun the intended target personnel. For example, a non-lethal percussion projectile 10 for a 76mm Mk 75 gun would include 1.3 pounds of explosive.

[0021] In an alternative embodiment, as shown in Fig. 4, the percussion projectile 10 includes an external sabot 60 to protect the composite case 20 from gun barrel interfaces and gun launch forces. Using a sabot 60 allows the composite case to be lighter, so that preferably a limited composite frame over an aerofoam and/or plastic type structure is used. Once the projectile 10 exits a gun barrel, the sabot 60 splits opens and is discarded, allowing the projectile 10 to continue to the target. The sabot 60 includes at least one obturator 52, which keeps the gases from the propelling charge behind the projectile 10. The composite case 20 utilizes the same air-bursting fuze as other embodiments.

[0022] In operation the percussion projectile 10 is detonated near or over the target utilizing the air-bursting fuze 40. The explosion from the detonation disintegrates the composite case 20 into sufficiently small fragments or particles so that they rapidly loose velocity or decelerate to a non-lethal state, i.e., the mass and velocity at which they might impact a being is unlikely to be lethal. In addition, the explosion creates an overpressure wave to disorient or incapacitate targeted personnel. Operationally, the air-bursting fuze 40 can be set to detonate by illuminating the target with a laser operatively connected to a computer that is in turn operatively connected to the gun mount used to fire the projectile 10. The laser provides data to the computer, and the computer calculates the range of the target and communicates this information to an inductive coil attached to the gun mount's muzzle. As the projectile passes by the coil, the air-bursting fuze 40 is electronically adjusted or set for the projectile's anticipated flight path. The projectile 10 is aimed to a point in space adjacent to or above a target so that the fuze 40 continues traveling forward along the projectile's flight path after detonation so as minimize harm.

[0023] Other enhancing or additional non-lethal effects can be carried and delivered by the projectile to the vicinity of the target, including crystalline or gelatine type skin irritants, rubber pellets, and stink bomb material and other maloderants. In fact, it should be apparent to those skilled in the art that the projectile is a delivery device for any existing or future desired type of non-lethal effects. As shown in Figures 1 and 2, preferably the composite case 20 has cavities 48 prefabricated into the fuselage 26, wherein the non-lethal effects 50 are contained during gun system firing and flight of the projectile. By positioning the cavities 28 in the fuselage 26, the non-lethal effects will travel outwardly from the projectile's line of flight when the projectile 10 is exploded.

[0024] Although the preferred embodiment and various alternative embodiments of the non-lethal percussion projectile have been described herein, it should be recognized that numerous changes and variations can be made to these embodiments that are still within the spirit of the present invention. The scope of the present invention is to be defined by the claims.

Claims

1. A projectile for delivering a non-lethal weapon to a target area, said projectile launched from a conventional tube style weapon, said projectile comprising:

a frangible cylindrical body, said frangible cylindrical body having a tapered nose at a first end, a blunt tail section at the second end and a hollow payload section disposed between the first end and the second end;
a fuze disposed within the tapered nose section; and
an explosive payload contained within the hollow payload section and operably connected to the fuze; said frangible cylindrical body divisible into a plurality of individual low mass elements upon a controlled ignition by the fuze of the explosive payload; said explosive payload also creating a pressure wave.

2. The projectile of claim 1 further including a non-lethal payload imbedded within the frangible cylindrical body.

3. The projectile of claim 2 wherein the non-lethal payload includes a plurality of pellets, said pellets

including an outer covering defining a non-lethal compound.

4. The projectile of claim 3 wherein the non-lethal compound is a skin irritant.

5. The projectile of claim 3 wherein the non-lethal compound is a malodorant.

6. The projectile of claim 1 further including an electromagnetic pulse device.

7. The projectile of claim 1 wherein the explosive payload is a thermobaric payload.

8. The projectile of claim 1 wherein the fuze is programmable for an air-burst ignition.

9. The projectile of claim 1 wherein the fuze is prefragmented.

10. The projectile of claim 1 further including a break away shell encapsulating the projectile, said break away shell including at least one obturator ring having a diameter slightly smaller than an inner diameter of the conventional tube style weapon; said break away shell separating from the projectile immediately after launch from the conventional tube style weapon.

11. The projectile of claim 1 wherein the frangible cylindrical body includes a fiber matrix construction, said fiber matrix construction composed of a plurality of fibers disposed to form a plurality of fiber matrix layers, said fiber matrix construction further including a fiber filler deposited into a plurality of voids between the plurality of fibers and between the plurality of fiber matrix layers.

12. The projectile of claim 11 wherein the frangible cylindrical body further includes an explosive layer disposed between fiber matrix layers.

13. The projectile of claim 11 wherein the frangible cylindrical body further includes a plurality of explosive areas disposed within voids of the fiber matrix construction.

13. A method for safely delivering a non-lethal effect to a target area, said method comprising;

firing a projectile from a tube type weapon, said projectile including a fuze and an explosive payload within a casing;
activating the fuze within the projectile;
detonating the explosive payload within the projectile; said explosive payload creating a non-lethal shock wave;
controlling a casing particle size formed by the detonation of the explosive payload, said casing particle size predetermined by a fiber matrix construction of the casing, said fiber matrix construction composed of a plurality of fibers disposed to form a plurality of fiber matrix layers, said fiber matrix construction further including a fiber filler deposited into a plurality of voids between the plurality of fibers and between the plurality of fiber matrix layers; and
directing the fuze beyond the target area, said fuze directed by a fuze guide disposed between the fuze and the explosive payload.

14. The method of claim 13 wherein controlling casing particle size includes changing the fiber orientation.

15. The method of claim 13 wherein controlling casing particle size includes manipulating a fiber matrix formulation.

16. The method of claim 13 wherein controlling casing particle size includes controlling a fiber volume fraction.

17. The method of claim 13 wherein controlling casing particle size includes a predetermined scoring of the fiber matrix construction on the inside of the casing

18. The method of claim 13 wherein controlling casing particle size includes a secondary explosive layer or explosive areas within the fiber matrix construction that will further enhance the disintegration of the casing.

19. The method of claim 13 wherein the non-lethal effect further includes a skin irritant, a malodorant, an eye irritant, or an electromagnetic pulse.

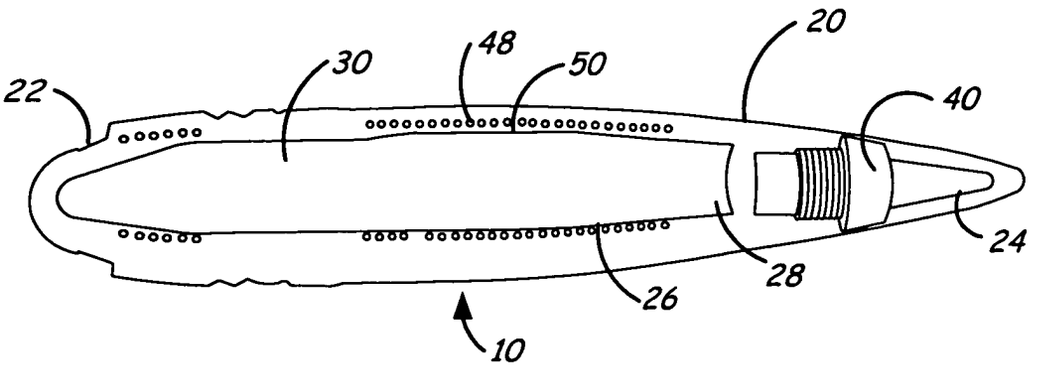

Fig. 1

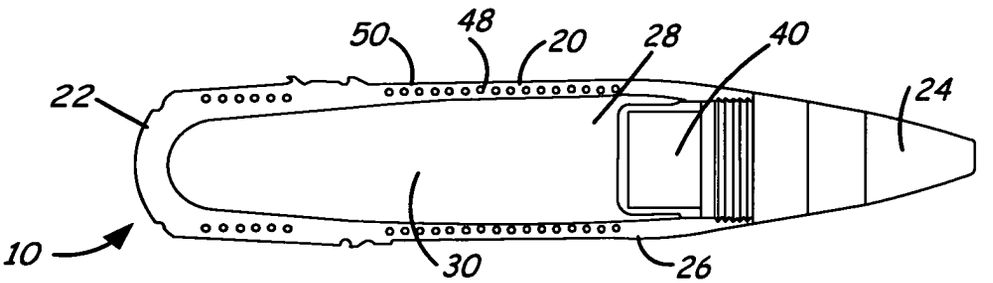

Fig. 2

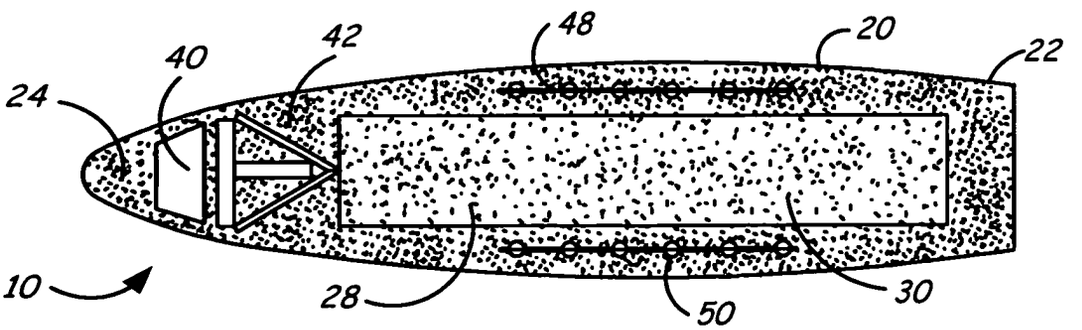

Fig. 3

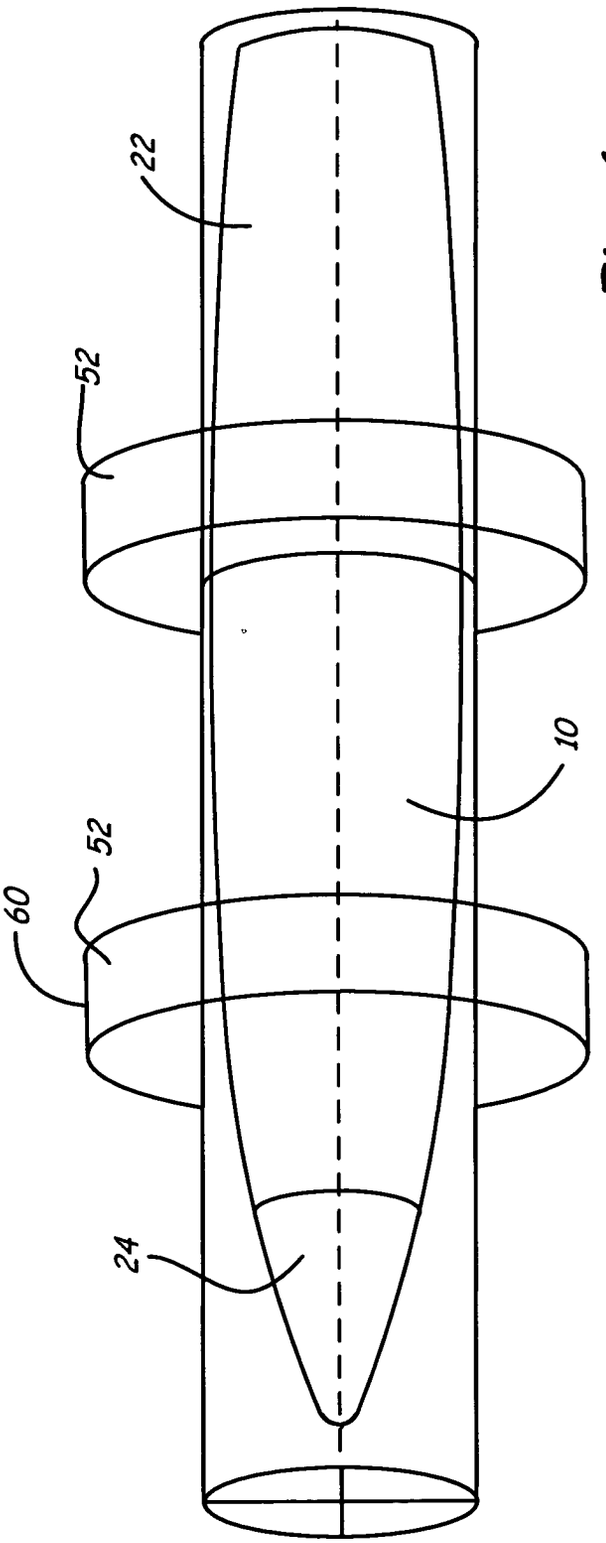

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 04 01 3195

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 August 2004	Bridge, S

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 01 3195

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