(19) DANMARK

(10) **DK/EP 3072113 T3**

Patent- og Varemærkestyrelsen

(12) Oversættelse af europæisk patentskrift

(51)	Int.Cl.:	***G 07 C 9/15 (2020.01)***	***E 05 G 5/00 (2006.01)***	***G 01 S 13/00 (2006.01)***
		G 01 S 13/87 (2006.01)	***G 01 S 13/88 (2006.01)***	***G 01 S 13/89 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2022-03-21**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2021-12-22**

(86) Europæisk ansøgning nr.: **14863169.0**

(86) Europæisk indleveringsdag: **2014-11-17**

(87) Den europæiske ansøgnings publiceringsdag: **2016-09-28**

(86) International ansøgning nr.: **US2014065879**

(87) Internationalt publikationsnr.: **WO2015077167**

(30) Prioritet: **2013-11-19 US 201361905940 P** **2014-01-22 US 201414160895**
2014-02-28 US 201461945921 P **2014-04-23 US 201414259603**
2014-06-30 US 201414319222

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(73) Patenthaver: **APSTEC Systems Ltd, 99 Triq Censu Busuttil, IKL 1200 Iklin, Malta**

(72) Opfinder: **KUZNETSOV, Andrey, Pr. Toreza 40, Korp. 7 Apt. 52, St. Petersburg 194223, Russiske Føderation**
GORSHKOV, Igor, V.O. Malyy Pr. 5 Apt. 1, St. Petersburg 199178, Russiske Føderation
KELLERMANN, David Gustav, 99 Triq Censu Busuttil, Iklin IKL 1200, Malta

(74) Fuldmægtig i Danmark: **Zacco Denmark A/S, Arne Jacobsens Allé 15, 2300 København S, Danmark**

(54) Benævnelse: **Intelligent screening-barriere**

(56) Fremdragne publikationer:
WO-A1-2012/107900
US-A- 4 586 441
US-A1- 2008 250 726
US-B1- 6 484 650
US-B1- 7 119 682

DESCRIPTION

FIELD OF THE INVENTION

[0001] This invention relates to a security barrier for the controlled transit of people, animals, and carried items, particularly for tourist attraction areas, high-capacity and high-flow areas, and mass transit areas such as train stations and airports.

BACKGROUND OF THE INVENTION

[0002] U.S. Patent Application No. 2003/0136052, by De Boer, discloses a revolving door, comprising a rotatable partition embodied such that in, at, or on the partition, one or more means for the detection of inadmissible goods is provided. U.S. Patent No. 6,742,301, to Schwarz, also discloses a revolving door, but with a metal detection function. Both inventions are a kind of automatic detection device, but are short in their capability of dealing with an individual who might be wearing or carrying a hidden dangerous object.

[0003] U.S. Patent No. 7,707,951, to Prasad, discloses a substantially automatic, robotic-like system to aid in preventing crime in high trafficked buildings and other public sites, comprising a counterclockwise rotating door which permits access in one direction only and is manually operated, two personnel detecting sensors, at least two other detectors, a low voltage power source and low voltage electronics, an electronic design to substantially automatically detect and detain persons attempting to enter a protected facility with a weapon or leave with a protected item, and where the entire security system is essentially contained within the space employed by the entry and or exit doorway. U.S. Patent Application No. 4,586,441 by Zekich discloses a security system for selectively allowing passage from a non-secure region to a secure region.

[0004] Prior art terrorist uncovering schemes, including but not limited to those mentioned above, are dangerous, since a terrorist most often detonates when realizing he has been caught in order to injure as many bystanders as possible. Security personnel who must approach a potential suicide bomber stand a very high risk, which also potentially impairs effectiveness of the security approach. It is advantageous to first detect potential target individuals and then confine them, in a secluded manner, to prevent harm to bystanders even if the target immediately detonates a worn explosive.

[0005] Additional challenges include: (1) how/where to install the system to achieve the maximum benefit, and (2) how the end user will treat cases of detection. Since a certain rate of false alarms will occur, there is a need for confirmation systems, and when a real threat is detected, it is essential to reduce as much possible damage as possible, e.g., by separating the threat from surrounding individuals and structures. These aspects should also be achieved while retaining acceptable traffic flow, or at least with minimal interruption of the same.

SUMMARY OF THE INVENTION

[0006] Claim 1 defines the invention. The present invention claims a security barrier (also referred to as system) for the screening of individuals, e.g., for application in areas with high traffic flows. The invention comprises at least two revolving door mechanisms, used as entrance and exit points to/from an isolated area located between the doors. A security barrier for screening of individuals is thus claimed, comprising at least two stationary cylinders, a revolving mechanism situated within each stationary cylinder comprising at least one blade comprised of blast-resistant material forming a revolving door, and an isolated area comprising at least two walls, located between said at least two stationary cylinders, wherein a first means for detection is employed within the isolated area as an individual travels through one of the stationary cylinders as an entrance cylinder, then through the isolated area, and finally through one of the stationary cylinders as an exit cylinder, as the revolving doors spin continuously around an axis in their respective stationary cylinders, creating a flow for continuous screening of moving individuals. Preferably, the security barriers of the present invention comprise a blast-resisting material within the walls of the isolated areas. The doors, as well as the walls and surrounding structures of the isolated area, are preferably made of blast-resisting glass and/or concrete, in order to mitigate a potential explosion or other act of terrorism. Screening mechanisms can be employed in the isolated area as well as within the entrance and exit points. More screening devices/mechanisms lower the likelihood of false alarms and allow for further confirmation of suspected individuals. The security barrier of the present invention can comprise e.g. a second means of detection employed in the entrance cylinder and a third means of detection employed in the exit cylinder wherein said revolving mechanisms stop to seal the isolated area upon a threshold-exceeding signal received from said means of detection. Various means for screening can be used including, but not limited to, metal detection, microwave imaging, video imaging, and infrared imaging. An alarm can be triggered if a signal from any of the screening mechanisms exceeds a pre-determined threshold value. Alternatively, a silent alarm can be triggered in a similar fashion, in order to alert and obtain first responders before alarming an individual carrying a potential explosive.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

Fig. 1 shows an example (top view/view from above) of the present invention, illustrating how a screening area is located between two revolving doors and how receivers and transmitters can be positioned in the area between doors. It also shows an example of how the concrete and blast-resistant materials/barriers can be positioned.

Fig. 2. Figs. 2A and 2B show examples of how receivers and transmitters can be positioned

within a revolving door itself — (2A) from top to bottom (side view), and (2B) from inside axel to outside boundary (top view).

Fig. 3 (top view). Fig. 3A shows an example of one embodiment of the present invention, where one transmitter, or transmitting array, sending various signals to one receiver. Fig. 3B shows another embodiment of the present invention, where one transmitting array send various signals to various receivers. Fig. 3C shows yet another embodiment where several transmitters and receivers are employed together.

Fig. 4 (top view) shows another embodiment of the present invention, where various transmitters and receivers of the means for detection are positioned in a circular fashion within a smart room between entrance and exit points.

Fig. 5 (side view/view from the front or back). Figs. 5A and 5B show examples of the heights at which receivers and transmitters can be positioned to obtain various screening angles, as well as the coupling of a second means for detection — a video imaging system. Fig. 5A regards transmitting means of detection. Fig. 5B regards reflecting means of detection.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Definitions

[0008] "Means for detection," as used herein, refer to various means for screening/detection which are applicable with the presently claimed system including, but not limited to, metal detection, microwave detection, video detection, microwave-video imaging, infrared detection, electromagnetic imaging, x-ray imaging, ultrasonic imaging, ultrasound imaging, and other known methods. Methods of detection are disclosed by the following patents: U.S. Patent No. 8,159,534, to Kuznetsov et al., U.S. Patent No. 8,228,374, to Kuznetsov et al., U.S Patent No. 6,791,487, to Singh et al., U.S. Patent No. 6,469,624, to Whan et al., U.S. Patent No. 5,600,303, to Husseiny et al, and PCT/US Patent Application No. PCT2013/027932, filed by Bergen et al.

[0009] "Microwave (MW) imaging," as used herein for the means of detection, can be achieved using various techniques. In one embodiment, the active microwave detection means disclosed in U.S. Patent Application No. 2014/160,895 (using methods based on the reflective characteristics of microwaves off of dielectric objects hidden underneath clothing or within luggage) are used to detect potentially dangerous objects within the system claimed herein. See also U.S. Patent No. 8,159,534, to Kuznetsov et al., U.S. Patent No. 8,228,374, to Kuznetsov et al., which are also mentioned above as additional applicable means for detection. In some embodiments, the MW imaging is performed by reflecting microwaves, while other embodiments employ a transmitted MW imaging method, as detailed in the patents listed above or described herein. Preferably, the means of detection comprised in the security barriers of the present invention comprises a reflected microwave imagining system or a transmitted microwave imaging system. In one embodiment, the means of detection comprised in the security barriers of the present invention comprises microwave imaging or a microwave imaging system synchronized with video imaging or a video imaging system. When a first, second, and third means of detection is used in the present invention, each of them can comprise transmitted or reflected microwave imaging. In one embodiment, each of them comprises a microwave imaging system synchronized with a video imaging system. The active microwave detection means can be coupled with means for video imaging (e.g., video cameras) in order to create a synchronized real-time image combining both microwave and video images of the same target at the same point in time.

[0010] The term "adjacent," as used herein, is defined as touching (i.e. in contact with), or within 5 meters of, any outside boundary of the isolated area (smart room) as described herein. The term is used to describe the positioning of blast-resistant concrete material structures which may be placed near or along the screening areas described herein. Such material structures, used, e.g., to minimize a blast radius, are placed in various strategic locations around a screening area, but they must be positioned within a certain range in order to be beneficial. Preferably, the security barriers of the present invention comprise a blast-resisting material structure adjacent to the isolated area.

[0011] The present invention improves on prior art methods by adding the capability to detect subjects at a forced (even if only slightly different) slower pace due to the revolutions of the revolving door and the maximum capacity within each section of the revolving doors. Additionally, the present invention improves on prior art methods because as a potential target is determined to be a potential threat, he or she is immediately isolated, and even if an explosive is detonated, individuals nearby will not be harmed because of the strategically placed revolving door and the surrounding structural components (including, but not limited to, concrete-containing barriers and blast-resistant glass) strategically placed in specific locations to isolate a detonated explosive within or near the revolving door.

[0012] Fig. 1 shows an example of a smart room with two revolving doors acting as entrance and exit (top view). The revolving doors are formed **300** stationary cylinders comprising at least one blade **310** comprised of blast-resistant material or concrete, but preferably glass (see Fig. 2B). The blades **310** create sections **305** within each stationary cylinder, and each stationary cylinder acts as either an entrance point or an exit point for moving individuals. Two types of barriers examples are illustrated in Fig. 1: concrete walls **1** (which could be installed in pre-fabricated sections), and blast-resistant glass or other blast-resistant material **2**, which is used both in wall material and in revolving door material. The walls and doors combine to form the "smart room," wherein various detection methods can be used to screen individuals moving through the space. Every material which makes up the smart room is comprised of blast-resistant glass and/or concrete, which also minimizes the effect of a potential explosion or other dangerous act. Fig. 1 also shows an example of how any means of detection can be positioned in the corners **3** of a screening area in order to obtain various interrogating areas

201. Individuals/traffic **5** can move in either direction **40**, thus each revolving door can act as a means for entering and as a means for exiting, depending on the direction of movement of a given individual.

[0013] Figs. 2A and 2B shows examples of how receivers **200** and transmitters **100** can be positioned within a revolving door, either (2A) transmitting from the bottom portion of the door to the top portion of the door, and vice versa; or (2B) from the outside boundary of the door to the inner boundary, and vice versa. As shown, several transmitters **200** and receivers **100** can be positioned along different portions of a door in order to obtain as many interrogating areas **201** as needed. Referring to Fig. 2B, each section **305** of each revolving door **300**, separated by blades **310** made of blast-resistant material or concrete, can comprise the same setup for means of detection as depicted in only one of the sections **305** in the figure. This allows for continuous flow and screening of individuals, as they move in either direction 40. If a high potential exists for false alarms, an embodiment employing additional means for detection within the revolving doors will help to lower the rate of such false alarms by screening a target several times (e.g., once in the first revolving door, a second time in the area between doors, and even a third time in the second revolving door). This particular embodiment, due to the ability to screen in more areas of the system, allows for a potentially faster flow of traffic but might also risk harm to more individuals because greater flow will lead to potentially more persons being located within the system at the same time (i.e., at a time when a threat is also located in the same area).

[0014] Figs. 3A, 3B, and 3C depict examples of various embodiments of placing the transmitters and receivers for means of detection employing transmitted signals. As a given individual **5** moves through a screening area, and in either direction **40**, a transmitter, or array of transmitters **200**, transmits various signal at various angles **202** to one receiver **100** (Fig. 3A) or to various receivers **100** (Fig. 3B). It is irrelevant on which side the transmitters and receivers are located so long as they are across from each other at any angle (note: for reflecting means of detection, the receivers and transmitters must be on the same side). Fig. 3C shows an example employing two transmitters, or arrays of transmitters **200** sending signals to two receivers **100**, creating two screening areas via signals at various angles.

[0015] Fig. 4 shows another example of a smart room **500** between two revolving doors **300** with a means of detection employing 6 transmitters **200** and 4 receivers **100**, in a circular fashion. The various angles of signals **202** create many screening areas and viewpoints, thus allowing for greater detection accuracy as individuals **5** move through the smart room **500**.

[0016] Fig. 5A and 5B (side view) shows an example of the various heights transmitters **200** and receivers **100** can be positioned, either within a smart room or within a door, creating various angles of signals (transmitted signals **202**, or reflected signals **203**) for detection. Fig. 5A depicts a transmitting signal **202** detection system. Fig. 5B depicts a reflecting signal **203** detection system. Additionally, these figures show an example of how a video imaging system **400** can be positioned to create an additional video screening area **401** thus forming, e.g., a combined MW-video imaging system. The additional video imaging can be synchronized with the MW imaging in real time to allow for more accurate identification of materials or individuals (e.g., an aspect that MW imaging, or any other coupled detection means, might not be able to obtain in time).

[0017] In one embodiment of the present invention, the detection means is located in an area **500** located between two or more revolving doors **300** (i.e. the smart room, isolated area). Thus, in this embodiment, the revolving doors **300** act only as a flow-controlling mechanism and not as a screening mechanism. By only allowing a maximum capacity (e.g., one person per section **305** of each revolving door **300**, or two persons per section, and so on, based on the amount and size of the sections) of individuals to enter the smart room **500** at a time, the revolving doors act as a barrier to entering a screening area termed the smart room, which employs any means of detection known in the art or otherwise disclosed herein. Controlling the speed (e.g., slowing down) of traffic minimizes the chance of overlapping individuals (which causes screening problems, potentially hiding objects because of a shadowing/hiding effect), and creates a steady flow in areas including but not limited to mass transit hubs. In this embodiment, when a dangerous hidden object is detected, the potential threat is isolated within the smart room by the revolving doors automatically stopping in response to an alarm signal. It should be noted that the design of each revolving door can contain different amounts of blades, or separations **310**. Thus, a revolving door can have 2 sections **305**, 3 sections, 4 sections, and so on. Also, the first revolving door need not contain the same amount of sections/blades as other doors making up the same smart room. For example, the first door can have 3 sections, while a second door has only two sections. It should also be noted that other embodiments can comprise more than two revolving doors in order to control the flow of persons and to create more isolated areas for additional screening (e.g., three revolving doors with 2 separate isolated areas).

[0018] In another embodiment of the present invention, a system is installed between two revolving doors (see Figs. 1 and 4, for example). Individuals and their belongings **5** are screened while they are between the doors, and in the case of a detected and signaled threat (the signal is based on the detection means reaching a threshold level of detection of a particular material), the revolving doors stop, creating a closed, or lock mode, isolating the suspected individual. In one embodiment the security barrier of the present invention comprises an automatic locking mechanism wherein the revolving doors stop to seal the isolated area in response to an alarm signaling an exceeded threshold to place a suspected individual in isolation. In another embodiment the security barrier of the present invention comprises an automatic locking mechanism wherein the revolving doors stop to seal the isolated area upon a threshold-exceeding signal received from the means of detection and place a suspected individual in isolation. This provides time for additional scanning (e.g., about 10 frames per second) and if the alarm does not continue or accumulate, the revolving doors begin moving again. In such a case, interference/stoppage of traffic flow lasts only for a few seconds and appears normal. If, however, the alarm continues and/or accumulates, the threat must be taken seriously and the target remains trapped because the revolving doors do not resume motion. Several other detection means can be employed in various embodiments to continue to monitor and confirm the threat while a target is trapped within a smart room.

[0019] In yet another embodiment of the presently claimed system, a reflected microwave imaging screening method (see Fig. 5B, for example) is the means for detection employed in the smart room and/or the revolving doors. One microwave imaging portal is setup by placing pairs of transmitters **200** and receivers **100** on the same side of the smart room or a revolving door, e.g. one below the other along a vertical line or one next to the other along a horizontal line. More pairs of receivers and transmitters allow for more angles of detection **202** to screen individuals travelling through the smart room **500** (see Fig. 4 for an illustration of one configuration of transmitters and receivers). An alarm is triggered if a signal from any of the screening mechanisms exceeds a pre-determined threshold value. The alarm can automatically, or according to a manual input by an operator, causes the smart room to lock (e.g., the revolving doors stop revolving) and isolate the target that caused the alarm. Alternatively, or additionally, a silent alarm can be triggered in a similar fashion (i.e. threshold value), in order to alert and obtain first responders before locking the smart room or otherwise alarming an individual carrying a potential explosive. The security barriers of the present invention can e.g. comprise a silent alarm emitted in response to a threshold-exceeding signal from the means of detection to alert authorities without affecting a suspected individual, or to alert authorities before sealing the isolated area and without affecting a suspected individual. Additional screening can occur via the same means or additionally coupled means for detection, which activate only for confirmation purposes (e.g., after an alarm is signaled). After further screening, the smart room can either remain locked (if the signal/alarm remains) or the doors will return to their normal function (e.g., revolving, opening-closing automatically).

[0020] In another embodiment also employing microwave imaging, the imaging can be performed via transmission of microwaves through objects located in the screening areas (see Fig. 5A, for example). In this particular embodiment, inspection of the object is based on analyzing the parameters of quasi-coherent microwave radiation transmitted through a monitored space. The dielectric constant, the shape, and the volume of an object carried on the body of an individual or in luggage are determined. Detection occurs by reconstructing a distribution of the dielectric constant value in the monitored space and then distinguishing the areas in space where dielectric constant values are close to the dielectric constant values of dangerous materials. The dielectric constant of the object is determined by measuring simultaneously a phase and an amplitude of a MW signal passing through the target. A single source or multiple sources of MW radiation may be used, as well as one receiver or multiple receivers of MW radiation. In some embodiments, the source(s) of radiation generate(s) radiation at multiple frequencies. The received signals are used to process changes in optical path lengths. The microwave signal transmitted through the interrogated object (e.g., a backpack) is compared with a signal which passes the same distance without the backpack in its way, i.e., an "optical path length through free space." The change in the optical path length of the microwave is calculated by measuring the shift between the maximum values of signal conversion (using the equation below) and its relative value when there is no object at all.

[0021] The equation used to calculate the maximum values discussed above is as follows:

$$|F(x)|^2 = \left(\sum^{Nf} \frac{A_i}{\;} \cdot \cos\left(\varphi_i - \varphi_0 + 2\pi \frac{x \cdot f_i}{\;} \right) \right)^2 + \left(\sum^{Nf} \frac{A_i}{\;} \cdot \sin\left(\varphi_i - \varphi_0 + 2\pi \frac{x \cdot f_i}{\;} \right) \right)^2$$

$$\Big(\textstyle\sum_{i=1} A_0 \quad \big(\quad c \;\big)\Big) \quad \Big(\textstyle\sum_{i=1} A_0 \quad \big(\quad c \;\big)\Big)$$

where Nf = number of frequencies, f_i = corresponding frequencies, A_i = amplitude of the signal transmitted through the inspected object, A_0 = amplitude of "free space" signal, ϕ_i = phase of the signal transmitted through the inspected object, $\phi_i 0$ = phase of "free space" signal, C = speed of light in vacuum, and x = parameter showing the distance value. The shift in a length of an optical path is calculated from the F(x) distribution (Fourier transform) and equals the variable "x" where F(x) value is at its maximum. In case of a "free space" the shift in a length of an optical path is zero and the F(x) value has its maximum at x=0.

[0022] Together with the measurement of the optical path lengths, the geometric dimensions and shape of the inspected object can also be measured by constructing a 3D stereo optical image of the object using, e.g., a system of video cameras comprising a stereo video pair. Joint information about dimensions of the inspected object and value showing the lengthening of the optical path of electromagnetic waves of the chosen frequency range makes it possible to determine the dielectric constant of the object, which, together with measurements of geometric dimensions and shape analysis, is used to determine a danger level of a screened object (by comparing the object's characteristics with reference characteristics of explosives and explosive devices).

[0023] In the event that a detected person is actually carrying an explosive, and in the case of a possible detonation, the damage to the surrounding areas and individuals is reduced by (1) concrete and (2) blast-resistant glass or other blast-resistant material, strategically located in specific positions to deflect and minimize a blast impact (see Fig.1, for example). The blast-resistant glass can optionally be coated (i.e. coupled with) plexi-glass material. Concrete and blast-resisting glass in the walls of the system, the material comprising the revolving doors, and/or in areas immediately surrounding the smart room, in combination with a screening mechanism, perform at least the following functions: (a) the detection, potentially one-by-one (passing through), in mass transit, (b) automatically stopping/isolating a target if and when detected, (c) allowing more time for other technology (e.g. not real-time technology) to further resolve an initial alarm, and (d) mitigating damage in case of explosion or other dangerous act (by, e.g., reducing blast pressure).

[0024] In another embodiment of the present invention, the screening, or detection, means can be employed in both the sections of the revolving doors and the isolated area(s) between the doors, thus allowing for a double-, triple-, and so on, ability to monitor a target (thus resulting in more accurate screening and alarm rates). The transmitters **200** can be placed across from the receivers **100** in a number of fashions, both within the revolving doors **300** and within an area between the doors **500**.

REFERENCES CITED IN THE DESCRIPTION

Cited references

Patent documents cited in the description

- US20030136052A [0002]
- US6742301B [0002]
- US7707951B [0003]
- US4586441A [0003]
- US8159534B [0008] [0009]
- US8228374B [0008] [0009]
- US6791487B [0008]
- US6469624B [0008]
- US5600303A [0008]
- US2013027932W [0008]
- US2014160895A [0009]

PATENTKRAV

1. Fremgangsmåde til genetisk manipulation af en C1-fikserende bakterie, hvilken fremgangsmåde omfatter indføring i en C1-fikserende bakterie, der indeholder et DNA-molekyle omfattende en målsekvens af et manipuleret, ikke-naturligt forekommende Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)/CRISPR-associeret (Cas) (CRISPR/Cas)-system omfattende én eller flere vektorer, der omfatter:

(a) en nukleotidsekvens, der koder for et guide-RNA, der hybridiserer med målsekvensen; og

(b) en nukleotidsekvens, der koder for et type-II Cas9-protein under styring af en inducerbar promotor;

hvor den C1-fikserende bakterie er *Clostridium autoethanogenum.*

2. Fremgangsmåde ifølge krav 1, hvor CRISPR/Cas-systemet endvidere omfatter på den ene eller flere vektorer:

(c) en nukleotidsekvens, der omfatter en 5'-homologiarm, der hybridiserer opstrøms for målsekvensen og en 3'-homologiarm, der hybridiserer nedstrøms for målsekvensen,

hvorved 5'-homologiarmen og 3'-homologiarmen hybridiserer med DNA-molekylet, og der opstår homolog rekombination, hvilket resulterer i udskiftning af målsekvensen med DNA placeret mellem 5'-homologiarmen og 3'-homologiarmen.

3. Fremgangsmåde ifølge krav 1 eller 2, hvor Cas9;

(i) er katalytisk aktiv; eller

(ii) er nickase Cas9.

4. Fremgangsmåde ifølge krav 1, hvor Cas9 er katalytisk inaktiv.

5. Fremgangsmåde ifølge krav 1, hvor Cas9 blokerer DNA-molekylet i et område, der koder for et gen, hvorved ekspression af genet reduceres.

6. Fremgangsmåde ifølge krav 1 eller 2, hvor Cas9 spalter DNA-molekylet i et område, der koder for et gen, hvorved ekspression af genet reduceres.

7. Fremgangsmåde ifølge krav 2, hvor DNA'et placeret mellem 5'-homologiarmen og 3'-homologiarmen bryder DNA-molekylet i et område, der koder for et område, som koder for et gen, hvorved ekspression af genet reduceres.

8. Fremgangsmåde ifølge krav 2, hvor DNA'et placeret mellem 5'-homologiarmen og 3'-homologiarmen koder for et eksogent gen, hvorved den homologe rekombination indsætter det eksogene gen i DNA-molekylet.

9. Fremgangsmåde ifølge krav 8, hvor den C1-fikserende bakterie udtrykker det eksogene gen.

10. Fremgangsmåde ifølge krav 1, hvor (a) og (b) placeres på de samme eller forskellige vektorer.

11. Fremgangsmåde ifølge krav 2, hvor (a), (b) og (c) placeres på de samme eller forskellige vektorer.

12. Fremgangsmåde ifølge krav 1, hvor CRISPR/Cas-systemet afledes af *Streptococcus pyogenes* eller *Streptococcus thermophilus.*

13. Fremgangsmåde ifølge krav 1, hvor den inducerbare promotor er en tetracyclin-inducerbar promotor eller en lactose-inducerbar promotor.

14. Fremgangsmåde ifølge krav 13, hvor den tetracyclin-inducerbare promotor er tet3no eller ipl12.

15. Fremgangsmåde ifølge krav 1, hvor den C1-fikserende bakterie er *Clostridium autoethanogenum* LZ1561, der er indleveret under DMSZ-accessionsnummer DSM23693.

DRAWINGS

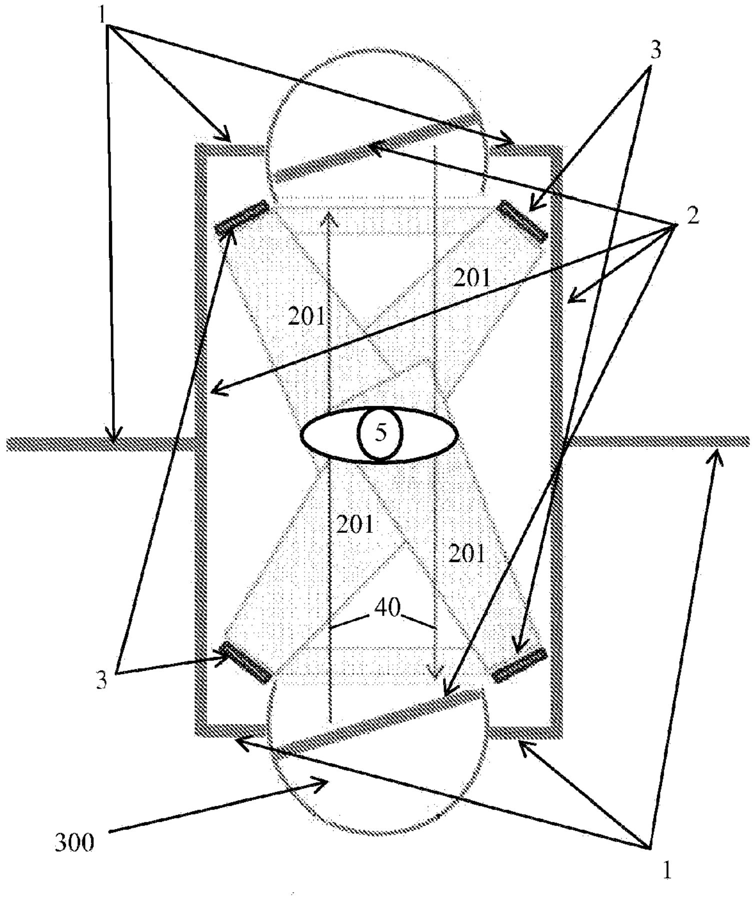

Figure 1

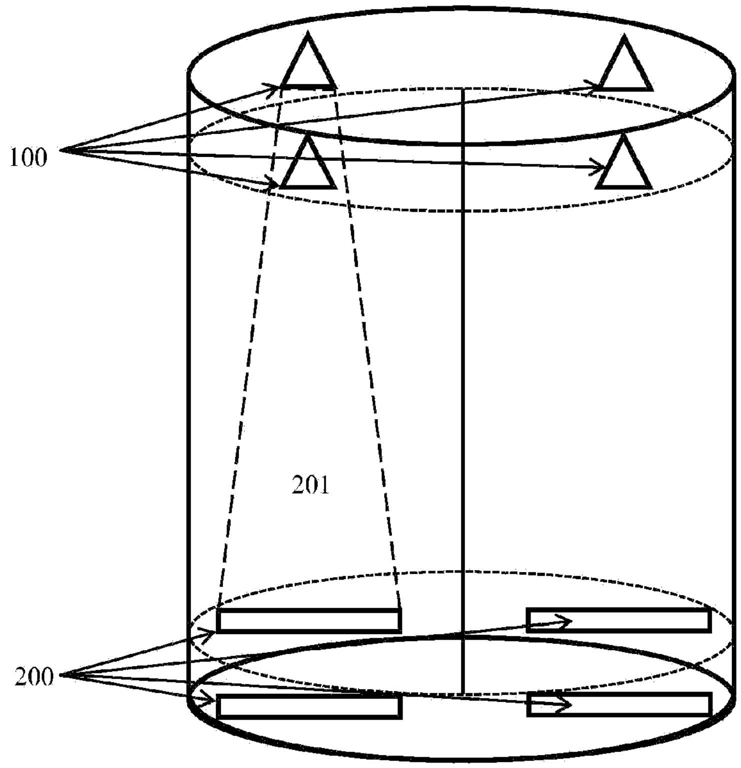

Figure 2A

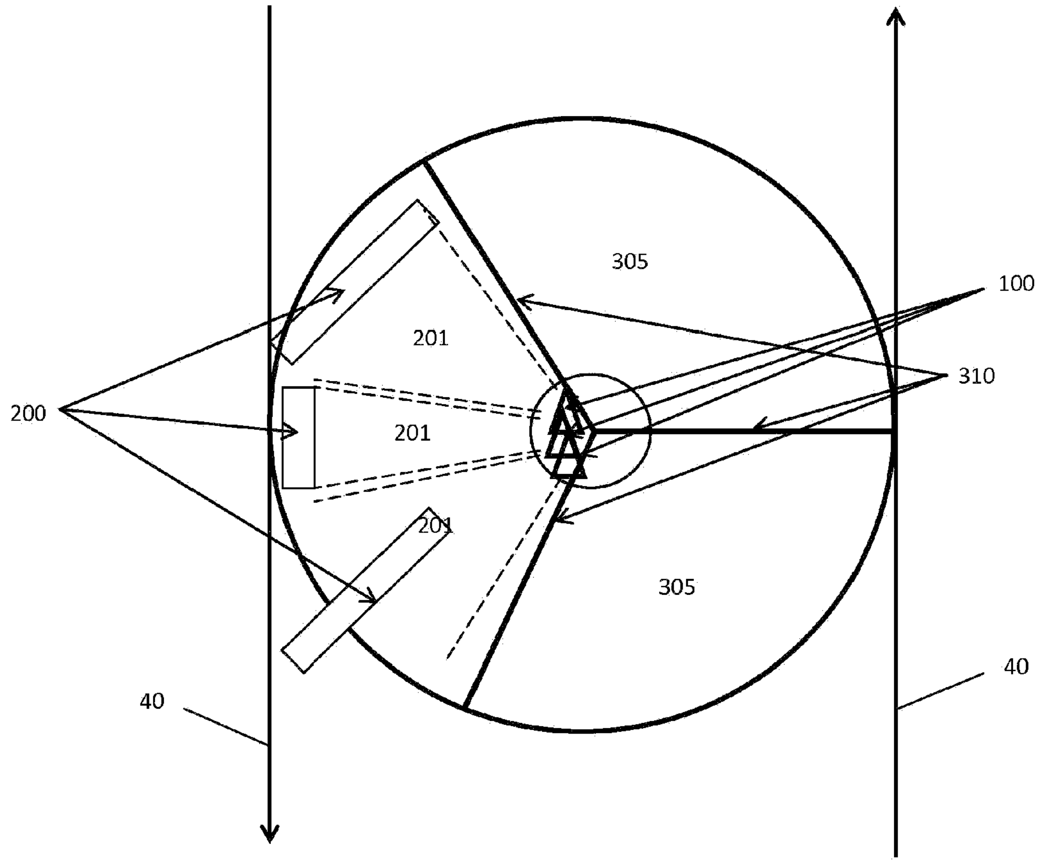

Figure 2B

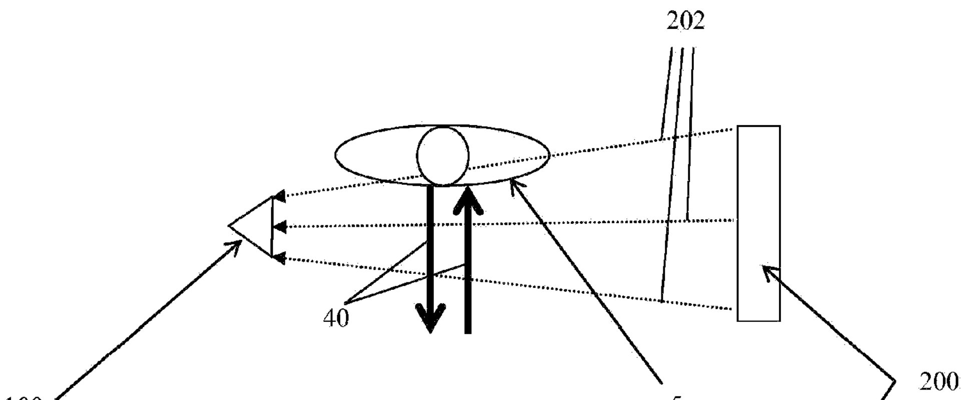

Figure 3A

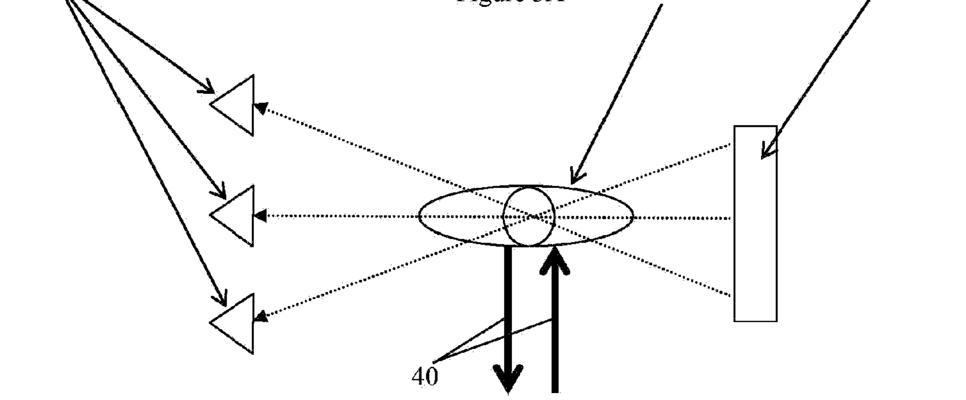

Figure 3B

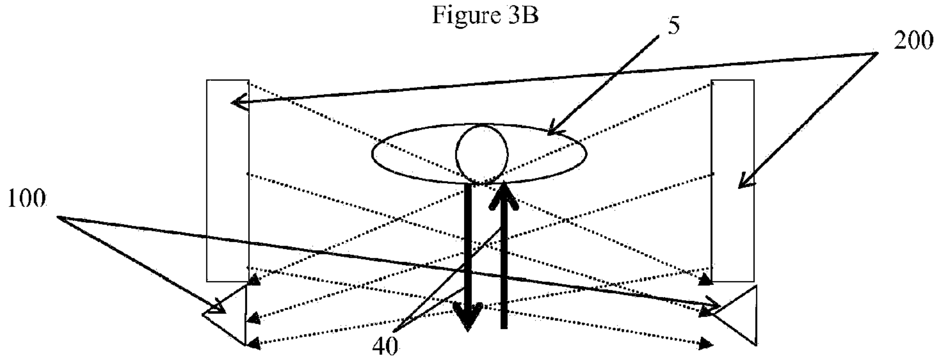

Figure 3C

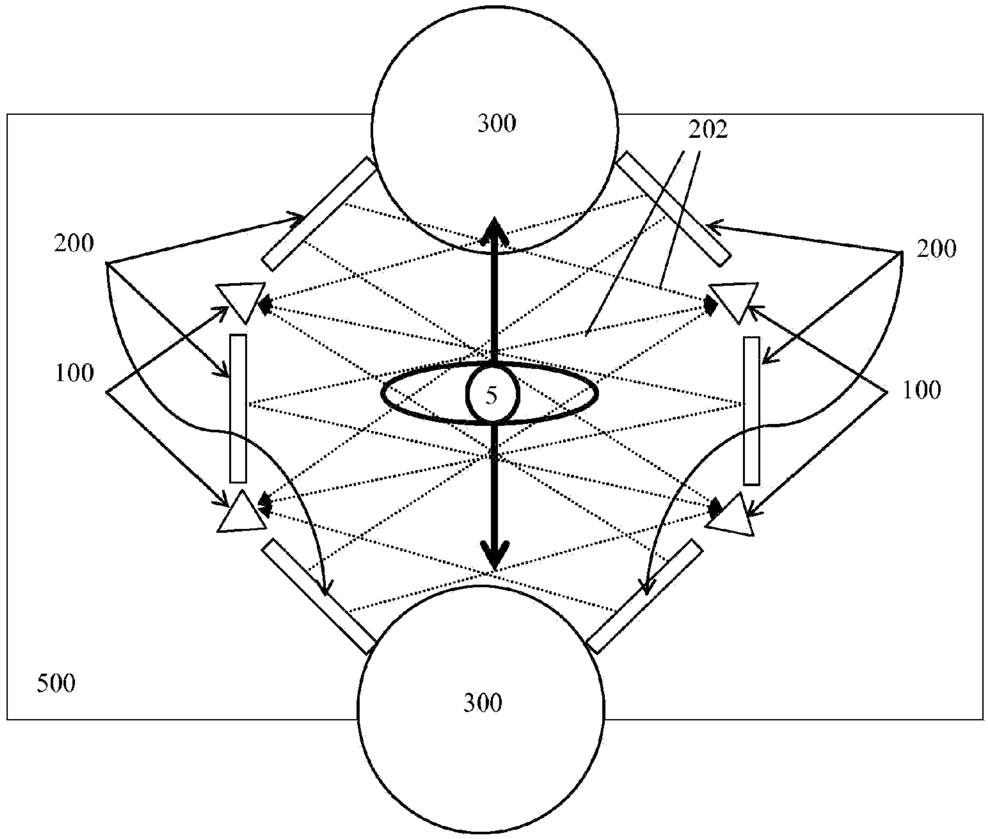

Figure 4

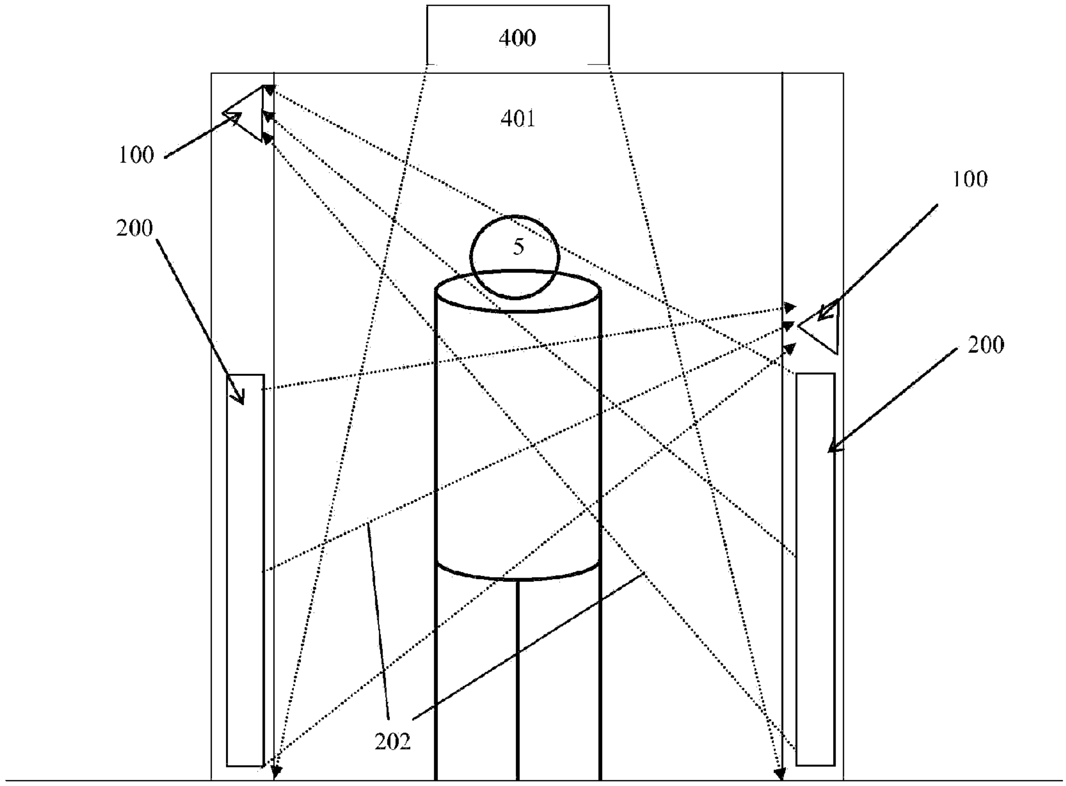

Figure 5A

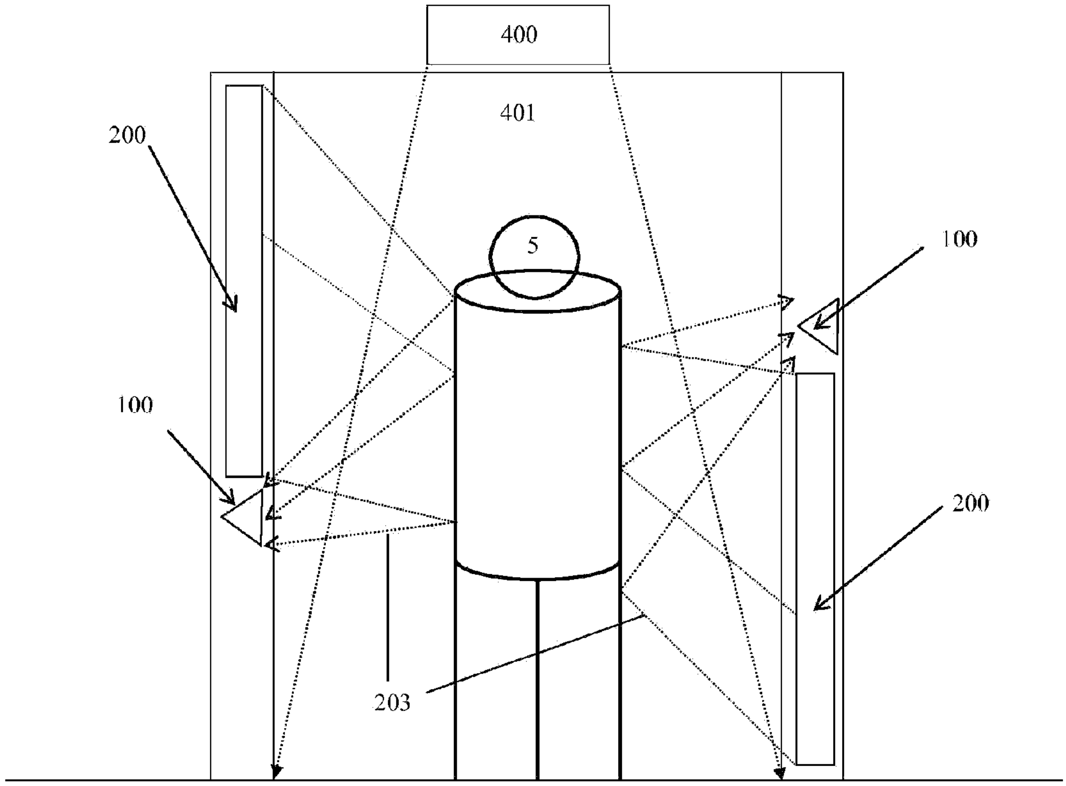

Figure 5B