HU000033353T2

(19) **HU**

(11) Lajstromszám: **E 033 353**

(13) **T2**

MAGYARORSZÁG
Szellemi Tulajdon Nemzeti Hivatala

EURÓPAI SZABADALOM
SZÖVEGÉNEK FORDÍTÁSA

(21) Magyar ügyszám: **E 10 447003**
(22) A bejelentés napja: **2010. 01. 26.**

(51) Int. Cl.: ***F41G 1/30*** *(2006.01)*
F41G 1/48 *(2006.01)*

(96) Az európai bejelentés bejelentési száma:
EP 20100447003
(97) Az európai bejelentés közzétételi adatai:
EP 2221571 A1 **2010. 08. 25.**
(97) Az európai szabadalom megadásának meghirdetési adatai:
EP 2221571 B1 **2017. 03. 15.**

(30) Elsőbbségi adatok:
200900078 **2009. 02. 12.** **BE**

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(54) **Továbbfejlesztett mozgatható pirospontos irányzék**

Az európai szabadalom ellen, megadásának az Európai Szabadalmi Közlönyben való meghirdetésétől számított kilenc hónapon belül, felszólalást lehet benyújtani az Európai Szabadalmi Hivatalnál. (Európai Szabadalmi Egyezmény 99. cikk(1))

A fordítást a szabadalmas az 1995. évi XXXIII. törvény 84/H. §-a szerint nyújtotta be. A fordítás tartalmi helyességét a Szellemi Tulajdon Nemzeti Hivatala nem vizsgálta.

SZTNH-100032591

The invention concerns an improved sighting device with a moving red dot.

In particular, the invention concerns a type of sighting device with a "moving red dot" as described in document EP 1,818,645 in the name of the same inventor.

The invention concerns a sighting device which is designed to be mounted on a fire arm for firing ammunitions having a non-flat ballistic trajectory, for example for firing grenades, which makes it necessary to shoot while providing a certain elevation angle to the fire arm as a function of the distance of the target.

In this type of sighting device, a light dot or light reticle is projected at infinity with such a firing angle in relation to the fire arm that the shooter obtains the correct elevation of his fire arm by aligning said dot or reticle with the target when aiming.

The sighting device with a moving red dot according to document EP 1,818,645 comprises a fixed light source; a rotating mirror; a flat reflecting blade or more generally a reflecting surface, whereby the light source produces a collimated light beam which is projected onto the reflecting surface so as to obtain a red dot or reticle which is visible to the shooter thanks to the reflection on the reflecting surface, whereby the beam is projected onto the reflecting surface by means of the rotating mirror whose inclination angle in relation to the produced light

beam can be adjusted in order to adjust the firing angle at which the red dot is observed by the shooter in relation to a direction of reference of the sighting device within a range of firing angles between a minimal firing angle and a maximal firing angle.

The thus obtained sighting device enables the shooter to adjust the angle of the rotating mirror as a function of the type of ammunition being used and the distance to the target, whereby said distance can be measured or estimated by the shooter.

The angle of the rotating mirror is adjusted for example by means of a control button having a scale which is calibrated as a function of the distance to the target or by means of an actuator controlled by an arithmetic system which makes it possible to calculate the angle to be provided to the rotating mirror as a function of the distance and possibly as a function of the type of ammunition that has been selected.

As soon as the angle of the rotating mirror is set, the shooter only has to observe the target and find out at what elevation of his fire arm the red dot is aligned with the target, which indicates that the fire arm is in the right firing position.

A disadvantage of this type of sighting device is that the maximal firing angle is restricted by the length of the reflecting surface in the plane of the light beam, since the length of the reflecting surface is all the larger as

the firing angle to be obtained is larger.

Thus, in order to be able to use the maximum range of any ballistic ammunition, one must be able to shoot at angles in the order of magnitude of 40° or more, which requires a relatively long reflecting surface, which has a negative effect on the size of the sighting device.

The invention aims to remedy the above-mentioned disadvantages and to provide a sighting device with a moving red dot having a small reflecting or semi-reflecting mirror with which firing angles of some 40° or more can be obtained.

This aim is reached according to the invention by means of a sighting device with a moving red dot to aim at a target in front of the sighting device which comprises

- a fixed light source;
- a rotating mirror;
- a reflecting surface,

whereby the light source produces a collimated light beam which is projected onto the reflecting surface so as to obtain a red dot or a reticle which is visible to the shooter thanks to the reflection on the reflecting surface when the eye of the shooter is in the reflected light beam, whereby the beam is projected onto the reflecting surface via the rotating mirror whose inclination angle in relation to the produced light beam can be adjusted in order to adjust the firing angle at which the red dot is observed by the shooter in relation to a direction of reference (X-X') of the sighting device within a range of firing angles

between a minimal firing angle and a maximal firing angle, whereinthe sighting device comprises at least one optical device with at least one transparent element situated in the path of the light beam between the rotating mirror and the eye of the shooter, that deviates the rays of the light beam by refraction and modifies their incidence on the reflecting surface in relation to a situation with the same firing angle but without this optical device such that the light beam deviates in its trajectory between the rotating mirror and the eye of the shooter, whereby the shape of the device is such that any deviations provoked by the latter on the light beam result in a reduced trajectory, compared to a situation without this optical device, to be travelled by the point of incidence of the light beam on the reflecting surface by rotating the mirror between two firing angles, at least for a part of the above-mentioned range of firing angles. The reflecting surface can be realised as a curved surface,whose convexity is turned towards the rotating mirror.

The optical device in a way produces a "compression" of the beam paths, and the aim of the thus obtained optical compression is to reduce the trajectory between the point of incidence of the light beam on the reflecting surface by rotating the rotating mirror between two firing angles, at least for part of the above-mentioned range of firing angles.

Thanks to this effect, firing angles in the order of magnitude of 40° or more can be obtained with a reflecting surface of a shorter length than with a sighting device which is not equipped with this optical device according to

the invention.

As a result, such a sighting device is less sizeable than the sighting devices of the same type with a flat reflecting blade and without these additional optical means.

For clarity's sake, a few embodiments of an improved sighting device with a moving red dot according to the invention are described hereafter as an example only without being limitative in any way, with reference to the accompanying drawings, in which:

figure 1 is a schematic side view of an improved sighting device according to the present state of the art, shown in a position of rest;
figure 2 is a section according to line II-II in figure 1;
figure 3 represents the sighting device from figure 1, but for a different firing angle;
figure 3B shows the sighting device of figure 3A, but for a firing position;
figure 4 shows the trajectory of the light beam in the sighting device of figure 1 for different firing angles;
figures 5 to 11 are views similar to those in figure 4, but for variants of a sighting device according to the invention;

Figures 1 and 2 represent a sighting device according to the state of the art described in document EP 1,818,645.

It concerns a sighting device 1 with a moving red dot which comprises a case 2 to be mounted on a fire arm 3, whereby the case 2 extends longitudinally, mainly parallel to the axis of the barrel of the fire arm 2.

Inside the case 2 is situated a fixed light source 4, producing a collimated light beam 5 with a central ray 5' whose optical axis X-X' is in this case parallel to the axis of the barrel of the fire arm 3.

In the given example, the light source 4 is a collimator composed of a converging lens 6 and of a lamp or another light source 7 having more or less the shape of a dot with reduced dimensions, for example in the order of one tenth of a millimetre, situated in the focal point 8 of the lens 6 and producing the red dot.

The collimated light beam 5 has a diameter A in the order of 15 to 20 millimetres, which offers the advantage that the cross dimensions of the width and the height of the sighting device 1 are reduced in relation to the known sighting devices.

A mirror 9 is placed in the collimated beam 5 at an angle B in relation to the optical axis X-X' of the produced light beam 5.

The mirror 9 is mounted in a rotating manner in the case 2 and it is fixed to that end on a transversal shaft 10 mounted in a rotating manner between the side walls 11 of

the case 2.

One far end 12 of the shaft 10 of the mirror 9 goes through one of the lateral walls 11 of the case 2 and is provided with an adjusting device 13 for the inclination angle B of the rotating mirror 9 in relation to the produced light beam 5, for example in the form of a turning knob with which the shooter can position the mirror 9 as a function of the distance of the target.

The above-mentioned control button 14 can be provided with a scale 15 representing the distance to the target, or with different scales for different types of ammunitions, whereby the ballistic characteristics of the latter are taken into account.

The light beam 5 is projected through a window 16 in the case 2 onto a reflecting surface 17 in the shape of a reflecting blade 17 so as to produce a red dot or reticle, visible to the shooter on the surface 17 of the reflecting blade which is mounted on a far end 18 of the case 2 at a fixed angle C of for example 45° in relation to the optical axis X-X' of the produced light beam 5.

The use of the sighting device 1 is as follows.

When in rest, i.e. when aiming in the axis of the fire arm 3 with an elevation E equal to zero, i.e. with the fire arm in a horizontal position as represented in figure 1, the angle of repose B of the mirror 9 will be for example 45°. The firing angle D is at that time 0°, said angle being the

angle between the light beam 5 reflected on the reflecting surface 17 and the optical axis X-X' or the axis of the fire arm 3.

The shooter 19 estimates the distance of the target and sets the appropriate inclination B of the mirror 9 by means of the distance-graded control button 13.

The light beam 5 is projected onto the reflecting surface 17 and it is reflected as illustrated in figure 3 towards the shooter 19 so as to produce a red dot or reticle that the shooter 19 may observe to infinity when the eye of the shooter 19 is situated in the light beam 5 reflected by the reflecting surface 17.

When the mirror 9 turns as represented in figure 3A, the deviation of the angle D of the beam amounts to two times that of the angle B of the mirror 9. In other words, when the mirror 9 turns for example 15° in relation to the position of rest of 45°, the angle D increases from 0° to 30°.

The inclination B of the mirror 9, which is a function of the distance of the target 14, thus determines the angle D at which the red dot can be seen by the shooter 19, and thus the elevation angle E that is provided to the fire arm 3, as represented in figure 3B, when the shooter aligns the red dot or the reticle with the target 14 which is visible next to or through said reflecting surface 17.

Figure 4 shows the trajectories of the central ray 5' of

the collimated beam 5 for four different values of the angle B of the rotating mirror 9 and thus for four corresponding values of the firing angles D, in particular for firing angles D of 0°, 10°, 20°, 30° and 38° respectively as indicated in the figure.

The point of incidence I of the central ray 5' of the light beam 5 on the reflecting surface 17 is situated at point I_0 for a firing angle D of 0°, whereas the point of incidence I for a firing angle D of 38° is situated at point I_{38}, almost at the distal far end of the reflecting surface 17. The point of incidence I of the central ray 5' thus shifts from point I_0 for a firing angle 0° to point I_{38} for a firing angle of 38°.

The length L of the reflecting surface 17 in the plane of the light beam 5 is thus dictated by the distance between the utmost points of incidence I_{38}en I_0 and thus by the maximal firing angle D that one wants to obtain and which, in the case of figure 4, is close to 40°.

In the case of figure 4, the length L of the reflecting surface is relatively important.

The invention aims to restrict the length L of the reflecting surface 17 without thereby implicating the maximal firing angle, so that it is still possible to obtain firing angles D of some 40° or more.

This aim is reached according to the invention by introducing one or several transparent optical devices

between the rotating mirror 9 and the eye of the shooter 19, having an adequate shape to deviate the rays of the collimated light beam 5 and modify their incidence on the reflecting mirror 9 compared to a situation with the same firing angle D but without said optical device 20.

In the case of figure 5, the optical device 20 is realised as a transparent device 21 having a rectangular section in the plane of the beam, situated between the rotating mirror 9 and the reflecting surface 17 and positioned parallel to the optical axis X-X'.

The transparent optical device 21 is designed such that the refractions which it provokes in the rays of the beam 5 reduce the length of the trajectory OI of the latter between the rotating mirror 9 and the point of incidence I on the reflecting surface 17, as can be seen when comparing figures 4 and 5, without and with an optical device 20 respectively, all the more when the optical device 20 has a high refractive index.

The optical device 20 provides for a "compression" of the paths OI of the beam 5 so to say, and this compression effect, which is more significant as the firing angle D gets larger, restricts the distance between the point of incidence I_0 of the beam 5 for a firing angle of 0°, and the point I_{38} for the firing angle of 38° which is close to the maximum firing angle D.

It thus restricts the length L of the reflecting surface 17 which is required to obtain the maximum firing angle.

Naturally, the optical device 20 must be sufficiently thick to allow the compression effect to produce a considerable reduction of the length L of the reflecting surface 17.

It should be noted that the rectangular form of the optical compression device 20 illustrated in figure 5 is merely given as an example, and that other forms may be used, as illustrated in figure 6, which represents an optical compression device 22 with a triangular section.

Figure 5 shows how the refraction produced on the hypotenuse 23 modifies the relation between the angle B of the rotating mirror 9 and the obtained firing angle D, and that the setting rules for the mirror should thus be adjusted as a function of the firing angle to be obtained, i.e. as a function of the distance of the target, and also that for small firing angles, the trajectory OI of the beam between the rotating mirror 9 and the reflecting surface 17 slightly increases, whereas for large angles, the trajectory OI is reduced, which allows to produce the desired effect, i.e. the reduction of the length of the reflecting surface 17 required to obtain the maximum firing angle.

The triangular device 22 shown in figure 6 is not a standard optical component, contrary to the rectangular device 21 in figure 5, but compared to the latter it is advantageous in that it is less sizeable, and consequently less heavy, which may be interesting for applications on a light fire arm.

In the examples of figures 5 and 6, the optical device 20 is placed between the rotating mirror 9 and the reflecting surface. Said optical device 20 may also be placed at the far end of the sighting device 1, i.e. between the reflecting surface 17 and the eye of the shooter 19, as shown in figure 7. Here as well, the refractions provoked in the beam 8 by the optical device 20 result in a reduction of the trajectory 01 travelled by the latter between the rotating mirror 9 and the reflecting surface 17, which produces the desired effect, i.e. the reduction of the length L of the reflecting surface that is required to obtain the maximum firing angle.

In the example of figure 7, we notice a major reduction in length L, but this advantage is partly lost due to the space required by the optical device 20.

Of course, it is possible to combine optical compression devices situated between the rotating mirror 9 and the reflecting surface 17 with optical compression devices situated between the reflecting surface 17 and the eye of the shooter 19.

According to an advantageous embodiment of the invention, the optical device 20 used for the compression of the paths of the beam 5 is a isosceles right angle prism 24 whose hypotenuse 25 acts as the reflecting surface 17, as shown in figure 8.

Note that the prism 24 intervenes between the rotating

mirror 9 and the reflecting surface 17 which forms its hypotenuse 25, as well as between said surface 17 and the eye of the shooter 19. Besides the fact that it combines the optical compression device 20 and the reflecting surface 17 in a single component, this configuration is advantageous in that it maximizes the portion of the trajectory of the light beam 5 in the glass of the prism, thus maximizing the compression effect as described above.

Due to the reflecting surface 17 formed by the hypotenuse 25, the prism is not transparent, however, for it entirely reflects the rays coming from the target 14, as shown in figure 9.

In order to remedy this problem, the prism 24 may be replaced by a beamsplitter cube 26, i.e. an assembly of two right angle prisms glued together at their hypotenuses 25, whereby the latter are coated with an appropriate glue or coating which makes the reflecting surface formed by the hypotenuses 25 semi-transparent, as well as the construction 26, as shown in figure 10.

Another variant of an optical device according to the invention is given in figure 11, showing an optical device 20 in the shape of a reflecting surface 17 made as a curved surface whose convexity is turned towards the rotating mirror 9.

It is clear that the invention is by no means limited to the examples described above, but that many modifications can be made to the above-described sighting devices with a

moving red dot while still remaining within the scope of the invention as defined in the following claims.

SZTNH-100032592

TOVÁBBFEJLESZTETT MOZGATHATÓ PIROSPONTOS IRÁNYZÉK

SZABADALMI IGÉNYPONTOK

1. Mozgatható pirospontos irányzék egy, az irányzékkal szemben lévő cél (14) célbavételére, amely irányzék magában foglal

- egy rögzített fényforrást (4);
- egy forgó tükröt (9);
- egy fényvisszaverő felületet (17),

amely fényforrás (4) kollimált fénynyalábot (5) állít elő, amely a fényvisszaverő felületre (17) van vetítve abból a célból, hogy a fényvisszaverő felületen (17) való visszaverődés révén létrejöjjön egy, a lövész (19) számára látható piros pont vagy szálkereszt, amikor a lövész (19) szeme a visszavert fénynyalábban (5) van, a nyaláb (5) a fényvisszaverő felületre (17) a forgó tükör (9) közvetítésével van vetítve, amelynek dőlésszöge (B) az előállított fénynyalábhoz (5) képest állítható annak az irányzószögnek (D) a beállítása céljából, amelyben a lövész (19) az irányzék (1) referenciairányához (X-X') viszonyítva a piros pontot látja, és amely egy legkisebb irányzószög és egy legnagyobb irányzószög közötti irányzószög-tartományban van, azzal jellemezve, hogy

az irányzék (1) magában foglal legalább egy optikai elemet (20), amely magában foglal legalább egy, a forgó tükör (9) és a lövész (19) szeme között a fénynyaláb (5) útjába helyezett átlátszó elemet (21, 22, 24, 26), amely fénytörés révén eltéríti a kollimált fénynyaláb (5) sugarait, és ahhoz a helyzethez képest, amikor ugyanekkora az irányzószög (D), de nincs jelen ez az optikai elem (20), úgy változtatja meg beesésüket a fényvisszaverő felületre (17), hogy a fénynyaláb (5) a forgó tükör (9) és a lövész (19) szeme közötti útvonalán eltérüljön, és amely optikai elemnek (20) olyan az alakja, hogy az általa a fénynyalábon (5) kiváltott eltérüléseknek az legyen a hatása, hogy ahhoz a helyzethez képest, amikor nincs jelen ez az optikai elem (20), a forgó tükörnek (9) két irányzószöghelyzet között, az irányzószögek tartományának legalább egy részében történő elfordulása révén csökkenjen a fénynyaláb beesési pontja által a fényvisszaverő felületen (17) megtett út (OI).

2. Mozgatható pirospontos irányzék egy, az irányzékkal szemben lévő cél (14) célbavételére, amely irányzék magában foglal

- egy rögzített fényforrást (4);
- egy forgó tükröt (9);
- egy fényvisszaverő felületet (17),

amely fényforrás (4) kollimált fénynyalábot (5) állít elő, amely a fényvisszaverő

felületre (17) van vetítve abból a célból, hogy a fényvisszaverő felületen (17) való visszaverődés révén létrejöjjön egy, a lövész (19) számára látható piros pont vagy szálkereszt, amikor a lövész (19) szeme a visszavert fénynyalábban (5) van, a nyaláb (5) a fényvisszaverő felületre (17) a forgó tükör (9) közvetítésével van vetítve, amelynek dőlésszöge (B) az előállított fénynyalábhoz (5) képest állítható annak az irányzószögnek (D) a beállítása céljából, amelyben a lövész (19) az irányzék (1) referenciairányához (X-X') viszonyítva a piros pontot látja, és amely egy legkisebb irányzószög és egy legnagyobb irányzószög közötti irányzószög-tartományban van, azzal jellemezve, hogy

a fényvisszaverő felület (17) görbe felületként van kialakítva, amelynek konvexitása a forgó tükör (9) felé van fordítva.

3. Az 1. igénypont szerinti irányzék, azzal jellemezve, hogy az optikai elemnek (20) olyan az alakja, hogy az általa a fénynyalábon (5) kiváltott eltéréseknek az legyen a hatása, hogy a fénynyaláb által a forgó tükör (9) és a fényvisszaverő felület (17) között megtett út (OI) ugyanarra az irányzószögre legalább az irányzószögek területén megközelítse a legnagyobb irányzószöget (D).

4. Az 1. igénypont szerinti irányzék, azzal jellemezve, hogy az optikai elem (20) a forgó tükör (9) és a fényvisszaverő felület (17) között van a fénynyaláb (5) útjába helyezve.

5. Az 1. igénypont szerinti irányzék, azzal jellemezve, hogy az optikai elem (20) keresztmetszete a nyaláb síkjában (5) téglalap alakú.

6. Az 1. igénypont szerinti irányzék, azzal jellemezve, hogy az optikai elem (20) keresztmetszete a nyaláb síkjában (5) háromszög alakú.

7. Az 1. igénypont szerinti irányzék, azzal jellemezve, hogy az optikai elem (20) magában foglal egy derékszögű, egyenlő oldalú prizmát (24), amelynek átfogója (25) tölti be a fényvisszaverő felület (17) szerepét.

8. Az előző igénypontok bármelyike szerinti irányzék, azzal jellemezve, hogy a fényvisszaverő felület (17) egy félig átlátszó felület.

9. Az 1. igénypont szerinti irányzék, azzal jellemezve, hogy az optikai elem (20) magában foglal egy sugárosztó kockát (26), azaz két, átfogóikkal egymáshoz illesztett prizmából (24) álló egységet, amelyek érintkezési felülete ragasztóval vagy megfelelő bevonattal van befedve, amely félig átlátszóvá teszi az egységet (26), és az átfogó (25) képezi a fényvisszaverő felületet (17).

10. Az előző igénypontok bármelyike szerinti irányzék, azzal jellemezve, hogy a legnagyobb irányzószög nagyságrendileg 40°-os vagy nagyobb.

(A meghatalmazott)

PRIOR ART

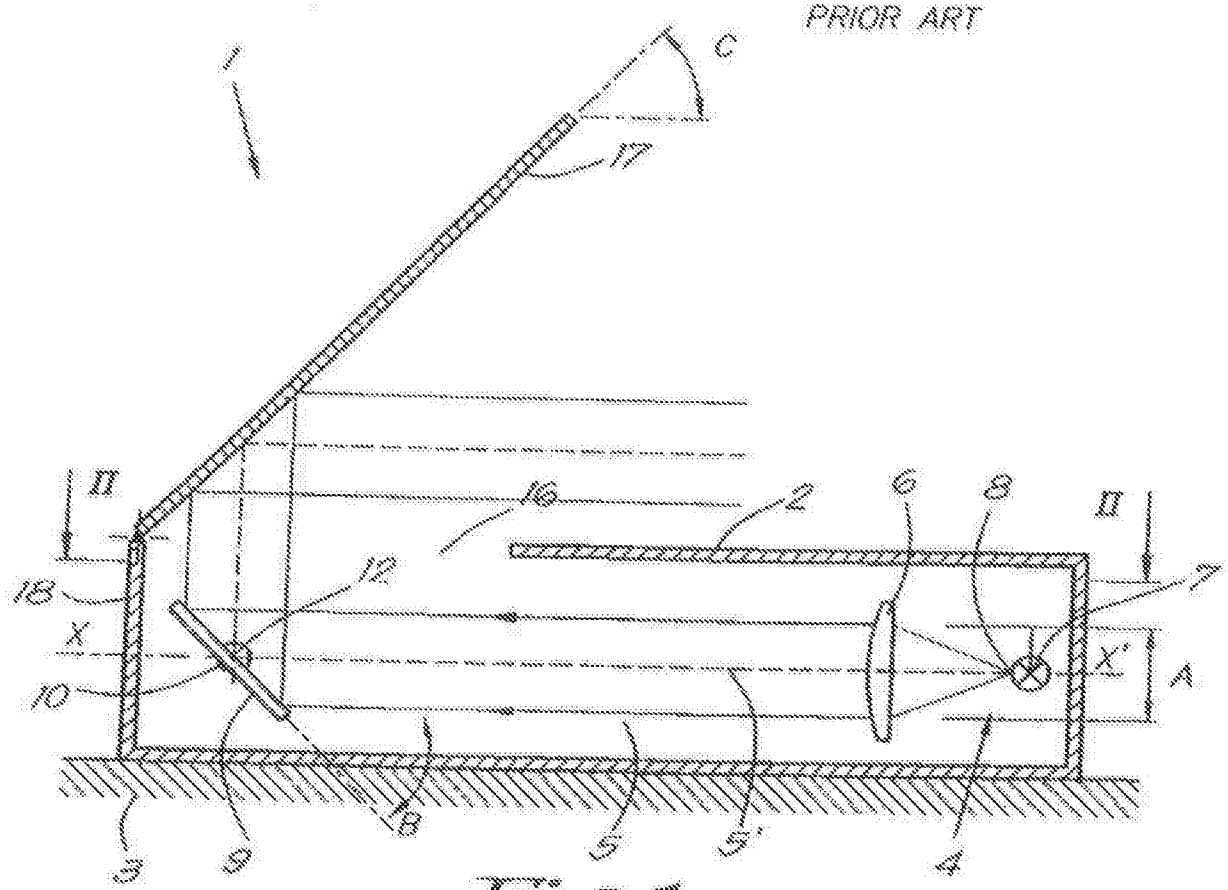


Fig. 1

PRIOR ART

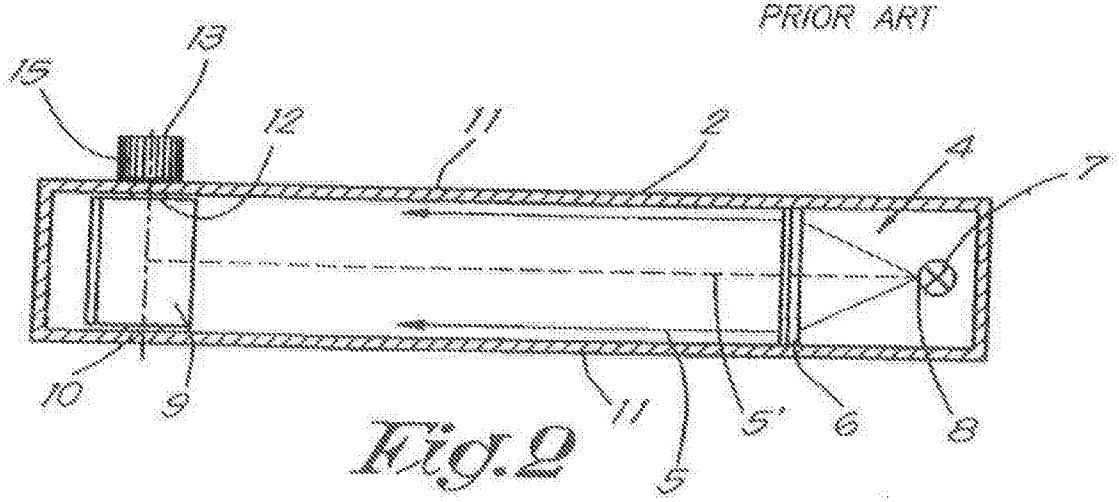


Fig. 2

SZTNH-100032593

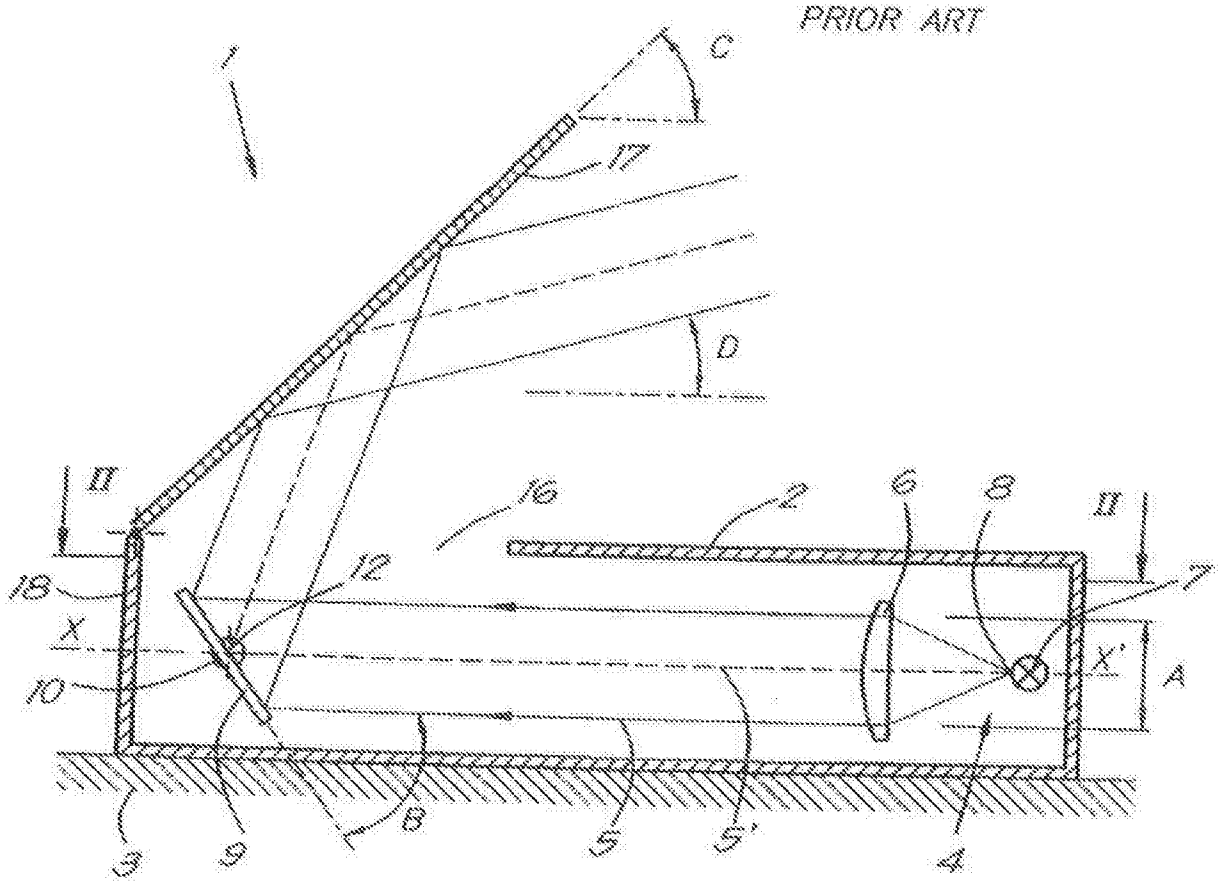
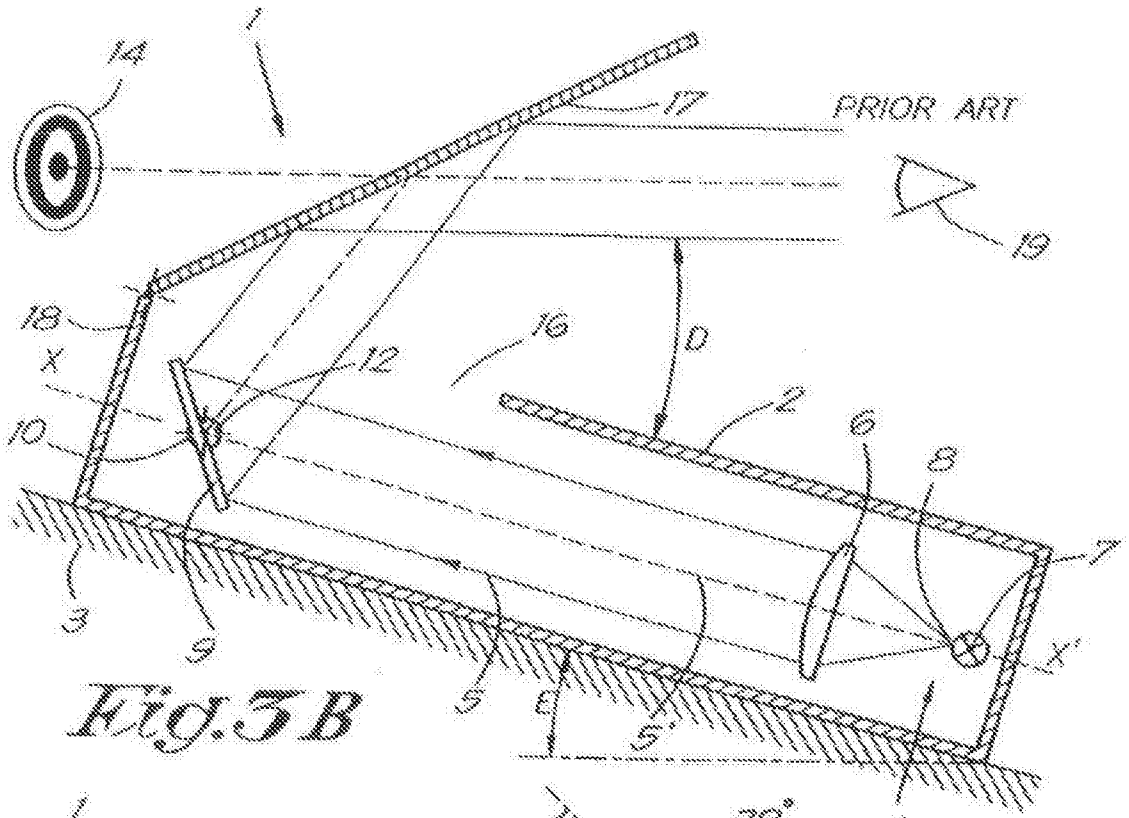


Fig.5A


14
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17
PRIOR ART
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9
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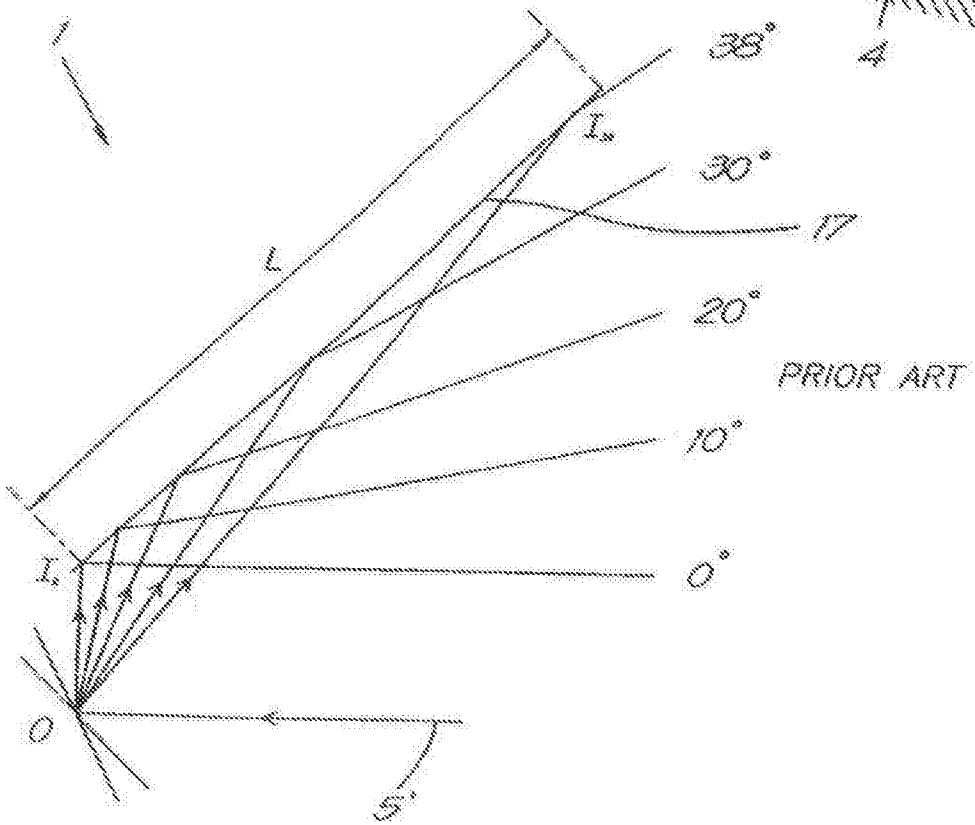
Fig.3B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30°
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20°
PRIOR ART
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Fig.4

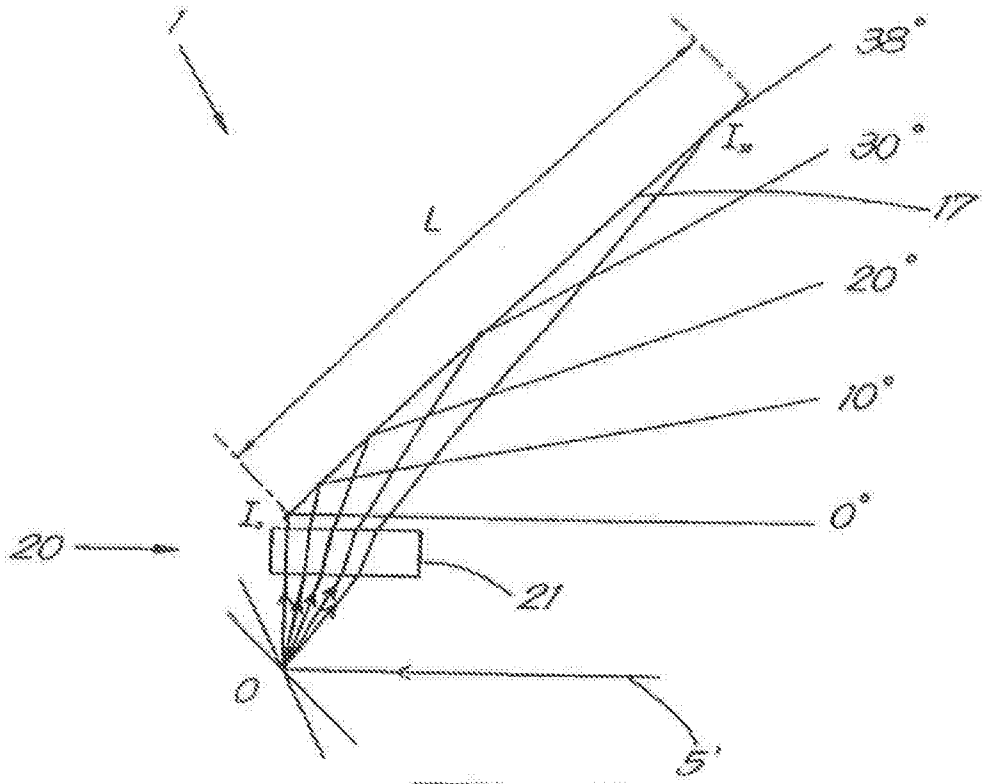

Fig.5

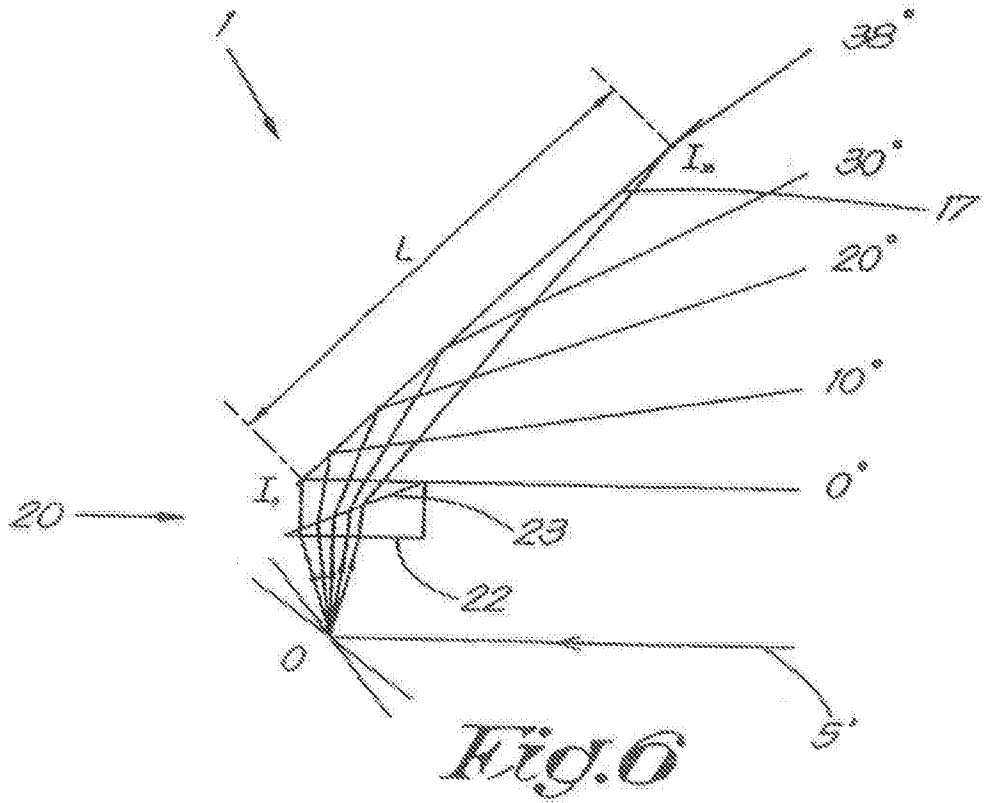

Fig.6

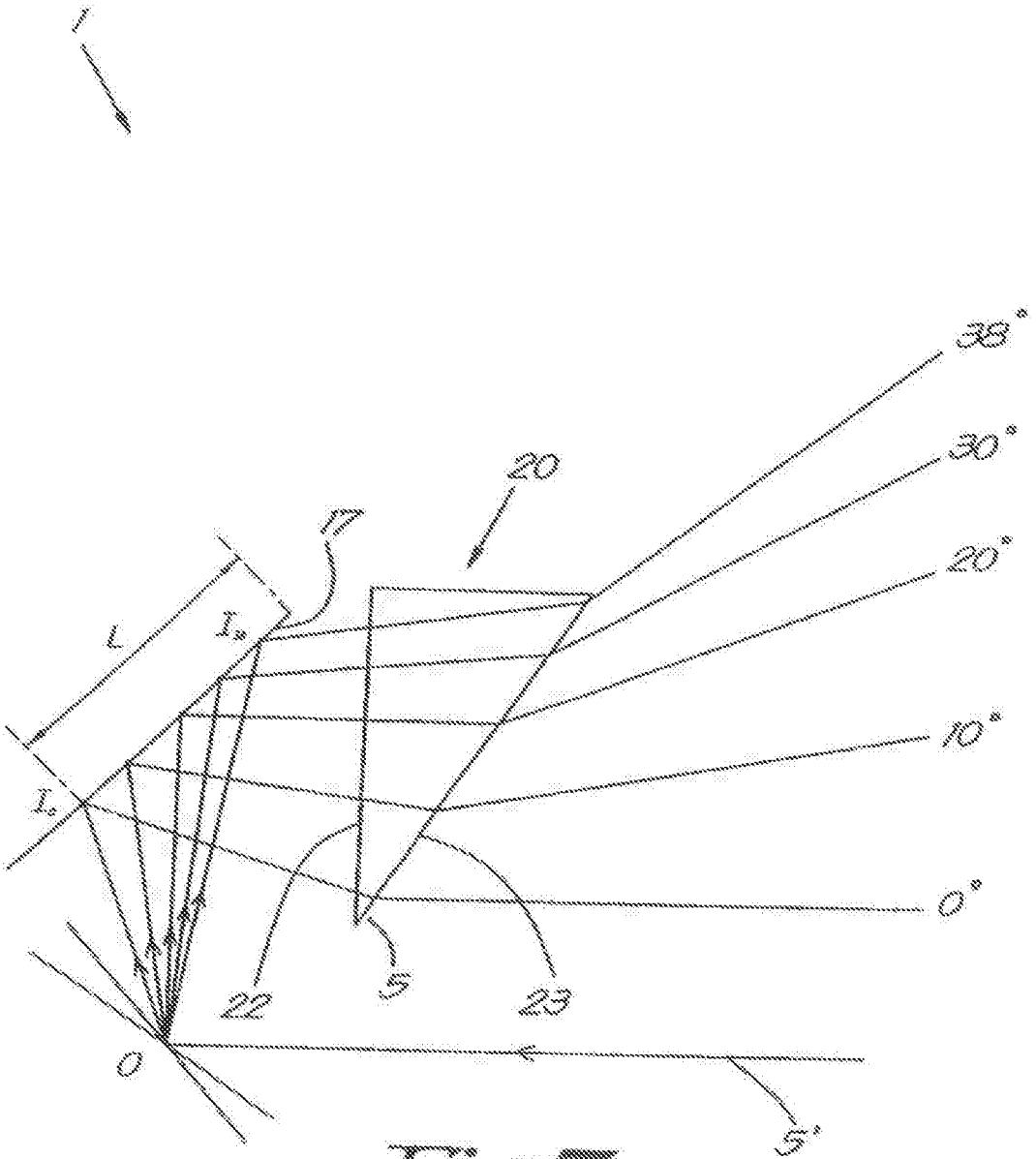

Fig. 7

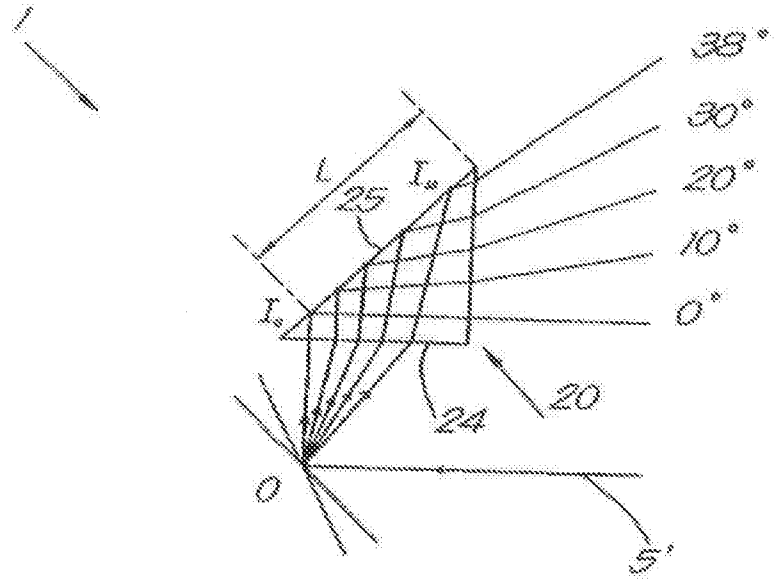

Fig.8

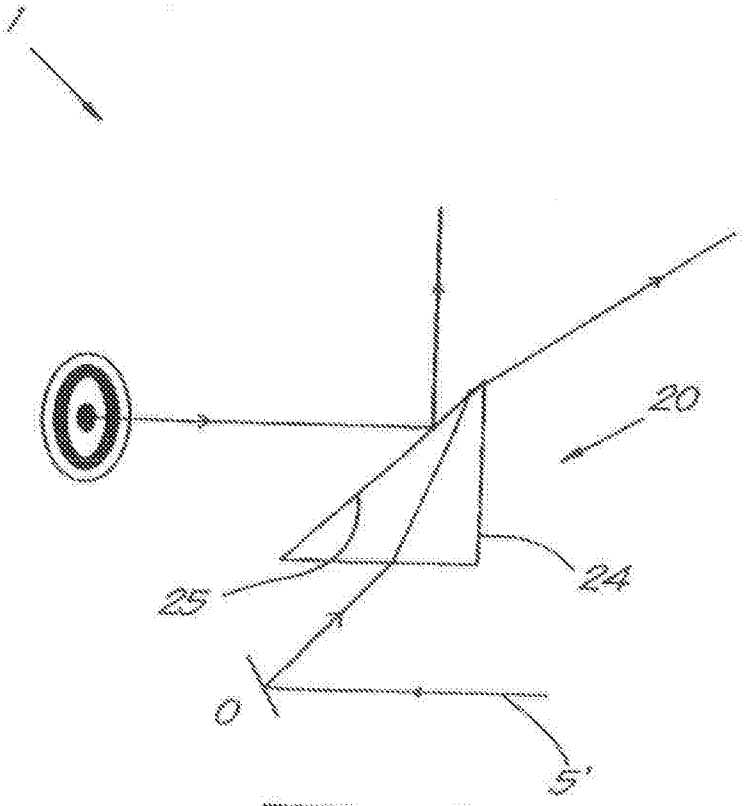

Fig.9

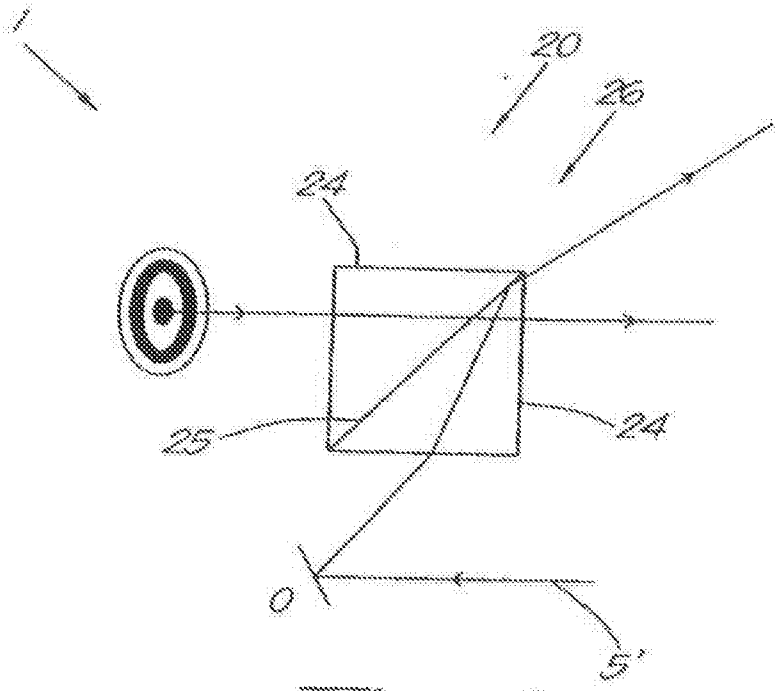

Fig.10

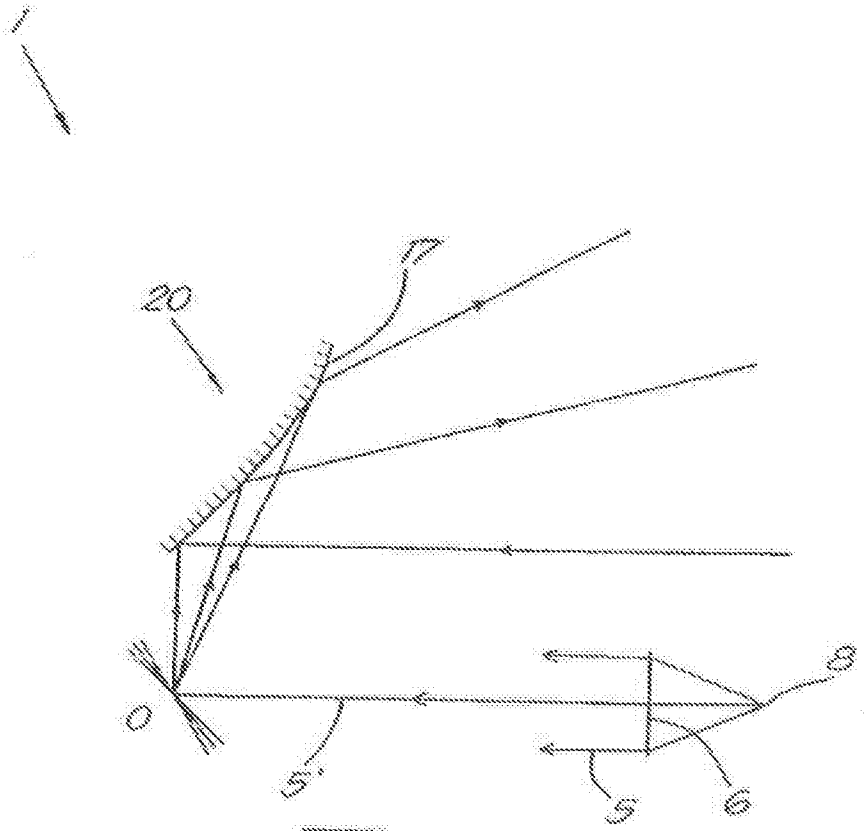

Fig.11