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(54) POCKET LIGHTER

(57) Pocket lighter comprising a main body (1) including a fuel reservoir (24), a valve (4) activated by a lever (9), a flint (5), an ignition wheel (6) located over said lever (9) and a windshield (11) that delimits a combustion chamber (3) and includes two side arms (12a, 12b) that cover the flanks of said ignition wheel (6) defining a projecting sector (16). It is difficult for a child to work the lighter according to the invention owing to the fact that it comprises a non-deformable protective element (13) that extends transversally to said side arms (12a, 12b) of windshield (11) above circumferential surface (7) of ignition wheel (6) and that the activating angle (27) of said ignition wheel (6) is greater than 10° and less than 90°.

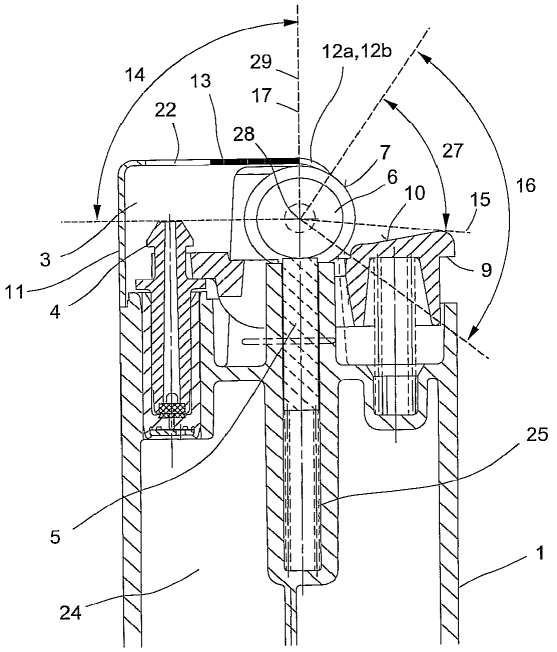

FIG. 3

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Description

Field of the invention

[0001] The invention relates to a lighter comprising a main body including a fuel reservoir, said main body having an upper base on which there is provided:

- a combustion chamber;
- a valve connecting said fuel reservoir to said combustion chamber;
- an ignition device suitable for producing and sending sparks to said combustion chamber, said ignition device comprising a flint and an ignition wheel mounted rotably on its axis and which can be activated by a user's finger, said ignition wheel having a circumferential surface comprising an abrasive strip that is in contact with said flint;
- a lever for activating said valve that is located next to said ignition wheel and which has an activating surface upon which a user's finger acts at the end of the activating movement of said ignition wheel;
- and a windshield delimiting said combustion chamber and comprising two side arms extending as far as the sides of said ignition wheel, so that, considering a lateral view of the lighter in a direction parallel to said axis, said circumferential surface of the ignition wheel projects from said windshield along at least one projecting sector, it being possible for a user's finger to activate said ignition wheel directly in at least one part of said projecting sector.

[0002] More particularly, the invention relates to a lighter of the type mentioned above which is specially designed to make it difficult for a young child, particularly a child under 51 months, to work it.

State of the art

[0003] The movement required to work a conventional lighter of the type indicated above is particularly simple and easy for a young child to achieve. In order to prevent the risk this involves, and in many cases, following the specific regulations that have been developed in various countries, lighter manufacturers have designed, and put on the market, several models incorporating a special design that makes working the lighter difficult. The design of these lighters must be such that it is very difficult for a young child to work them, without making it excessively difficult for an adult to work them. Various lighters are known of the type considered that fulfil these requirements to a greater or lesser degree, although they all have drawbacks, as will be seen below.

[0004] A first group of known lighters essentially maintains the simple operating principle of conventional lighters and the lighting action is made more difficult by making it harder to activate the ignition wheel. Basically, this difficulty to activate the wheel is achieved by increasing in the radial force that a user must exert with its finger in order to apply to the circumferential surface of the ignition wheel the tangential force that is necessary to rotate said wheel, thus overcoming the friction resistance of the flint. In some cases, this effect is achieved by providing the circumferential surface of the wheel with a geometry whereby, given a radial force exerted by a user's finger, the tangential friction coefficient in the finger application area is less than in a conventional lighter; in other cases, this same effect is achieved by providing elements that hinder, but do not prevent, a finger's radial access to said circumferential surface.

[0005] In the solution proposed by document EP0829686, rings are provided that have a smooth circumferential surface, in the ignition wheel proper or on the sides of said wheel, so that in order to rest the finger in contact with the ignition wheel and rotate it, the finger must also rest on the smooth surface of the rings.

[0006] Similarly, document WO9701734 describes a lighter in which the ignition wheel is provided with two thumb wheels similar to those in most conventional lighters, but with the particular condition that they have a smooth circumferential surface.

[0007] Also, similarly, document US5096414 adopts the solution of providing circular, smooth surface discs flanking the ignition wheel. In an alternative solution, this document also proposes that the ignition wheel be slightly sunken between the side arms of the windshield, so that when the finger tries to reach the circumferential surface of the ignition wheel, it must necessarily rest on said arms, with only the fingertip reaching said surface, an increased radial force being required for this.

[0008] The solution proposed in documents US5520197, US5735294 and US5769098 consists in providing a flexible element that extends above the circumferential surface of the ignition wheel, so that in order for the finger to reach said surface, it is necessary to first use the finger to deform said flexible element, exerting a radial force for this purpose.

[0009] Document US5897307 describes a lighter combining two features for achieving said effect of increasing the radial force that is required to activate the ignition wheel. On the one hand, the thumb wheels on the ignition wheel have a reduced diameter with respect to a conventional lighter and they also have a smooth circumferential surface. On the other hand, the ignition wheel is provided on level or slightly sunken with respect to the windshield. So, in order to access the circumferential surface of the ignition wheel in the radial direction, the finger must rest on the edges of the windshield and bend so that only the fingertip reaches this surface.

[0010] The lighters of this first type, in other words those based on increasing the radial force required to activate the ignition wheel, suffer from the drawback that said force tends to reduce as the lighter is used, whereby the safety of the lighter reduces over time. In fact, in order to begin the rotary movement of the ignition wheel, it is necessary to overcome the wheel's static friction force

on the flint. Although normally this friction force is ensured by the action of a spring that pushes the flint against the wheel, said friction force weakens over time due to the wear of the actual flint and, sometimes, also to the ageing of the spring. On the other hand, in the lighters including a flexible element that hinders radial access to the ignition wheel, as is the case in documents US5520197, US5735294 and US5769098 cited above, the properties of said flexible element diminish over time and with use, owing to the mechanical fatigue of said flexible element which is activated each time the lighter is used.

[0011] A second type of known lighters is based on the introduction of additional mechanical elements which, under certain conditions, prevent the ignition wheel from being rotated. The lighters in this group suffer from the main drawback that a mechanical complication is introduced, which makes the manufacturing of lighters more expensive and often has a negative effect on their robustness. The lighters referenced in documents US5520197, US5735294 and US5769098 cited above, can be classified in this group because, as well as the features mentioned above, they also comprise blocking means which prevent the ignition wheel from being rotated when the lever is activated. This prevents a child from activating the lever with one hand and the wheel with the other, thus producing a spark. Also, it is worth mentioning document US4717335, which describes a lighter provided with abutment means for the ignition wheel's rotary movement, so that once the wheel has been activated in the appropriate direction for producing the spark, it can only be re-activated in the same direction if, beforehand, said wheel is drawn back in the opposite direction. In addition to introducing the mechanical complication mentioned above, this solution suffers from the drawback that it does not really hinder conventional lighter operation, since, instead, it just modifies the operating principle, and a child can easily deduce this.

Disclosure of the invention

[0012] The purpose of the invention is to overcome the drawbacks mentioned, providing a lighter that essentially maintains the operating principle of conventional lighters and which is specially designed to make it difficult to effectively activate the ignition wheel, making it virtually impossible for a young child to achieve, particularly a child under 51 months, and without introducing any element in the lighter that complicates its mechanical structure and, also, so that the lighter's safety cannot reduce over time and through use.

[0013] This purpose is achieved by means of a lighter of the type indicated at the beginning, characterised in that it comprises a non-deformable, protective element that extends transversally to said side arms of the windshield above the circumferential surface of the ignition wheel, so that said protective element covers, at least partially, a sector of said circumferential surface in a vertical projection, said circumferential surface in said covered sector thus becoming totally inaccessible for a user's finger; and in that said projecting sector is located next to said lever, the activating angle of said ignition wheel being defined in said projecting sector as the angle at which said circumferential surface of the ignition wheel is accessible in the radial direction with respect to said axis, said activating angle being greater than 10° and less than 90°, and preferably greater than or equal to 30° and less than or equal to 70°.

[0014] It is worth mentioning that the vertical direction must be understood to be the direction normally corresponding to the vertical direction in the lighter's normal position of use. In the lighters of the type under consideration, this vertical direction can be assimilated to the axial direction of the lighter valve, which normally coincides with the longitudinal direction of the lighter's main body.

[0015] It is also worth clarifying that in defining the ignition wheel's activating angle as the angle at which the circumferential surface of the ignition wheel is accessible in the radial direction with respect to the axis thereof, it must be understood that within this activating angle any straight line drawn in the radial direction from said axis does not cut any element of the lighter.

[0016] Moreover, by the term non-deformable protective element, it must be understood that said protective element cannot become deformed or be moved by the action of a user's finger in a normal use of the lighter.

[0017] It will be observed that the lighter according to the invention advantageously combines two features. The first feature consists of the presence of the protective element extending over the ignition wheel, making a sector of said wheel totally inaccessible to a user's finger. It must be understood therefore that thanks to the presence of said protective element, it is absolutely impossible for a user's finger to come into contact with the circumferential surface of the ignition wheel in the sector that is covered vertically by said protective element. In other words, in said covered sector it is impossible for the finger to act upon the ignition wheel. The second feature consists in that the ignition wheel's activating angle, which is defined in said wheel's projecting sector between said protective element and said lever, being maintained within the range of values indicated above.

[0018] It is important to highlight that these two features are inseparable; in fact, they must exist simultaneously so that the lighter has the desired properties, i.e.: that it is sufficiently difficult for a child to work, but sufficiently easy for an adult.

[0019] It has been noticed that the movement for activating the ignition wheel, performed naturally by a user, including young children, always begins by placing the thumb finger on the top of the ignition wheel. The purpose of the first feature of the lighter according to the invention, i.e. the provision of a protective element in the way indicated, is that this natural movement be started forcibly by placing the finger on said protective element, so that the movement is started without coming into contact with

the circumferential surface of the ignition wheel. Next, the finger slides over the protective element until it falls onto the ignition wheel's projecting sector, which is when contact is made with the circumferential surface of said ignition wheel and its activating movement is begun. In this way the natural operating movement is maintained, but the ignition wheel is prevented from being activated in the initial phase, while the finger slides over the protective element, and it is also achieved that said finger is in motion when it comes into contact with the ignition wheel. By virtue of said protective element, when the finger comes into contact with the ignition wheel, it applies a force having a radial component that is less than when the activating movement is started with the finger stopped, as happens in conventional lighters and the prior art. Thanks to this, when performing the natural movement mentioned, a young child cannot work the lighter, whereas an adult can operate it easily.

[0020] However, it has been observed that said protective element is not enough. In fact, if the ignition wheel's projecting sector is wide enough, a young child can adopt a similar, alternative activating movement by placing its finger on said ignition wheel's projecting sector, below said protective element, and starting the activating movement at this point. The purpose of the second feature of the invention, which consists in reducing the ignition wheel's activating angle to a value included in the range mentioned above, is that said first alternative movement is not effective when performed by a young child. In fact, so that the activation of the ignition wheel produces a spark, not only is it necessary to be able to start rotation by first overcoming the friction of the flint (for which it is necessary to apply a sufficient radial force that can keep the finger in the tangential direction, as seen earlier), but also for the ignition wheel's rotary movement to acquire a minimum speed. With a reduced activating angle it is impossible for a young child to obtain this minimum speed.

[0021] It has also been observed that if only the activating angle is reduced and said protective element is omitted, the lighter does not work satisfactorily. In fact, although the lighter is designed so that the windshield's side arms hide the top of the ignition wheel, it is possible to perform a second, alternative operating movement that is similar to the natural movement described above, but in which a greater radial force is applied, which is sufficient to introduce the fingertip between said side arms and reach the ignition wheel. This possibility is overcome by providing said protective element according to the invention. Moreover, although said protective element prevents the ignition wheel being operated effectively by a young child, it facilitates the wheel being activated by an adult, because the initial speed the finger acquires when sliding over said protective element contributes to reaching the ignition wheel's minimum rotation speed when the activating angle is reduced. This is only effective with adults, because the movement must be fast and have a sufficient radial force.

[0022] The ignition wheel's activating angle can be delimited by the own limits of said projecting sector, but also at the bottom by the lever and/or at the top by the protective element proper. Therefore, there are four possible configurations included within the framework of this invention.

[0023] In a first advantageous configuration, the radius centred on said axis and tangent to the lever's activating surface in the angular position closest to said protective element cuts said projecting sector, whereby said radius forms the lower border of said activating angle, and the radius centred on said axis and tangent to said protective element in the angular position closest to said lever does not cut said projecting sector, whereby the top border of said activating angle coincides with the top border of said projecting sector.

[0024] In a second advantageous configuration, the radius centred on said axis and tangent to the lever's activating surface in the angular position closest to said protective element cuts said projecting sector, whereby said radius forms the lower border of said activating angle, and the radius centred on said axis and tangent to said protective element in the point closest to said lever cuts said projecting sector, whereby said radius forms the top border of said activating angle.

[0025] In a third advantageous configuration, the radius centred on said axis and tangent to the lever's activating surface in the angular position closest to said protective element does not cut said projecting sector, whereby the lower border of said activating angle coincides with the lower border of said projecting sector, and the radius centred on said axis and tangent to said protective element in the angular position closest to said lever does not cut said projecting sector, whereby the top border of said activating angle coincides with the top border of said projecting sector.

[0026] In a fourth advantageous configuration, the radius centred on said axis and tangent to the lever's activating surface in the angular position closest to said protective element does not cut said projecting sector, whereby the lower border of said activating angle coincides with the lower border of said projecting sector, and the radius centred on said axis and tangent to said protective element in the angular position closest to said lever cuts said projecting sector, whereby said radius forms the top border of said activating angle.

[0027] Preferably, said circumferential surface sector that is covered by said protective element in a vertical projection, has its limit closest to said lever in an angular position between minus 20° and plus 30°, and more preferably between minus 5° and plus 5°, taking the vertical line passing through said axis as the origin and taking the positive angular direction to be the one stretching more directly between said vertical line and said lever.

[0028] Preferably, in the angular position, with respect to said axis, located on the vertical line passing through said axis, said circumferential surface of the ignition wheel does not project from said windshield.

[0029] More preferably, the circumferential surface of the ignition wheel does not project from said windshield in any of the angular positions between 0° and 20° positive, taking the vertical line passing through said axis as the origin and taking the positive angular direction to be the one stretching more directly between said vertical line and said lever.

[0030] The applicant has ascertained that these preferable positions of the protective element and the ignition wheel with respect to the windshield are those which provide a greater positive effect when the natural activating movement mentioned above is performed. In other words, they provide a maximum activation obstacle for a young child, while at the same time, they make it suitably easy for an adult to perform this movement.

[0031] Advantageously, said protective element is integral with said windshield and is made up of two opposed legs extending from the top edges of the windshield's side arms. Also, preferably, together with the top edges of the windshield, said protective element defines an outlet from said combustion chamber. This solution is effective and the production thereof economical, since the windshield lends itself to various purposes. Also, preferably, said protective element has a flat top surface that is coplanar with the top edges of the windshield's side arms, so that the finger slides optimally over said surface when the natural activating movement described above is initiated.

[0032] In an alternative solution, said protective element is a part which is independent from the windshield, and it is shaped like a bridge that stretches over said ignition wheel. For example, said part must be attached to the windshield's side arms or to the ignition wheel axis, and it can pass inside or outside said side arms.

[0033] Preferably, for any of the solutions described, the ignition wheel's position is such that, considering any radial direction centred on said axis, the minimum distance between the protective element and the circumferential surface of the ignition wheel is less than or equal to 0.5 mm, and more preferably, less than or equal to 0.3 mm. By reducing this separation distance, a larger diameter ignition wheel can be mounted, so that the tangential force needed to obtain a given torque is advantageously reduced. Moreover, since the protective element is virtually touching the circumferential surface of the ignition wheel, it cannot be deformed by an excessive radial force because it immediately abuts against said surface.

[0034] Preferably, within said activating angle, in the angular position in which said circumferential surface projects from said windshield for a maximum distance in the radial direction centred on said axis, said maximum distance is greater than or equal to 0.1 mm and less than or equal to 2 mm. This is the optimum arrangement for effectively activating said ignition wheel without it being too easy for a young child to operate.

[0035] Advantageously, said ignition wheel comprises, flanking said abrasive strip, two thumb wheels having a larger diameter than said abrasive strip, said thumb wheels having a grooved surface that forms the part of said circumferential surface that projects from said windshield along at least one projecting sector. This is the usual ignition wheel configuration found in conventional lighters. Naturally, the invention can be worked with any other type of ignition wheel.

Brief description of the drawings

[0036] Other advantages and characteristics of the invention will be appreciated from the following description, in which, with a non-limiting character, preferable embodiments of the invention are explained, with reference to the accompanying drawings, in which:

Figs. 1, 2 and 3 are, respectively, a side elevation view, a plane view and a partial sectional view of a first embodiment of the lighter according to the invention;

Fig. 4 is a top view of a second embodiment of the lighter according to the invention;

Fig. 5 is a perspective view of the windshield of the lighter in Fig. 4;

Figs. 6 and 7 are, respectively, a partial side elevation view and a top view of a third embodiment of the lighter according to the invention;

Figs. 8 and 9 are, respectively, a partial side elevation view and a top view of a fourth embodiment of the lighter according to the invention;

Figs. 10 and 11 are, respectively, a partial side elevation view and a top view of a fifth embodiment of the lighter according to the invention.

Detailed description of embodiments of the invention

[0037] In a first embodiment of the invention illustrated in Figs. 1 through 3, the lighter is made up of a main, oblong, plastic body 1 comprising a liquated gas reservoir 24 and having a top base 2 on which there is mounted a lever 9 having a top activating surface 10, a valve 4 activated by said lever 9, an ignition device consisting of an ignition wheel 6 rotably mounted on its own axis 28 on vertical supports (not shown in the figures) and a flint 5 that is kept in contact on the circumferential surface 7 of ignition wheel 6 by the action of a thrusting spring 25, and finally a windshield 11 that delimits a combustion chamber 3 over said valve 4 and has two side arms 12a, 12b flanking both sides of ignition wheel 6.

[0038] Ignition wheel 6 is provided with a central abrasive strip 8, which is the one that is in contact with flint 5, and two thumb wheels 19a, 19b having grooved surfaces 20a, 20b upon which a user's finger acts when activating wheel 6. Circumferential surface 7 of wheel 6 is therefore made up of said grooved surfaces 20a, 20b and by said central abrasive strip 8. Considering a side view parallel to said axis 28 (Figs. 1 and 3), thumb wheels 19a, 19b have a greater diameter than said central abrasive strip 8 and they project from said windshield 11 along

a projecting sector 16 located next to lever 9.

[0039] Windshield 11 is a U-shaped, metallic part in snap attachment with main body 1 through lugs 26 that cooperate in corresponding housings. The top edges of said arms 12a, 12b of windshield 11 have a flat extension 13 that is coplanar to said top edges and defines therewith an outlet 22 from combustion chamber 3. Said flat extension 13 forms a protective element that vertically covers a sector 14 of circumferential surface 7 of ignition wheel 6, so that in said sector 14 said circumferential surface 7 is completely inaccessible to a user's finger. In Figs. 2 and 3 it is observed that the right edge of said flat extension or protective element 13 is located on vertical line 29 that passes through axis 28, so that said covered sector 14 has its limit 17 closest to said lever 9 in an angular position of 0° if said vertical line 29 is taken as the origin. The value of the minimum distance between protective element 13 and circumferential surface 7 of ignition wheel 6, is 0.2 mm. In this case, said minimum distance is on vertical line 29 and it is the distance between the lower face of protective element 13 and the grooved surfaces 20a, 20b of thumb wheels 19a, 19b.

[0040] Activating angle 27 of ignition wheel 6, defined as the angle at which said circumferential surface 7 of ignition wheel 6 is accessible in the radial direction with respect to said axis 28, is defined at the bottom by the radius 15 centred on axis 28 and tangent to activating surface 10 of lever 9 in the angular position closest to protective element 13, and at the top by the top border of projecting sector 16. Said activating angle 27 has a value of 62°. Within said activating angle 27, circumferential surface 7 projects in the radial direction from said windshield 11 at a maximum distance of 1 mm.

[0041] The top border of projecting sector 16 is arranged in an angular position of 33° positive, taking vertical line 29 passing through said axis 28 as the origin and taking the positive angular direction to be the one extending more directly between said vertical line 29 and said lever 9. As can be seen in the side view in Figs. 2 and 3, in all the angular positions to the left of this border, in other words those having a value less than 33° positive, circumferential surface 7 of ignition wheel 6 does not project from said windshield 11.

[0042] In the second embodiment shown in Figs. 4 and 5, windshield 11 is shaped such that the manufacture thereof is easier and more economical. In this case, protective element 13 is made up of two opposed legs 18a, 18b extending from the top edges of side arms 12a, 12b of said windshield 11. In all other aspects, the configuration of the lighter is similar to that detailed in the first embodiment described above.

[0043] Figs. 6 and 7 illustrate a third embodiment wherein ignition wheel 6 projects very little from windshield 11. The largest diameter part of circumferential surface 7 of ignition wheel 6, made up in this case of grooved surfaces 20a, 20b of thumb wheels 19a, 19b, projects from said windshield 11 at a maximum, radial distance of just 0.2 mm. Moreover, as can be seen in Fig. 7, legs 18a, 18b forming protective element 13 have a different design to that of the previous embodiment, which also facilitates the manufacturing of windshield 11.

[0044] The fourth embodiment shown in Figs. 8 and 9 is different from the others in that windshield 11 has a shape such that it laterally covers the lower part of ignition wheel 6, just above lever 9, so that in this case the lower border of activating angle 27 is not defined by tangent 15 to lever 9 as before, instead it coincides with the lower border of projecting sector 16. The top border of activating angle 27 also coincides with the top border of projecting sector 16.

[0045] Finally, Figs. 10 and 11 illustrate a fifth embodiment wherein protective element 13 and windshield 11 are not integral as is the previous cases. Instead, in this case, said protective element 13 is an independent, bridge-shaped part, stretching over ignition wheel 6. The ends of said bridge-shaped part 13 pass through the space reserved between side arms 12a, 12b of windshield 11 and the flanks of ignition wheel 6, and they are attached to axis 28. In this case, as can be seen in Fig. 10, the top border of activating angle 27 does not coincide with the top border of projecting sector 16, which in this case is on vertical line 29. Instead it is made up of radius 23 that passes through axis 28 and is tangent to protective element 13 on its edge closest to lever 9.

Claims

1. Pocket lighter comprising a main body (1) including a fuel reservoir, said main body (1) having a top base (2) on which there is provided:

   - a combustion chamber (3);
   - a valve (4) connecting said fuel reservoir to said combustion chamber (3);
   - an ignition device suitable for producing and sending sparks to said combustion chamber (3), said ignition device comprising a flint (5) and an ignition wheel (6) rotably mounted on its axis (28) and which can be activated by a user's finger, said ignition wheel (6) having a circumferential surface (7) comprising an abrasive strip (8) in contact with said flint (5);
   - a lever (9) for activating said valve (4) which is located next to said ignition wheel (6) and which has an activating surface (10) upon which a user's finger acts at the end of the activating movement of said ignition wheel (6);
   - and a windshield (11) delimiting said combustion chamber (3) and comprising two side arms (12a, 12b) extending as far as the sides of said ignition wheel (6), so that, considering a side view of the lighter according to a direction parallel to said axis (28), said circumferential surface (7) of ignition wheel (6) projects from said windshield (11) along at least a projecting sector

(16), it being possible for a user's finger to activate said ignition wheel (6) directly with the user's finger in at least one part of said projecting sector (16);

characterised in that:

- it comprises a non-deformable protective element (13) that extends transversally to said side arms (12a, 12b) of windshield (11) above said circumferential surface (7) of ignition wheel (6), so that said protective element (13) covers at least partially a sector (14) of said circumferential surface (7) in a vertical projection, therefore making said circumferential surface (7) in said covered sector (14) totally inaccessible to a user's finger; and
- said projecting sector (16) is located next to said lever (9), the activating angle (27) of said ignition wheel (6) being defined in said projecting sector (16) as the angle at which said circumferential surface (7) of ignition wheel (6) is accessible in the radial direction with respect to said axis (O), said activating angle (27) being greater than 10° and less than 90°.

2. Lighter according to claim 1, **characterised in that** said activating angle (27) is greater than or equal to 30° and less than or equal to 70°.

3. Lighter according to claims 1 or 2, **characterised in that** the radius (15) centred on said axis (28) and tangent to said activating surface (10) of lever (9) in the angular position closest to said protective element (13) cuts said projecting sector (16), whereby said radius (15) forms the lower border of said activating angle (27), and radius (23) that is centred on said axis (28) and tangent to said protective element (13) in the angular position closest to said lever (9) does not cut said projecting sector (16), whereby the top border of said activating angle (27) coincides with the top border of said projecting sector (16).

4. Lighter according to claims 1 or 2, **characterised in that** radius (15) centred on said axis (28) and tangent to said activating surface (10) of lever (9) in the angular position closest to said protective element (13) cuts said projecting sector (16), whereby said radius (15) forms the lower border of said activating angle (27), and radius (23) centred on said axis (28) and tangent to said protective element (13) in the point closest to said lever (9) cuts said projecting sector (16), whereby said radius (23) forms the top border of said activating angle (27).

5. Lighter according to claims 1 or 2, **characterised in that** radius (15) centred on said axis (28) and tangent to said activating surface (10) of lever (9) in the angular position closest to said protective element (13) does not cut said projecting sector (16), whereby the lower edge of said activating angle (27) coincides with the lower border of said projecting sector (16), and radius (23) centred on said axis (28) and tangent to said protective element (13) in the angular position closest to said lever (9) does not cut said projecting sector (16), whereby the top border of said activating angle (27) coincides with the top border of said projecting sector (16).

6. Lighter according to claims 1 or 2, **characterised in that** radius (15) centred on said axis (28) and tangent to said activating surface (10) of lever (9) in the angular position closest to said protective element (13) does not cut said projecting sector (16), whereby the lower border of said activating angle (27) coincides with the lower border of said projecting sector (16), and radius (23) centred on said axis (28) and tangent to said protector element (13) in the angular position closest to said lever (9) cuts said projecting sector (16), whereby said radius (23) forms the top border of said activating angle (27).

7. Lighter according to any of claims 1 to 6, **characterised in that** said sector (14) of circumferential surface (7) covered by said protective element (13) in a vertical projection has its limit (17) closest to said lever (9) in an angular position between minus 20° and plus 30°, taking vertical line (29) passing through said axis (28) as the origin and taking the positive angular direction to be the one stretching between said vertical line (29) and said lever (9).

8. Lighter according to claim 7, **characterised in that** said sector (14) of circumferential surface (7) covered by said protector element (13) in a vertical projection has its limit (17) closest to said lever (9) in an angular position between minus 5° and plus 5°, taking vertical line (29) passing through said axis (28) as the origin and taking the positive angular direction to be the one stretching directly between said vertical line (29) and said lever (9).

9. Lighter according to any of claims 1 to 8, **characterised in that** in the angular position on vertical line (29) that passes through said axis (28), said circumferential surface (7) of ignition wheel (6) does not project from said windshield (11).

10. Lighter according to claim 9, **characterised in that** said circumferential surface (7) of ignition wheel (6) does not project from said windshield (11) in any of the angular positions between 0° and 20° positive, taking vertical line (29) that passes through said axis (28) as the origin and taking the positive angular direction to be the one stretching directly between said vertical line (29) and said lever (9).

11. Lighter according to any of claims 1 to 10, **characterised in that** said protective element (13) forms an integral part with said windshield (11) and it is made up of two opposed legs (18a, 18b) that extend from the top edges of said side arms (12a, 12b) of windshield (11).

12. Lighter according to any of claims 1 to 11, **characterised in that** said protective element (13) delimits, together with the top edges of windshield (11), an outlet (22) from said combustion chamber (3).

13. Lighter according to claims 11 or 12, **characterised in that** said protective element (13) has a flat top surface that is coplanar with the top edges of said side arms (12a, 12b) of windshield (11).

14. Lighter according to any of claims 1 to 10, **characterised in that** said protective element (13) is an independent part of said windshield (11), said part being shaped like a bridge stretching over said ignition wheel (6).

15. Lighter according to any of claims 1 to 14, **characterised in that**, considering any radial direction centred on said axis (28), the minimum distance between said protective element (13) and said circumferential surface (7) of ignition wheel (6) is less than or equal to 0.5 mm.

16. Lighter according to claim 15, **characterised in that**, considering any radial direction centred on said axis (28), the minimum distance between said protective element (13) and said circumferential surface (7) of ignition wheel (6) is less than or equal to 0.3 mm.

17. Lighter according to any of claims 1 to 16, **characterised in that**, within said activating angle (27), in the angular position in which said circumferential surface (7) projects from said windshield (11) at a maximum distance along the radial direction centred on said axis (28), said maximum distance is greater than or equal to 0.1 mm and less than or equal to 2 mm.

18. Lighter according to any of claims 1 to 17, **characterised in that** said ignition wheel (6) comprises, flanking said abrasive strip (8), two thumb wheels is (19a, 19b) having a greater diameter than said abrasive strip (8), said thumb wheels (19a, 19b) having a grooved surface (20a, 20b) which forms the part of said circumferential surface (7) that projects from said windshield (11) along at least one projecting sector (16).

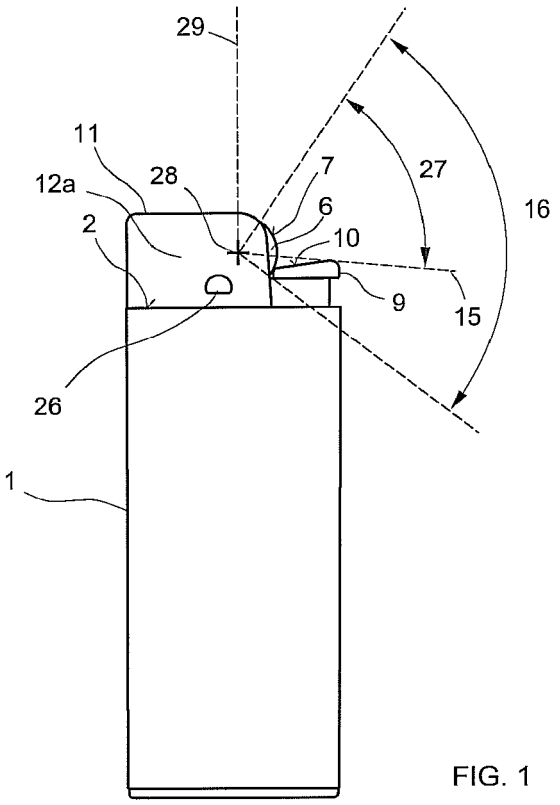
29
11
12a
28
7
6
10
27
16
2
9
15
26
1

FIG. 1

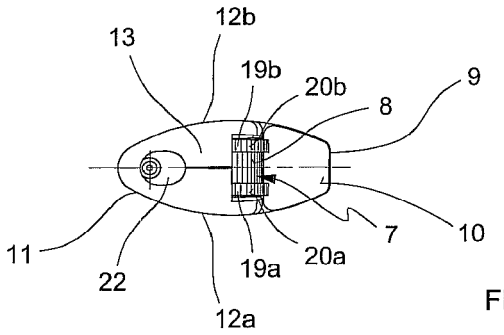
13
12b
19b
20b
9
8
11
22
19a
20a
7
10
12a

FIG. 2

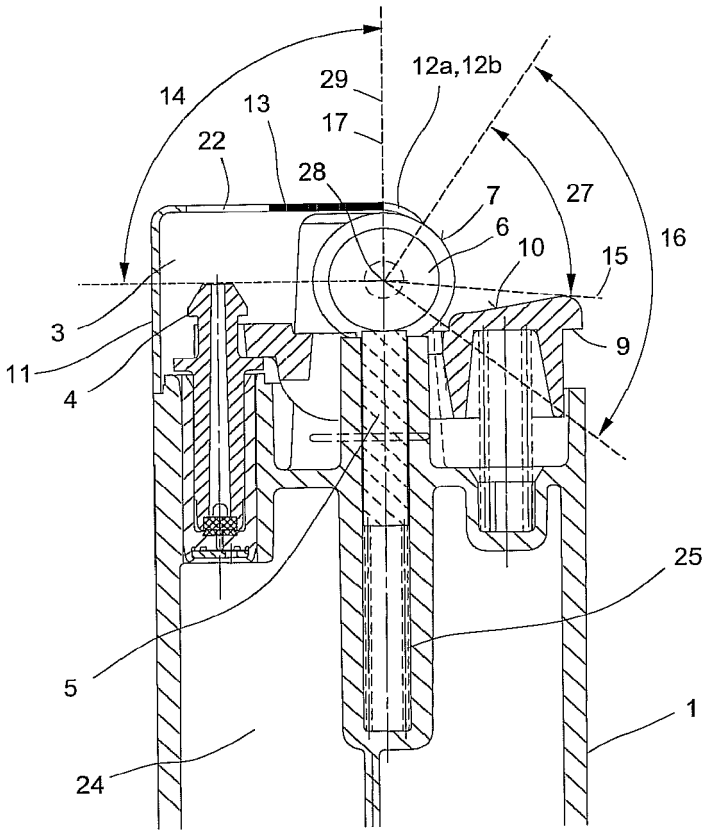

FIG. 3

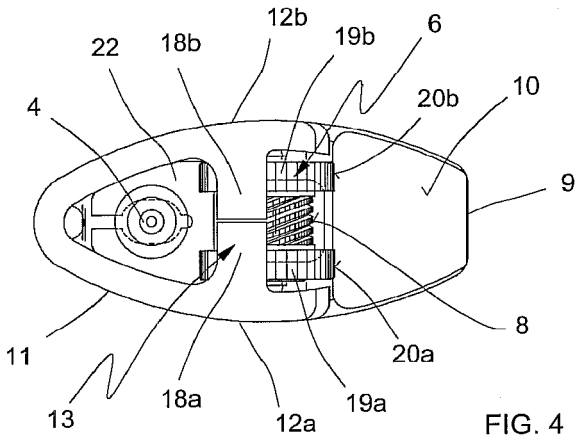
12b
22
18b
19b
6
4
20b
10
9
8
11
20a
13
18a
19a
12a

FIG. 4

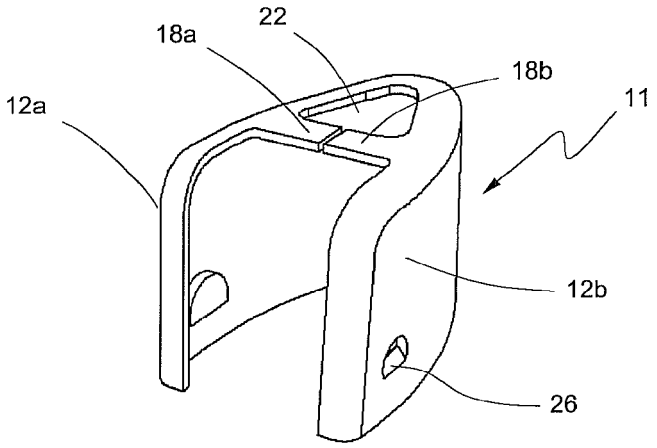
18a
22
18b
11
12a
12b
26

FIG. 5

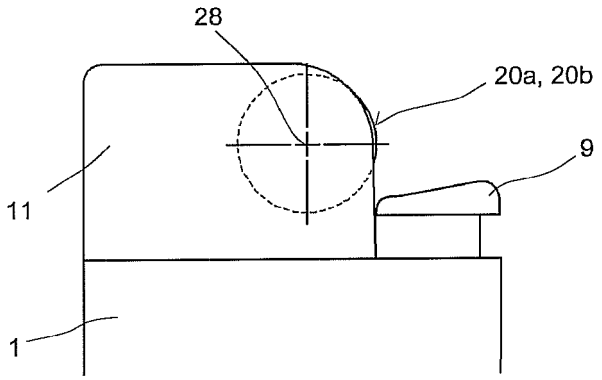

FIG. 6

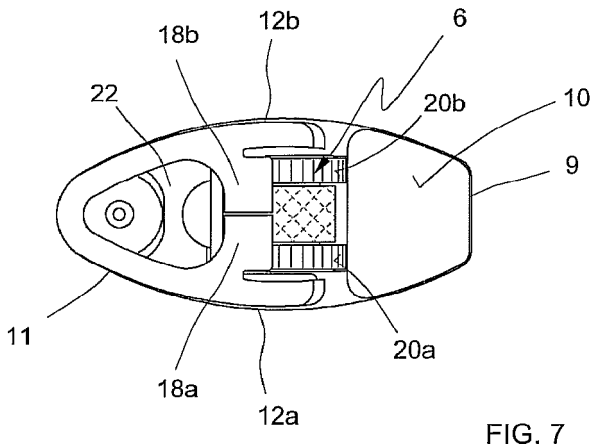

FIG. 7

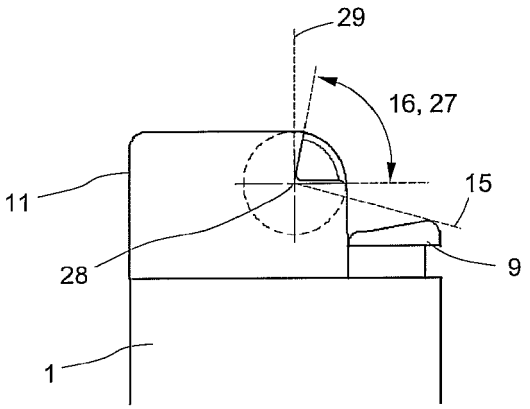

FIG. 8

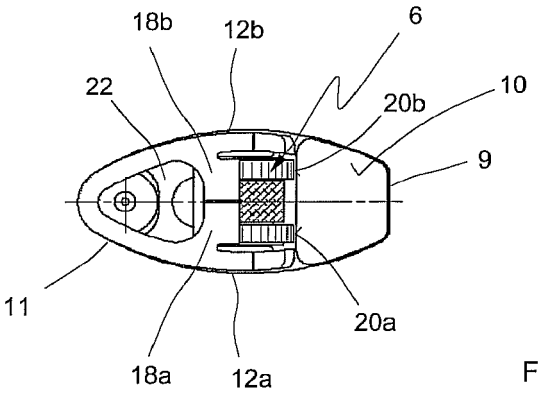

FIG. 9

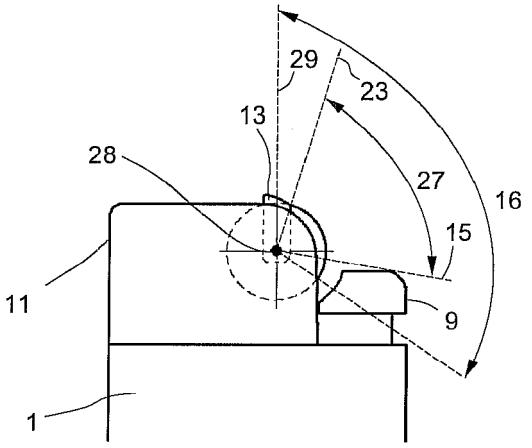

FIG. 10

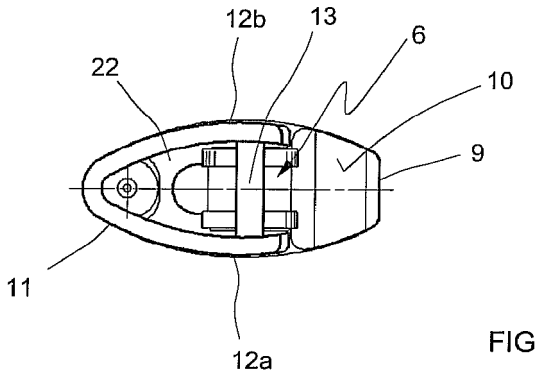

FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ ES 2004/000474

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 F23Q2/16, F23Q2/46

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 ' F23Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CIBEPAT,EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US2003194669 A (CHANG) 10.16.2003, **paragraph (0029), [0033],[0043],[0044], figures 2, 5, 6**	1-6,9-13,15-18
X	WO02065019 A (SWEDISH MATCH LIGHTERS BV) 22.08.2002, **page 4, line 5-page 8-line 22**	1,3-8,11,12, 14-17
A	EP1348909 A (TOP CHAMPION DEV EUROP LTD) 01.10.2003, **abstract, figures 1-8**	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 December 2004 (16.12.2004)	**05 January 2005 (05.01.2005)**
Name and mailing address of the ISA/ **S.P.T.O.**	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No
PCT/ ES 2004/000474

Patent document cited in search report	Publication date	Patent familiy member(s)	Publication date
US2003194669 A	16.10.2003	NONE	----------
EP 1348909 A	01.10.2003	EP 20030251014	19.02.2003
		GB 2388894 A	26.11.2003
		TR 200400339 T	21.04.2004
		DE 03251014 T	19.05.2004
		ES 2211377 T	16.07.2004
WO02065019 A	22.08.2002	NONE	----------

Form PCT/ISA/210 (patent family annex) (July 1992)

REFERENCES CITED IN THE DESCRIPTION

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- US 5735294 A **[0008] [0010] [0011]**
- US 5769098 A **[0008] [0010] [0011]**
- US 5897307 A **[0009]**
- US 4717335 A **[0011]**