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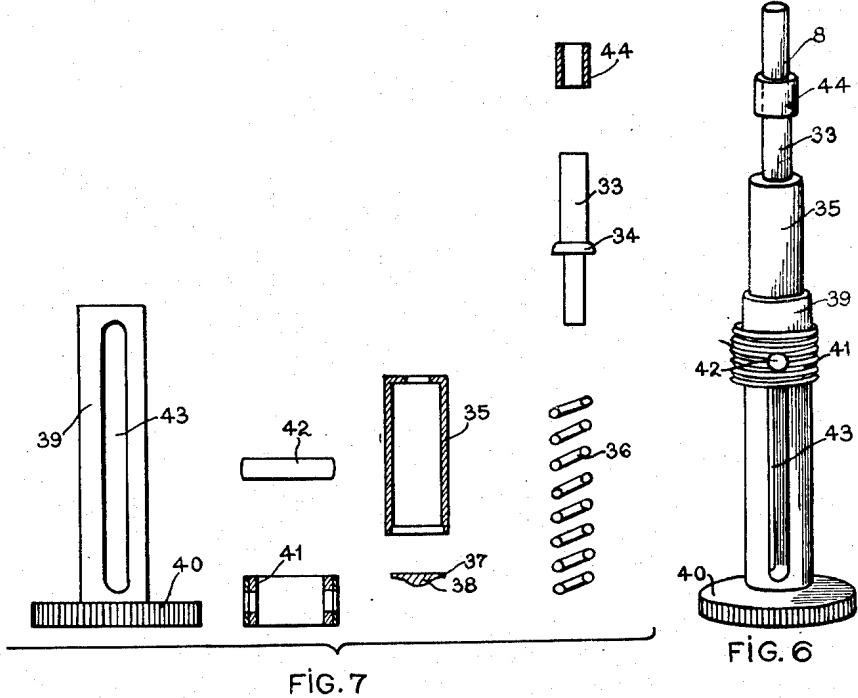
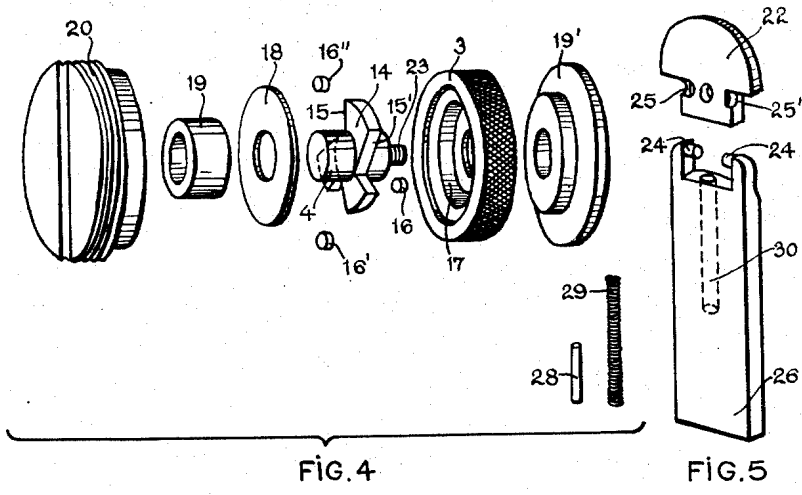
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FRICITION TYPE LIGHTER

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FRICITION TYPE LIGHTER

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5 Claims. (Cl. 67—6.1)

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This application is a continuation of abandoned application Serial Number 113,140 filed August 30, 1949.

The present invention relates to improvements in pyrophoric or friction type lighters, that is, to lighters of the type comprising a primary source of thermal energy formed by a ferro-cerium "flint" adapted to have particles ripped off it by an abrasive member, said particles being brought to an incandescent state by friction.

It is known that conventional lighters of this kind have in addition a secondary source of heat energy, which in a sense fulfills the function of a relay, and is usually formed by a wick fed with a suitable fuel such as petrol or a liquefied or solidified gaseous fuel, or further a German tinder or amadou wick. Such a lighter for its operation essentially relies on the production of sparks by the friction wheel rubbing against the ferro-cerium flint, and causing the projection of a somewhat dispersed fan-like shower or spray of incandescent ferro-cerium particles. As a result of such dispersion of the particles and due also to the fact that the direction and intensity of the spray of sparks depends on a rather large number of factors, especially on the manner in which the flint is presented to the friction wheel, on the bearing pressure of the flint against the friction wheel, as well as on the speed of rotation imparted to the latter, the operation of such lighters, as is well known, is highly uncertain.

The object of the present invention is a pocket lighter wherein the tobacco (cigarettes or pipes) is ignited directly by the ferro-cerium particles stripped from the flint by an abrasive member, without using a wick fed by an auxiliary fuel such as petrol, or an amadou wick. Lighters for directly igniting easily inflammable materials, such as gas or flash powders (for instance magnesium) by sparks stripped from a flint have been already proposed. Lighters of this type comprise a casing containing a rotating abrasive wheel against which the flint is pressed and a relatively long discharge tube leading from the interior of the casing to a trough fixed to the outer wall of the casing and containing the powder to be ignited said tubing being arranged to receive the sparks stripped from the flint and to project them on this inflammable powder. However such a device is unable to ignite materials which are not so easily inflammable as flash powder, for instance tobacco, even if a concentrated and directed jet of sparks is obtained by means of the discharge tube. The

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reason is that the particles of ferro-cerium are instantaneously ignited when stripped from the flint and burn during their path from the flint to the material to be ignited so that when impacting on said material they do not bring to that material a sufficient quantity of heat which is necessary to cause the ignition. It is for instance well known that if a shower of sparks is obtained by applying a piece of iron against a rotating grind stone it is sometimes possible to ignite therewith very inflammable gaseous or liquid substances but it is practically impossible to ignite therewith a solid material such as paper or tobacco, for the time of combustion of the particles of iron is very short and still shortened due to the high velocity with which they are displaced in the air.

Assuming for instance that the complete instantaneous combustion of a particle of iron having a mass of 0.1 mg. evolves instantaneously a quantity of heat of 4 small calories with an instantaneous rise of temperature up to 800°; assuming further that a small quantity of tobacco must receive to be ignited a thermal energy or 1 small calorie during 4 seconds at a temperature of 200°, it is clear that said quantity of tobacco will not be ignited by the combustion of the said iron particle which will instantaneously supply a thermal energy of 4 small calories, but it will be very easily ignited by the same energy supply distributed over 4 seconds.

The time of combustion of particles of ferro-cerium depends upon the following factors:

The size of the particles: the combustion will be longer if the volume of the particles is higher.

The quantity of air or oxygen supplied to the particles during their combustion.

The velocity with which the particles is projected for its friction in the air produces a rise of temperature which increases with the velocity.

One of the objects of the present invention is to produce a controlled combustion of particles of ferro-cerium stripped from a flint by an abrasive member in order to make possible the ignition of tobacco.

Another object of the invention is to reduce the speed of combustion of particles of ferro-cerium in order to allow a sufficiently slow liberation of heat energy to be produced which is adapted to ignite tobacco.

A further object of the invention is to control the quantity of air supplied to the particles of ferro-cerium during their path from the flint to the tobacco to be ignited.

A further object of the invention is to make

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possible the use of flints of greatly increased length over that of the flint generally heretofore.

Still another object of the invention is to control the pressure exerted by the flint on the abrasive member in order to provide ferro-cerium particles of substantially constant size in order to avoid large variations of the time of combustion.

With these and other objects in view, the pocket lighter according to the invention comprises a casing, walls forming a substantially closed chamber within said casing an abrasive member and a flint positioned to bear on said member, driving means operable from the outside of said casing, to impart to said abrasive member and flint a relative movement, substantially the entire volume of said chamber being occupied by the member to which the movement is imparted by said driving means, a short discharge duct opening in said chamber in position to receive particles stripped by said abrasive member from said flint, an enlarged outlet provided on the outer end of said duct to receive the end of a cigarette in relatively sealed relationship.

A further feature of my invention is the provision of an air inlet duct in the chamber. The purpose of this inlet is to permit a limited flow of air through the chamber into a cigarette due to a suction exerted by the smoker upon the other end of the cigarette, thus allowing a rapid ignition of the tobacco.

Due to the fact that the abrasive member substantially fills the chamber arranged in the casing and to the restricted air inlet duct, the quantity of air available for feeding the combustion of the ferro-cerium particles stripped from the flint is limited, so that this combustion is relatively slow; the duct transmitting said particles to the surface of the tobacco to be ignited being short, the particles strike the tobacco before the end of their combustion so said a sufficient quantity of thermal energy remains available for heating and igniting the tobacco.

A lighter constructed as just described is capable of two alternative types of operation. In a first type of operation the tip of the cigarette having been introduced in, or the bowl of the pipe being applied to the enlarged outlet of the discharge duct, there is first imparted to the abrasive wheel a relatively slow rotation adapted to cause ferro-cerium particles to be stripped off without being ignited, said particles then dropping upon the surface of the tobacco; thereafter a quick impulse is imparted to the friction wheel effective to project upon the tobacco surface ignited ferro-cerium particles which cause ignition of the particles already present upon the tobacco which later then becomes ignited in turn. According to another form of operation, a rapid rotation is immediately imparted to the friction wheel and a suction is simultaneously exerted by the smoker upon the cigarette or pipe. This suction produces a depression in the discharge duct and in the chamber containing the abrasive wheel, resulting in that the oxygen supplied to the particles stripped from the flint is reduced so that said particles strike the tobacco before their complete combustion and are able to ignite the tobacco. Furthermore, when imparting rapid rotation to the abrasive wheel, the speed of rotation obviously increases rapidly from zero to a certain value, so that the first particles stripped from the flint when the rotation is started, are projected in a not ignited state on the surface of the tobacco and are ignited only by further projection of already ignited particles stripped

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from the flint when the speed of rotation reaches a high value, so that the whole thermal energy evolved by the combustion of said first particles is utilized, as in the first case, for igniting the tobacco.

To provide a fuller understanding of my invention there will now be described, by way of illustrating rather than limitation, one form of embodiment of direct-ignition lighter devoid of any source of secondary energy, according to my invention; with reference to the accompanying drawings which illustrate the lighter on an enlarged scale and wherein:

Fig. 1 shows the lighter in vertical section with a new flint therein,

Fig. 2 is a vertical cross sectional view on line II--II of Fig. 1, the flint being shown as having a certain amount of wear,

Fig. 3 is a vertical cross sectional view similar to Fig. 1, but showing a flint which is nearly completely worn out,

Fig. 4 illustrates in perspective "exploded" view the parts cooperating to mount the abrasive wheel,

Fig. 5 similarly illustrates the parts cooperating to drive the friction wheel in rotation,

Fig. 6 shows in vertical perspective view the flint controlling mechanism,

Fig. 7 shows in vertical elevation and in section the various parts making up the assembly of Fig. 6, in disassembled conditions.

As shown in the drawings and more especially in Figs. 1 and 2, the body 1 of the lighter has formed therein a shallow chamber 2 in the form of a flat cylinder in which is mounted an abrasive wheel 3 on a spindle or pivot 4, there being a relatively small annular gap 5 between the periphery of the abrasive wheel and the cylindrical wall of the chamber 2. The chamber 2 communicates with a cylindrical recess 6 formed through the lighter body 1, through a bore 7 through which a flint 8 is adapted to be fed into engagement with the wheel 3. The chamber 2 also communicates with the exterior, first through a discharge duct 9 for the ferro-cerium particles stripped off the flint 8 by the abrasive wheel 3, and in the second place through an air inlet duct 10. The discharge duct 9 terminates in a cylindrical recess 11 forming an outlet opening or socket in which is mounted a metal bushing or ring 12 having an outer enlarged portion projection beyond the outer surface of the lighter, and allowing the outlet 11 of the duct 9 to be conveniently centred in the bowl of a pipe; within the ring 12 there is also mounted an annular member 13 having the general configuration clearly shown in Fig. 3 for insertion of a cigarette end to be ignited.

My invention includes means enabling the abrasive wheel to be rotated by imparting to its drive spindle a rotary reciprocatory motion, thereby greatly facilitating operation of the lighter and for this purpose the abrasive wheel 3 is mounted upon its spindle 4 through the interposal of a free-wheel drive. To that end, the spindle 4 carries a flange 14 in the periphery of which suitable camming inclines 15, 15', 15'' are machined to receive suitable ball or roller elements such as 16, 16', 16'' (Figs. 1 and 4) while the abrasive wheel is formed with a cylindrical recess 17 the peripheral wall of which provides a runway or race for said balls or rollers. A washer 18 serves to retain the balls in position and the whole assembly is retained between the bearings 19, 19' of the spindle 4 by means of screw plug

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20, threaded into the cylindrical recess 21 formed in the lighter body, and an element 22 screwed over the threaded end 23 of the spindle 4. The element 22 has a collapsible key 26 (Fig. 5) pivoted to it by means of pins 24 projecting into sockets 25, 25' formed in the element 22; the key 26 in idle condition is retractable into a housing recess 27 formed in the rear face of the body 1. Within the key member 25 there is a longitudinal bore 30 which houses a spring-urged plunger 28 with its actuating spring 29. When the key 26 is swung downwardly about its pivots 24, 24' to its retracted condition, the plunger 28 engages the flat under-face of member 22 thereby releasably locking the key in its retracted position.

Similarly when the key has been swung to its extended or projecting positions of Fig. 2, the plunger 28 engages the face of member 22 (see Fig. 5). It will readily be seen that in this extended condition of the key, the latter may be rotated or twirled back and forth as between thumb and finger, thereby similarly rotating back and forth the member 22 and spindle 4, which through the one-way drive device previously described will impart a one-way rotation to abrasive wheel 3.

As previously mentioned, the flints 8 used are of increased length, e. g. about an inch long, carefully machined so as to be perfectly cylindrical in shape. The flint is guided at the inlet into the chamber 2 by a bushing 31 mounted in the bore 7 which connects the chamber 2 with the central recess 6, said bushing being made of a suitable heat resisting metal, quenched and ground to shape. The bushing is formed with a taper inlet 32 for a purpose to be described later.

The flint 8 is held in engagement against the abrasive wheel (Figs. 1, 6 and 7) by a rod 33 carrying a piston-like flange 34 thereon slidable in a cylinder 35 containing a spring 36 which engages at one of its ends the under side of the piston 34 and at its opposite end the bottom member 37 of the cylinder 35, said bottom member being formed as a part crimped in the lower end of the cylinder and provided on its underside with a hemispherically-shaped boss. It will be seen that as a result of the above arrangement the expansion stroke of the spring is restricted by engagement of the piston or flange 34 against the top of the cylinder 35; if the expansion stroke is provided equivalent in value to about one tenth the length of the spring, the spring remaining still compressed at the end of said stroke, a practically constant bearing pressure will be obtained. Upon the spring reaching its fully expanded condition as a result of the wear on the flint, the spring may be restored to its initial compressed condition by the following means: the cylinder 35 is itself mounted for sliding movement within a tubular member 39 housed in the recess 6 of the lighter and the member 39 is rotatable by means of an actuating knob 40 rigid therewith. About the tube 39 there is freely mounted an externally threaded bush 41 engaging complementary threads formed over part of the length of the cylindrical recess 6. The bush 41 is provided with a diametrically extending cross-pin 42 which extends through a diametrically-opposed pair of longitudinal grooves 43, 43', formed in the wall of the tube 39. It will readily be seen that if the tube 39 is rotated by means of knob 40, the bush 41 is moved in rotation by the rod 42 and is forced up through the recess 6 as a result of its threaded engage-

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ment therewith, thereby pushing the cylinder 35 upwards through the action of the rod 42 upon which the boss 38 provided at the bottom of cylinder 35 bears. In order to facilitate flint replacement, the flint is connected with the rod 33 by a small rubber tube 44. When the flint is worn out to such a great extent that the rod 34 projects into the bushing 31 the rubber tube will be forced back by the bushing and pushed back along the rod 34, as clearly shown in Fig. 3.

From the bottom face of the lighter body 1, upwardly extending bores 45, 45' are formed around the central recess 6, to serve as a magazine for storing spare flint elements. These bores are sealed by a common resilient metal disc 46.

It may be seen from the above disclosure that my improved lighter possesses the outstanding advantage of operating without requiring the provision of any auxiliary fuel, such as petrol or gas, or the like. Windy conditions which generally are a great source of trouble for conventional lighters when used outdoors, in no way disturb proper operation of the lighter of my invention. It furthermore makes it possible to light a cigarette without having to inhale and even without having to place the cigarette in one's mouth during the lighting operation. Finally, the improved mounting of the friction wheel and the flint results in a perfectly smooth operation of this device, which only may be compared in this respect to high precision mechanisms.

It will of course be understood that an improved lighter constructed according to my invention may be supplied with any suitable automatic actuating device of conventionally used type, wherein rotation of the abrasive wheel may be caused by action of a preliminary cocked spring, or the like.

It is to be understood that my invention is not restricted to the exemplary embodiment and to the constructional details thereof as illustrated and described, and modifications may be made within its scope as defined by the ensuing claims.

Throughout the specification and claims, the word "flint" has for the sake of brevity been used to designate any suitable composition adapted, upon frictional engagement with a steel friction wheel, to have a great number of minute particles ripped off its surface and brought to an incandescent state by the heat generated. Ferrocium is one well-known example of such compositions.

What I claim is:

1. A pocket lighter comprising a casing, walls forming a substantially closed, flat cylindrical chamber within said casing, a rotatable abrasive wheel mounted in said chamber and dimensioned to occupy substantially its whole volume, means connected to said wheel and operable from the exterior of the casing for rotating said wheel, a flint positioned to bear on said wheel, means for pressing said flint, against said wheel, a short discharge duct opening in said chamber at a point adjacent to the flint and disposed in substantially tangential relation with said chamber to receive the pyrophoric particles stripped by the abrasive wheel from the flint, an enlarged outlet provided on the outer end of said duct for receiving the end of a cigarette with a snug fit, a restricted conduit connecting said chamber with the exterior at a point substantially opposite to that of the discharge duct, whereby pyrophoric particles may be drawn through said duct and into said outlet without receiving an unrestricted supply of air.

2. A pocket lighter according to claim 1, adapted to the use of flints of substantially increased length comprising spring means for applying the flint against the abrasive member with a substantially constant pressure, said means comprising a relatively long spring, means for transmitting the pressure of said spring to the flint, means for compressing said spring and means whereby the expansion of the spring is limited to a comparatively small fraction of its length, said spring remaining still compressed at the end of its expansion stroke; and means whereby said spring may be axially displaced as a whole by successive small increments equal to the said limited expansion stroke; the total permissible distance by which said spring may be displaced as a whole being substantially equal to the length of the flint.

3. A pocket lighter as in claim 1 wherein said constant-pressure flint applying means comprise a cylindrical recess formed in said casing connected with said chamber through a restricted flint-guiding neck portion and opening at its outer end at the base of said casing, a cylinder member shorter than said recess in axial extent and axially movable therein, a flint-actuating rod projecting into said cylinder through a guiding aperture formed in the cylinder top and supporting an annular flange within said cylinder, a comparatively long spring acting at its outer end against the bottom of said cylinder and at its inner end against the under side of said flange, the inner end of said rod engaging the outer end of said flint under the pressure exerted by said spring, whereby expansion of said spring is restricted by abutment of said flange against the top of said cylinder, and means for bodily shifting, said cylinder with said spring therein inwards by an amount equivalent to the difference in length of said spring from its contracted to its expanded condition after the amount of wear of said flint has caused such abutment.

4. A pocket lighter as in claim 1 wherein said constant-pressure flint applying means comprises a cylindrical recess in said casing, a cylinder shorter in axial extent than said recess axially movable therein, a spring in said cylinder acting at its outer end against the cylinder bottom, a flint-actuating rod extending into said cylinder through an aperture in the inner end thereof and having a flange in said cylinder serving as abutment for the inner end of said spring, said flange

abutting the top of said cylinder to restrict expansion of said spring, a tubular member interposed between said cylinder and said recess and freely rotatable with respect thereto, an outwardly threaded ring surrounding said tubular member for free rotation thereon engaging complementary internal threads in said recess, a diametric cross-pin across said ring engaging longitudinal grooves in said tubular member, a hemispherical boss depending from the outer side of the cylinder bottom and engaging said cross pin, whereby rotation of said tubular member will cause axial displacement of said ring up and down said recess; and an externally arranged actuating knob rigid in rotation with said tubular member.

5. A pocket lighter as in claim 1 to wherein said flint-applying means comprises a cylindrical recess formed in said casing connecting with said chamber through a restricted flint-guiding and centering neck portion, constant-pressure flint actuating spring means in said recess including a flint-actuating rod spring-pressed at its outer end and abuttingly engaging a flint at its inner end; a sleeve of rubber-like material releasably connecting the adjacent ends of said flint and said rod; and a shouldered flint-guiding bushing having a smaller diameter section seated in said neck portion and a larger diameter section in said recess, said flint adapted to extend through said bushing to be guided and centered thereby, and the outer end of the perforation in said larger-diameter bushing section being outwardly flared so as to push back said rubber sleeve upon said sleeve reaching said bushing.

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