March 5, 1963 V. VIRTANEN 3,079,781

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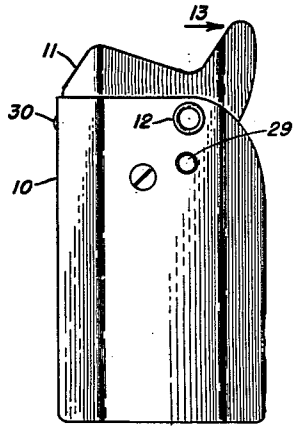


Fig-1

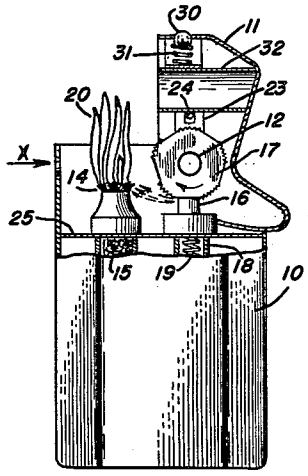


Fig-2

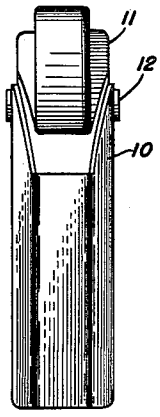


Fig-3

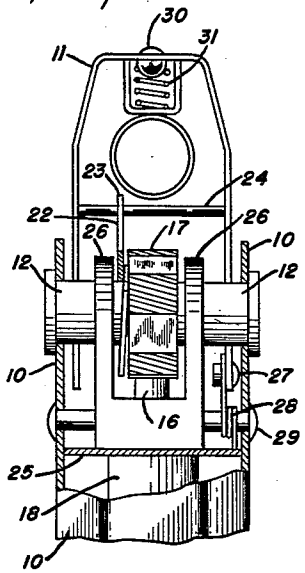


Fig-4

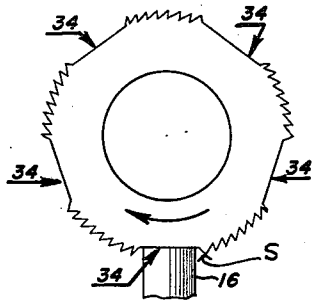


Fig-6

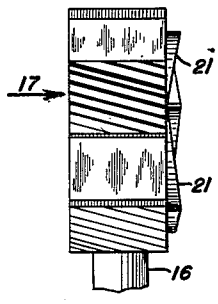


Fig-7

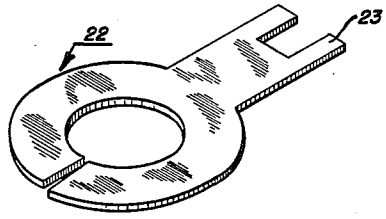


Fig-5

VALDEMAR VIRTANEN
INVENTOR.

BY Rudolph J. Jurick
ATTORNEY

March 5, 1963 V. VIRTANEN 3,079,781

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Filed April 26, 1960 2 Sheets-Sheet 2

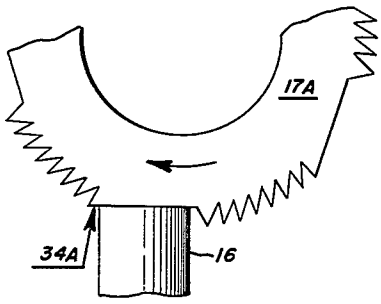


Fig-8

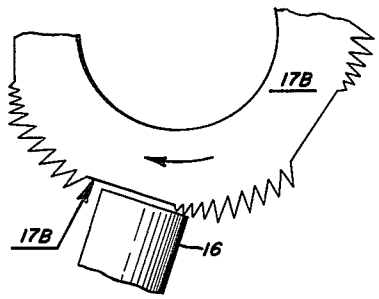


Fig-9

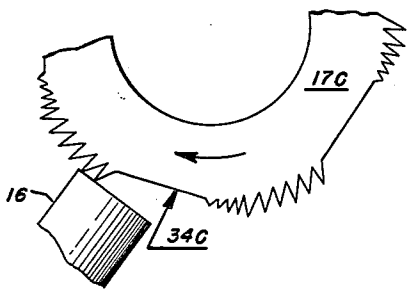


Fig-10

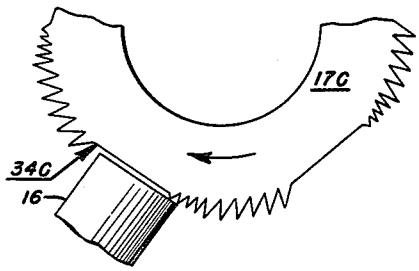


Fig-11

VALDEMAR VIRTANEN
INVENTOR.

BY Rudolph J. Zuick
ATTORNEY

United States Patent Office

3,079,781

Patented Mar. 5, 1963

3,079,781

LIGHTER

Valdemar Virtanen, Madison, N.J., assignor of thirty percent to Rudolph J. Jurick, Morris Township, N.J.

Filed Apr. 26, 1960, Ser. No. 24,775
2 Claims. (Cl. 67—7.1)

This invention relates to pyrophoric lighters of the class wherein a finger-operable means is operatively coupled to a spark-producing mechanism for igniting a wick and more particularly to a lighter of novel construction and high operating reliability.

Although my invention will be described with specific reference to pocket lighters, it will be apparent that the inventive features are equally adapted for incorporation in larger lighters generally referred to as table lighters.

Lighters of the class to which this invention is directed may be of the semi-automatic or fully automatic type. A semi-automatic lighter is one having a normally-closed cover member that is rotatable, by the user's finger, to the open position. Rotation of the cover member to the open position imparts a corresponding rotation to a sparking wheel which is in peripheral contact with a flint, thereby generating sparks which are directed to a saturated wick. In such semi-automatic lighter the cover member must be rotated manually to the closed position. In a fully automatic lighter, the cover member is spring-biased such that it automatically returns to the normally-closed position upon removal of the user's finger therefrom.

The operating reliability of a lighter depends upon a positive and adequate production of sparks for each and every actuation of the sparking wheel. In lighters of conventional construction, therefore, it is necessary for the user to impart a brisk, rotational force to the finger-operable member to cause a rapid rotation of the sparking wheel against the flint. A relatively slow rotation of such member generally is inadequate to produce the necessary sparks for such positive ignition of the wick. Various arrangements have heretofore been proposed to render it impossible for the user to rotate the sparking wheel at a velocity below that required for the positive production of adequate sparks. These arrangements include means restraining rotation of the sparking wheel until the pressure exerted on the cover member exceeds a predetermined magnitude. Once this pressure is exceeded, the cover member snaps to the open position thereby imparting a corresponding snap-action rotation of the sparking wheel. However, the prior arrangements providing a snap-action operation of the lighter are complicated and/or delicate mechanisms including gears, plungers, levers, or etc., all of which increase substantially the manufacturing and assembly costs and tend to reduce the operating life of the device due to wear and misalignment of the parts. A lighter made in accordance with this invention provides a snap-action operation for the positive ignition of the wick and requres a minimum number of parts.

An object of this invention is the provision of a lighter having simple, novel means for producing a snap-action operation and which is of simple construction thereby reducing manufacturing costs and providing a long, reliable operating life.

An object of this invention is the provision of a lighter wherein all operative components of the spark producing mechanism are mounted on a common shaft.

An object of this invention is the provision of a lighter wherein a snap-action actuation of the sparking wheel is achieved by disposing at least a portion of the flint end in one of a plurality of recesses formed in the peripheral surface of the sparking wheel.

An object of this invention is the provision of a fully automatic lighter having a sparking wheel rotatable about a shaft, a finger-operable member rotatable about said shaft, means normally biasing the finger-operable member to the closed position, means for imparting a corresponding rotation to the sparking wheel upon rotation of the finger-operable member to the open position, and means restraining rotation of the sparking wheel until the pressure exerted on the finger-operable member exceeds a predetermined magnitude.

These and other objects and advantages will become apparent from the following description when taken with the accompanying drawings showing several embodiments of the invention. It will be understood, however, that the drawings are for purposes of illustration and are not to be construed as defining the scope or limits of the invention, reference being had for the latter purpose to the claims appended hereto.

In the drawings wherein like reference characters denote like parts in the several views:

FIGURE 1 is a side view of a pocket lighter made in accordance with this invention and showing the finger-operable cover member in the normal, closed position;

FIGURE 2 is a similar view showing the cover member in the open position and with certain parts broken away for purposes of description;

FIGURE 3 is a view showing the back of the lighter;

FIGURE 4 is an enlarged, fragmentary view of the upper portion of the lighter taken in the direction of the arrow marked X in FIGURE 2, with certain parts shown in section and with the wick omitted;

FIGURE 5 is an isometric view of the split, spring washer for providing a ratchet rotation of the sparking wheel;

FIGURE 6 is an enlarged side view showing a sparking wheel made in accordance with one embodiment of this invention;

FIGURE 7 is a side view of the wheel shown in FIGURE 6;

FIGURE 8 is an enlarged, fragmentary, side view of a sparking wheel made in accordance with another embodiment of this invention;

FIGURE 9 is a similar view showing another form of the sparking wheel; and

FIGURES 10 and 11 are similar views of a sparking wheel made in accordance with still another embodiment of the invention.

Referring, now, specifically to FIGURES 1–4, the lighter housing comprises a case **10** of a convenient size to be held in the hand and a cup or cover member **11** that is pivotally secured to the case by a rivet, or shaft, **12**. The upper surface of the cover preferably is formed to include a more or less upstanding surface **13** to accommodate the thumb of the user so that a generally downward, clockwise pressure applied thereto by the thumb will cause the cover to rotate about the shaft **12** to the open position as shown in FIGURE 2. The cover **11** is spring biased to the closed position as will be described hereinbelow.

The lower portion of the case constitutes a chamber for the lighter fluid. A wick **14** extends into the fluid chamber through a bushing **15** and a rod of flint **16** has one end pressed into contact with the peripheral surface of a sparking wheel **17**. The flat end protrudes from a bushing **18** which bushing extends through the fluid chamber and communicates with a threaded hole formed in the base of the lighter. The threaded hole is closed by a screw having an inner end in contact with a coiled spring **19** which biases the flint against the sparking wheel. Such construction is conventional in this art and, therefore, is not shown in detail in the drawings.

In lighters of this type, the peripheral surface of the sparking wheel has teeth formed thereon so that rotation of the wheel against the flint generates sparks which are directed to the fluid-saturated wick to produce a flame 20. As is well known in this art, one face of the sparking wheel is provided with a plurality of sloping, integral bosses 21 (see FIGURE 7), generally five in number, each boss being defined by an upstanding, substantially, radially-extending wall. Drive means in the form of a radially-split washer 22 (see FIGURE 5) made of suitable spring material, is disposed on the same shaft as the sparking wheel and in abutting relation to that face of the sparking wheel which carries the bosses 21. The arrangement is such that rotation of the washer in one direction causes the offset portion of the washer to engage the upstanding wall of a cooperating boss to thereby rotate the wheel one-fifth of a revolution. Rotation of the washer in the reverse direction merely results in such offset portion sliding over the sloping surface of the boss into position to engage the upstanding wall of the adjacent boss. Thus, oscillatory rotation of the washer through an appropriate angular extent results in a ratchet type action to cause a step-by-step rotation of the wheel in one direction.

The radially-split washer 22 is provided with an integral extension or arm 23 having a bifurcated end. In the assembled lighter, see particularly FIGURES 2 and 4, the cover 11 carries a pin 24 which is disposed in the slot formed in the arm 23 of the washer 22. It is here pointed out that the finger-operable member or cover 11, the sparking wheel 17 and the split washer 22 are all mounted on a single shaft 12. This is one of the important features of the invention. The shaft 12 may be a rivet having each end peened over, as shown. Alternatively, the shaft may be of the screw type, as is common practice in this art. In any case, the mounting of operating components of the sparking mechanism on a single shaft provides economy of manufacture, ease of assembly and, importantly, promotes a long trouble free operating life.

The assembly of the operative components of the lighter is best shown in FIGURE 4. The wall 25, defining the fluid chamber, carries a generally U-shaped member having spaced arms 26 which serve as bearings for the shaft 12, which shaft extends through opposed side walls of the case 10. The split washer 22 is mechanically coupled to the rotatable cover 11 by means of the pin 24 passing through the slot formed in the washer arm 23. The action is such that rotation of the cover to the open position produces a corresponding rotation of the washer 22 which, in turn, produces a corresponding rotation of the sparking wheel 17. Rotation of the cover back to the closed position merely results in a slip action of the washer relative to the sparking wheel. As shown in FIGURE 4, the cover 11 also carries a small, headed rivet 27 which serves as a stop for one end of a suitable spring wire 28. An intermediate portion of the wire is coiled about a fixed pin 29 and the other end abuts the wall 25. The spring wire is arranged so that the cover 11 normally is biased to the closed position. Such spring-biased cover results in a fully-automatic lighter in that the cover returns to the closed position upon removal of the user's thumb therefrom. In a semi-automatic lighter, the spring 28 is omitted and the cover must be closed manually after each operation of the lighter. In the latter case, it is desirable to provide a simple latching arrangement for retaining the cover in the closed position. This function is readily provided by a small ball bearing 30 partially protruding from the front wall of the cover and spring-biased by a coiled spring 31. The front wall of the case is provided with an aligned opening or detent to accommodate a portion of the ball bearing when the cover is in the closed position and overlapped thereby. A tube 32 snuffs out the flame when the cover is returned to the normal closed position.

I provide a snap-action rotation of the sparking wheel, in response to rotation of the cover to the open position, by a novel configuration of the peripheral surface of the sparking wheel. Reference is now made to FIGURES 6 and 7 which show the sparking wheel 17 and the cooperating end of the flint 16. In this case, the peripheral surface of the wheel is provided with a plurality of recesses 34. The number of such recesses corresponds to the number of bosses 21 formed in the wheel face. Each recess has a peripheral length slightly greater than the diameter of the flint and the recesses are so oriented with respect to the bosses 21 that the end of the flint is disposed within a recess when the cover of the lighter is in the closed position. Thus, when the user applies a rotative pressure to the cover, the flint end will tend to prevent rotation of the wheel 17 (and the cover) until the pressure applied to the cover is sufficient to overcome the restraining force arising by reason of the end surface of the flint lying within the outer diameter of the wheel. By proper design of the flint-biasing spring 19 (see FIGURE 2), the depth of the peripheral recesses 34, and the slope of the trailing wall S of the recess, the finger pressure required to produce a snap rotation of the wheel can be held to a practicable range. The important feature of such construction of the wheel lies in the fact that it is impossible to rotate the wheel slowly to produce a non-ignition operation of the lighter.

It is not necessary that the peripheral recesses formed in the sparking wheel have a length to accommodate the entire end of the flint. FIGURE 8 is a fragmentary view showing an arrangement wherein the axis of the flint 16 is laterally offset relative to a vertical plane containing the rotational axis of the wheel. In this case, the peripheral recesses 34A have bottom walls lying substantially on a segment of the circle corresponding to the wheel diameter. As shown in FIGURE 8, the relative disposition of the flint and the sparking wheel is that which prevails when the cover of the lighter is in the closed position.

FIGURE 9 illustrates another embodiment of the invention as it relates to the sparking wheel and flint. Here the axis of the flint 16 is angularly offset with respect to the vertical, diametric line of the wheel. The leading teeth, that is, those which will strike the flint upon clockwise rotation of the wheel, are progressively of increased radial length. When the cover of the lighter is in the closed position, the flint and wheel are oriented as shown in the drawing. It will be noted that the shortest tooth rests upon the end surface of the flint. By reason of the offset flint axis, the pressure required to rotate the sparking wheel must be sufficient to press the flint generally downwardly against the force of the flint-biasing spring. The magnitude of such pressure will depend upon the compression characteristic of the flint-biasing spring and the extent to which the flint axis is offset from vertical. As the wheel rotates, the leading tooth scrapes into the inclined end surface of the flint, thereby requiring an increased finger pressure for further wheel rotation. As the flint is depressed, the next longer tooth also scrapes into the flint surface and so on until the longest tooth forces the flint down to the maximum extent. Thus, in this arrangement, the progressively longer teeth scrape along the inclined flint surface requiring a progressively increasing force to maintain wheel rotation through one cycle of operation. This requirement for a progressively increasing actuating force prevents a slow rotation of the wheel by the user. Further, and importantly, the action of the progressively longer teeth against the inclined surface of the flint end results in a multiple scraping action, thereby producing positive sparking for ignition of the wick.

The flint generally used in lighters of this type is relatively soft. Consequently, in a conventional lighter having a sparking wheel of uniform diameter, that is, wherein the teeth are all of equal length, the end surface of the flint soon becomes worn and conforms to the wheel diameter. When this occurs, the possibility of failure increases, that is, each and every operation of the lighter does not produce adequate sparking for positive ignition of the

wick. With the wheel constructed as shown in FIGURES 6–8, the possibility of failure due to this cause is very substantially reduced due to the positive snap-action of the wheel. With the construction shown in FIGURE 9, the wearing down of the flint end is of no consequence, with respect to lighter operation, as some portion of the flint end always is disposed within the circle generated by the longest teeth of the wheel.

Reference is now made to FIGURES 10 and 11 which illustrate an arrangement providing an exceptionally smooth lighter operation and, at the same time, the positive generation of sparks more than adequate for ignition of the wick. This embodiment of the invention is somewhat similar to that shown in FIGURE 9 in that those teeth moving into contact with the flint surface are of progressively increased length. However, the peripheral extent of each wheel recess is somewhat shorter. When the cover of the lighter is in the closed position, the flint and the wheel 17C are oriented as shown in FIGURE 10. Specifically, the last two or three of the trailing teeth rest upon the flint surface. Now, as the wheel is rotated a small extent, these teeth will move beyond the flint permitting the flint to snap toward the wheel under the action of the flint-biasing spring. When the flint snaps into the peripheral recess 34C, it strikes at least one of the relatively short teeth, as shown in FIGURE 11, causing such teeth actually to dig into the flint surface. As stated hereinabove, the flint is relatively soft. However, the difference in diameter between the longest and shortest teeth on the wheel is very small. Also, the force exerted against the flint by the flint-biasing spring is not unduly great, so that the extent to which the short teeth bite into the flint surface is only to a minor extent. Nevertheless, such puncturing of the flint surface is sufficient to cause a substantial scraping action of the teeth along the inclined flint surface in response to further wheel rotation thereby producing a great quantity of sparks.

It will now be apparent that a lighter made in accordance with this invention includes a minimum number of parts. The finger-operable member, or cover, the sparking wheel, and the wheel-driving split washer constitute the working elements of the sparking mechanism. These elements are rotatably mounted on a common shaft thereby eliminating complex gearing and promoting a long operating life. The arrangement for providing a snap action of the sparking wheel involves merely the provision of recesses in the peripheral surface of the wheel as contrasted to spring and/or plunger mechanisms heretofore proposed.

While I have shown and described various specific embodiments of my invention, those skilled in this art will have no difficulty in making changes and modifications as described or required. For example, it is apparent that the split washer for rotation of the sparking wheel need not be provided with a bifurcated end for accommodation of a pin carried by the cover. The configuration of the cover may be such that a plain arm on the washer may be confined between suitable detents, or etc., to assure simultaneous rotation of the cover and washer. Also, the number and form of the recesses formed in the peripheral surface of the sparking wheel may be altered to suit production requirements. These and other changes and modifications may be made without departing from the spirit and scope of the invention as recited in the following claims.

I claim:

1. A lighter comprising a generally rectangular case having front, side and end walls, a transverse wall closing an end of the case in a plane spaced inwardly from the free edges of the front and side walls, the rear wall of the case terminating at said transverse wall to thereby form a clearance area, a wick extending through said transverse wall, a bearing bracket carried by said transverse wall, a shaft carried by said bracket, a sparking wheel rotatably mounted on said shaft and having peripheral teeth in contact with an end of a flint, a ratchet drive rotatably mounted on said shaft to rotate the sparking wheel, a unitary hollow cover having a portion disposed within the said clearance area, said cover including finger-operable means for rotating it about the axis of said shaft to open position, said cover having a headed rivet, a fixed pin connecting the side walls of said case, a spring coiled about said pin and having one end engaging said rivet and the other end engaging said transverse wall so as to always urge the cover to closed position, and means mechanically coupling the ratchet drive to the cover for rotation of the sparking wheel when the cover is rotated from closed to open position.

2. In a lighter of the class comprising a case, a wick, a flint, a sparking wheel carried by a shaft and having peripheral teeth adapted to contact an end of said flint, a finger-operable member, means to spring-bias said member to a single first position, a ratchet drive member mounted on the said shaft and coupled to the finger-operable member, said drive member cooperating with the said wheel to impart limited angular rotation to the wheel upon movement of the finger-operable member from the first to a second position; the improvement wherein the finger-operable member is a unitary, hollow cover enclosing the said flint, wheel and wick when in the first position, wherein the said cover is pivotally mounted on the said shaft such that the said shaft constitutes the rotational axis of said finger-operable member, the sparking wheel is provided with a plurality of spaced recesses formed in the periphery thereof, wherein the teeth proximate to one end of each recess have a radial length less than that of the teeth proximate to the other end of each recess, and wherein one face of said wheel is provided with a plurality of sloping bosses corresponding in number and spacing with said recesses and the ratchet drive member sequentially engages said bosses during operation of the lighter, said bosses being so positioned with respect to said recesses that the end of the flint is in surface contact with at least one of the relatively longer teeth proximate to the other end of a recess when the finger-operable member is in the first position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,038,048	Kilstrom	Apr. 21, 1936
2,552,718	Hutchinson et al.	May 15, 1951
3,007,328	Zahn	Nov. 7, 1961

FOREIGN PATENTS

495,249	France	June 21, 1919
669,384	France	Aug. 3, 1929
413,181	Great Britain	July 12, 1934
933,835	France	Jan. 5, 1948
188,127	Austria	Dec. 27, 1956