Sept. 6, 1949. R. L. BURCHETT ET AL 2,481,195

PYROPHORIC LIGHTER

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Fig. 1

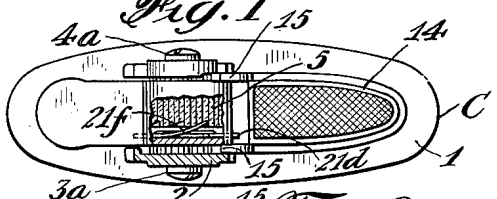


Fig. 2

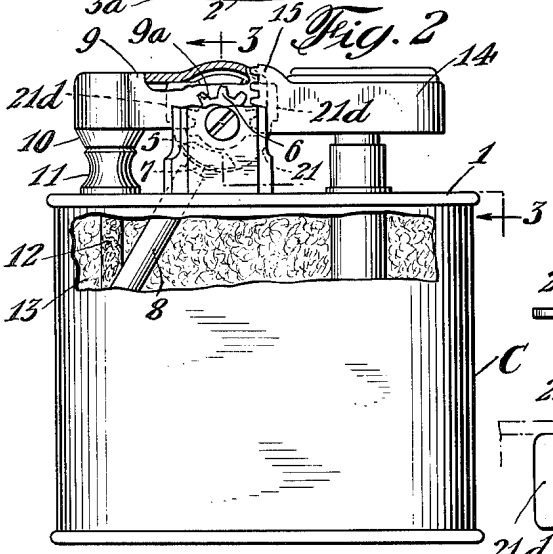


Fig. 3

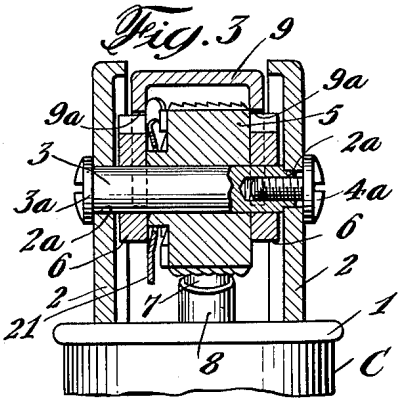


Fig. 5

Fig. 6

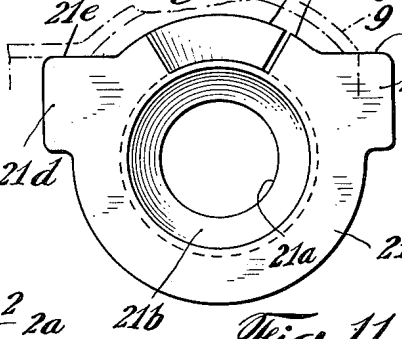


Fig. 7

Fig. 8

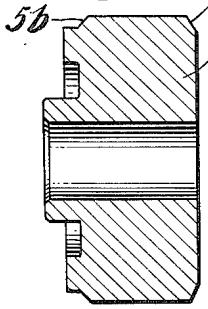


Fig. 4

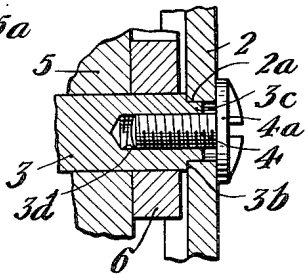


Fig. 11

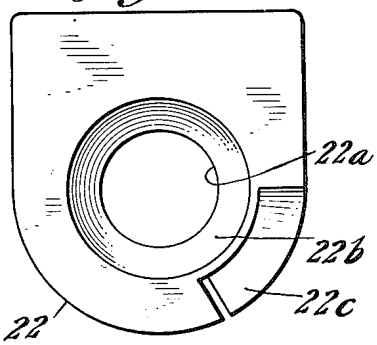


Fig. 9

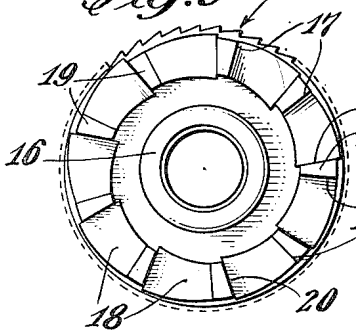
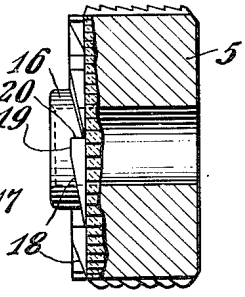


Fig. 10



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PYROPHORIC LIGHTER

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Fig. 12

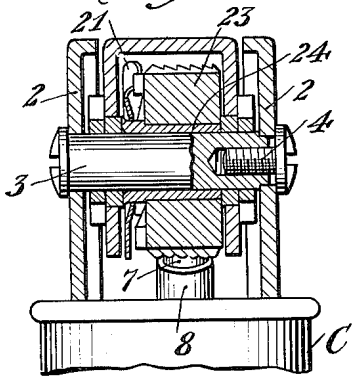


Fig. 13

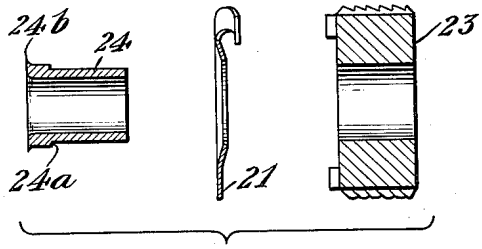


Fig. 15

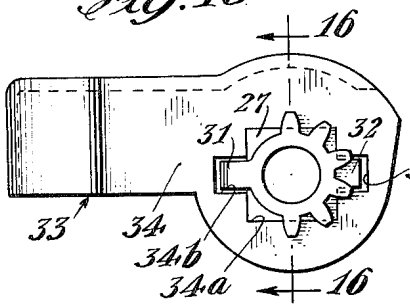


Fig. 16

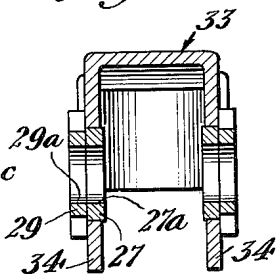


Fig. 14

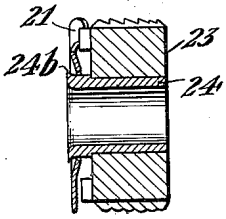


Fig. 17

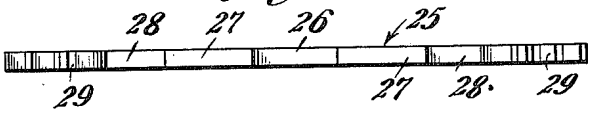


Fig. 18

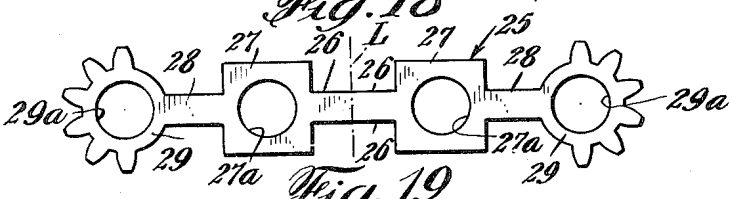


Fig. 19

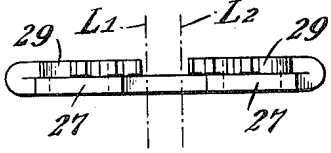
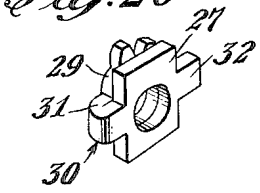


Fig. 20



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2,481,195

UNITED STATES PATENT OFFICE

2,481,195

PYROPHORIC LIGHTER

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Application January 9, 1946, Serial No. 640,064

4 Claims. (Cl. 67—7.1)

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Our invention relates to pyrophoric lighters.

The usual pyrophoric lighter comprises a serrated wheel which is engaged by a spring-pressed pyrophoric element. Each time that the lighter is operated, a step of rotative movement is imparted to the serrated wheel. In accordance with our invention, the serrated wheel of such a pyrophoric lighter is loosely mounted on a member or axle which, in an improved manner, is nonrotatably secured to a pair of supporting standards therefor.

Our invention has further reference to ratchet mechanism for imparting step-by-step rotative movement to the serrated wheel of a pyrophoric lighter, such mechanism comprising a clutch disk which is supported in a novel manner by a tubular extension or shoulder which projects from the serrated wheel.

Further, our invention relates to novel pinion or gear segment arrangements which are associated with the side walls of a snuffer lever to thereby produce an oscillatory unit forming part of the lighter mechanism.

Still further, our invention relates to a method of producing a serrated wheel for a pyrophoric lighter which involves the initial formation of chamfers or bevels at the peripheral corners of an unfinished wheel and the subsequent formation thereon of peripheral serrations and side face ratchet teeth.

Our invention has further reference to a novel method of producing integral gear segment and block arrangements which are associated with the respective side walls of a snuffer lever for a pyrophoric lighter.

Various other objects, advantages and features of our invention will become apparent from the following detailed description.

Our invention resides in the features, combinations, arrangements and method steps of the character hereinafter described and claimed.

For an understanding of our invention and for an illustration of some of the forms thereof, reference is to be had to the accompanying drawings, in which:

Figure 1 is a plan view, partly broken away, showing a pyrophoric lighter constructed in accordance with our invention;

Fig. 2 is an elevational view, partly broken away, showing the pyrophoric lighter of Fig. 1;

Fig. 3 is an enlarged, vertical sectional view, partly in elevation, taken on the line 3—3 of Fig. 2 looking in the direction of the arrows;

Fig. 4 is an enlarged, vertical sectional view illustrating a detailed feature of the invention;

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Figs. 5, 6 and 7 are elevational views showing the novel clutch disk of our invention;

Fig. 8 is a vertical sectional view showing an incomplete wheel destined to form a serrated wheel for a pyrophoric lighter;

Figs. 9 and 10, respectively, are front and side elevational views showing a finished serrated wheel formed from the wheel shown in Fig. 8;

Fig. 11 is an elevational view showing a modified form of clutch disk;

Fig. 12 is a vertical sectional view, partly in elevation, illustrating an improved operating arrangement for a pyrophoric lighter;

Fig. 13 is a vertical sectional view showing parts of the mechanism of Fig. 12 in disassembled relation;

Fig. 14 is a vertical sectional view illustrating the parts of Fig. 13 in assembled relation;

Fig. 15 is an elevational view showing a snuffer lever and an associated gear segment arrangement;

Fig. 16 is a transverse sectional view taken on the line 16—16 of Fig. 15 looking in the direction of the arrows;

Figs. 17 and 18, respectively, are elevational and plan views illustrating a blank destined to form the two gear segment arrangement shown in Fig. 16;

Fig. 19 is an elevational view showing the blank of Figs. 17 and 18 after it has been subjected to a manufacturing operation; and

Fig. 20 is a perspective view illustrating a novel gear segment arrangement of our invention.

Referring particularly to Figs. 1 and 2, we have shown a pyrophoric lighter casing C having a top wall 1 from which a pair of spaced standards or supports 2 extend in parallel, vertical relation. These standards 2 are provided, respectively, with apertures or passages 2*a* which are transversely alined for the reception of a horizontal axle or member 3 having its head 3*a* flushly engaging the exterior surface of that standard 2 at the left, Fig. 3. Referring to Figs. 3 and 4, the other end of the axle 3 is shown as comprising a flange or shoulder 3*b* beyond which extends a diametrically reduced end portion 3*c* of said axle 3. As illustrated, the shoulder 3*b* abuts the inner surface of that standard 2 at the right, Figs. 3 and 4, and the axle end portion 3*c* is freely received in the passage 2*a* formed in said last named standard 2. Extending into the axle 3 at the end thereof opposite the head 3*a* is a threaded passage 3*d* which receives the threaded shank of a screw 4, the head 4*a* of which flushly engages the exterior surface of that standard 2 at the right, Figs. 3 and 4.

In view of the foregoing, it will be understood that the head 3*a* of the axle 3 may be held stationary by a screw driver and that another screw driver may be engaged with the head 4*a* of the screw 4 to tighten the same. As a result, the shoulder 3*b* of the axle 3 is brought into binding engagement with the inner surface of the adjacent standard 2 and the flat underside of the screw head 4*a* is brought into binding engagement with the exterior surface of said standard 2. Hence, during operation of the lighter mechanism as hereinafter described, rotation of said axle 3 is positively prevented.

As shown particularly in Fig. 3, the axle 3 supports a hardened metallic, peripherally serrated wheel 5 and a pair of gear segments 6 which are disposed at opposite respective sides of said serrated wheel 5. The arrangement is such that the serrated wheel 5 and the gear segment 6 are freely rotatable on the axle 3. In known manner, a pyrophoric element 7 projecting from an appropriate tube 8 is maintained under spring pressure in engagement with the serrated wheel 5.

A snuffer lever 9 comprising parallel side walls is so constructed that each side wall, in proper location, has a tooth-shaped piercing 9*a*. These tooth-shaped piercing 9*a* are transversely alined and each of them, in meshing relation, receives a gear segment 6. Accordingly, in the manner hereinafter described, the gear segments 6 may be actuated to effect unitary rotary movement thereof and the associated snuffer lever 9 about the axis defined by the axle 3. As well known in the art, the snuffer lever 9 may carry a snuffer cap 10 which engages the upper surface of a wick tube 11 secured to the top casing wall 1. A wick 12 extends through and terminates above the wick tube 11, said wick 12 depending into the casing C where it is disposed in fuel-transferring relation with suitable fuel such as that contained in a mass of cotton 13 or the like.

From a consideration of Fig. 3, it will be noted that the thickness of each gear segment 6 is substantially greater than the thickness of each side wall of the snuffer lever 9. Further, the arrangement is such that the outer portion of each gear segment 6 is disposed outwardly of the adjacent side wall of the snuffer lever 9. A thumb or finger piece 14 mounted for vertical reciprocatory movement in known manner above the top casing wall 1 comprises a pair of parallel rack extensions 15 which mesh, respectively, with said outer portions of the respective gear segments 6.

Referring to Figs. 3 and 10, the aforesaid serrated wheel 5 is shown as comprising an integral tubular extension 16 which is symmetrical with respect to the longitudinal axis of the axle 3, this tubular extension 16 forming a shoulder which supports the clutch disk hereinafter referred to. The side face of the serrated wheel 5, between the tubular extension 16 and the periphery thereof, is shaped to form a circular row of ratchet teeth as indicated at 17, Fig. 9, each ratchet tooth defining an arc of the circle. With the serrated wheel 5 disposed in a vertical plane as shown in Figs. 9 and 10, each ratchet tooth 17 comprises an inclined surface 18 which merges into a surface 19 (the high part of the ratchet tooth) disposed in a vertical plane extending preferably parallel with the plane of the serrated wheel 5. The surface 19 terminates in a surface 20 (the part of the ratchet tooth which is gripped by the hereinafter described clutch tooth of the clutch disk) extending longitudinally and approximately radially of the serrated wheel 5. At its "low" or inner end, the surface 19 merges into the inclined surface 17 of the next successive ratchet tooth, this being the low part of the ratchet tooth. In view of the foregoing, it will be understood that all of the ratchet tooth surfaces 19 are disposed in a common plane extending parallel with the plane of the serrated wheel 5. As an incident of the manufacturing operation, each ratchet tooth has flared configuration along the arc defined thereby, Fig. 9.

Referring to Figs. 5, 6 and 7, we have shown a disk or member 21 formed preferably from hardened, resilient steel and having a circular passage 21*a*, the diameter of which is slightly greater than the diameter of the aforesaid shoulder 16 of the serrated wheel 5. In accordance with the invention and as indicated at 21*b*, the disk 21 is provided with a circular dished portion extending circumferentially around the disk passage 21*a*. Further, the disk 21, at any selected location in the outer portion thereof, is slotted generally in a radial direction so that the resilient disk material may be displaced and permanently set in angular relation to the disk plane whereby there is formed a resilient, clutch tooth 21*c* which is disposed at the same side of said disk 21 as is the aforesaid dished portion 21*b* thereof. Still further, the disk 21, in the plane thereof, should be provided with symmetrical, oppositely extending end portions 21*d*, 21*d* disposed at the upper side thereof when said disk 21 is positioned as shown in Fig. 6, the upper straight surfaces 21*e* of these projecting portions being joined by a curved surface 21*f* which, in part, is defined by the upper surface of the clutch tooth 21*c* when the latter is positioned between said portions 21*d* and 21*d*, as described.

In Fig. 3, the parts of lighter mechanism hereinbefore described are shown in assembled relation. The axle 3 is non-rotatably secured to the standards 2 in the manner described above and said axle 3 supports the serrated wheel 5 and gear segments 6 in such manner that these parts are freely oscillatory thereon. The standards 2 closely engage the respective outer surface of the gear segment 6 and, hence, prevent movement of the assembly longitudially along the axle 3. In the manner described, the gear segments 6 are meshed with the respective tooth-shaped piercings 9*a* of the snuffer lever 9. The clutch disk 21 is mounted for free movement on the tubular extension 16 of the serrated wheel 5 and the upper straight surfaces 21*e* together with the connecting curved surface 21*f* of said clutch disk 21 are in engagement with the corresponding interior surface of the snuffer lever 9 as indicated in Figs. 2 and 6. By virtue of the arrangement last described, the clutch disk 21 is associated with the snuffer lever 9 in such manner that it is oscillatory therewith as a unit. The clutch tooth 21*c* of the clutch disk 21, due to its inherent resiliency and set configuration, engages that surface of the serrated wheel 5 on which the hereinbefore described ratchet teeth 17 are formed and, during operation of the lighter mechanism, coacts in ratchet fashion with said ratchet teeth.

When the thumb piece 14 is manually depressed, Fig. 2, the rack extensions 15 thereof coact with the respective gear segments 6 to effect oscillatory movement in a clockwise direction, Fig. 2, of the snuffer lever 9 and the clutch disk 21. In response to this movement, the clutch tooth 21*c* of said clutch disk 21 engages a ratchet tooth surface 20 and, as a result, the serrated wheel 5

is caused to partake of clockwise movement, Fig. 2, along with the snuffer lever 9 and the clutch disk 21. As a result, the serrated wheel 5 coacts with the pyrophoric element 7 to produce a shower of sparks which are directed toward and into engagement with the upper end of the wick 12 which is now exposed.

When the thumb piece 14 is released, a spring, not shown, returns said thumb piece to elevated position and, as a result, the snuffer lever 9 is also returned to its normal position, Fig. 2. As stated, the clutch disk 21 moves with the snuffer lever 9 and, therefore, during the snuffer lever movement last described, said clutch disk 21 moves with respect to the serrated wheel 5, which at this time is stationary, the clutch tooth 21c idling or sliding past the ratchet teeth 17.

A lighter mechanism of the character described above is advantageous in several respects. Thus, the member or axle 3, by virtue of the described clamping arrangement therefor, continuously remains stationary or non-rotatable with respect to its supporting standards 2. Therefore, during operation of the lighter mechanism, there is no tendency for wear to occur between the member 3 and said standards 2 with resultant enlargement of the standard passages 2a and consequent undesired misalignment of the lighter parts.

Another feature of importance centers around the tubular extension or shoulder 16 of the serrated wheel 5 and the clutch disk 21. This tubular extension 16 effectively supports the clutch disk 21 and the dished portion 21b of the latter serves to prevent any substantial movement of said clutch disk 21 either toward or from the serrated wheel 5 or the adjacent gear segment 6. Preferably, the thickness of the clutch disk 21 is of the order of 0.007 inch more or less. For practical manufacturing tolerances and in the absence of the dished portion 21b, undesired sidewise movement of said clutch disk might develop during operation of the lighter mechanism. If so, the clutch disk 21 might become displaced from its supporting shoulder 16 and come to rest on the axle 3 in which case the mechanism would bind or become inoperative.

The clutch disk 21 may advantageously be formed by a simple stamping operation and the provision of the end portions 21d, 21d effectively anchor said clutch disk within the snuffer lever 9.

Referring to Fig. 11, we have shown a modified clutch disk 22 which may have any required or desired outer configuration and which preferably, is formed from hardened, resilient steel. The clutch disk 22, the same as the aforesaid clutch disk 21, is provided with a circular passage 22a which is surrounded by a dished portion 22b, the outer portion of said disk 22 at any suitable location, being provided with an angular clutch tooth 22c. The upper surface of the clutch disk 22 is defined by a straight surface which, at its corners, engages the interior surface of the snuffer lever 9 when these parts are supported in assembled relation by the member or axle 3. Accordingly, it will be understood that, when the clutch disk 22 forms part of a lighter mechanism, said clutch disk 22 is oscillatory as a unit with the snuffer lever 9 and serves to impart uni-directional movement to the serrated wheel 5 in the manner hereinbefore described with respect to the clutch disk 21.

Referring to Fig. 8, we have shown a wheel blank 5a from which the serrated wheel 5 is to be formed, the wheel 5a being complete except for hardening thereof to the desired temper and the

formation thereon of the peripheral serrations together with the ratchet teeth 17. In accordance with the invention, each peripheral corner of the wheel 5a is beveled or chamfered as indicated at 5b. When the wheel 5a is subjected to a pressing operation in order to form the ratchet teeth 17, the material is displaced outwardly toward the periphery of the serrated wheel. The bevel or chamfer 5b at the left, Fig. 8, permits such displacement of material to occur without resulting in radial enlargement of the wheel at the side thereof on which the ratchet teeth are formed. Should such radial enlargement occur the effect thereof would be undesirable because interfering with the formation of the peripheral serrations hereinafter described. Thereafter, when the wheel 5a is subjected to a cutting or other operation in order to form the peripheral serrations which are engaged by the pyrophoric element 7, the peripheral material moves sidewise to some extent with consequent increase in the thickness of the wheel at its periphery. However, due to the presence of the bevels or chamfers 5b, this increase in thickness does not become large or greater than the normal thickness of the serrated wheel. Hence, during operation of the assembled lighter mechanism, there is no undesired engagement of the serrated wheel 5 with the side walls of the snuffer lever. The bevels or chamfers 5b, then, permit formation of the serrations and ratchet teeth on the wheel 5a without increase in dimensions at the peripheral corners thereof. This is advantageous because preventing the production of a finished serrated wheel which is dimensionally inaccurate and, hence, not properly cooperative with the associated parts of a lighter mechanism.

Referring to Fig. 13, we have shown a serrated wheel 23 which corresponds with the serrated wheel 5 hereinbefore described with the exception that the longitudinal passage therethrough has somewhat greater diameter. A tubular shaft 24 is adapted to extend into the passage of the serrated wheel 23 to the extent permitted by a flange 24a defined by said shaft 24. At its end toward the left, Fig. 13, the shaft 24 terminates in an enlarged portion or shoulder 24b.

Either clutch disk 21 of the character hereinbefore described, or equivalent, is passed from right to left, Fig. 13, onto the tubular shaft 24 and seated on the enlarged portion thereof toward the left. In this connection, it will be understood that the internal diameter of the circular passage of the clutch disk 21 is slightly larger than the external diameter of said enlarged shaft portion whereby said clutch disk is freely rotatable on said tubular shaft 24. After this assembly has been completed, the tubular shaft 24 is passed into the central passage of the serrated wheel 23 until the shaft flange 24a engages said serrated wheel 23. This yields an assembly of the character illustrated in Fig. 14 and, in connection therewith, it will be understood that the tubular shaft 24 is secured to the serrated wheel 23 in any desired manner, as by a driven fit, that these parts are rotatable together as a unit. As regards the assembly last noted, it will be understood that the clutch disk 21 is freely rotatable on the extending portion of the tubular shaft 24 and that the diameter of the enlarged portion 24b of said shaft 24 is greater than the diameter of the circular clutch disk passage whereby the clutch disk 21 is retained in position on the end of the tubular shaft 24.

In Fig. 12, we have shown a lighter mechanism of which the assembly illustrated in Fig. 14 forms a part. The lighter mechanism of Fig. 12 operates in the same advantageous way as hereinbefore described with respect to the lighter mechanism of Figs. 1, 2 and 3.

Referring to Figs. 17 and 18, we have shown a one-piece blank 25 which, at opposite respective sides of the transverse center line L, is formed from duplicate portions. From the location of the center line L, each blank portion, in the order named, comprises a strip-like member 26, a square block or member 27 having a central passage 27*a*, a neck 28 and a pinion or gear segment 29 having a central passage 29*a*. In accordance with the invention, the respective gear segments 29 are folded symmetrically onto the blocks 27 to produce the structure illustrated in Fig. 19 wherein a part only of the integral strip-like members 26 are exposed. This folding operation is characterized by alinement of the respective sets of block and gear segment passages 27*a*, 29*a* all of which may have any desired or required diameter. Thereafter, the structure of Fig. 19 is cut along the lines L1, L2 to thereby produce a pair of duplicate gear segment arrangements 30 of the character shown in Fig. 20. In connection with this gear segment arrangement, it will be noted that the ends of the gear teeth extend to some extent beyond the sides of the block 27. Further, it will be noted that each gear segment arrangement 30 comprises a folded member 31 which is formed from the neck 28 previously described and that, in alinement therewith, a member 32 extends from the block 27, this member 32 being a part of the aforesaid strip-like member 26.

In Figs. 15 and 16, we have illustrated a snuffer lever 33 which, in known manner, comprises a pair of parallel side walls 34, 34 depending from an integral top wall. Each side wall 34, in the enlarged portion thereof, is provided with a square passage 34*a*, these passages 34*a* being transversely alined and each being adapted to receive the block 27 of a gear segment arrangement. Extending in opposite directions from each passage 34*a* are alined clearance passages 34*b*, 34*c* adapted to very loosely receive the members 31 and 32 of the aforesaid gear arrangement.

In view of the foregoing, it will be understood that each snuffer lever passage 34*a* is adapted to have disposed therein a block 27 of a gear segment arrangement 30, the gear segment 29 of each gear segment arrangement being disposed exteriorly of the adjacent snuffer cap surface, Fig. 16, and facing in the opposite direction from the snuffer cap end of the snuffer lever. From a consideration of Fig. 16, it will be noted that the ends of each set of gear teeth are in engagement with an exterior wall surface of the snuffer lever 33. Inward displacement of the two gear segment arrangements is thereby prevented, this being a highly desirable feature because contributing to the ease of the assembling operation. It will also be noted that the sets of passages 27*a*, 29*a* are in transverse alinement for the reception of the hereinbefore described axle 3, or equivalent.

It will be obvious to those familiar with the type of pyrophoric lighter herein illustrated that the assembly illustrated in Fig. 16 may readily be associated with the other component parts of the lighter mechanism to produce a complete lighter assembly as shown in Fig. 12. When assembled, the rack extensions 15 hereinbefore described mesh with the respective gear segments 29. Upon depression of the thumb piece, power is transmitted to said gear segments 29 and thence to the snuffer lever 33 by way of the driving connections formed by the blocks 27 which, as described, closely engage the surfaces defining the respective snuffer cap passages 34*a*.

Gear segment arrangements of the character described can be preduced more expeditiously and less expensively than can prior art arrangements utilizable for the same purpose. The gear or pinion teeth are more perfect and the critical dimension between facing surfaces of the blocks 27, Fig. 16, conforms in a highly desirable manner to the requirements imposed by manufacturing requirements.

While the invention has been described with respect to certain particular preferred examples which give satisfactory results, it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent is:

1. A lighter having a fuel casing, an axle supported adjacent said casing, a wick, a snuffer for said wick having a side wall provided with a non-circular opening adjacent said axle, and a fitting of U-shaped section having its legs pivoted about said axle, one of said legs engaging in the aforesaid opening in the snuffer said wall, and the remaining leg of said fitting being disposed outwardly of said snuffer side wall, a reciprocable fingerpiece located adjacent said snuffer, said last mentioned leg of the fitting and said fingerpiece having complementary driving and driven parts engaging to open and close the snuffer as the fingerpiece is reciprocated.

2. A lighter having a fuel casing, spaced parallel supporting standards projecting therefrom, an axle extending between said standards, a wick, a snuffer for said wick having opposite side walls disposed between said standards, each side wall having a non-circular opening adjacent said axle, and fittings of U-shaped section having their legs pivoted about said axle respectively adjacent said standards, the inner legs of said fittings respectively engaging in the aforesaid openings in the snuffer side walls, and the remaining legs of said fittings being respectively disposed outwardly of said snuffer side walls, a reciprocable fingerpiece located adjacent said snuffer, the last mentioned legs of said fittings and said fingerpiece having complementary driving and driven parts engaging to open and close the snuffer as the fingerpiece is reciprocated.

3. A lighter having a fuel casing, an axle supported adjacent said casing, a sparking wheel mounted upon said axle and having a central hub extending from one side face thereof, said last mentioned face of the sparking wheel having ratchet teeth surrounding said hub, a pawl plate rotatably surrounding said hub and having a pawl finger engageable with said ratchet teeth, a wick adjacent the said sparking wheel, a snuffer for said wick having a side wall engaging the outer face of said pawl plate, and means for opening and closing said snuffer, said snuffer and pawl plate having parts engaging to actuate the pawl plate and wheel upon opening movement of the snuffer.

4. A lighter having a fuel casing, an axle supported adjacent said casing, a sparking wheel mounted upon said axle and having a central hub

extending from one side face thereof, said last mentioned face of the sparking wheel having ratchet teeth surrounding said hub, a pawl plate having a dished annular central portion rotatably engaging said hub and having a pawl finger engageable with said ratchet teeth, a wick adjacent the said sparking wheel, a snuffer for said wick having a side wall engaging the outer face of said pawl plate, and means for opening and closing said snuffer, said snuffer and pawl plate having parts engaging to actuate the pawl plate and wheel upon opening movement of the snuffer.

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