Oct. 17, 1950

M. O'KEEFFE

2,526,151

SPARK PRODUCING MECHANISM

Filed June 2, 1947

4 Sheets-Sheet 1

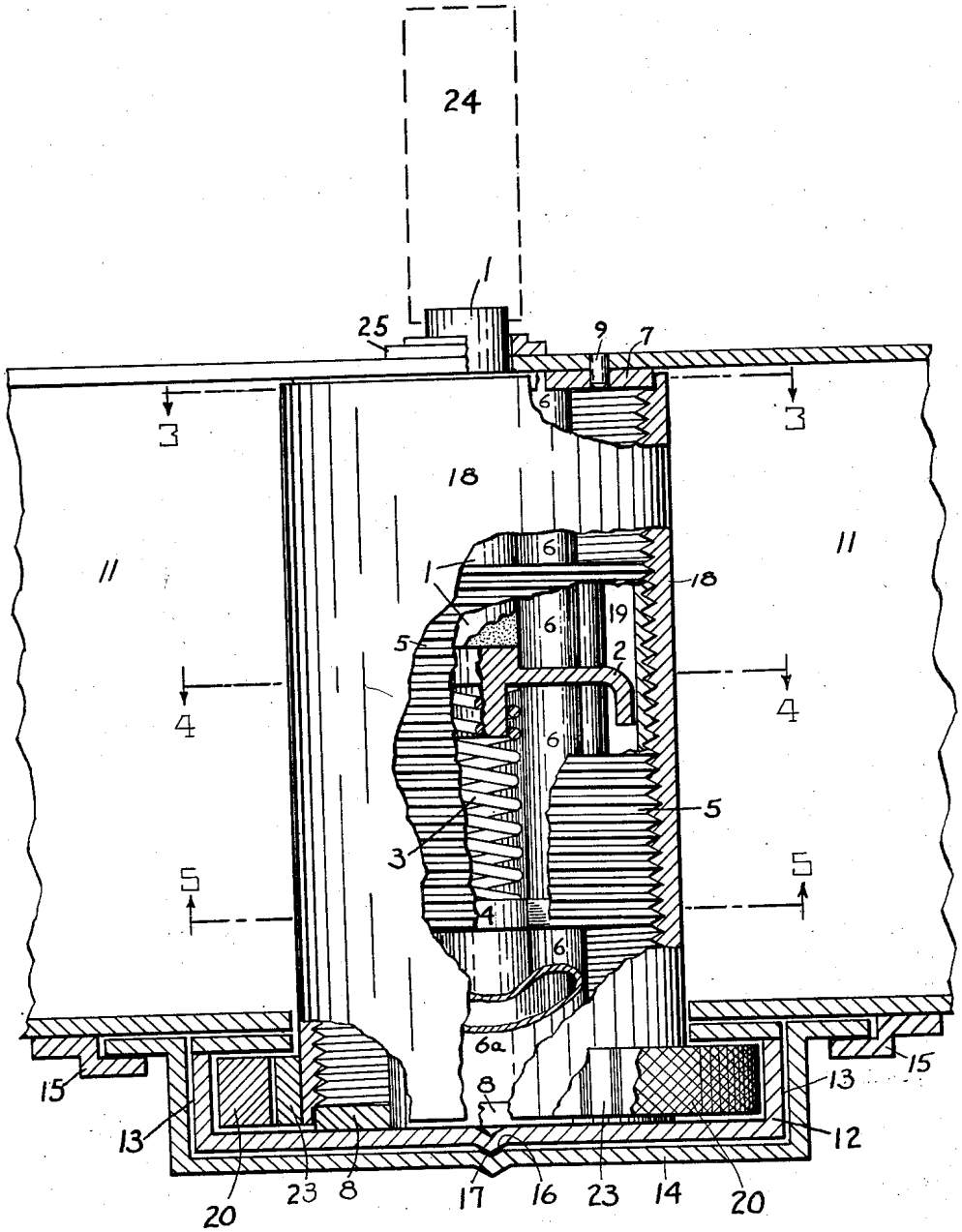

Fig. 1

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4 Sheets-Sheet 2

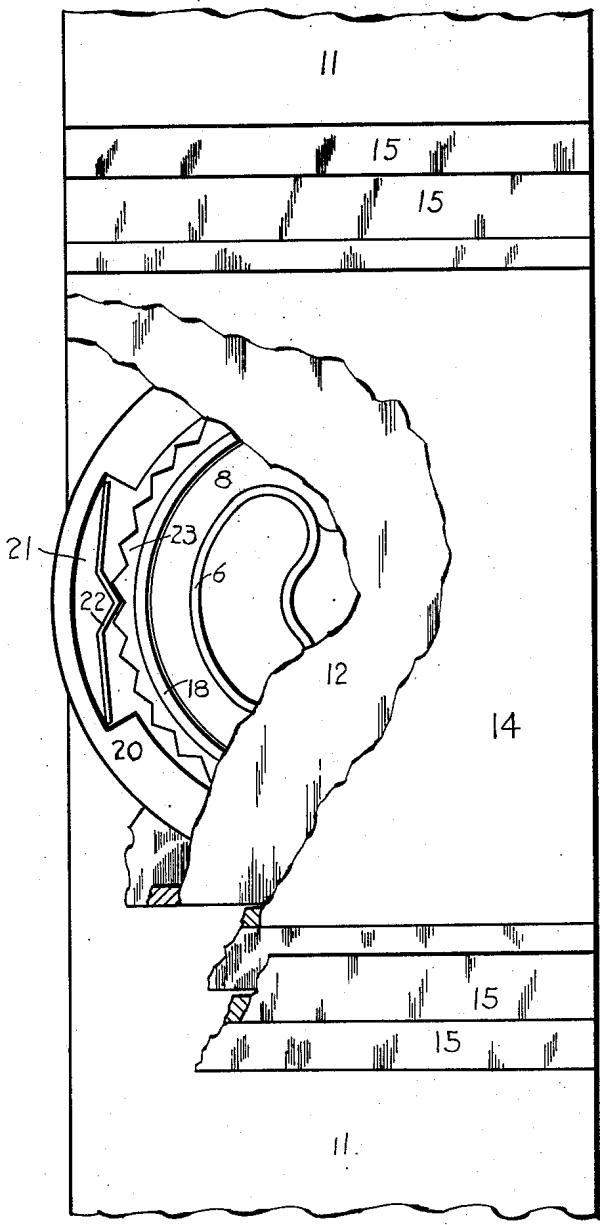

Fig. 2

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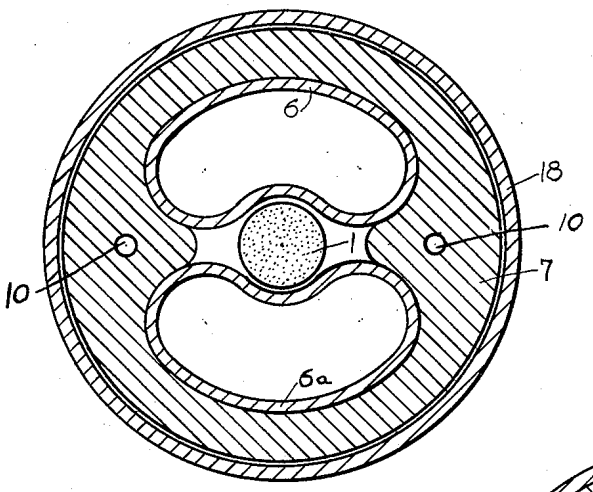

Fig. 3

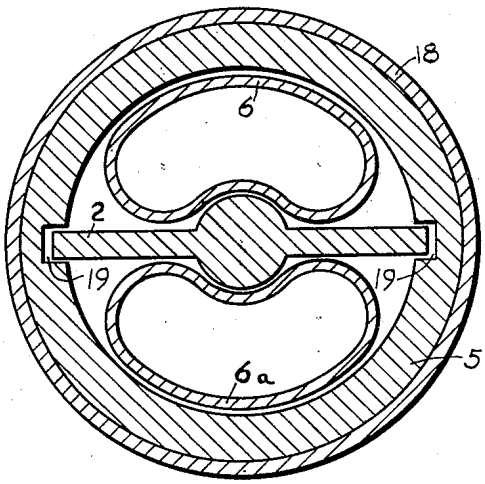

Fig. 4

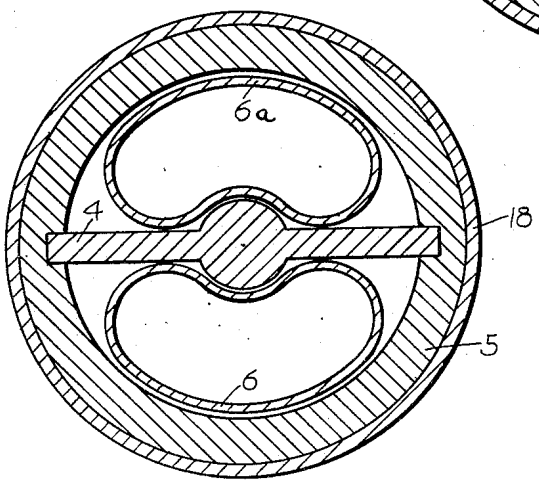

Fig. 5

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SPARK PRODUCING MECHANISM

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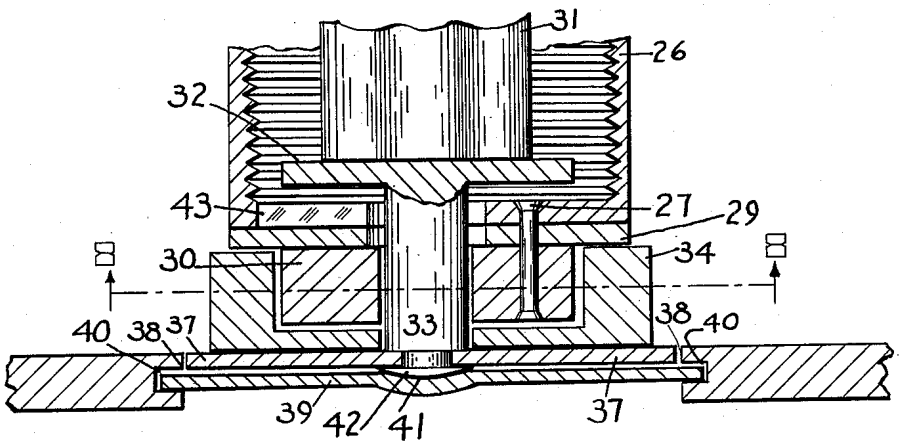

Fig. 6

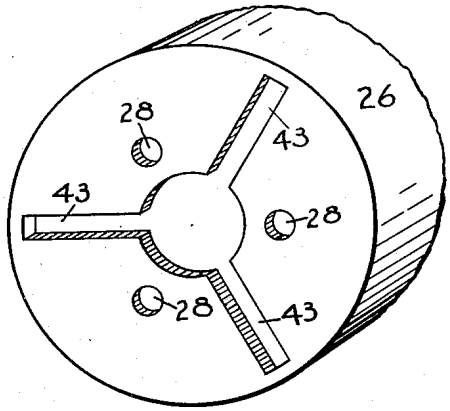

Fig. 7

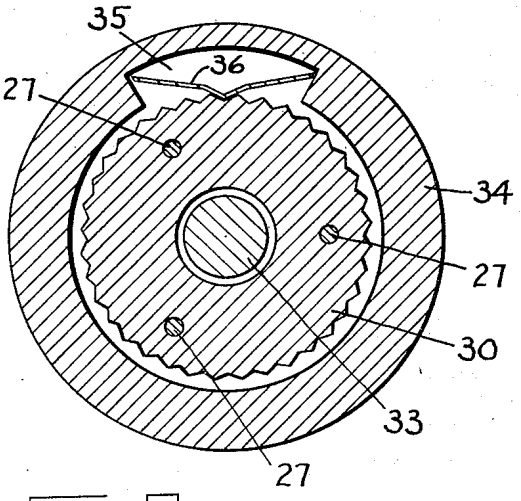

Fig. 8

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UNITED STATES PATENT OFFICE

2,526,151

SPARK PRODUCING MECHANISM

Michael O'Keeffe, Bronx, N. Y.

Application June 2, 1947, Serial No. 751,666

5 Claims. (Cl. 67—7.1)

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My invention relates to spark producing mechanism of the type which embodies a pyrophoric material to produce sparks to ignite a flame, which may be used for any desired purpose, ordinarily that of igniting cigarettes, cigars, pipes and the like.

One of the objects of my invention is to provide a flint actuating mechanism wherein the pressure exerted by the flint against the friction wheel may be maintained within predetermined limits.

Another object of my invention is to provide a flint mechanism in which a flint of unusually long length can be used. At present flints are so short as to necessitate frequent renewal. My invention permits the use of a long flint and thus avoids the inconvenience of frequent renewal.

Further object of my invention is to provide storage space for spare flints within the mechanism such that unusually long flints of the same length as those used in the mechanism can be stored.

An additional object of my invention is to provide a simple means for removing the flint mechanism from the case or body of the lighter in order to replace the flints.

Another object of my invention is to provide a simple flint mechanism which can be entirely replaced as a unit without difficulty.

Another object of my invention is to provide a mechanism in which there is no danger of accidental fire or explosion due to sparking within the mechanism that might set off fumes inside of the mechanism.

Another object of my invention is to provide a mechanism for holding the flint in a vertical and rigidly fixed position with respect to the friction wheel, especially when the flint has been worn down to a short length, and thus avoid having the remaining part of the flint become useless due to being pushed out of alignment which commonly occurs with prior art mechanisms.

Another object of my invention is to provide a mechanism which cannot be damaged by someone inadvertently turning the adjusting wheel too tightly.

Other objects of my invention will be apparent from the following description.

For an understanding of my invention, and for an illustration of one form of the same, reference is had to the accompanying drawings, in which

Fig. 1 is a partially cutaway elevation view,

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illustrating the general assembly of my flame producing mechanism.

Fig. 2 is a bottom cutaway view showing the arrangement of a part of the mechanism.

Fig. 3 is a sectional view on the line 3—3 in Fig. 1.

Fig. 4 is a sectional view on the line 4—4 in Fig. 1.

Fig. 5 is a sectional view on the line 5—5 in Fig. 1.

Fig. 6 is a vertical sectional view of the lower part of another form of my spark producing mechanism.

Fig. 7 is a detailed perspective view of a part of the mechanism of Fig. 6.

Fig. 8 is a sectional view on the line 8—8 in Fig. 6.

Referring to the drawings, flint 1, the floating crossbar 2, the coil spring 3, the fixed crossbar 4 and the threaded plug 5 are all restrained from movement in a radial direction by the kidney shaped tubes 6 and 6a. The kidney shaped tubes 6 and 6a are in turn restrained from movement in a radial direction by the top end plate 7 and the bottom end plate 8. The top end plate 7 and the bottom end plate 8 are permanently secured to the kidney tubes 6 and 6a by soldering or similar means. Top end plate 7 is held in a fixed position with respect to the case and the sparking wheel by the two locating pins 9, one not shown, which fit into locating holes 10 in top end plate 7. The locating pins 9 serve to detachably secure the kidney tubes 6 and 6a to the body of the lighter case 11. The channel end plate 12 which has squared parallel ends 13 that mate with the hatshaped retaining slide 14. This hatshaped retaining slide 14 is held in place by Z-shaped clips 15 which are permanently attached to the bottom of the lighter case 11 and further held in place by dimple 16 in channel end plate 12 and dimple 17 in slide 14.

Threaded plug 5 has external threads which cooperate with the internal threads of rotatable tube 18. Plug 5 has key ways 19 diametrically opposite to each other. Crossbar 4 is fixed in position at the bottom of the key ways 19. Floating crossbar 2 has its outer ends turned downward to provide larger bearing surface on the sides of the key ways 19 to prevent tilting of the crossbar 2.

The knurled wheel 20 has a recess 21 in which is positioned the ratchet spring 22. Ratchet spring 22 is positioned so as to cooperate with the teeth of ratchet collar 23 which is permanently

secured to the threaded tube 18, thus forming a spring loaded clutch.

Flint 1 rests on floating crossbar 2 which in turn is forced upwardly against the bottom of flint 1 by coil spring 3. Fixed crossbar 4 pushes upwardly against coil spring 3 and is fixed to the threaded plug 5.

In operation of my mechanism the knurled wheel 20 is turned, carrying with it ratchet spring 22 which cooperates with teeth of the ratchet collar 23. This causes ratchet collar 23 and threaded tube 18 to turn. Threaded plug 5 is prevented from turning by floating crossbar 2 and fixed crossbar 4 reacting radially against stationary kidney tubes 6 and 6a. As a result, when tube 18 is turned, plug 5 is forced upward or downward, depending on the direction of rotation. This results in a vertical movement of fixed crossbar 4 which presses against coil spring 3 and floating crossbar 2. Crossbar 2 in turn exerts pressure on flint 1 to force it against friction wheel 24.

Whenever the friction between flint 1 and friction wheel 24 becomes insufficient to produce proper sparking, due to wearing away of the flint, the operation, above described, is repeated by turning knurled wheel 20 so as to force flint 1 upward and reestablish the predetermined proper friction. This operation is repeated when necessary until the flint is entirely consumed. The flint will remain vertical to the end, being held by kidney tubes 6 and 6a and collar 25. This avoids loss of a considerable part of the flint due to its being pushed out of alignment when near its end, as usually occurs in prior art flint mechanisms.

One of the principal objectives is obtained by predetermining the maximum amount of pressure that can be applied to the friction wheel 24 by the flint 1. This can be readily accomplished due to the fact that the relationship between the friction of the spring loaded clutch, composed of prestressed ratchet spring 22, together with ratchet collar 23, and the stress of coil spring 3 determines the pressure of flint 1 against the friction wheel 24. Thus, when coil spring 3 has been compressed to the dimension producing the desired pressure of flint 1 against the friction wheel 24, further rotation of the knurled wheel 20 results in deflection of ratchet spring 22, causing the same to slip over the teeth of the ratchet collar 23. This produces a clicking sound which indicates to the user that the maximum required pressure of the flint 1 against friction wheel 24 has been attained. If a material, such as a phenolic plastic is used for the ratchet collar 23, then ratchet spring 22 would not make any sound when slipping over the ratchet collar 23. Nevertheless, a distinct click could be felt although no additional pressure would be applied against flint 1 by further turning of the knurled wheel. Thus the pressure could not be accidentally increased and the mechanism could not be accidentally damaged or excessive flint wear caused by too much pressure or turning of the knurled wheel.

The kidney shaped tubes 6 and 6a serve primarily to hold the flint 1 and coil spring 3, as well as other parts of the mechanism in a vertical position. This also prevents the flint from being forced into an angular position when it has been almost entirely used up since the top end of the flint 1 is supported by the collar 25. A similar effect could be produced by extending the inner edge of the kidney shaped tubes 6 and 6a upwardly alongside of the flint and through the case 11 so as to replace the collar 25 in supporting the flint 1. Such a partial projection of the top edges of kidney tubes 6 and 6a could also be used to position the top end of the mechanism in the case 11 and thus also replace the locating pins 9. This is another form of my invention which is not illustrated.

It should be noted that the position of kidney tubes 6 and 6a is such that their broader dimension is parallel to the axis of the friction wheel 24 and thus is perpendicular to the direction of the force applied by friction wheel 24 on flint 1.

Another function of the kidney tubes 6 and 6a is that they may be utilized to store spare flints since they are hollow and can accommodate two flints apiece. The spare flints are not illustrated in the drawings. Access to the spare flints may be had by sliding sideways the hatshaped retaining slide 14 then withdrawing the mechanism assembly from the bottom of the lighter case. The spare flint may then be inserted in the kidney tubes 6 and 6a for storage or may be removed from the same, as desired. The ends of the kidney tubes 6 and 6a are open at the top and closed at the bottom when the assembly is removed from the case 11. When the assembly is in position for normal use the tops of the kidney tubes 6 and 6a are covered by the top of the lighter case 11, thus preventing loss of the spare flints when the lighter is in use.

The removal of the entire mechanism as described above shows another important feature of my invention, namely that the entire mechanism can be removed and replaced with a new one very readily, if desired.

As explained above, in operation, the knurled wheel 20 is turned and through ratchet spring 22 and ratchet collar 23 the tube 18 is caused to rotate. This results in vertical movement of threaded plug 5 which carries with it the fixed crossbar 4 so as to compress coil spring 3. Coil spring 3 exerts pressure on the floating crossbar 2 which raises it upwardly against flint 1, contacting friction wheel 24, under any desired and predetermined pressure.

It should be noted that by use of my mechanism no rotating part comes in frictional contact with flint 1 while it is being tightened, since the floating crossbar 2 always remains in the same vertical plane but is free to move vertically. This avoids the danger of an internal spark in the mechanism during the tightening which might be coupled with the presence of inflammable or explodable mixture in the mechanism and the resultant danger of explosion of the lighter. My lighter is, therefore, explosion proof.

As described above, Figs. 6, 7 and 8 illustrate another form of my invention in which the entire mechanism is recessed into the case 11 so that the bottom of case 11 is perfectly flat and the lighter has a flat bottom so that it can stand by itself. This is desirable for some types of lighters. Also, the form of my invention, shown in Figs. 6 and 7 has certain advantages from the point of view of manufacture in that the entire bottom portion of the mechanism can be assembled upsidedown and the assembly completed by one riveting operation.

This form of my invention embodies the same basic operating principles as the form of my invention shown in Fig. 1 described above. Internal parts of the mechanism not shown in Figs. 6, 7 and 8 are the same in both forms of my in-

vention. These parts are, flint 1, floating crossbar 2, coil spring 3, fixed crossbar 4, threaded plug 5, top end plate 7, locating pins 9, locating holes 10, key ways 19, friction wheel 24 and collar 25.

However, in the form shown in Fig. 6 the parts are so designed that the entire mechanism is contained within the lighter case and does not project below the bottom of the case so that the lighter case has a flat bottom.

In Fig. 6 the internally threaded tube 26, which corresponds to tube 18 in Fig. 1, is attached by means of three rivets 27 passing through holes 28 in the inwardly flanged lower end of threaded tube 26 to bottom plate 29 and ratchet collar 30. Kidney tubes 31, which are similar to the kidney tubes 6 and 6a in Fig. 1 are secured by solder or other means to the upper surface 32 of the flanged pivot 33.

The knurled wheel 34, containing a recess 35 which holds the ratchet spring 36, is positioned to revolve about the flanged pivot 33 which is riveted at its lower end to a rectangular plate 37, the parallel ends of which are positioned adjacent to the inwardly facing ends 38 of the lighter case, thus providing means for preventing rotation of the rectangular plate 37.

The comp'ete mechanism assembly is firmly held in p'ace by a rectangular slide 39, the two ends of which are adapted to enter grooves 40 in the ends 38 of the case. The rectangular slide 39 has a downwardly dimpled area 41 in the center which cooperates with the fabricated head 42 of the riveted flanged pivot 33, thereby detachably securing the mechanism assembly in position for normal use. The dimpled area 41 also prevents the slide 39 from being accidentally displaced.

In Fig. 7 the detailed construction of the bottom portion of interna'ly threaded tube 26 is shown. The slots 43 are provided for ease in manufacture so that the bottom of tube 26 can be readily flanged over without danger of wrinkling the tube. In Fig. 8 is shown the location of the ratchet spring 36 and the relationship of the cooperating ratchet collar 30 and knurled wheel 34 which form a spring loaded clutch on the line 8—8 of Fig. 6.

This form of my invention operates in a similar manner to that of the form shown in Fig. 1 and described above. Accordingly, it has all of the advantages of that form of the invention plus a greater simplicity and ease of construction and the recessed mechanism permitting a flat bottom lighter. It is, therefore, the preferred form of my invention.

As will be apparent from the above description herein, my invention also enables the flint to be of any desired length. Thus it has been customary in the past to use flints of about ¼'' in length, whereas by means of my invention flints of one inch or longer may be used. Thus in some special type lighters flints as long as seven inches may be used and with my means of avoiding excessive friction on the flint such flints would last almost indefinitely.

Another feature, not illustrated, is that floating crossbar 2 is restrained from falling out of plug 5 by peening over the ends of key ways 19. This serves to maintain a minimum pressure on coil spring 3 which is thus prestressed.

Another feature of my invention, not illustrated, is that there may be an overrun stop at the top and bottom of plug 15 and tube 18. This overrun stop can be formed by removing one complete circle of thread from the top and bottom of plug 5 so as to leave a square flat face on the last thread instead of the usual taper. An inward projection in the thread at the top and bottom of tube 18 is inserted which cooperates with the flat face, formed by removing the last thread of plug 5 so as to stop the movement of plug 5 when it comes to the end of tube 18. This overrun stop serves to prevent damage to the mechanism that might be caused when it is removed from the lighter and tube 18 is accidentally turned without using the spring loaded clutch.

A number of variations in the form of my invention are possible and will be apparent to one skilled in the art. Thus, for example, the kidney tubes 6 and 6a may be replaced by tubes having other cross sections such as circular with a channel on one side, or the kidney tubes 6 and 6a may each be replaced with two or more tubes of circular cross sections so arranged as to maintain the mechanism in a vertical position and perform the other functions of the kidney tubes 6 and 6a as described above. Also, threads on the internally threaded tubes 18 and 26 and on the threaded plug 5 may be replaced by other means of transmitting the motion from the tube to the plug, such as cooperating spirals on the tubes and plug.

It is apparent that I have described a new and novel form of spark producing mechanism for use in igniting a flame which may be used for any desired purposes such as cigarette lighters. Changes and variations in the form of my invention are possible, as discussed above, and others may occur to those skilled in the art. I do not, therefore, desire to be limited to the exact form of device disclosed by me for purposes of illustration but rather to the scope of the invention as it is defined in the following claims.

I claim:

1. In a spark producing mechanism, an internally threaded and rotatably supported tube, a nonrotatable plate adjacent each end of said tube, a plurality of members axially movable within said tube and including a plug in threaded engagement with said tube and having an axial bore and two diametrically opposed longitudinal slots, a crossbar fixed to said plug, a floating crossbar guided in said slot, a coiled compression spring interposed between said crossbars, and a flint bearing against the outer face of said floating bar; a rigid connection between said end plates, such connection extending through the bore in said plug and formed to hold said axially movable members against radial displacement and said plug against rotary movement and manually operable means on the exterior of said tube for rotating the tube.

2. A spark producing mechanism in accordance with claim 1, characterized by said rigid connection being a pair of opposed kidney-shaped tubes spaced apart to slidably receive said crossbars and providing containers for extra flints.

3. A spark producing mechanism in accordance with claim 1, characterized by said manually operable means comprising a spring loaded clutch including two concentric ring members encircling said tube with the inner ring fixed to said tube and the outer ring independently rotatable, a spring pawl, one of said members having a segmental recess for housing said pawl, and circumferentially arranged teeth on said other member for engagement with said pawl.

4. The combination, with a lighter case having an opening in one wall for receiving a flint and

a large opening in an opposite wall, of a spark producing mechanism insertable and removable as a unit through said larger opening, inter-engaging means on said case and said unit for locating the latter and maintaining it against lateral displacement, and a movable closure for said larger opening, said spark producing unit including an internally threaded tube, manually operable means engageable from the exterior of said casing for rotating said tube, a flint, a plug in threaded engagement with said tube and having an axial bore, said plug being axially movable on rotation of said tube, fixed means extending through said bore for guiding said flint in axial movement and holding said plug against rotation, and means carried by said plug for supporting and exerting a resilient end pressure against said flint.

5. A combination in accordance with claim 4, but characterized by said flint supporting means carried by said plug including a crossbar fixed to the plug, a floating crossbar guided in the bore of the plug and a coiled compression spring interposed between said crossbars; by said fixed means extending through said bore comprising a pair

of parallel kidney-shaped tubes spaced apart to slidably receive said crossbars and provide containers for extra flints; and by said manually operable tube rotating means comprising a slip clutch disengaging when a predetermined pressure is exerted against said flint.

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