Oct. 3, 1950 F. E. MILLER ET AL 2,524,462

PRESSURE REGULATING MECHANISM

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Fig. 1

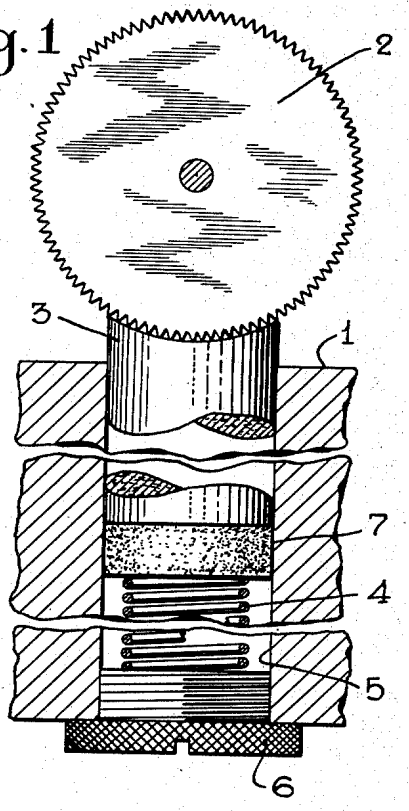


Fig. 2

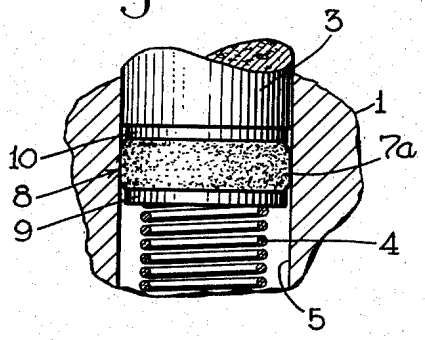


Fig. 3

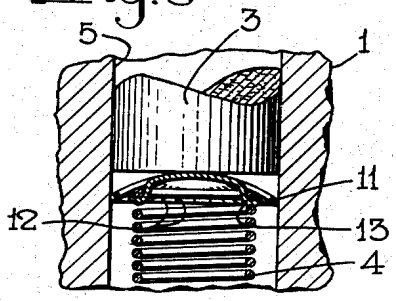


Fig. 4

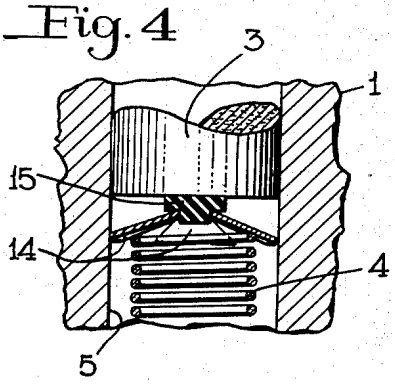


Fig. 6

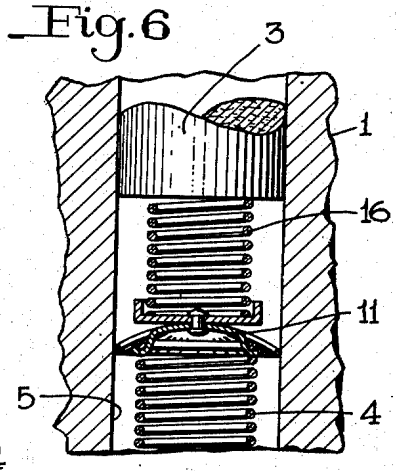
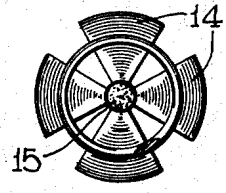


Fig. 5



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PRESSURE REGULATING MECHANISM

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8 Claims. (Cl. 67—7.1)

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This invention relates to pressure regulating devices for maintaining a substantially constant pressure, or a pressure varying between chosen limits, on an element through relatively long travel of said element.

In cigarette lighters of the type embodying a manually operated steel spark wheel having a serrated face engaging the end of a flint for producing a spark upon turning of the wheel against the flint, the flint must be pressed against the wheel with force. A relatively long spring is usually employed for thus urging the flint against the wheel and when the flint is new the pressure of the spring is so great that it is not only difficult to turn the wheel but the flint wears away abnormally rapid. On the other hand before the flint is completely worn away it has to be discarded because, due to extension of the spring, the pressure of the flint against the wheel has become so reduced as to be insufficent to produce a spark upon rotation of the wheel thereagainst. It has been found that only during some intermediate portion of the length of the flint is the pressure of the spring against the flint such as to permit turning of the wheel with ease and without undue wear of the flint and yet positively insure sparking.

The principal object of the invention is therefore the provision of a mechanical pressure regulating means for delivering and maintaining a desired degree of force, either substantially constant, or within desired limits, from a force applying medium such as a spring, on an element throughout relatively long travel or wear life of said element.

In accordance with the object as applied for example to a cigarette lighter, the pressure regulating means is interposed between the pressure medium or flint actuating spring of the lighter, and the flint itself. The pressure medium is provided with adequate initial pressure or stored force to press the flint against the spark wheel throughout the wear life of the flint, and the pressure regulating means is operative to automatically limit the amount of force applied from the pressure medium to the flint throughout its full wear life to a substantially constant, desired degree to facilitate easy turning of the spark wheel and yet assure production of sparks and maximum life of the flint. It has been found in practice that the force of the pressure medium may be many times that required to press the flint against the spark wheel to insure the production of an adequate spark, and that the pressure regulating means will consistently feed this force to the flint in just the right degree to obtain the desired results.

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The pressure regulating means may take various forms as will be hereinafter described, and the primary pressure medium need not be a spring as employed in cigarette lighters as will later become obvious. Moreover the invention is not limited in use to cigarette lighters but may be employed wherever it is desired to maintain an element under substantially constant pressure, or under pressure within a chosen range of pressures, throughout relatively long movement of said element. As further examples, the pressure regulating means is especially adapted for regulating pressure of brushes against armatures in electric motors and for maintaining a chosen pressure on a body of liquid, such as in a lubricant system.

Other objects and advantages will become apparent from the following more detailed description of the invention.

In the accompanying drawing; Fig. 1 is a cross-sectional view of a portion of a cigarette lighter embodying one form of the invention; Figs. 2, 3, 4 and 6 disclose other embodiments of the invention; and Fig. 5 is a bottom plan view of the embodiment shown in Fig. 4.

Description

As shown in the drawing, 1 designates the usual housing of a cigarette lighter employed for illustrating one use only of the invention, 2 the manually operative steel spark wheel, 3 the flint, the end of which engages the serrated peripherial face of said wheel, and 4 a source of power such as the usual spring for pressing said flint against said wheel with force to produce a spark upon turning said wheel against said flint. The flint 3 is slidably mounted in a suitable bore 5 in the casing 1 along with the spring 4, a cap 6 being secured to said casing for maintaining said spring compressed against the flint 3. The spring 4 differs from those ordinarily employed only in that it is designed to provide at least adequate force of the flint 3 against wheel 2 to ensure the production of sparks when the flint is substantially completely worn away, but at this time the force of spring 4 may be much greater, if desired, since the pressure regulating means, to be presently described, regulates the amount of force transmitted from said spring to said flint and thereby limits the pressure of said flint against wheel 2 to just the correct amount.

According to the invention as disclosed in Fig. 1, the pressure regulating means may comprise a cylindrical resilient element 7 preferably made of material such as rubber, movably disposed in bore 5 and located between and engaging with the adjacent ends of the flint 3 and spring 4. After the

flint 3 and element 7 are assembled in the casing, the spring 4 is placed in position and initially compressed manually. Following this, the cap 6 is screwed home as shown to further compress and maintain compressed the spring 4. As the spring 4 is being compressed it acts through the rubber element 7 to press the flint 3 against wheel 2. When a certain pressure of flint 3 against wheel 2 is thus developed the reaction of said flint against element 7 is such as to squeeze said element radially into locking contact with the wall of bore 5 to prevent further transfer of pressure from spring 4 to said flint upon further compression of spring 4. It will be noted that while the pressure of spring 4 against element 7 is much greater than the desired pressure of said element against the flint 3 said element transmits to said flint only sufficient pressure to cause a reaction against said element to cause it to be squeezed into locking contact with the wall of the bore 5 to prevent transmission of further pressure to flint 3, whereby the pressure of flint 3 against wheel 2 is limited to an amount which just ensures the desired sparking by easy turning of wheel 2 and which consequently minimizes wear of flint 3 and hence provides for maximum life thereof.

When the wheel 2 is turned to provide sparking the flint 3 wears away and moves under the resiliency of element 7 in the direction of said wheel which results in a reduction in its reactive force against said element and hence in a reduction in the gripping force between said element and the wall of bore 5, as a result of which, the much greater force of spring 4 shifts the element 7 in said bore according to the wearing away of flint 3 until said element again locks against the wall of said bore upon the reaction of flint 3 becoming again increased to the desired degree. The element 7 will thus be moved by spring 4 along the bore 5 and maintain the flint 3 in contact with wheel 2 throughout the full length of said flint with a very much reduced force as compared to that of spring 4 acting on said element. It has been found that with element 7 made of rubber of suitable resiliency and of proper axial length and having a substantially free sliding fit in bore 5 when said element is free that throughout the full length of the flint 3, the resistance to turning of wheel 2 remains substantially constant and that sparking occurs upon each turning of said wheel, indicating that the pressure regulating means 7 acts, as the flint 3 wears away, to permit sufficient force to be transmitted from the spring 4 to the flint to maintain a substantially constant pressure of said flint against the spark wheel 2,

The pressure of the flint 3 against the wheel 2 is determined by the free diameter of the element 7 with respect to that of bore 5, for if the diameter of element 7 is reduced a greater reaction from flint 3 is required to squeeze said element into locking engagement with the wall of bore 5 than if it is increased, hence any desired pressure of flint 3 against wheel 2 may be obtained by providing an element 7 of proper diameter.

Theoretically, the element 7 may "inch" along the wall of bore 5 as the flint 3 wears away, but with an element 7 of proper axial length, the steps of such "inching" are so small that a substantially constant transfer of force from spring 4 to the flint occurs to maintain the constant action above described. Increasing the axial length of element 7 provides a very definite "inching" of element 7 resulting in a range of variations in pressure of flint 3 against wheel 2 which might be very desirable for uses other than in cigarette lighters or the like.

The structure shown in Fig. 1 has been tried and found to operate to accomplish the desired results and the reason why it so operates is believed to be as above described.

Particularly in cigarette lighters the element 7 is small and to facilitate handling thereof an element 8 such as shown in Fig. 2 of the drawing may be employed in its stead. The element 8 constitutes a part 7*a* the peripherial surface of which is provided for contact with the wall of bore 5, like element 7 of the mechanism shown in Fig. 1 and secured to one end of element 8 is a hard follower 9 against which the spring 4 acts. The follower 9 may be made of any suitable material such as hard rubber or metal to the opposite sides of which are attached the part 7*a* and adjacent end of spring 4 whereby said spring and the element 8 may be handled as a unit. A similar follower 10 may be provided on the opposite end of part 7*a* to avoid adhesion between said part and the part 3 against which it operates where such parts are in contact for a considerable period of time as might be the case in certain uses of the invention.

According to the modification shown in Fig. 3 of the drawing a dished metal disc 11 made of thin flexible spring material is used in place of the rubber element 7 or 8 of the mechanism shown in Figs. 1 and 2, respectively. The disc 11 is disposed with its convex face engaging at its center the flint 3 while the spring 4 engages the opposite face of said disc. The diameter of the disc 11 is such as to just enter bore 5 when free and under pressure from spring 4 and reaction from flint 3 is adapted to be forced into locking contact with the wall of said bore. In use, when the pressure reaction from flint 3 reduces, the force of disc 11 against the wall of bore 5 will reduce to permit spring 4 to move said disc and flint in bore 5, and as the reaction of said flint increases the pressure of spring 4 will expand the said disc so that the edge thereof will engage said wall to absorb the pressure of said spring over and above that acting on the flint. In this manner the disc 11 will limit the amount of pressure transmitted from spring 4 to flint 3 to a chosen degree and less than the pressure of spring 4 on said disc. To provide greater flexibility the disc 11 may be provided with radial slits 12 extending inwardly from its edge, if desired. To facilitate handling, the end of spring 4 may be connected to disc 11 in any suitable manner, such as by a plurality of spaced apart fingers 13 struck from said disc and bent around the end coil of said spring. The fingers 13 also act to hold the spring centrally with respect to the disc 11.

In Figs. 4 and 5 of the drawing the pressure regulating means is in the form of a plurality of circular metal segments 14 arranged in spaced apart relation with their inner ends secured as by bonding to a rubber button 15 and with their outer edges arranged for contact with the wall of bore 5. When disposed in bore 5 the segments 14 are adapted to form a generally concave structure with spring 4 engaging the concave face and the button 15 projecting from the opposite face engaging flint 3. In this structure it will be noted that the segments 14 act like levers, the reaction from flint 3 acting on one end of said levers in opposition to the force of spring 4 acting on the levers closer to their

lines of contact with the wall of bore 5 than the connection with flint 3. Hence a certain reactive force from flint 3 is capable of overcoming a much greater force of spring 4 to cause the circular edges of segments 14 to be forced into locking engagement with the wall of bore 5 by said spring and thereby limit the amount of force applied to flint 3.

The structures shown in Figs. 3, 4 and 5 of the drawing will limit transmission of force from spring 4 to flint 3 to a substantially constant degree but in each case the amount of force transmitted may be predetermined, as in Fig. 3, by the location of the connection between the disc 11 and flint 3 and spring 4, and in Fig. 4 by proper selection of the line of contact between spring 4 and the segments 14 to provide the desired ratio of lever arms for the force of spring 4 and reactance from flint 3.

If for some certain use of the invention disclosed in Figs. 3 and 4 of the drawing, it is desired to provide a definite range of pressure change on the flint 3 this may be accomplished by interposing a spring 16 between the flint 3 and the pressure regulating means, such as 11, as shown in Fig. 6 of the drawing. In accordance with this modification, the pressure regulating means 11 will "inch" up upon a chosen reduction in reactance from spring 16 until such reactance is increased to the necessary degree to stop such movement, whereupon the pressure regulating means 11 will remain stationary until the reactance of spring 16 again reduces, due for example to wear of flint 3, to a degree to release the pressure regulating means 11 from the wall of bore 5 to a degree sufficient to permit spring 4 to again effect movement thereof.

Summary

It will now be seen that we have provided a mechanical pressure regulating means which is automatically operative in accordance with opposing forces of a power source and the reactance of a pressure operated element to maintain a pressure on said element substantially constant, or within predetermined limits, for a relatively long movement of said element. The pressure regulating means permits initial storing of sufficient energy in the power source to insure at least the desired or substantially same pressure on the pressure operated element at the end of its traverse as provided thereon at the beginning of its traverse.

Having now described the invention what we claim as new and desire to secure by Letters Patent is:

1. Mechanism for maintaining a substantially uniform degree of advancing pressure on movable, force opposed, means, said mechanism comprising in combination with said means, power means for moving said force opposed means, a part fixed with respect to said force opposed means, and resilient means operative by reactive force of said force opposed means to render said power means effective to expand said resilient means into gripping relation with said fixed part for thereby limiting pressure applied to said force opposed means by said power means to a fraction of that of said power means.

2. A structure as defined in claim 1 in which the resilient means comprises a rubber-like element subject opposingly to reactive force of said material and pressure of said power means and which when free has substantial sliding contact with said fixed part.

3. Means for maintaining a substantially uniform degree of advancing pressure on a movable, force opposed element slidable in a bore, said means comprising in combination with said element and the wall of said bore, power means for moving said element, and resilient means in said bore subject to pressure of said power means and reactive force of said element and expansible by a chosen degree of said reactive force into gripping relation with the wall of said bore for thereby limiting pressure applied to said element by said power means to a fraction of that of said power means.

4. A structure as defined in claim 3 wherein said resilient means comprises a flexible metal dished disk disposed with its peripheral edge in sliding contact with the wall of the bore and subject on its concave face to pressure of said power means and on its convex face to reactive force of said element applied closer to the center of said disk than the pressure of said power means.

5. A structure as defined in claim 3 wherein said resilient means comprises a plurality of levers radiating from the axis of said bore in spaced apart relation and providing a generally concave structure with the adjacent ends of said levers at the convex side of said concave structure operatively connected to said slidable element and the opposite ends in contact with the wall of said bore and subject on the concave side of said structure, adjacent said opposite ends, to pressure of said power means.

6. A structure as defined in claim 3 comprising means securing said resilient means to said power means.

7. Means for maintaining a substantially uniform degree of advancing pressure on a movable, force opposed element, said means comprising in combination with said element, a spring acting on said element for applying advancing pressure thereto, power means for compressing said spring, a fixed element, and resilient means connecting said spring and power means operative by reactive force of said spring into gripping relation with said fixed element to limit pressure applied to said spring by said power means to a fraction only of the power of said power means.

8. A mechanism for advancing in a casing bore, or the like, and for limiting the pressure of a member against a movable element, such as the pressure of a flint against the spark wheel of a cigarette lighter, said mechanism comprising in combination with said member and wall of said bore, a spring confined in said bore under a pressure to provide at least the desired advancing pressure on said element through out its full traverse, and resilient means disposed in said bore between said element and spring operative by reaction of said desired pressure on said element into gripping engagement with said wall for limiting the pressure applied by said spring to said member to said desired pressure.

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