April 15, 1941. H. D. REGAR 2,238,852

SPARK PLUG

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Fig. 1

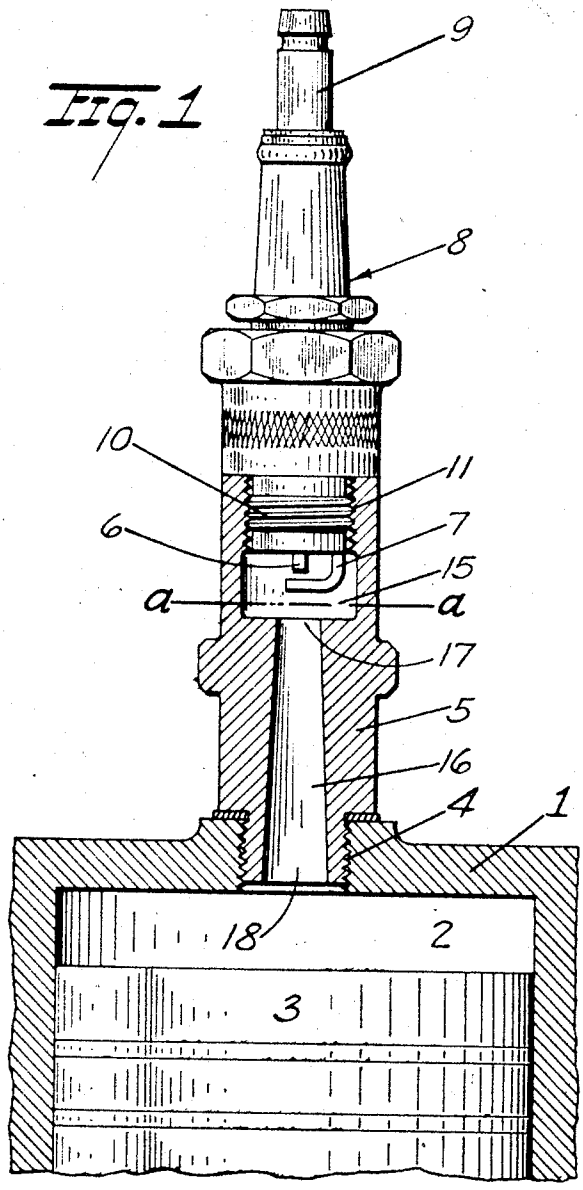
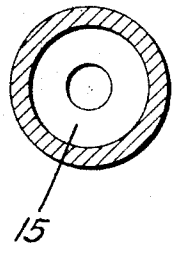


Fig. 2



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SPARK PLUG

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2 Claims. (Cl. 123—169)

My invention relates to new and important improvements in the construction of a spark plug employed for igniting the combustible charges in the cylinder of an internal combustion engine, my object being to provide for an assured, more uniform and completely effective combustion of such charges under all engine running conditions, by a novel indirect and retarded ignition of the highly compressed main portion of the charge in the cylinder from the flame of a spark-ignited portion of said main charge separately confined in a chamber having a higher degree of temperature and a lower degree of compression than the charge in said cylinder.

My spark plug provides means for separating such pre-ignited portion of the main cylinder charge, effectively increasing its temperature and reducing its compression, and freely transmitting its flame to said main charge, and the nature of such means and their method of operation will be more fully described hereinafter in connection with the accompanying drawing, and their novel features set forth in the appended claims.

Fig. 1 is mainly a cross sectional elevation showing an engine cylinder and piston therein and my improved spark plug mounted thereon, the upper portion of said plug being in sectional side elevation.

Fig. 2 is a cross-sectional view taken on the line *a*—*a* of Fig. 1.

Under the conditions of modern engine construction, the rapid succession of explosions, when ignited directly by the instantaneous action of an electric spark, causes incomplete combustion and roughness of action with consequent pinging and other sounds in the form of ticks, knocks, and the like, and it is my object to overcome these objections by a flame ignition of the main charge from a pre-ignited portion thereof confined in a separate chamber. Such chamber and pre-ignition, I am aware, are not in themselves new, but as employed heretofore, involved baffled communication with the cylinder to prevent oil-fouling of the spark points, and has no conception or possibility of use in accordance with my present invention.

Referring to the drawing, 1 indicate a fragmentary part of the engine block, 2 a cylinder bore therein, and 3 the head of the cylinder shown in high position to compress a combustible charge ready to be ignited, a screw-threaded aperture 4, in communication with the cylinder bore 2 being provided as heretofore for a spark plug connection.

My improved spark plug is shown as having a screw threaded end engaging in aperture 4 and comprises an upwardly projecting tubular portion 5, with porcelain insulated spark points 6 and 7 at its upper end. As shown in the drawing, the points 6 and 7 are mounted in a separate plug 8, of usual construction, with a post 9 for connection to the electric wiring and timing apparatus as heretofore to regulate the spark jumps across the points 6 and 7, and said plug 8 has a screw-threaded end 10 to engage the internally threaded upper end 11 of tubular portion 5 so as to form a composite section of the latter. Interiorly portion 5 is recessed to form a chamber 15 enclosing the points 6 and 7, and said chamber has a direct and unobstructed communication with cylinder 2 through a tapered passageway 16, the smaller end 17 of which opens in said chamber 15 and the larger end 18 into cylinder 2. A portion of each combustible charge in cylinder 2, when compressed by the upward movement of piston 3, will pass through passageway 16 to chamber 15, and due to the reduced end 17, such portion entering the larger chamber 15 will expand to reduce its compression.

It is recognized that a uniform heat of each compressed charge produces more assured and effective ignition, but it is impossible to maintain uniform heat in the cylinder 2 due to the heavy inrush of each new cool charge, causing disadvantageous variations greatly affected by change in engine speeds. I have found that by making the tubular portion 5 of my spark plug of a special alloy, the heat in chamber 15 may be desirably raised and normally maintained by the spark ignited explosions therein, and overheating controlled by air circulation passing around tube 5 from the effect of the usual engine fan or motion of an automobile. And I have found that an alloy containing a high percentage of copper effectively answers all needs, the spark ignited explosions of the reduced-compression portion of each main charge quickly heating the tube 5 to a higher degree than cylinder 2, and the small amount of such charge entering chamber 15 having practically no effect in chilling its temperature.

From the foregoing description it will be readily understood that each charge entering cylinder 2 and being compressed by piston 3 will pass a portion thereof through passageway 16 to chamber 15, in which chamber it will expand to reduce its compression and, due to the ready heat conductivity of copper alloy tube 5, such charge portion will be heated above the main portion in cylinder 2 for positive and assured ignition by the

spark jumping across the gap between points 6 and 7. The flame produced by ignition of this small portion is passed without obstruction through passageway 16 to cylinder 2, and because of the larger end 18, such flame is spread over the compressed main charge in said cylinder causing a comparatively slow and retarded but a thorough ignition of said main charge, producing a complete combustion thereof and maximum energy therefrom.

My improved spark plug, it will be readily seen, provides a new and improved method of thoroughly and effectively igniting the main charge in the cylinder from the flame of a spark-ignited small portion of said main charge. And the desirably increased and substantially uniform heat of said charge portion and its reduced compression assures positive ignition at each spark jump, while its flame is spread over the main charge to most effectively ignite the same for a comparatively retarded and slow combustion assuring entire consumption of each charge.

What I claim:

1. The method of firing a compressed charge of combustible gases in the cylinder chamber of an internal combustion engine, which comprises forcing a portion of each cylinder charge through a restricted communicating way into a firing chamber extension of said cylinder chamber, reducing the pressure of such charge portion by natural expansion in said firing chamber, heating said charge portion by conducted heat from its chamber confining walls, firing said portion by means of an electric spark in said firing chamber, and directing the flame of said chamber-ignited portion back through said communicating way and spreading the same over the compressed charge in said cylinder chamber to ignite the entire mass of the latter.

2. A spark plug for igniting the combustible charges in the cylinder chamber of an internal combustion engine, comprising a plug section having spark-gap points at its lower end, and an engine-connecting continuation section therefor of a heat-conductive alloy and having a firing chamber at its upper end enclosing said plug points, and a downwardly spreading tapered central aperture having its upper end communicating with said firing chamber and its lower end communicating with said cylinder chamber; said firing chamber having a larger diameter than its communicating end of said central aperture, and said aperture being straight and free of obstructions and forming the only entrance and exit of combustible gases to said firing chamber.

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