

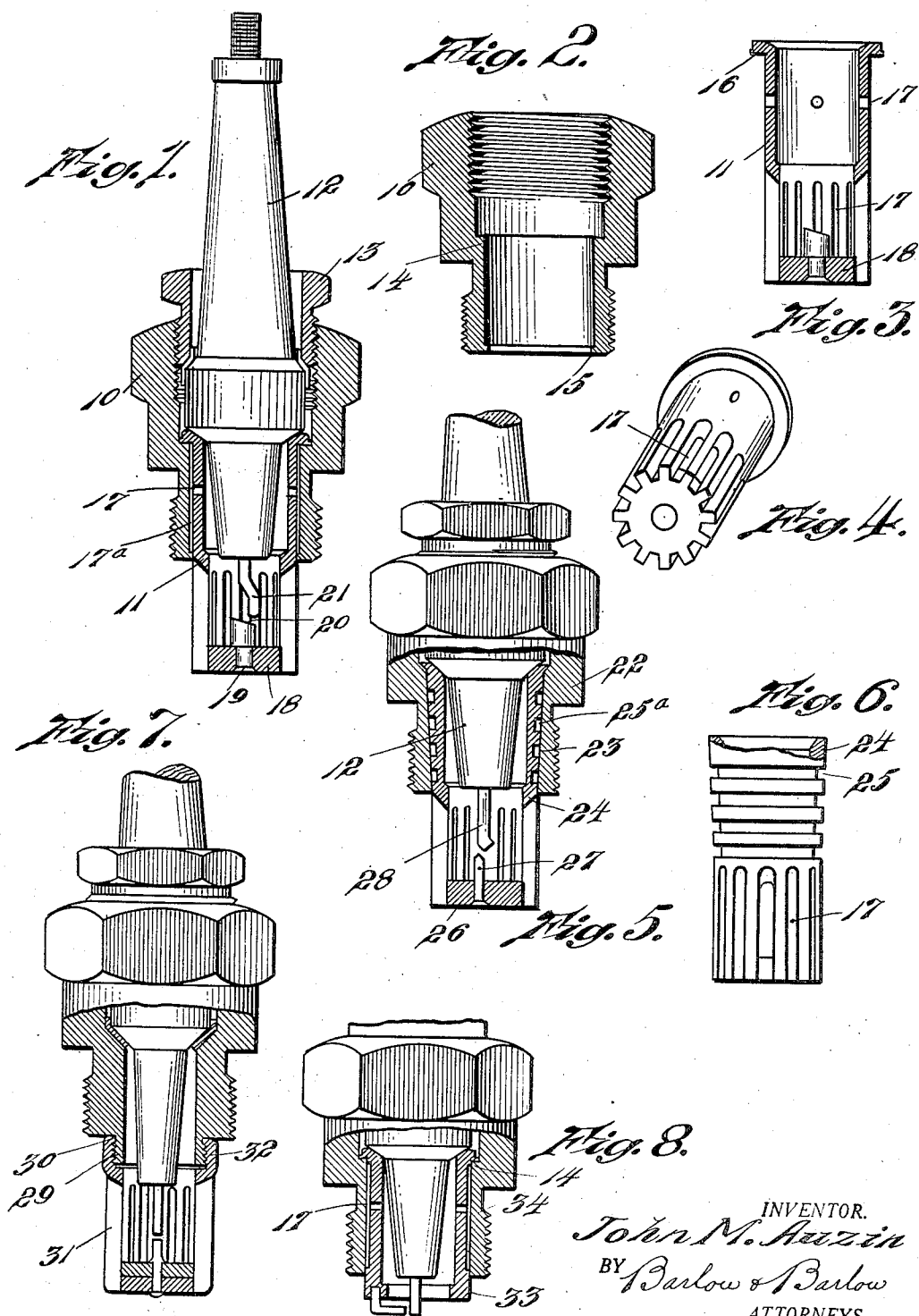
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SPARK PLUG FOR INTERNAL COMBUSTION ENGINES

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SPARK PLUG FOR INTERNAL COMBUSTION ENGINES

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My present invention relates to internal combustion engines, and has particular reference to an improved construction of spark plug therefor.

One object of my invention is to provide an improved construction of spark plug which will eliminate fouling and minimize carbonization.

Another object of my invention is to provide a spark plug construction which will serve as an effective heat exchanger and which will help to vaporize the incoming fuel and maintain the vapor in the vicinity of the spark plug in a dry, heated condition.

A further object is to provide a construction which will minimize the number of parts required and utilize screw machine products, therefore lowering the cost of manufacture, assembly and repair.

An additional object is to provide a construction which will permit a positive adjustment of the spark gap in a simple and effective manner.

Still another object is to heat insulate the metal part surrounding the lower portion of the power electrode at and above the portion of the plug that is screwed into the cooled cylinder head.

Still another object is to provide a spark plug that will function properly with the lower grade hydro-carbons, such as kerosene or a mixture of gasolene and petroleum.

With these and other objects and advantageous features in view, the invention consists of novel arrangements of parts more fully disclosed in the detailed description following, in conjunction with the accompanying drawing, and more particularly set forth in the appended claims.

In the drawing:

Fig. 1 is a sectional view of a preferred form of spark plug;

Fig. 2 is a sectional view of the spark plug shell;

Fig. 3 is a sectional view of the spark plug cage;

Fig. 4 is a perspective view of the spark plug cage;

Fig. 5 is a view, partly in section, of a modified form of spark plug;

Fig. 6 is a view, partly in section, of the cage formation therefor;

Figs. 7 and 8 are elevations, partly in section, showing further modifications.

It has been found that where a spark plug is new it is clean and the heat absorbing and heat radiating coefficient is high, heat from the plug vaporizing to a dry state the fuel within and adjacent to the plug. When this small amount of dry fuel is ignited by the spark it burns or combusts rapidly, exerting a sudden pressure on the poorer vaporized fuel and causing a general quick combustion.

As the plug becomes covered with a scaly encrustation, called carbon, the metal part of the plug loses its heat absorbing and heat radiating qualities, causing the fuel surrounding the plug to remain in a wet state. When this wet fuel is ignited it burns slowly, the rise in compression resulting from the combustion of fuel adjacent to the plug is slow and the result is a generally slow and poor combustion and loss of power.

As the pistons of the motor wear, oil leaks by and finds its way onto the walls of the combustion chamber. Even a new and clean plug will lose some of its efficiency if it remains oily while in operation, the oil destroying the heat radiating properties.

Only a thin layer of oil can stay on a clean plug at the operating temperature but when oil comes in contact with a heavily carbonized plug, the carbon acts very much like a sponge, absorbing and holding great quantities of oil and still further decreasing the heat radiating properties of plug.

It has been therefore found desirable to construct a spark plug which is simple to manufacture and assemble, and which minimizes carbonization of the plug by retaining sufficient heat from the exploding charges to thoroughly dry and heat the incoming cool charge, particularly in the vicinity of the spark plug. I have therefore devised a spark plug which has a charge heating chamber, the walls and base of this chamber being of substantial volume in order to retain the necessary heat, the chamber being insulated from the cylinder walls by an air pocket or the like.

I have also designed the spark plug parts to permit screw machine production thereof, thus reducing the cost of manufacture, assembly, and repair; and the following is a detailed description of several constructions which embody the principles of my invention.

Referring to the drawing, the embodiment shown in Figures 1 to 4 includes a spark plug body 10 of the usual form for screw threadedly engaging the cylinder engine walls, a novel cage construction 11, a central porcelain 12 and the usual porcelain locking nut 13. The spark plug body 10 is recessed to provide an upwardly projecting annular shoulder 14, the sides of the shoulder sloping outwardly and downwardly, and is also provided with an annular ring or flange 15 adjacent the base thereof. As shown in Figure 3, the cage 11 has a flange 16 at the upper end thereof which has a small annular positioning shoulder 16a, this flange being adapted to seat on the shoulder 14. The cage 11 is preferably made of a ductile material such as copper, and the flange 16 is therefore forced downwardly over the shoulder 14 to lock the cage within the spark plug body. If desired, a non-corroding metal such as nickel alloy may be used for the cage, the shoulder 14 being flattened to a certain extent if the cage material is harder; in any event, a firm contact is obtained. A plurality of slots 17 are formed in the lower portion of the cage, the solid sides of the cage engaging the annular ring 15 to provide a closed air pocket 17a between the cage and the spark plug body, this closed air pocket communicating with the interior of the spark plug through a series of openings or ports 17 positioned intermediate the annular ring 15 and the shoulder 14. As will be noted from Figure 3, the base 18 of the cage is quite thick and the cage itself is quite solid, the cage therefore serving as a heat exchange device which receives heat from the exploding gases, retains the heat on account of the surrounding air chamber, and gives up the stored heat to the incoming cool gases to dry and heat the gases adjacent the spark plug and in the charge receiving chamber. The spacing of the flange 16 by its positioning shoulder 16a assists in heat insulating the flange, and maintains the upper edge of the cage in heated condition.

The width of the air, or outer chamber, is determined, preferably by trial, so as to permit the radiation of sufficient heat to prevent melting of the cage, and still maintain the cage hot enough to prevent carbonization.

Approximately half the cylindrical area of the lower portion of the cylinder is removed by the multiplicity of slots, in order to allow a ready ingress and egress of the explosive mixture. The slots are carried through the thick bottom plate as shown in Figure 4, in order to increase the surface contacted by the incoming charge. On the in-

take stroke, as the incoming charge rushes in a certain amount of fuel and air will pass through the grid and absorb some of the heat retained from the previous explosion. As the inlet valve closes and as the charge moves upwards, the surplus heat in the bottom plate is transmitted to the grid bars to again bring the grid to a high temperature and in turn heat the charge that enters the chamber. As the pistons move upwardly on the compression stroke, some of the charge will strike the bottom of the plate and will move through the grooves into the chamber, thus being heated on three sides. I have shown the grid as formed by a tapered cutter, but a straight or round-edge cutter may be used, if desired.

As shown in Figure 1, the base 18 has a central ground electrode 19 riveted therein, the ground electrode having a sloping upper surface 20; the power electrode 21 attached to the porcelain 12 is bent outwardly, whereby a very accurate adjustment of the spark gap may be obtained by rotating the porcelain 12 and its power electrode with respect to the sloping surface of the ground electrode.

The positioning of the cage 11 as above described minimizes deposits of carbon on the spark plug, by preventing the adhering of any moist charge forming constituents thereon, since the retained heat of the cage immediately vaporizes any contacting fluid. In addition, there is no forcing of carbon or carbon forming materials into the air chamber, as the pressure is balanced through the communicating ports 17, and the burning gases must first pass through the inner chamber, thus preventing passage of carbon forming materials to the outer air chamber. The improved construction therefore maintains the operating efficiency of the spark plug at a continuous high level, giving exceptional pick-up qualities and power qualities to the engine equipped with the improved spark plug. It has also been found that the explosive mixture enters the spark plug during compression and forces any retained combusted gases into the annular chamber, thus filling the interior of the spark plug with explosive mixture.

If desired, a form of spark plug body and cage such as indicated in Figures 5 and 6 may be used, the body 22 having a tapered bore 23, and the cage 24 being correspondingly tapered at the upper end thereof, and having a depending slotted portion similar to the form shown in Figures 3 and 4. The cage 24 is provided with a series of radial recesses 25, which form a series of air pockets 25a that effectively serve to heat insulate the cage from the spark plug body. Instead of the type of ground electrodes shown in Figure 1, the base 26 of the cage may be provided with an eccentric ground electrode pin 27, the porcelain 12 having its power electrode 28 slightly bent at the lower end

thereof to adjustably cooperate with the ground electrode 27.

Instead of forming the depending cages as illustrated in Figures 1 and 5, the body of the spark plug may be formed with a small screw threaded depending portion 29 having a groove 20 adjacent the upper end thereof. A cage 31 similar in appearance to the lower portion of cage 11, but having an upper internally threaded flange portion 32, may be screwed on the depending portion 29, the upper end of the portion being turned or forced into the recess 30 to securely lock the cage 31 in place. The base 18 may if desired, have additional base disks secured or riveted thereto, preferably by the ground electrode to increase the heat storing capacity, as shown in Figure 7, the thickness of these additional disks being adjusted in accordance with the design and the intended use of the spark plugs.

Another constructional form which has advantageous features is the form shown in Figure 8, the spark plug body being similar in general appearance to the spark plug body 10 in that a shoulder 14 of similar character is provided, but differing in that no annular ring 15 is necessary. Instead, the cage is formed as indicated at 33, with an annular recess 34, the base of the cage contacting the depending portion of the spark plug body to provide an air chamber formed between the annular recess 34 and the inner wall of the spark plug body. This form is preferably provided with communicating ports 17 such as shown in Figure 3.

The novel spark plug constructions above described thus take advantage of the fact that hydro-carbon fuels can apparently withstand more heat at high speeds than at the lower speeds and the plugs are therefore so designed that the plug temperature quickly changes as the speed of the motor changes.

At slow speeds particles of carbon will collect on the plug but this carbon is of the dry and powdery type and not scaly. As the motor speed is increased the temperature of the plugs is also increased and when driving from forty to forty-five miles per hour, or more, depending on the maximum of car speed, the plugs attain sufficient heat to drive off the carbon that may have collected while running at low speeds.

My improved spark plug construction therefore utilizes easily manufactured screw machine parts, is quickly assembled without need of a gasket between the cage and the spark plug body, provides a small charge receiving chamber which retains sufficient heat to continually dry and heat the incoming cool charges and eliminates carbonization by preventing the incrustation and accumulation of carbon forming materials on the spark plug.

The spark plug body and cage constitute

a body section which is preferably formed in two parts, as such formation permits use of different materials for the parts and facilitates manufacture. The annular chamber between the two parts is preferably continuous but may if desired be interrupted by ribs or the like, a series of horizontal ribs being shown for example in Fig. 6. While the preferred cage construction has a closed lower end, as shown for example in Fig. 3, the lower end may be partly or fully open, as for example shown in Fig. 8.

While I have described certain structure forms of spark plugs specifically, it is obvious that desired changes in the formation of the cage, in the manner of securing the cage to the spark plug body, and in the relative proportioning of parts, may be made without departing from the spirit and the scope of the invention as defined in the appended claims.

I claim:

1. A spark plug having a body section, a central core therein, the body section adjacent the lower end of the central core having an annular air chamber and terminating in a depending heat exchanging cage, and ports communicating said annular air chamber with the interior of said cage.

2. In a spark plug, an outer body section, a central insulating core, a power electrode secured to said core and having its end eccentrically positioned, and a ground electrode secured to said outer body section and having its end terminating in a sloped surface, whereby the spark gap may be adjusted by turning the power electrode end with respect to the sloped surface of the ground electrode end.

3. A spark plug having a body portion, a central core therein, a cage between said body portion and said core, and means providing an annular air chamber between the cage and the body portion, said cage having port means therethrough, and said air chamber being otherwise sealed from the combustion chamber.

4. A spark plug having a body portion, a central core therein, a cage between said body portion and said core, and means providing an annular air chamber between the cage and the body portion, said cage having port means therethrough communicating the interior thereof with said air chamber and having apertured depending walls, said air chamber being otherwise sealed from the combustion chamber.

5. A spark plug having a body portion, a central core therein, a cage between said body portion and said core, and means providing an annular air chamber between the cage and the body portion, said cage having port means therethrough communicating with said air chamber and having apertured depending walls and a heat retaining base, said air

chamber being otherwise sealed from the combustion chamber.

6. A spark plug having a body portion having a bore, a central core therein, a cage in said bore between said body portion and said core and spaced from said body portion to provide an annular chamber, and closures for both ends of said annular chamber, one of the walls of said annular chamber having an opening therethrough.

7. A cage for a spark plug comprising a cup-shaped body having a series of longitudinal slots at the lower end thereof, and an opening through the wall of the upper end thereof.

8. A cage for a spark plug comprising a cup-shaped body having a series of equally spaced longitudinal slots at the lower end thereof, and an opening through the wall of the upper end thereof.

9. A cage for a spark plug comprising a cup-shaped body having a series of longitudinal equally spaced longitudinal ribs of uniform thickness at the lower end thereof, and an opening through the wall of the upper end thereof.

10. A cage for a spark plug comprising a cup-shaped body having a series of longitudinal equally spaced longitudinal ribs at the lower end thereof, said ribs being of uniform thickness.

11. In a spark plug for a combustion chamber, a body section having a central core-receiving bore and provided with exterior cylinder-engaging threads in the lower portion thereof, a core in said bore, the lower portion of said body section adjacent said threads having spaced walls forming a substantially closed air chamber, and port means in one of said walls forming the sole communication between said air chamber and said bore.

12. In a spark plug for a combustion chamber, a body section having a central core-receiving bore and provided with exterior cylinder-engaging threads in the lower portion thereof, a core in said bore, the lower portion of said body section adjacent said threads having spaced walls forming a substantially closed air chamber, and port means in the wall separating said air chamber and said bore forming the sole communication between said air chamber and said bore.

In testimony whereof I affix my signature.
JOHN M. AUZIN.