

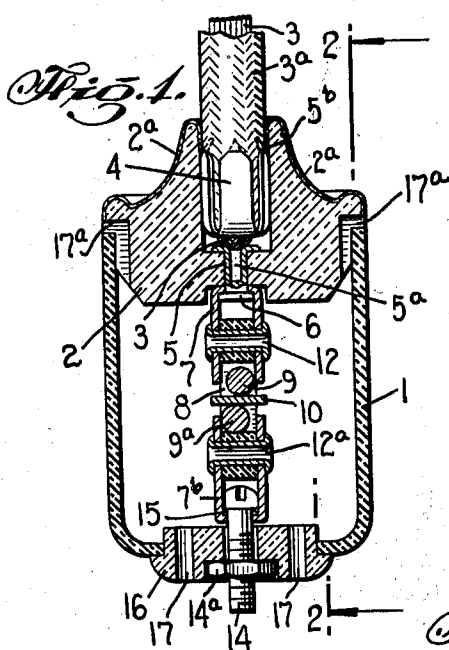
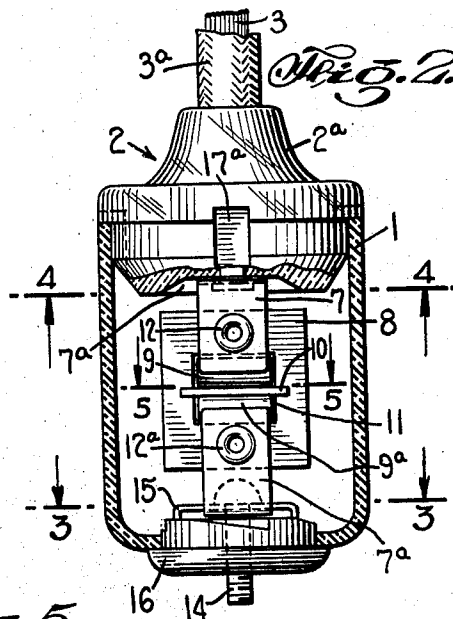
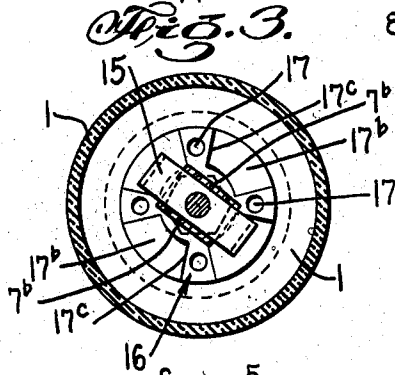
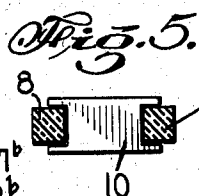
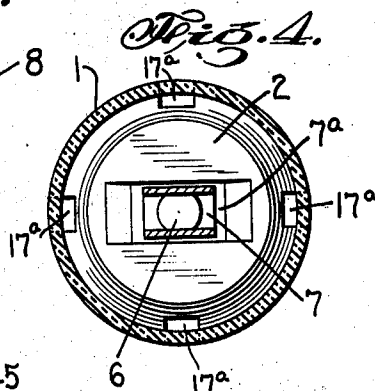
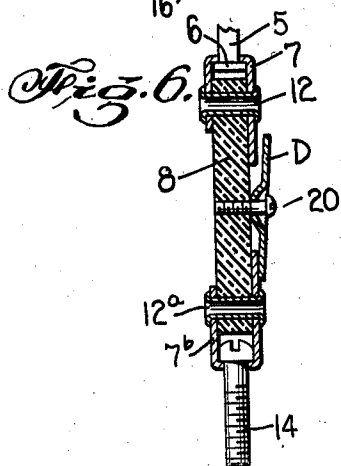
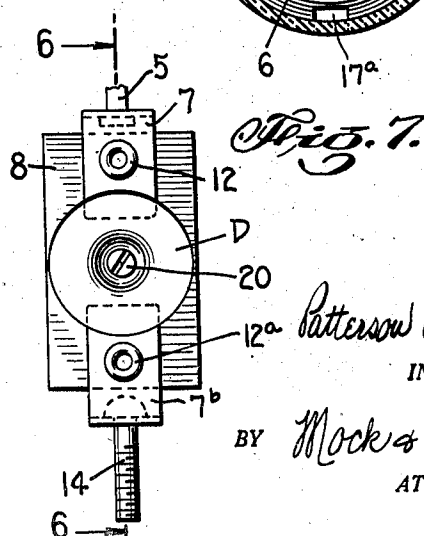
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P. O. STEWART

1,839,004

HIGH TENSION IGNITION AMPLIFIER

Filed June 10, 1931



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HIGH TENSION IGNITION AMPLIFIER

Application filed June 10, 1931. Serial No. 543,375.

My invention relates to a new and improved high-tension ignition amplifier.

One of the objects of my invention is to provide an attachment which may form part of the high-tension circuit of an ignition system, and which will produce an oscillatory discharge, between the electrodes of the spark plug of an internal combustion engine.

Another object of my invention is to produce a device of this type which shall be of minimum resistance.

Another object of my invention is to provide in combination, in a device of this type, one or more electrodes made of material on which an insulating coating is formed by the passage of electric current, and one or more electrodes made of material on which a coating of relatively good conductivity is formed by the passage of current.

Another object of my invention is to include in a device of this type a recessed cap or end piece made of a non-carbonizing dielectric material, the processing of which automatically forms means for aiding the secure connection of the high-tension wire to the device.

Another object of my invention is to provide vent holes in a device of this type, whereby any condensed moisture or gases that may be formed will be dissipated.

Another object of my invention is to include in a device of this type, a simple built-in locking means to preclude disassembly or the disturbing of any adjustments.

Other objects of my invention will be set forth in the following description and drawings which illustrate a preferred embodiment thereof, it being understood that the above general statement of the objects of my invention is intended merely to generally explain the same and not to limit it in any manner.

Fig. 1 is a sectional view partially in elevation.

Fig. 2 is a sectional view on the line 2—2 of Fig. 1.

Fig. 3 is a sectional view on the line 3—3 of Fig. 2.

Fig. 4 is a sectional view on the line 4—4 of Fig. 2.

Fig. 5 is a sectional view on the line 5—5 of Fig. 2.

Fig. 6 is a sectional view on the line 6—6 of Fig. 7.

Fig. 7 is an elevation showing a modification.

In the embodiment shown in Figs. 1—5, the attachment comprises a casing 1 made of any suitable insulating material, such as a condensation resin, fibre, or the like.

For convenience, it is assumed the device is held in the vertical position shown in Fig. 1, although the operation thereof is not dependent upon any particular position.

The casing 1 is provided with a cover 2, which is preferably made of porcelain. The high tension lead 3 is inserted into the recess of the cap or cover 2, and it is provided with a metal terminal member 4 which makes firm contact with the terminal member 5, which is formed like a hollow rivet, and is expanded so that it is firmly locked in the corresponding opening 5a of the cover 2.

In order to firmly anchor the high tension wire 3 in position, without any external mechanical securing means, a coating 2a of glaze may be formed upon the porcelain cap 2.

When the glaze 2a is applied, this is preferably done by means of spraying device, so that the liquid enters the upper end of the recess 5a, to about the point 5b. When baked this glaze constricts the outer end of the recess 5a, down to about the point 5b, in order to form an undercut at the inner end of said recess 5a.

The contact member 4 has its wall separated into sections by means of V-shaped slits, so that said member 4 can be forced into the wider or inner portion of the recess 5a, and it then forms a positive lock, due to the expansion of said member 4, which holds the wire 3 in position with great firmness. The end of the member 4 is soldered or otherwise suitably connected to the inner exposed end of the wire 3. The wire 3 is provided with suitable insulation 3a.

The inner end of the member 5 is provided with a head 6, which holds a yoke 7 in position. This yoke 7 has its side walls of rectangular shape, and the upper end of the yoke 7

is located in a recess 7a in the inner end of the cap 2, so that the yoke 7 can only turn to a limited extent. A lower yoke 7b is provided, having the same shape and dimensions 5 as the upper yoke 7 and said yokes 7 and 7b are connected to a plurality of intermediate sheets of fibre or other insulating material 8.

These sheets of fibre form an inner casing in which electrodes 9 and 9a are movably 10 held. The electrodes 9 and 9a are separated by a partition member 10, and the ends of said partition 10 are provided with recesses, as shown in Fig. 5. This partition member 10 can be diagonally introduced into the common opening 11 which is formed in said fibre 15 members, and the metal partition member 10 can then be turned until it is horizontal, in which position it fits closely but freely, so that said partition member 10 has a limited 20 up and down movement. Hence, the three members 9, 9a and 10 can vibrate in a vertical direction, under the influence of the vibration of the engine.

In order to assemble the parts, the fibre 25 pieces 8 can be first riveted to the upper yoke 7 by means of a rivet 12, the rollers 9 and 9a and the partition member 10 can then be inserted into proper position and the lower yoke 7b can then be riveted to the rectangular 30 fibre pieces 8, by means of a rivet 12a.

Before this is done, a screw 14 is inserted through an opening in the bottom of the lower yoke 7b.

Likewise, the U-shaped spring member 15 35 is placed in position before the screw 14 is passed through an opening provided in said spring 15 and an opening provided in the bottom of the yoke member 7b.

The bottom of the casing 1 is closed by a 40 member 16, made of porcelain or other suitable insulating material, and a nut 14a clamps the closure 16 firmly in position. The bottom closure 16 is provided with openings 17, in order to ventilate the casing, and for this 45 purpose the cap 2 is provided with any suitable number of recesses or openings 17a, so that the casing is thoroughly ventilated in every position which it may assume.

The inner surface of the closure member 16 50 is provided with depressions 17b which are shaped like ratchet teeth, so that the ends of the blade spring 15 can abut the shoulder portions 17c of said depressions 17b, in order to prevent the cap 2 and its associated parts 55 from turning.

In order to assemble the parts, the nut 14a is placed within the recess provided for this purpose in the closure 16, and the cap 2 together with all the inner parts suspended 60 therefrom is inserted, until the threaded end of the screw 14 passes through the threaded opening of the nut 14a. The cap 2 is now turned in a clockwise direction until the members 2 and 16 are firmly clamped to- 65 gether. It is then impossible to reversely

turn the cap 2, in the counterclockwise direction, because this is prevented by the spring 15 and the ratchet-tooth depressions 17b.

The unit therefore is permanently assembled and the factory adjustment cannot be 70 tampered with.

It is well known that the oxide caused by an electric spark or arc on electrodes of brass, nickel, iron, etc., is a relatively good 75 conductor of electricity and that the oxide formed under the same conditions on aluminum, tungsten and similar metals has a relatively high resistance, it is also well known that the single jump subsidiary gap used in 80 ignition systems relies on a rise in potential for its effects. The use of the multiple pump quenching gap, which produces an oscillatory high tension discharge is also well known and it is with the latter type of device 85 my invention deals.

From the first the designers and inventors of these devices have used the same metals for all of the electrodes, that is in devices using 90 nickel electrodes, all of the electrodes were of nickel; in the devices using tungsten all of the electrodes were of tungsten; in the devices using electrodes of a metal of which the oxide was a conductor the electrodes were 95 spaced far enough apart to preclude the fouling or short-circuiting of the device by the oxide formed, and of course these gaps added an appreciable resistance to the circuit.

In the devices using aluminum, tungsten and such metals, although the gaps were very 100 minute at the start and the resistance was much lower than the devices which initially had wider gaps, the resistance rapidly built up due to the increasing thickness of the layers of non-conducting oxide formed by the 105 action of the current. Heretofore this increase of resistance was either ignored, or a safety gap was placed in parallel so the current could by-pass or the oxide was partly removed by vibration. In my new invention 110 the insulating oxide formation is reduced to just one-half the amount with the same number of gaps.

While I do not wish to be restricted to any particular material or combination of materials, referring to Fig. 1, I prefer to make 115 the yokes 7 and 7b and the member 10 of brass and to make the members 9 and 9a of aluminum. Thus when the member 14 is suitably connected to the distributor head of an internal combustion engine, and the high 120 tension wire from the coil is inserted in the recess 5a, the high tension current will pass through the members 7, 9, 10, 9a and 7b.

By choosing the materials as above specified, the current passes through four minute 125 gaps, yet has only a total resistance of four very thin layers of insulating oxide to overcome, first when passing from the yoke 7 to the member 9, secondly from the member 9 to

the member 10, thirdly from member 10 to the member 9a, and fourthly when it passes from the member 9a to the yoke 7b. If all of the parts were made of aluminum the resistance would be double that of my combination.

The electrode members 9 and 9a are preferably in the form of elongated rollers, and they are sufficiently wide so as to make fairly close contact with the adjacent sides of the yoke 7 and the yoke 7b. Indeed, the coated surfaces of the rollers 9 and 9a may be in constant contact with the inner surfaces of the yokes 7 and 7b.

The vibration and rubbing contact which is thus produced causes any excess of aluminum oxide coating to flake off, so that the resistance of the device never becomes undesirably high.

Although I have shown the metal alternating, first of one group (non-insulating oxide) then of the other (insulating oxide), it is to be understood that I do not wish to be restricted to that sequence or arrangement, and although I have shown what I now believe to be the preferred structure, other structures and modifications can be used in order to produce a plurality of gaps, such as a chain, a series of disks, or a rolling contact. A simple modification is shown in Figs. 6 and 7. A fibre sheet 8 is connected by means of rivets 12 and 12a to yokes 7 and 7b in the manner previously specified, and a screw 14 is connected to the lower yoke 7b, in the manner previously specified. The holding spring 15 is employed in the manner previously specified, and the general construction of the parts is the same. A disk D is made of aluminum is loosely held in position by means of a screw 20, so that said disk can vibrate up and down to a limited extent and it can freely oscillate so that it makes alternate contact with the yokes 7 and 7b. Likewise, the fit of the disk D upon the screw 20 is sufficiently free, in order to permit the disk D to simultaneously contact with the adjacent sides of the yokes 7 and 7b.

The principle of operation of this device is the same as that previously specified.

When the high tension voltage is imposed upon the ignition system, this voltage must rise to a point sufficiently high to break down the insulating coatings formed upon the aluminum member or members. When this insulating coating is broken down, the secondary current discharges through the terminals of the spark gap in the form of an oscillatory discharge of high frequency.

The cap 2 is provided with recesses 17a, so that there will always be a natural circulation of air through the openings 17 and recesses 17a and through the device, thus ventilating it sufficiently, irrespective of the position of the device. The device is normally held with its axis in the vertical position.

It will be noted that the recesses or openings 17a provide inlet passages which are perpendicular to the longitudinal axis of the device. The openings 17 provide outlet passages which are parallel to said longitudinal axis. When the device is used on an automobile or other vehicle, it is rapidly moved. Likewise, it is normally in the path of a current of air which is produced by the fan which forms part of the engine. Assuming that the axis of the device is normally held in the vertical position, as this would be its position in nearly all cases, the air current which is produced by the motion of the vehicle and by the fan enters the top of the casing through the lateral inlet passages. This air current is downwardly deflected so that a substantial part of it passes out through the opening 17, thus thoroughly ventilating the device.

Even if the path of the air current is parallel to the longitudinal axis of the device, the same effect will be secured because the air current will build up an excess of pressure at the cap 2 and it will produce a relative vacuum at the bottoms of the openings 17. Hence, a current of air would be induced through the casing 1. This induced current of air is of great value in preventing corrosion of the parts within the casing. The sparks produced within the casing generate ozone, which has a powerful oxidizing action upon the metal parts. Likewise, if the casing 1 is made of a resin of the phenol-formaldehyde type, the ozone combines with gases which are given off by this condensation resin, thus producing additional corrosion of the metal parts and of the fibre parts within the casing. While I prefer to have the inlet openings of the casing transverse with respect to the longitudinal axis, and to have the outlet openings substantially parallel to said longitudinal axis, I do not wish to be limited to this specific arrangement. It is sufficient if the casing has openings which are axially separated to an extent sufficient to cause a current of air to pass through the casing. This ventilating means makes it possible to make the body of the casing out of bakelite which is superior to fibre for many reasons. Likewise, even if the bottom openings 17 are omitted, the shape of the cap causes any air which enters the openings 17a to be downwardly deflected, thus ventilating the casing. This current of air causes any condensed moisture to be dried or removed, and it drives out any gases formed by the passage of the current through the gaps. The electrodes 9 and 9a are provided with a thin coating of lacquer before they are inserted, in order to provide the necessary insulation until the layers of oxide are built up.

In order to conveniently specify the invention in the claims, I refer to conducting

members on which a layer of good conductivity is formed by the passage of the current, as "brass" members. Likewise, I refer to members on which a relatively non-conducting layer is formed by the passage of electric current, as "aluminum" members. Hence, whenever I refer to "brass" in the claims, it is to be understood that I wish to cover all equivalent metals, and the same is true when I refer to "aluminum" in the claims.

The advantage of using the porcelain cover 2 is that it is non-carbonizing. If a perfect contact is not made between the high tension wire 3 and its member 4, or between the members 4 and 5, a spark is formed. If the member 2 is made of a condensation resin such as "bakelite", this spark will carbonize and burn through the cover, or interfere with the direct circuit which is desired. These disadvantages are avoided by the use of unglazed porcelain directly adjacent the member 4, and this unglazed porcelain also has a very high frictional grip on the member 4. I have shown a preferred embodiment of my invention, but it is clear that numerous changes and omissions can be made without departing from the spirit of my invention.

I claim:

1. In an ignition amplifier for internal combustion engines, a plurality of conducting members forming a spark gap, said members having a limited free relative movement with respect to each other under the influence of engine vibration, one of said members being made of brass and the other being made of aluminum.

2. In an ignition amplifier for an internal combustion engine, a casing, movable conducting members located in said casing and having a limited relative movement with respect to each other and forming a spark gap or spark gaps, said casing having ventilation openings at separated portions of the wall thereof, said ventilation openings being axially separated from each other to an extent sufficient to cause a ventilating current of air to be induced through said casing.

3. In an ignition amplifier for an internal combustion engine, a series of conducting members having a limited free relative movement with respect to each other under the influence of the vibration of the engine, said members forming a series of spark gaps, the alternate members of said series being respectively made of brass and of aluminum.

4. In an ignition amplifier for an internal combustion engine, a plurality of terminals, a partition member located between said terminals and movable relative thereto, and electrode members respectively located between said terminals and said partition member.

5. In an ignition amplifier for an internal combustion engine, a holding member made

of insulating material and provided with an opening, yoke-shaped terminal members connected to said holding member at opposite ends of said opening, a partition member movably located in said opening, and electrode members loosely confined between said yokes and the opposite surfaces of said partition member.

6. In an ignition amplifier for an internal combustion engine, a holding member made of insulating material and provided with an opening, yoke-shaped terminal members connected to said holding member at opposite ends of said opening, a partition member movably located in said opening, and electrode members loosely confined between said yokes and the opposite surfaces of said partition member, said yokes and said partition member being made of brass and said electrode members being made of aluminum.

7. In an ignition amplifier for an internal combustion engine, a casing having end closures, conducting members located within said casing, said conducting members being relatively movable under the influence of the vibration of the engine, and forming a spark gap or spark gaps, said closure members having terminal members to which said conducting members are connected, and ratchet means adapted to lock said end closures in position, in order to prevent said casing from being opened.

8. In an ignition amplifier for an internal combustion engine, spark amplifying means enclosed in a casing, closure means for said casing, threaded parts holding said closure means and said casing together, and ratchet means cooperating with said threaded parts to prevent said closure means and said casing from being opened.

9. In an ignition amplifier for an internal combustion engine, a casing having a first end closure and a second end closure, a first terminal member connected to the first closure member and a second terminal member passing through the second closure member, said second terminal member being externally threaded and being located in a bore of the second closure member, a nut mounted upon the second terminal member and located in a recess in the second closure member, a plurality of relatively movable conducting members located in said casing and in inductive relation with said terminal members, the parts between said terminal members being turnable in unison with said first terminal member, the inner surface of said second closure member including ratchet teeth, said parts including a spring adapted to engage said ratchet teeth.

10. A part for the ignition circuit of an internal combustion engine comprising a casing having circuit means therein which include a spark gap, at least a part of said casing being made of insulating and non-car-

bonizing material, said part having a recess adapted to receive a lead wire, a current terminal located in said part and adapted to make contact with said lead wire.

5 11. A part for the ignition circuit of an internal combustion engine comprising a casing having circuit means therein which include a spark gap, at least a part of said casing being made of insulating and non-carbonizing material, said part having a recess
10 adapted to receive a lead wire, a current terminal located in said part and adapted to make contact with said lead wire, said recess being constricted at its outer end.

15 12. In the ignition circuit of an internal combustion engine, a casing, circuit means located within said casing and including a spark gap, said casing having vent means on its periphery, said vent means being axially
20 separated to an extent sufficient to cause a current of air to be induced through said casing.

13. A part for the ignition circuit of an internal combustion engine comprising a casing
25 said casing having circuit means therein which includes a spark gap, having an end member made of insulating and non-carbonizing material, a terminal member connected to said end member, said end member having
30 a recess whose inner end is of larger diameter than the outer end thereof, and a high tension wire having an expansible metal member connected thereto, said metal member being adapted to make contact with the
35 adjacent terminal member, said expansible member being adapted to engage the constricted outer end portion of said recess, in order to hold said wire in position.

14. A part for the ignition circuit of an
40 internal combustion engine comprising a casing said casing having circuit means therein which include a spark gap, having an end member made of insulating and non-carbonizing material, a terminal member connected to said end member, said end member
45 having a recess whose inner end is of larger diameter than the outer end thereof, and a high tension wire having an expansible metal member connected thereto, said metal member being adapted to make contact with the
50 adjacent terminal member, said expansible member being adapted to engage the constricted outer end portion of said recess, in order to hold said wire in position, said end
55 member being made of porcelain and having a glazed coating which extends into the outer end of said recess.

15. In the ignition circuit of an internal combustion engine, a casing having circuit
60 means located therein, said casing having a plurality of inlet openings which are inclined to the longitudinal axis of the casing, said casing also having deflecting means adapted to axially deflect the air which enters said openings.

16. In the ignition circuit of an internal combustion engine, a casing having circuit means located therein, said casing having a cap connected thereto, said cap having an interior portion which projects into said casing, said cap forming passages which comprise inlet openings and which are inclined to the longitudinal axis of the casing and said cap also forming passages in its projecting portion which are inclined to the first mentioned passages, when said cap is fitted into the casing.

In testimony whereof I affix my signature.

PATTERSON O. STEWART.

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