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H. STADLER ETAL

3,308,758

IGNITION DEVICE

Filed July 2, 1965

FIG. 1

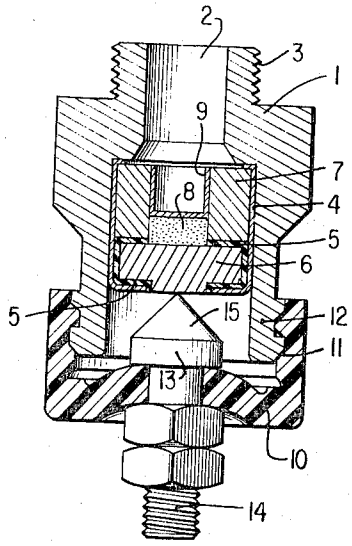
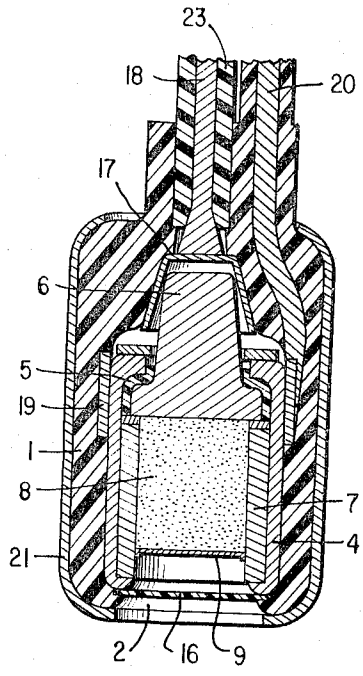


FIG. 2



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IGNITION DEVICE

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17 Claims. (Cl. 102—28)

The present invention relates to an ignition device, and more particularly, to electrically operated primers.

For purposes of releasing shifting or control and regulating operations, for example, upon exceeding predetermined temperatures, measuring pressures, current amplitudes or the like, for initiating mechanical operations such as, for example, separating of securing pins, opening of valves, etc., for the starting of ignition and combustion processes as well as for numerous other occasions, electric primers are used in many installations, which are provided with a pole piece made of electrically coductive material within a mechanically rigid cap-shaped casing also made of electrically conductive material and in which the pole piece separated from the casing by an insulation is held in the electrically conductive connection with the casing by way of an electrically conductive ignition composition. The current supply thereby takes place by way of the pole piece and the conductive ignition composition to the casing connected with the ground.

These electrical primers or percussion caps have proved themselves as extraordinarily well suited for the aforementioned intended purposes. With installations in which they have to be ready for operation over long periods of time, their construction and assembly as regards the establishment of a permanent electrical connection between the two poles of the primer and the current lead-in conductors thereof and especially the establishment of a permament contact between pole piece and the current supply coordinated thereto involves considerable difficulties, especially as the otherwise possible soldering of supply wires or the like to the two poles of the primer are out of question by reason of the danger of a premature ignition or also decomposition of the ignition composition pressed into the primer cap and against the pole piece at the relatively high required soldering temperatures. It is also conceivable to establish the electrically conducting connection between the primer cap and the mass by a pressing-in of the primer into a corresponding receiving device and to connect the pole piece with the current supply line, for instance, by means of an adjustable screw. However, over longer periods of time and especially with temperature fluctuations, this may lead readily to a loosening or decrease of the contact pressure whereby the conductive connection is then at least rendered questionable. The same is also the case with installations which are exposed to more or less strong and frequent movements or vibrations by reason of the danger of loosening of the threaded contact. Finally, it would also be conceivable to establish the electrically conducting connection between the poles of the primer and the supply lines by spring contacts, however, such measure is relatively complicated and expensive.

It is the aim of the present invention to avoid the aforementioned disadvantages and to create an ignition element with the use of an electrical primer which is provided within a cap of electrically conductive material with a pole piece of electrically conductive material insulated with respect thereto as well as with an electrically conductive ignition composition keeping the pole piece in the conductive connection with the cap, whereby also over longer periods of time an electrically conductive connection is assured between the current supply lines and

ground in such ignition device. According to the present invention, this is achieved in that the primer is pressed into a mechanically rigid casing of electrically conductive material which is provided with an exhaust aperture in extension of the primer composion and is adapted to be connected with the ground preferably directly and permanently or mechanically detachably, for example, by means of a threaded connection or the like, and in that the pole piece of the primer is held in resiliently yielding contacting pressure connection with a mechanically rigid contact element of electrically conductive material which is adapted to be connected directly or indirectly mechanically with the current source and is held in a cap of thermoplastic material, preferably of polyethylene or polypropylene that is under mechanical stress and is secured to the casing by means of a threaded connection or the like at the end opposite the exhaust aperture.

Insofar as an ignitability of the primer element is desired or necessary over longer distances, the present invention proposes to arrange the primer in a casing of thermoplastic material, especially of polyethylene or polypropylene provided with an exhaust aperture in the extension of the primer composition which is under mechanical pre-stress when assembled, and to hold the primer by means of the casing in resiliently yielding contact pressure connection by way of its two poles with contact elements embedded into the casing and connected by insulated connecting wires led out of the casing through the mechanical securing means. Especially for the protection of the plastic casing, the latter may be provided with a mechanically rigid metallic cover.

Accordingly, it is an object of the present invention to provide an ignition device of the type described above which obviates the aforementioned shortcomings and drawbacks encountered with the prior art constructions in a simple and operationally reliable manner.

It is another object of the present invention to provide a primer element which is so constructed and arranged as to assure good electrical contact between the various parts, notwithstanding the absence of soldered connections.

A further object of the present invention resides in the provision of a primer device in which a permanent contact is assured between the various electrical connections and pole pieces thereof without danger of premature ignition or decomposition of the ignition composition.

Still another object of the present invention resides in the provision of a primer device which is reliable in operation over long periods of time notwithstanding temperature fluctuations and/or vibrations to which it may be exposed.

Still a further object of the present invention resides in the provision of an ignition device which is simple in construction and relatively inexpensive in manufacture and assembly without detriment to the reliability of operation over long periods of time.

Further objects, features, and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawing which shows, for purposes of illustration only, two embodiments in accordance with the present invention, and wherein:

FIGURE 1 is a longitudinal cross-sectional view through a first embodiment of an ignition element adapted to be threadably secured in accordance with the present invention; and

FIGURE 2 is a longitudinal cross-sectional view through a modified embodiment of an ignition element in accordance with the present invention having current supply wires.

Referring now to the drawing wherein like reference numerals are used throughout the two views to designate

like parts, and more particularly, to FIGURE 1, the electrical primer illustrated therein essentially consists of the cap 4, of the pole piece 6 separated from the cap 4 by the insulation 5 as well as of the electrically conductive ignition composition 8 electrically connecting the pole piece 6 by way of the reinforcement 7 with the cap 4 and having a cover 9. This primer is so pressed into the casing 1 provided with the exhaust aperture 2 as well as with the threaded extension 3 that the exhaust aperture 2 is disposed in extension of the ignition composition 8. The cap 10 is arranged on the end of the casing 1 opposite the exhaust aperture 2 and is secured by means of mutually engaging annular projections 11 and grooves 12. The contact element 13 is held in the cap 10 by means of an extension. The cap 10 made of thermoplastic material, especially of polyethylene and propylene, is subjected to such mechanical stress when assembled that the contact pin 13 together with its conical point 15 are held in permanent resiliently yielding contacting pressure connection with the pole piece 6.

If an electric current is supplied by way of an ignition means, battery, or the like, or also by way of a current network connected directly or also indirectly by way of a lead-in wire connection to the rear end 14 of the contact pin 13, then the current flows by way of the contact element 13, the pole piece 6, the ignition composition 8, the reinforcement 7, and the cap 4 to the casing 1 connected by means of the threaded extension 3 with the ground of the installation (not shown) whereby the ignition composition 8 is ignited and thus the intended operation is released.

According to FIGURE 2, in which parts corresponding to those of FIGURE 1 are designated by the same reference numerals, the primer is surrounded on all sides by the casing 1 which is made of thermoplastic material, especially of polyethylene and which is under mechanical stress, leaving the exhaust aperture 2 in extension of the ignition composition 8; the contact element 17 with its feed wire 18 as well as the contact element 19 with its feed wire 20 are also held in resiliently yielding contacting pressure connection with the pole piece 6 and the cap 4, respectively, by means of this mechanically stressed casing 1. In contrast to the insulation of the wire 20 made in one piece with the casing 1, the insulation 23 of the wire 18 is established separated. Of course, however, the insulation of wire 18 could also be made in one piece with the casing 1.

The casing 1 is provided with a mechanically rigid metallic cover 21 for the protection of the casing 1, especially during insertion into an accommodating device (not illustrated) of an installation, also not illustrated. The cover 21, like the casing 1, is, of course, provided with an exhaust aperture. In addition to the cover 9, a polyethylene foil 16 is inserted for the better protection of the ignition composition 8 at the exhaust side of the cap 4 between the cap 4 and the casing 1.

The function and operation of the ignition element of FIGURE 2 is the same as already described in connection with FIGURE 1.

A particular advantage of the arrangement and of the construction in accordance with the present invention of the first-described element is its re-usability in that it may be charged repeatedly through the exhaust aperture 2 with an electric primer which may also contain a thermic mixture. A further advantage of both ignition devices is the fact that they can be tested at all times as to their operability whereby the electrical resistance thereof is measured by means of a measuring voltage, of for example, 1.5 volts, connected to the ignition element. If this resistance lies within the prescribed range, then the desired operating safety and reliability is given. Furthermore, the obtainable small ignition times of, for example, 0.2 to 0.3 ms. with an ignition energy of about 2 mw. are advantageous as they permit utilizing the ignition element according to the present invention also for technological measurements.

While we have shown and described two embodiments in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible of numerous changes and modifications as known to persons skilled in the art; and we, therefore, do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

We claim:

1. An ignition element for an electrical ignition device, comprising:
   - mechanically rigid casing means of electrically conductive material forming a first pole piece,
   - said mechanically rigid casing means being provided with exhaust aperture means in the extension of the ignition composition and being adapted to be connected with ground, and a primer assembly arranged at least in part in said casing means including electrically conductive means forming a second pole piece, insulation means between said first and second pole pieces, ignition composition means electrically connected in series between said second pole piece and said casing means,
   - mechanically rigid contact means of electrically conductive material in electrical connection with each of said first and second pole pieces, each of said first and second pole pieces being in series connection with their respective contact means and said ignition composition means,
   - and means for normally holding at least one of said contact means in resiliently yielding contact pressure connection with its corresponding pole piece including cap means of thermoplastic material operatively connected with said casing means and mechanically stressed in the assembled unfired normal condition.

2. An ignition element for an electrical ignition device, comprising:
   - mechanically rigid casing means of electrically conductive material,
   - primer means pressed into said casing means including pole means, ignition composition means electrically connected in series between said pole means and said casing means, contact means of electrically conductive material directly engaging said pole means on the side opposite said ignition composition means, said pole piece being electrically connected in series between said contact means and said ignition composition means, and means for normally holding said contact means in resiliently yielding contact pressure connection with said pole means including cap means of thermoplastic material secured onto said casing means and mechanically stressed in the assembled unfired normal condition.

3. An ignition element according to claim 2, wherein said casing means is provided with exhaust aperture means in the extension of the ignition composition, said contact means being mechanically rigid, and including insulation means between said pole means and said casing means.

4. An ignition element for an electrical ignition device, comprising:
   - a primer assembly including mechanically rigid first pole means of electrically conductive material, second pole means, ignition composition means electrically in series between said first pole means and said second pole means, a contact means of electrically conductive material for each of said pole means,
   - and means for holding each of said pole means in resiliently yielding contact pressure connection with their corresponding contact means including casing means accommodating therein said primer assembly and essentially consisting of thermoplastic material, said casing means being mechanically stressed in the assembled position,

and insulated line means extending through said casing means and operatively connected with said contact means.

5. An ignition element according to claim 4, wherein said first pole means is provided with exhaust aperture means in the extension of the ignition composition, said casing means is provided with exhaust aperture means in extension of said ignition composition, said insulated line means is mechanically connected with said contact means, and including insulation means between said first and second pole means.

6. An ignition element according to claim 4, wherein said thermoplastic casing means is provided with a mechanically rigid metallic cover means.

7. An ignition element according to claim 5, wherein said thermoplastic casing means is provided with a mechanically rigid metallic cover means.

8. An ignition element, comprising: a primer cap including a first pole piece, a second pole piece, insulation means for electrically insulating said first pole piece from said second pole piece, ignition means including an ignition composition and being electrically connected in series between said first pole piece and said second pole piece, and a substantially rigid first casing enclosing and securely holding in assembled relationship said pole pieces, said insulation means and said ignition means as a single unit; a second substantially rigid casing for securely receiving said primer cap; an electrical contact engaging and in series circuit connection with one of said pole pieces; and mounting means resiliently mechanically connecting said contact with said second casing and resiliently urging said contact into secure tight engagement with said one of said pole pieces in the normal unfired condition of said ignition element.

9. The ignition element according to claim 8, wherein said electrical contact has one conically formed terminal end engaging said one of said pole pieces, an intermediate annular portion of reduced diameter and opposite threaded terminal end portion for mechanically receiving an electrical lead.

10. The ignition element according to claim 9, wherein said mounting means is a cup-shaped thermoplastic closure cap having a substantially central aperture with walls securely engaged within said contact annular portion of reduced diameter; said second casing including a substantially tubular portion; said closure cap being telescopically engaged with one end of said tubular portion.

11. The ignition element according to claim 10, wherein the other end of said tubular portion has an external threaded extension for mounting the ignition element and establishing a ground connection; said second casing extension having a substantially axial passageway for communicating with said primer cap to constitute an exhaust aperture; said tubular portion having an internal cylindrical portion of greater diameter than said exhaust aperture and opening in the direction toward said closure

cap for securely holding said primer cap and providing an opening for the assembly of said primer cap; said second casing having an annular shoulder portion between said exhaust aperture and said cylindrical portion to constitute abutment means for resisting the resilient engaging force of said electrical contact; said second casing being electrically connected in series with the other of said pole pieces.

12. The ignition element according to claim 11, wherein said ignition composition is electrically conductive.

13. The ignition element according to claim 8, wherein said second casing is metallic, has a tubular portion, and internally extending annular flange portions at each end of the tubular portion; said mounting means comprising a thermoplastic substantially tubular element received securely within said second casing and engaging said second casing along substantially the entire internal surface thereof.

14. The ignition element according to claim 13, wherein said primer cap is mounted securely within said substantially tubular mounting means; said electrical contact engaging said primer cap around a substantial portion of the periphery thereof and being tightly mounted between said mounting means and said primer cap; an electrically conductive feed wire extending from the outside of said second casing through said mounting means and establishing electrical contact with said electrical contact.

15. The ignition element according to claim 14, wherein the other of said pole pieces has a portion extending outwardly of said first casing; a second electrical contact having a substantially cup shape receiving said other pole piece extension telescopically; said mounting means resiliently urging said second contact into secure electrical engagement with said other pole piece extension; a second feed wire extending through said mounting means and being electrically connected with said second contact.

16. The ignition element according to claim 15, wherein said primer cap, said mounting means, and said second casing each has aligned exhaust apertures for exhausting the combustion product of said ignition composition.

17. The ignition element according to claim 16, wherein said ignition composition is electrically conductive.

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