United States Patent

[11] **3,577,208**

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[73] Assignee **The United States of America as represented by the Secretary of the Navy**

[54] **ELECTROSTATIC GROUNDING PROBE FOR USE IN EXPLOSIVE ATMOSPHERES**
6 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **317/2,** 174/6, 200/51.09, 200/144AP
[51] **Int. Cl.** **H01r 3/06,** H05f
[50] **Field of Search** ..... 174/5, 5.1, 5.2, 6; 200/144 (APR), (Inquired), 51.09

[56] **References Cited**

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2,020,402	11/1935	Edwards et al.	200/51.09X
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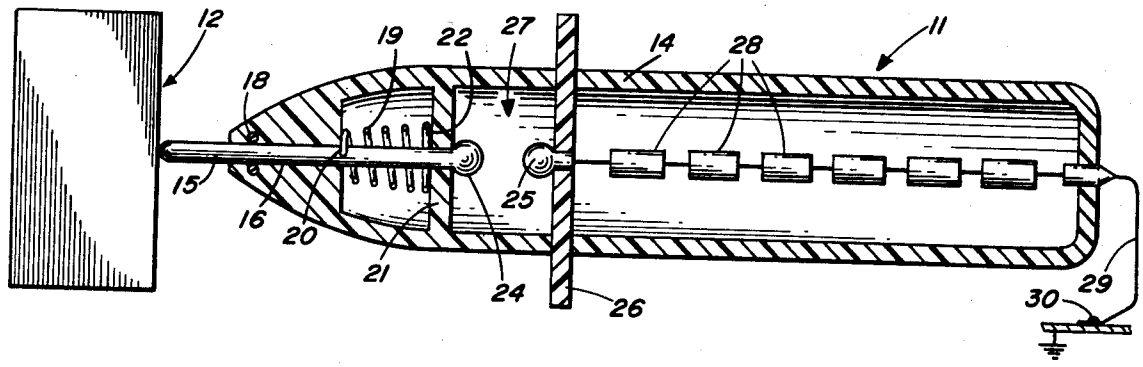
ABSTRACT: A grounding probe having a stationary contact connected to ground through a high resistance. A movable contact is normally biased away from the stationary contact but can be moved adjacent the stationary contact by pressing it against the object to be grounded. The area where stationary and movable contacts come together is enclosed so that any spark is isolated from the atmosphere.



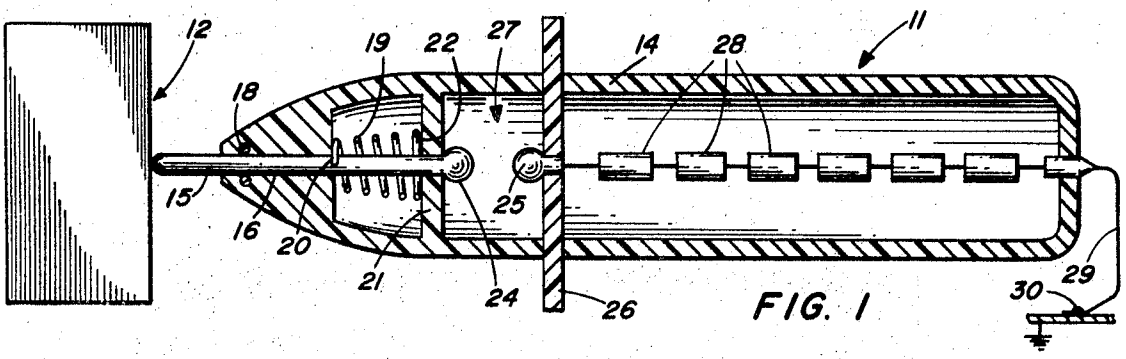


FIG. 1

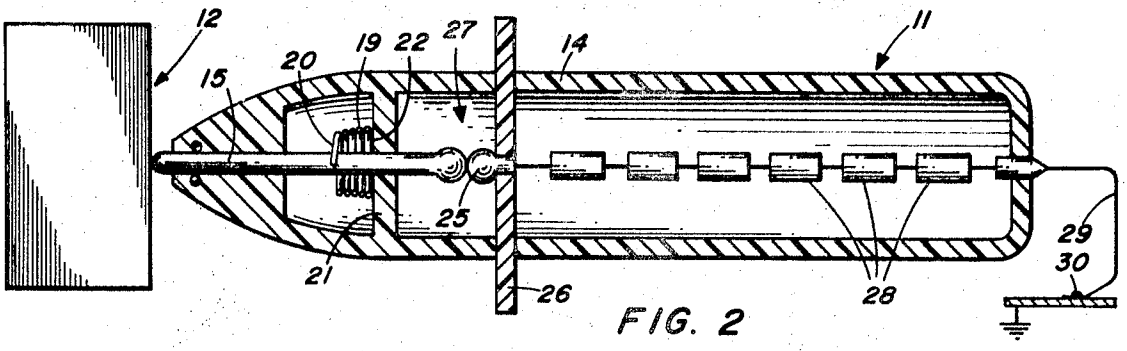


FIG. 2

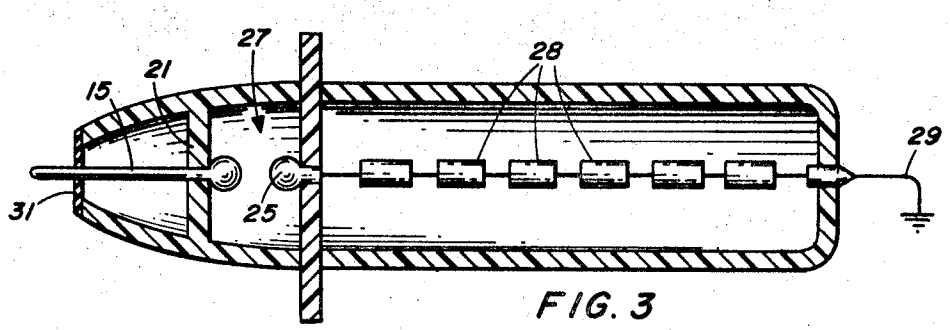


FIG. 3

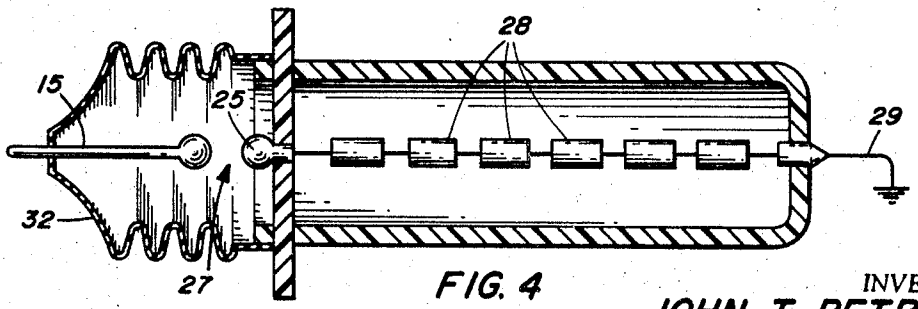


FIG. 4

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ELECTROSTATIC GROUNDING PROBE FOR USE IN EXPLOSIVE ATMOSPHERES

GOVERNMENT INTEREST IN THE INVENTION

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to electrostatic grounding devices and in particular to electrostatic grounding devices in which any sparks created are isolated from the surrounding atmosphere.

2. Description of the Prior Art

Prior art grounding devices and particularly those devices used to ground ammunition were usually unsafe when used in explosive atmospheres or around electroexplosive devices. A simple ground wire connection to ammunition results in a high energy discharge which may ignite dust or explosive vapors in the atmosphere. High current flow through this ground wire may also induce electrical currents in electroexplosive devices nearby thereby detonating them. Furthermore, since relatively high currents have to be carried by the ground wire, prior art grounding devices include bulky wires and bulky ground connections making them cumbersome to handle.

SUMMARY OF THE INVENTION

Applicant has devised a device to overcome the disadvantages of the prior art by slowly draining the electric charge from an electrostatically charged object, such as ammunition, and preventing an energetic spark from occuring in a potentially dangerous atmosphere. A movable contact is pressed against the charged object thereby causing closure of a spark gap between the movable contact and a ground contact. The ground contact is grounded through a series of high resistances, and the area of the spark gap is enclosed from the surrounding atmosphere.

A primary object of this invention is to provide a device for grounding an electrostatically charged object which isolates any spark from the surrounding atmosphere.

It is another object of this invention to provide a device which drains the charge relatively slowly from an electrically charged object.

It is a further object of this invention to provide a grounding probe in which the current carried by the grounding wire is relatively small.

It is still a further object of this invention to provide a grounding probe which can be used without the danger of shock to the user.

Another object of this invention is to provide a grounding probe which can be activated by pressing it against a charged object.

Other objects, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows in cross section, the electrostatically grounding probe of applicant's invention with the spark gap in its open position;

FIG. **2** shows the grounding probe of FIG. **1** with the spark gap in its closed position; and

FIGS. **3** and **4** show in cross section alternate constructions of applicant's grounding probe.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A preferred embodiment of applicant's grounding probe is shown in FIG. **1**, generally designated by reference numeral **11** and having a plastic or other nonconducting casing **14**. In

the forward end of casing **14** is an aperture **16** and a wall **21** having an aperture therethrough aligned with aperture **16**. A movable probe **15** is mounted in aperture **16** and the aligned aperture in wall **21** for sliding movement lengthwise of the probe. A helical spring **19** having one end **20** secured by conventional means to probe **15** and its other end **22** in abutment with a wall **21** is provided to normally bias movable probe **15** to a position in which it is extended from casing **14**. Rearwardly of wall **21** is another wall **26** having mounted therein a stationary probe **25**. The area between stationary probe **25** and end **24** of movable probe **15** is a spark gap which, as can be seen, is in an enclosed spark chamber **27**. An O-ring **18** or other sealing device makes a seal with movable probe **15** to prevent dust or explosive vapors from entering spark chamber **27** through aperture **16**. Stationary probe **25** is grounded through a series of resistors **28**, a light grounding wire **29** and a light ground connection **30**. The total resistance provided by resistors **28** depends on the size of the charge to be discharged by the probe. Generally the total resistance should be greater than 10 megohms. In practice a resistance of 132 megohms has been used to safely discharge potential up to 30,000 volts.

As can be seen, spring **19** normally biases probe **15** so that spark gap **27** is in an open condition. To operate applicant's grounding probe casing **14** is grasped and movable probe **15** is pressed against an electrically charged object such as ammunition. This may cause a small spark between probe **15** and the object; however, the magnitude of this spark is insufficient to ignite a potentially dangerous surrounding atmosphere under normal operating conditions because of the small capacitance of probe **15**. The device is then pushed toward the object, thus compressing the retainer spring **19** and causing spark gap **27** to close. As the gap closes there will be a particular distance at which the air within the gap undergoes electrical breakdown. This particular distance will depend upon the charge being grounded. When the breakdown occurs a spark will result between end **24** of probe **15** and probe **25**. The current flow during breakdown is limited by resistors **28** thereby preventing a powerful spark from occurring in spark chamber **27**. When the gap is fully closed, as shown in FIG. **2**, the ammunition is completely discharged. When the probe is removed from the object spring **19** returns probe **15** to its extended position and the probe is ready for use again.

The original spacing of end **24** of probe **15** and probe **25** will determine the operating range of the probe. It has been found that a 1 inch gap allows proper operation at electric potentials up to 30,000 volts. For higher voltages a larger gap would have to be used.

Use of a high resistance **28**, besides limiting the power discharged in the spark gap **27**, also reduces the current flow in ground wire **29**. This lessens the likelihood that currents will be induced in nearby electroexplosives by the current in ground wire **29**. This reduced current flow also permits use of a light ground wire and ground connectors to increase portability and ease of handling of the grounding probe. Furthermore, since grounding wire **29** carries a small current, hazards from accidental contact with power lines or electronic equipment are reduced.

FIG. **3** shows an alternate construction for applicant's grounding probe. In this embodiment probe **15** is fixed to a flexible diaphragm **31**. When the probe is pressed against the charged object diaphragm **31** is flexed inward thereby closing the spark gap **27**.

FIG. **4** shows another alternate embodiment of applicant's invention. In this embodiment movable probe **15** is fixed to a bellows **32**. The bellows is normally in an extended position, however it can be compressed by pressing probe **15** against an object to be grounded to close spark gap **27**.

Obviously many modifications are possible in view of the above teachings. The probe **15** in the preferred embodiment should be a fair conductor, rigid, and have end **24** shaped into a hemisphere of a diameter preferably not less than one-tenth of an inch. In practice it has been made of brass having a steel ball at end **24**. However other possibilities are clearly availa-

ble. Probe body **14** can be constructed of any rigid material of high dielectric and mechanical strength. Plastics such as "Lucite," "Plexiglass" or "Lexan" may be used. O-ring **18**, used to seal the spark chamber in the preferred embodiment from dust or vapors, is only one of several possible sealing means. Also spark chamber **27** may contain or be pressurized with dry nitrogen or other insulating vapor thus increasing the potential necessary for breakdown of the spark gap. Resistors **28** may be of any construction.

I claim:

1. A grounding device for use in explosive atmospheres comprising:

a housing made from insulating material;

a spark chamber within said housing;

a first contact mounted within said spark chamber;

a movable second contact mounted within said spark chamber and extending outwardly from said housing;

biasing means retaining said second contact in a position normally spaced from said first contact;

means for grounding said first contact;

said grounding means including high resistance means enclosed in said housing and separated from the spark chamber by a partition; and

sealing means surrounding the outwardly extending portion of said movable contact at the front end of said housing to prevent explosive vapors from entering said spark chamber.

2. The grounding device of claim **1** wherein said biasing means comprises a spring.

3. The grounding device of claim **2** wherein said sealing means comprises an O-ring.

4. The grounding device of claim **1** wherein said biasing means comprises a diaphragm attached to the front end of said housing.

5. The grounding device of claim **4** wherein said biasing means comprises a bellows attached to the front end of said housing.

6. The grounding device of claim **1** wherein said spark chamber contains an insulating vapor under pressure.