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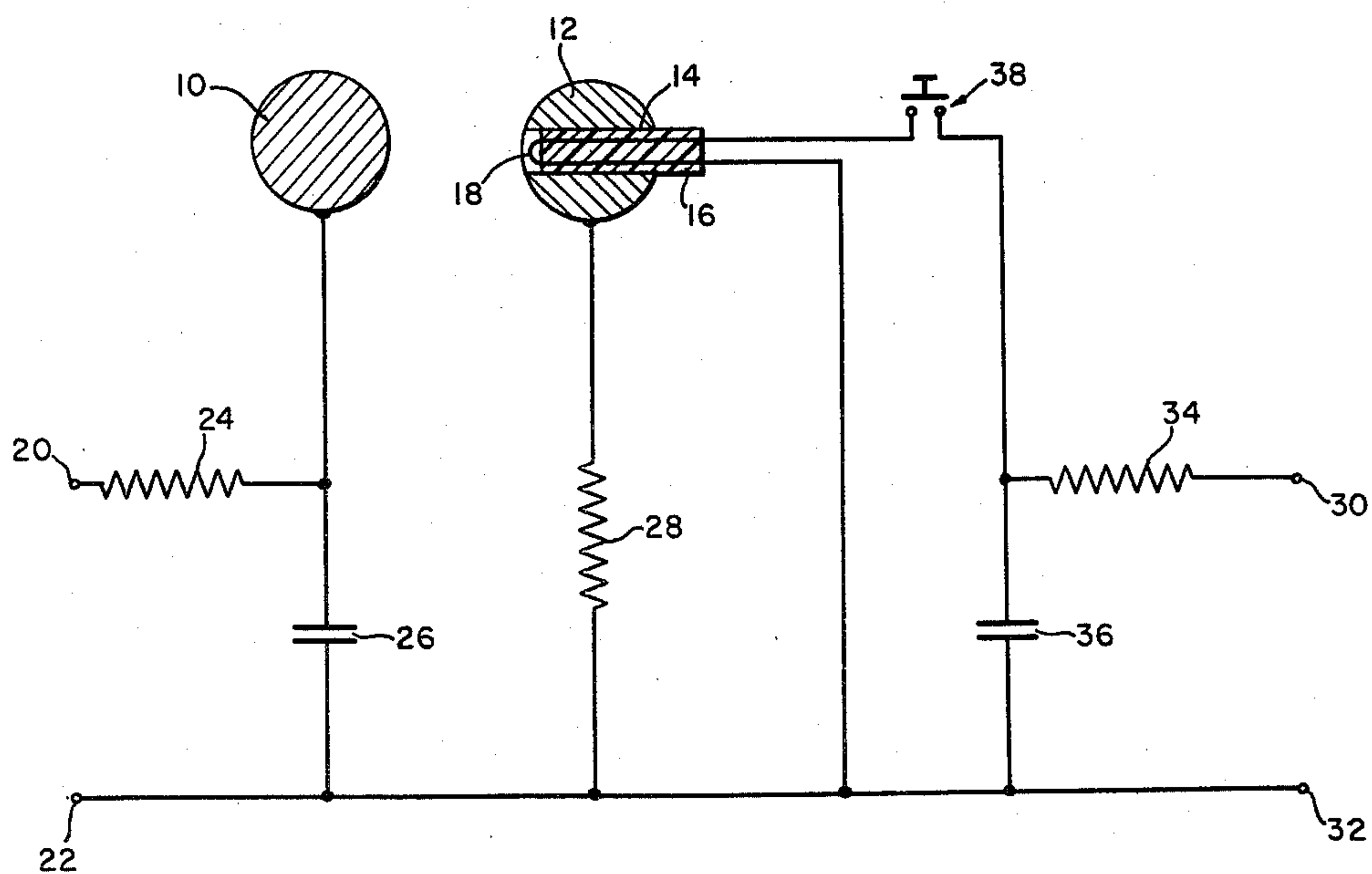
R. W. BUNTENBACH

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BRIDGE WIRE TRIGGERED SPARK GAP

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FIG. 1



INVENTOR.

RUDOLPH W. BUNTENBACH

BY *R. Seever*

ATTORNEY

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BRIDGE WIRE TRIGGERED SPARK GAP

Rudolph W. Buntentbach, Lafayette, Calif., assignor to General Precision, Inc., a corporation of Delaware

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6 Claims. (Cl. 315-173)

This invention relates to apparatus for initiating the flow of electric current across a gap, and more particularly to apparatus utilizing the explosion of a bridge wire to initiate the flow of electric current across an air gap.

Under normal atmospheric conditions, electric current will flow initially across a gap if sufficient voltage is maintained across the air gap to overcome the resistance of the air. However, due to the electrical properties of air, the voltage required to initiate arcing is relatively high and varies beyond reasonable tolerances, since changing atmospheric conditions cause relatively large variations in the voltage required to bridge a gap.

In the past, gaps have been initially fired by imposing across the gap, a fixed voltage below the voltage required to overcome air resistance, and by injecting charged particles, such as ions or electrons, or even light into the field existing between the gap electrodes when it is desired to fire the gap. Such particles are ionized and hence reduce the resistance of the air in the gap, or in the case of light, the air molecules forming the gap are ionized directly. Another means for accomplishing the initial firing of a gap has been the addition of a shorter and auxiliary gap proximate to the main gap. When the auxiliary gap is fired, the spark discharge across the auxiliary gap is sufficient to inject charged particles into the main gap. However, this method requires relatively high auxiliary gap voltages to attain positive firing and response time reproducibility in the firing of the main gap. This requirement of relatively high auxiliary gap voltage lessens considerably the advantages obtained by the use of the auxiliary gap.

Briefly described, this invention provides apparatus for firing an air gap, said apparatus utilizing a bridge wire which can be exploded by a relatively low voltage, said explosion introducing ionized particles into the air gap.

An object of this invention is to provide an air gap firing mechanism which is not subject to variations in atmospheric conditions.

Another object of this invention is to provide a firing mechanism which is safe from the possibility of accidental firing.

Still another object is to provide a firing mechanism which can be actuated by a relatively low voltage and which yields high reproducibility and reliability.

Other objects and advantages of this invention will be readily appreciated by reference to the following detailed description when considered in connection with the accompanying drawing in which:

Figure 1 is a schematic diagram of apparatus for firing an air gap by means of the bridge wire circuit embodying this invention.

In Figure 1, electrodes 10 and 12 are spaced at a desired separation. Electrode 12 contains a cavity 14 which is shaped to receive a plastic insert 16. An exploding bridge wire 18 is mounted on plastic insert 16 just at or near the leading edge of electrode 12. The main voltage supply is introduced across terminals 20 and 22 through resistor 24 which limits the flow of current from the main

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voltage supply. A capacitor 26 is connected between the terminal 22 and resistor 24. The electrode 10 is connected to the junction of resistor 24 and capacitor 26. Electrode 12 is connected through a load resistor 28 to terminal 22.

The bridge wire voltage supply is connected to terminals 30 and 32. A resistor 34 is connected to terminal 30, and a capacitor 36 is connected to terminal 32. Resistor 34 and capacitor 36 are connected together and their junction is connected to a switch 38. The switch 38 is connected to the bridge wire 18 which in turn is connected to the terminal 32. The terminals 22 and 32 are connected together.

The voltage of the main voltage supply is normally maintained at a level somewhat less than the voltage required to initiate current flow across the main gap. Firing of the main gap is accomplished by exploding the bridge wire 18 so that charged particles are injected into the gap. The bridge wire is exploded when the switch 38 closes the circuit between the capacitor 36 and the bridge wire 18. The capacitor 36 is charged by the bridge wire voltage supply through the resistor 34.

An important aspect of this invention is the discovery that the bridge wire voltage supply need only be of the order of several hundred volts. Experimentally, it has been determined that satisfactory firing can be obtained using a carbon bridge wire with the bridge wire voltage supply as low as 150 volts. However, metallic bridge wires can also be used.

As examples, the following physical and electrical characteristics of this apparatus have been observed to operate successfully.

With a main gap of .025 inch, approximately 3000 volts were required to fire the main gap without assistance. However, with bridgewire assistance, 400 volts were sufficient to fire the main gap.

With a .240 inch gap, 22,000 volts were required to fire the main gap without assistance. However, with bridgewire assistance, 2000 volts were sufficient to fire the main gap.

The importance of this invention as a safety device can readily be seen. The main gap voltage can be maintained at a safe level so that no accidental firing could possibly occur. Yet a relatively small voltage can initiate firing when desired. The bridge wire trigger circuit is economical, simple, and yields high reproducibility and reliability.

The term "firing" of an air gap, for the purpose of this invention, is defined as initiating the flow of electric current across said gap.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that numerous modifications or alterations may be made without departing from the spirit and the scope of this invention as set forth in the appended claims.

Having thus described the invention, what is claimed is:

1. Apparatus for initiating the flow of electric current between a pair of electrodes separated by an air gap, said apparatus comprising an exploding bridge wire adjacent one of said electrodes, and means for exploding said bridge wire by the passage of electric current through said bridge wire.

2. Apparatus according to claim 1, in which the means for exploding the bridge wire comprises a capacitor for storing electric charge and a source of electric current for charging said capacitor.

3. Apparatus for initiating the flow of electric current between two electrodes comprising first and second electrodes in spaced relationship, one of said electrodes having a cavity therein, a support in said cavity and an exploding bridge wire mounted on said support for initiating arcing between said electrodes.

4. Apparatus for initiating the flow of electric current across a gap, said apparatus comprising first and second electrodes in spaced relationship, one of said electrodes having a cavity therein, a support in said cavity, an exploding bridge wire mounted on said support, a source of electric current, and means including a switch for controlling the flow of said electric current through said bridge wire whereby initial arcing between said electrodes is accomplished.

5. Apparatus for initiating the flow of electric current between a pair of electrodes separated by an air gap comprising an exploding bridge wire positioned adjacent one of said electrodes.

6. Apparatus for initiating the flow of electric current

across a gap comprising a first and second electrode, an exploding bridge wire associated with said electrodes, electrical connectors attached to said bridge wire and switching means adapted to control a flow of electric current across said bridge whereby initial arcing between said electrodes is accomplished.

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