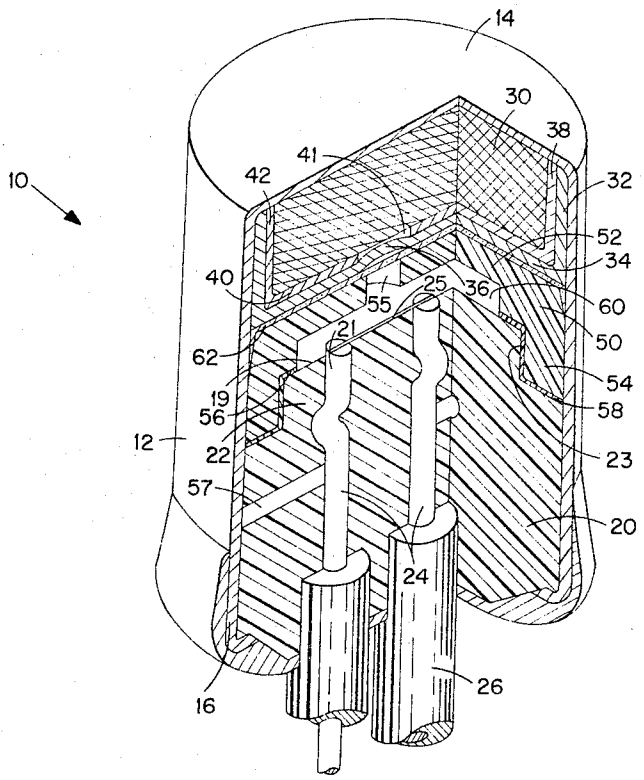
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IGNITER SQUIB

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IGNITER SQUIB

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

This invention relates to an ignitor squib and more particularly to an improved ignitor squib of the general class disclosed in an application filed by Robert E. Betts for "Ignitor Squib" filed August 31, 1960, Serial Number 53,314, and now Patent No. 3,100,447.

It is an object of this invention to provide an improved ignitor squib of the indicated class.

Another object of this invention is to provide an ignitor squib wherein products of bridge wire ignition are concentrated on a desired portion of the pyrotechnic.

These and other objects of the invention will become more apparent upon consideration of the following detailed description and accompanying drawing which is a perspective view, partly in section, of the ignitor squib.

In the illustration the ignitor squib **10** is shown to include a housing **12** having a closed end **14** and an open end **16**. Open end **16** is adapted to receive a phenolic bridge plug **20**. One end **22** of the plug is reduced so as to provide an annular space **23** between the plug and the sides of housing **12**.

To provide an electrical connection to the squib, a pair of crimped lead wires **24** are molded in plug **20** so that they do not extend beyond the face **19** of end **22**, of plug **20**. These wires are joined at the ends **21** thereof by a resistance containing bridge wire **25**. The bridge wire extends adjacent the face **19** of plug **20** and connects to wires **24**. The other end of wires **24** are covered by suitable insulating material **26** which is molded in plug **20**.

A pyrotechnic **30** is retained in the closed end **14** of the housing by a cup-shaped diaphragm **32** and a cup-shaped metal die **38**. The diaphragm is force-fitted with housing **12** and is spaced from end **22** of plug **20**. Diaphragm **32** acts a Faraday shield, protecting the pyrotechnic from ignition by static charges passing through or building up on the surface of material **30**. Base portion **34** of the diaphragm is provided with a center section having a dimple **36** formed therein.

Die **38** is form fitted within diaphragm **32** and includes a base **40** and a peripheral wall **42**. Base **40** has a central hole **41** formed therethrough concentric with dimple **36** for purposes explained hereinbelow. Wall **42** is disposed to direct the exploding force of the pyrotechnic **30** out through the end **14** of housing **12**.

An element **50**, formed of a dielectric material, is placed between plug **20** and diaphragm **32**. The function of element **50** is threefold; to insure diaphragm **32** remains spaced from plug end **22**, to prevent arcing between the bridge wire and the diaphragm, and to concentrate the products of bridge wire ignition on the diaphram. Element **50** is substantially cup-shaped having a base **52** and a downward projecting wall **54**. The element is disposed so as to have its base **52** adjacent diaphragm base **34** and its wall **54** extended into annular space **23**. An annular lip **56** formed in element wall **54** seats the element on the face of plug end **22**. A dielectric sealant **58** bonds the element to plug **20**. The disposition of element **50** defines a compartment **60** enclosed by element wall **54**, element base **52** and the face of plug end **22**. A bore **55** defines a passage through the element base to the area of dimple **36**.

To prevent arcing from the bridge wire through the bore in element **50** to the diaphragm, an insulator **62** is disposed between element **50** and the diaphragm and extends across the bore. And to provide a means for the discharge of static electricity from the ignitor, a plurality of air gaps **57** are formed in the phenol plug **20** and are disposed in communication with the lead wires **24** and housing **12**, to form a path of lowest resistance between the housing and lead wires.

The ignitor squib is mounted in any known manner and the power for operating the squib and the control means (not shown) are connected to lead wires **24**. Power for exploding the bridge wire of an embodiment having, for example, a bridge wire of .1 ohm resistance, can be achieved by charging a one microfarad capacitor to 2000 volts. The capacitor is then discharged to the bridge delivering a voltage in excess of 500 volts in approximately one microsecond and a current density of one million ampheres per square centimeter of cross sectional bridge wire area.

The squib is actuated by operation of the control means which connects an electrical source to the bridge wire. When the required electrical energy reaches the bridge wire it is converted to heat, thereby developing pressure in the bridge wire and compartment. This action causes the bridge wire to explode increasing the heat and pressure in compartment **60**. This heat and pressure is then directed by bore **55** to the diaphragm. As the area of bore **55** is relatively small compared to the area of compartment **60**, the force produced by the heat and pressure is intensified. This intensified force, after first rupturing insulator **62**, encounters the lower area of dimple **36**. The dimple is forced, by the heat and pressure, to expand upward through hole **41** to shear against die **38**. Shearing of dimple **36** allows heat and pressure from the exploding bridge wire to contact the pyrotechnic.

The burning pyrotechnic then produces heat and pressure within the squib. The die wall **42** effectively contains the lateral pressure forces produced by the burning pyrotechnic and directs the total heat and pressure force to the closed end **14** of housing **12**. The closed end is then ruptured forcing hot gases and burning particles into contact with surrounding material.

As the volume of compartment **60** is a factor in determining the pressure produced by the burning bridge wire, various modifications can be made in the configuration of focusing element **50** to control pressure in the compartment. For example, the surface of element base **52** forming the top of compartment **60** can be generally dome-shaped to increase compartment volume. A dome or surface inclined toward bore **55** would also provide a means to direct the products of bridge wire ignition to the bore.

Thus it will be appreciated that this invention provides an improved ignitor squib of the class indicated.

It is also to be understood that various modifications of the ignitor squib described herein can be resorted to that is within the spirit and scope of the appended claims.

The invention claimed is:

1. An improved igniter squib comprising:
   (a) a housing having a closed end and an open end;
   (b) a metal container having a pyrotechnic therein disposed in said housing adjacent said closed end and cooperating therewith for complete enclosure of said pyrotechnic for shielding thereof from static charges;
   (c) a bridge plug extending into said housing through said open end;
   (d) a firing circuit carried by said plug including a pair of lead wires extending through said plug and into said housing, and a bridge wire carried by said plug and connected to said lead wires, said

bridge wire being disposed in spaced relation with said pyrotechnic;

(e) focusing means carried in said housing and disposed for concentrating the igniting energy from said bridge wire to said pyrotechnic responsive to a predetermined build-up of said igniting energy, said focusing means including a substantially cup-shaped member of dielectric material having the wall thereof partially surrounding said bridge plug and the base thereof adjacent said pyrotechnic, said base having a bore therethrough for directing the ignition energy from said bridge wire to said pyrotechnic.

2. A device as set forth in claim **1** in which said bore is centrally located in said base.

3. An improved igniter squib comprising:

(a) a housing having a head end and an open end;

(b) a pyrotechnic disposed in said head end;

(c) a cup-shaped retaining member mounted in said head end for retention of said pyrotechnic between said head end and said retaining member;

(d) a bridge plug extending into said housing through said open end and provided with a face disposed in spaced relation with said cup-shaped retaining member;

(e) a bridge wire carried on said face of said bridge plug and connected to a source of energy for energization to explode said bridge wire and produce a force therefrom;

(f) force focusing means including a substantially cup-shaped spacer provided with a base having a bore therethrough, said cup-shaped spacer disposed adjacent said retaining member and provided with an annular wall depending from said base and partially enclosing said bridge plug to form a compartment between said bridge plug and said spacer;

(g) said compartment being closed by the face of said bridge plug; and

(h) said bridge wire being disposed in said compartment.

4. An improved igniter squib comprising:

(a) a housing;

(b) a pyrotechnic material disposed in said housing;

(c) a diaphragm mounted in said housing for support of said pyrotechnic material, said diaphragm being cup-shaped and having the wall thereof force fitted with said housing and partially enclosing said pyrotechnic material and provided with a base having a rupturable portion in the form of a dimple disposed therein;

(d) a firing circuit extending into said housing in spaced relation with said diaphragm; and,

(e) a member interposed between said diaphragm and said pyrotechnic material and provided with a bore adjacent said rupturable portion to serve as a die against which said rupturable portion can shear responsive to energization of said firing circuit to concentrate substantially total ignition energy to said pyrotechnic.

5. A device as set forth in claim **4** in which:

(a) said die is cup-shaped to form fit with said diaphragm and includes a base having said bore centrally disposed therethrough; and

(b) said dimple disposed in mating contact with the periphery of said bore to shear thereagainst responsive to ignition of said firing circuit.

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