Aug. 4, 1964 S. OSTROW 3,143,069

EXPLODING TAPE

Filed May 18, 1960

2 Sheets-Sheet 1

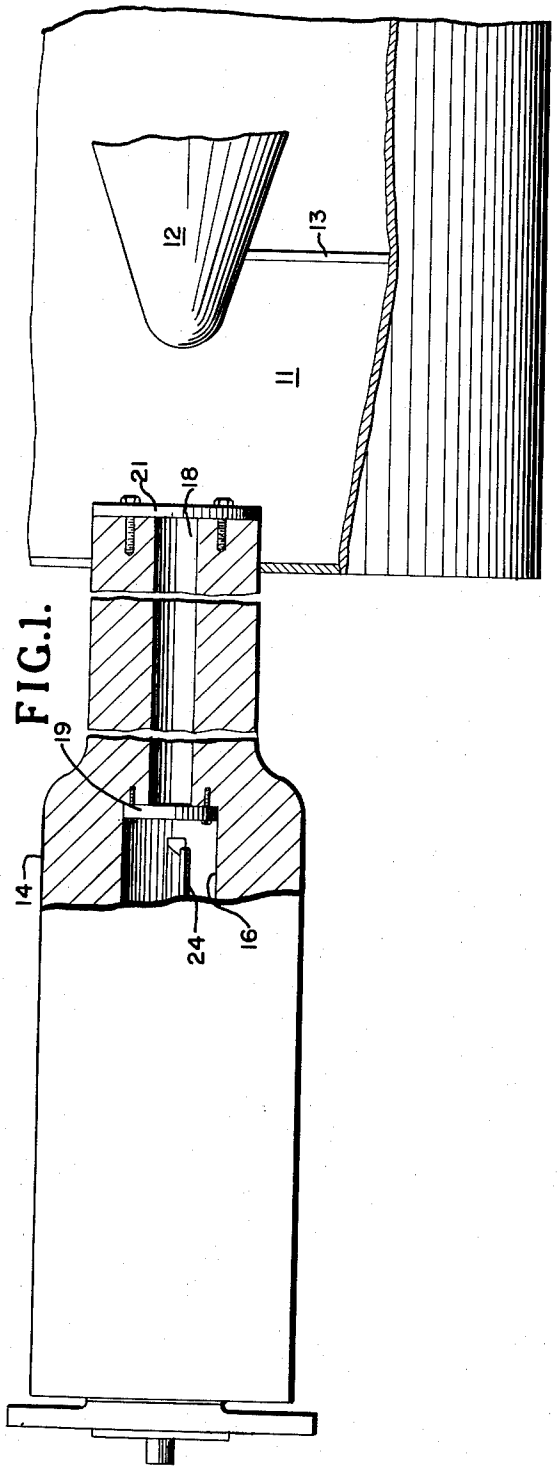


FIG.1.

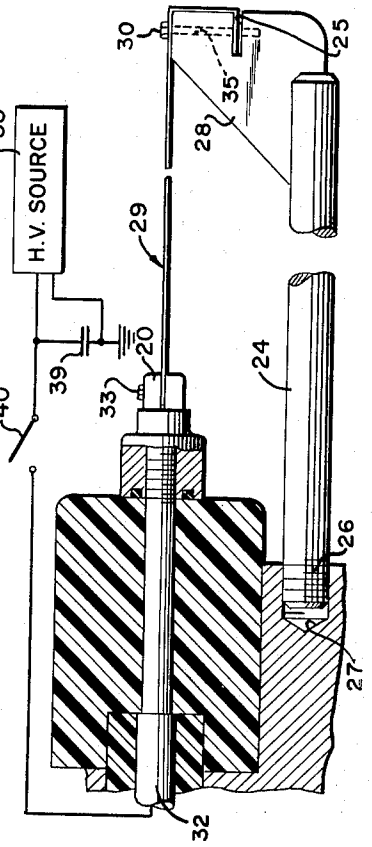


FIG.7.

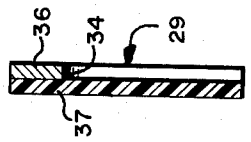


FIG.5.

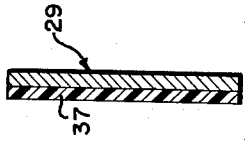


FIG.4.

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FIG.6.

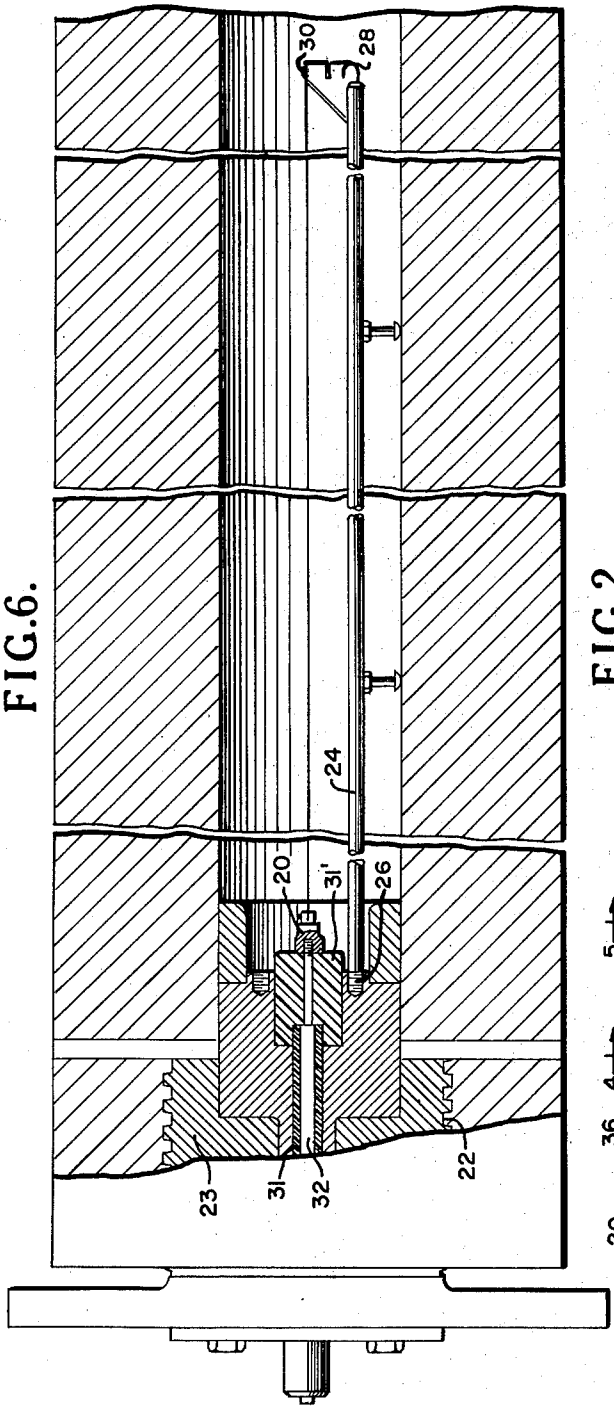


FIG.2.

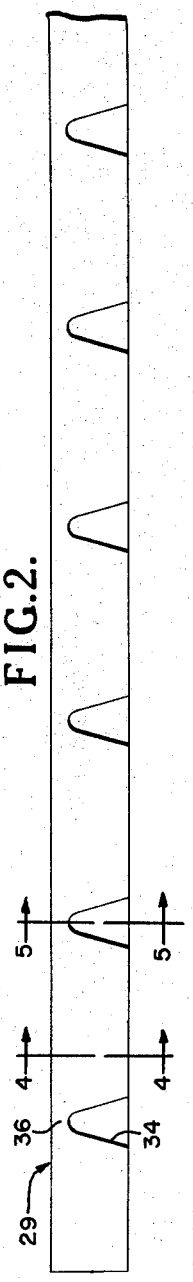
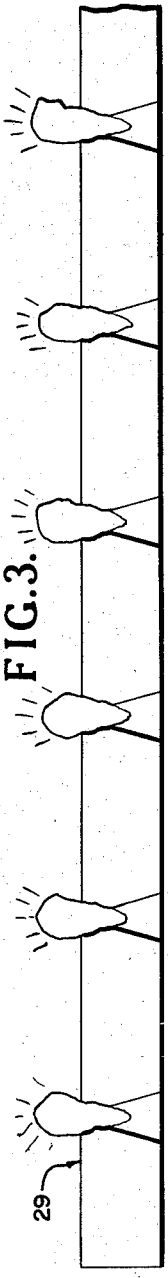


FIG.3.



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EXPLODING TAPE

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3 Claims. (Cl. 102—28)
(Granted under Title 35, U.S. Code (1952), sec. 266)

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.

This invention relates to an exploding metallic tape of the type used to ignite compressed combustible gases.

An object of the present invention is to provide means by which to ignite compressed combustible gases where such gases are confined within a comparatively large chamber and where it is desirous that the ignition take place over the entire chamber simultaneously.

Another object of the invention is the provision of an igniting means for a compressed combustible gas which in the igniting process will be substantially consumed so that no residue having effective mass remains.

A further object of the invention is the provision of an explodable metallic tape having a length commensurate with the chamber containing compressed combustible gas which the explosion of the tape is to ignite and to form said tape so that the explosion of the tape occurs simultaneously at a plurality of points along the length of the tape.

It is a still further object to provide an explodable metallic tape for igniting a compressed combustible gas, throughout the length of the chamber containing the gas, and to support the tape with a material cemented thereto which material will be consumed with the exploding tape so as to leave a residue of insignificant mass.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is an illustration of the application of the invention;

FIG. 2 is a top plan view of the tape;

FIG. 3 is a view similar to FIG. 2 taken at the time of ignition;

FIG. 4 is a section on line 4—4 of FIG. 2;

FIG. 5 is a section on line 5—5 of FIG. 2;

FIG. 6 is a sectional view of the tape holder; and

FIG. 7 illustrates a wiring diagram suitable for use with the present invention.

Referring to the drawings, FIG. 1 diagrammatically illustrates the object of the invention as applied in the apparatus in which it is used. A wind tunnel **11** has a model **12** mounted therein on a support **13**. The model is exposed to a sudden blast of gases moving at supersonic velocity and measurements of the temperature and pressure are taken at different places on the model. High speed cameras (not shown) take pictures during this extremely short interval of time and the pictures are studied and analyzed. As the models are preferably missiles designed to travel in the upper atmosphere at supersonic speeds the importance of obtaining test data which accurately portrays the behavior of the model under simulated conditions existing in the atmosphere is of utmost importance. It is necessary, therefore, that the blast of gas be free of any particles of solid mass. The metals within the gun, the blowout valves, and the igniter support must be capable of withstanding heat and pressure. The tape itself must be completely consumed.

The blast of gases is generated in a gun **14** having a

compression chamber **16** and a reduced barrel **18** which extends into the wind tunnel **11**. Between the compression chamber **16** and the barrel **18** there is located a steel blowout diaphragm valve **19** which is scored and subject to bursting at a predetermined pressure. Since the details of valve **19** are not necessary to an understanding of the present invention, further description of the valve is believed unnecessary. A second similar diaphragm valve **21** is located at the termination of the gun, that is, at the end of the barrel and within the wind tunnel.

The compression chamber **16** has a threaded breech **22** into which is turned a breech plug **23**. The breech plug supports a rigid rod **24** in the threaded hole **26** which rod is secured to the plug by screw threads **27**. At the free end of the rod a substantially triangular shaped rest **28** is welded or otherwise attached to the rod **24**. The rest **28** is slotted at **25** to receive the end of the tape and a set screw **30** which turns entirely into the hole **35** holds the tape secured in the slot. The end is first secured in the slot and the tape folded over the set screw and stretched above the rod **24** to the fixture **20** at the end of the breech plug **23**.

Also carried in the breech plug is an insulator tube **31** and a cylindrical insulator plug **31'** housing a contact rod **32** which carries the fixture **20**. The tape **29** is secured to the fixture by a set screw **33**.

The tape **29** is approximately three feet long, one-half inch wide and of the thinness of metal foil. Referring to FIGS. 2, 3 and 4, the metallic tape **29**, preferably of aluminum, is formed with a plurality of notches **34** which leave reduced portions **36** of substantially one-fourth the width of the tape and in length less than the dimension of the width. The portions **36** provide areas of high resistance to the passage of a high voltage electric current.

The tape is strengthened by a plastic tape **37** such as cellophane tape adhering to one side thereof. This tape is of a width and length equal to the greatest width and length of the tape and is uncut at the locations of the notches **34**. The cellophane tape serves to support the metallic tape throughout its extent and particularly at the reduced portions. The span of approximately three feet would probably break an unsupported metallic tape.

Referring to FIG. 7 a source of high voltage **38** is connected to a condenser **39**, one side of which is grounded. The other side is connected through a switch **40** to the contact rod **32** of the breech plug.

In use, combustible gases in the nature of hydrogen, oxygen and helium are compressed in the chamber **16** by any suitable means and the switch **40** closed. The high voltage current from the condenser passes through the contact wire to the tape and produces a burning of the tape simultaneously at the reduced portions as illustrated in FIG. 3. This ignites the compressed gases simultaneously at a plurality of points throughout the extent of the gas chamber causing a rapid combustion. The pressure generated by the expanding gases bursts the diaphragm valve **19** and in turn the diaphragm valve **21** expanding into the wind tunnel at supersonic speed to buffet and impinge on the model **12** exerting pressure and causing temperature changes on and in the model.

Should there be any foreign particles in these expanding gases their contact with the model would adversely effect the experiment. It is necessary that both the metallic tape and the supporting cellophane tape be entirely consumed or that such residue as is left have negligible mass.

The effects of the blast on the model are recorded and designs of the model altered and revised accordingly.

This type of igniter is necessary for the combustion desired to produce the correct expansion of gases, and to completely burn so that no appreciable residue is left.

Obviously many modifications and variations of the

present invention are possible in the light of the above teachings. It is therefore to be understood, that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. The combination of a combustion-supported gas-filled chamber, a flexible metallic foil tape disposed in said chamber, and means for passing electrical current through said foil to initiate combustion thereof, said tape comprising a thin strip of aluminum foil having substantial width and relatively continuous running length, a plurality of equally sized notches disposed at equal ignition point intervals along the length of said tape, each of said notches extending inward from one and the same edge of the foil and reducing its width to a narrow bridging portion connecting the unnotched portions of the foil, the bridging portions each being of a size to be heated and burned simultaneously by passage of electrical current along the length of the tape.

2. An ignition tape comprising thin flexible aluminum foil having a substantially even width along its relatively continuous running length, and a combustible substantially equally sized plastic tape disposed adjacent to a surface of said metal foil and adhering thereto as a flexible continuous running support therefor, said aluminum foil tape having evenly sized notches evenly spaced at desired ignition point intervals along its length, each notch extending inward from one and the same side reducing the width of said tape to a relatively narrow bridging portion connecting the contiguous unnotched portions of said foil, each bridging portion being reduced in width by said notch sufficient to be heated and burned simultaneously by the passage of electrical current along the length of said tape.

3. An elongated closed cylindrical chamber having a quantity of explosive gas under pressure stored therein, a thin metallic tape disposed axially within said chamber substantially throughout the length thereof, comprising thin flexible aluminum foil having a substantially even width along its relatively continuous running length, and a combustible substantially equally sized plastic tape disposed adjacent to a surface of said metal foil and adhering thereto as a flexible continuous running support therefor, said aluminum foil tape having evenly sized notches evenly spaced at desired ignition point intervals along its length, each notch extending inward from one side reducing the width of said tape to a relatively narrow bridging portion connecting the contiguous unnotched portions of said foil, each bridging portion being reduced in width by said notch sufficient to be heated and burned simultaneously by the passage of electrical current along the length of said tape.

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