Nov. 21, 1961 M. M. NEWMAN 3,009,982

LIGHTNING DIVERTERS

Filed March 10, 1958

FIG. 1

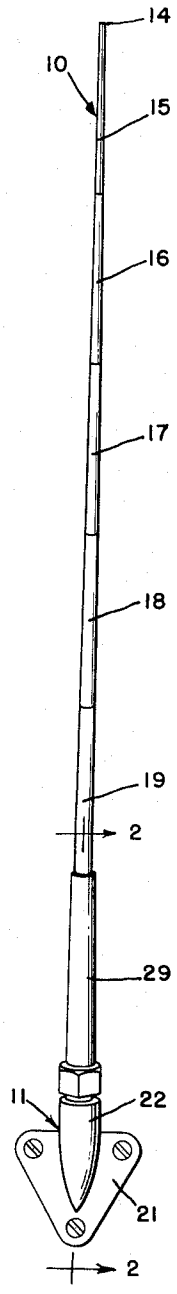


FIG. 3

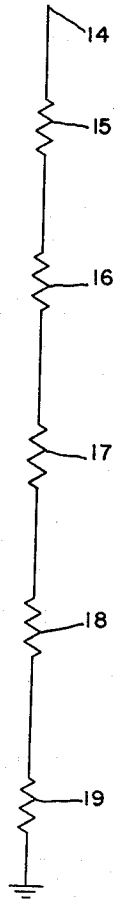
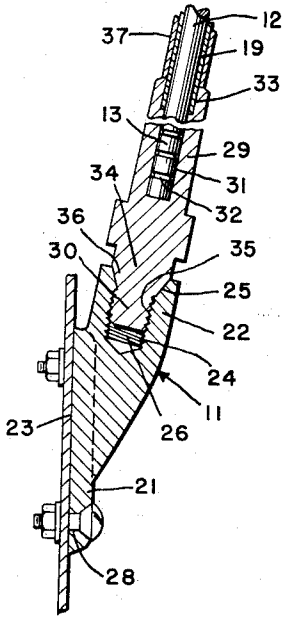


FIG. 2



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LIGHTNING DIVERTERS

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The herein disclosed invention relates to lightning diverters and has for an object to provide a diverter adapted to be mounted adjacent critical areas and which will effectively serve to divert lightning away from the objects located at such areas.

Another object of the invention resides in providing a diverter particularly useful in conjunction with aeroplanes and which can be used to protect critical areas such as fuel vents and similar objects.

Another object of the invention resides in providing a lightning diverter which will not cause radio noise or interference.

A still further object of the invention resides in providing a lightning diverter which will not cause precipitation static interference and which will function as a static discharger for quietly discharging electrical charges collected on the metal skin of the aeroplane.

An object of the invention resides in providing a lightning diverter and precipitation static discharger which may be used on transonic aircraft.

An object of the invention resides in constructing the diverter in the form of a whip having an insulating core attached to a suitable metal mounting which in turn is secured to the fuselage of the aeroplane adjacent the critical area, and in further forming a non-inductive resistor on said core extending from the tip to said mounting and connected to said mounting.

A still further object of the invention resides in grading the resistance of said resistor along the extent thereof and preferably so that the resistance per unit length is greater at the tip than at said mounting.

An object of the invention resides in dividing the resistor in sections, each adjoining section having a progressively lesser or greater resistance than the preceding section.

Another object of the invention resides in forming the resistor as a painted layer encircling a core of insulating material.

A still further object of the invention resides in the particular construction for attaching the whip to the mounting and the mounting to the skin of the fuselage.

Other objects of the invention reside in the novel combination and arrangement of parts and in the details of construction hereinafter illustrated and/or described.

In the drawings:

FIG. 1 is an elevational view of a lightning diverter illustrating an embodiment of the invention.

FIG. 2 is a sectional view taken on line 2—2 of FIG. 1 and drawn to a greater scale.

FIG. 3 is a wiring diagram of the electrical circuit of the invention.

The lightning arrester shown consists of a whip **10** which is mounted on a mounting **11**. This mounting is adapted to be mounted on a lightning dispersing surface at the locality of an object desired to be protected from lightning.

The whip **10** consists of a core **12** which is constructed of a resilient electrical insulating material such as fiber glass. This core is preferably tapered in form having an attached end **14** and a free end **14** and being of lesser cross-sectional at its free end than at its attached end. Mounted on the core **12** are a number of resistors **15**, **16**, **17**, **18** and **19** which make contact with one another and which extend throughout the entire length of the exposed portion of the whip. The resistor **15** has the

greatest resistance and the following resistors each have a lesser value of resistance than the one preceding. The values of the resistances preferably vary in accordance with a geometrical progression, though other types of variation may be employed. The resistors are most conveniently made by applying resistive coatings to the core in the form of a paint or by molding the resistors on the core. In each case the resistors make contact with one another so that a single resistive unit results whose resistance varies progressively throughout its length. In actual practice, resistors varying in the ratio of 10 to 1 have been found practical and the following value of resistances for the various resistors have given satisfactory results:

	Megohms/square
Resistor **15**	100
Resistor **16**	10
Resistor **17**	1
Resistor **18**	.1
Resistor **19**	.01

It is to be noted that no metal or other highly conductive tip is applied to the free end of the whip, so that the lightning first strikes the high resistance element of the resistive unit.

The mounting **11** is in the form of a metal casting and has a base **21** with a boss **22** extending outwardly therefrom. Base **21** is formed with a surface **23** adapted to overlie and conform to the configuration of the surface to which the diverter is to be applied. The surface **23** is considerably greater in extent than the cross-sectional area of the whip so as to readily disperse the lightning charge and prevent injury to the structure on which the diverter is mounted. The base **21** is constructed with a number of holes **28** through which bolts may pass and by means of which the mounting **11** may be attached to the structure on which it is to be mounted. The boss **22** has an open ended bore **24** which is formed at its outer end with a frusto-conical socket **25**. Said boss is further formed with internal threads **26** at the portion of the bore **24** which adjoin the socket **25**. The axis of the bore **24** may be placed at an angle with reference to the surface **23** as shown in FIG. 2.

The attached end **13** of the core **12** of whip **10** is mounted in a metal ferrule **29**. This ferrule has a bore **31** formed in it and of dimensions to receive the attached end **13** of the core **12**. The core **12** may be cemented in place in the bore **31** or the same may be molded in place in said bore. The surface of the end **13** is roughened as indicated at **32** to procure better adhesion between the core and the ferrule. The outer end of the bore **31** is formed with an enlargement **33** in which the resistor **19** extends and by means of which the resistor is brought into firm contact with the ferrule.

The outer end **30** of the ferrule **29** is formed with threads **35** which screw into the threads **26** of the boss **22**. The portion **34** of the ferrule **29** adjacent the threads **35** is provided with a frusto-conical part **36** which fits into the socket **25** in boss **22** and which makes intimate contact with the mounting **11**. The resistive unit of the whip **10** is covered by an insulating protective coating **37** which extends down to the ferrule **29**.

The action of the diverter is as follows: The resistive unit acts as a voltage divider. The voltage drop across resistor **15** is considerably greater than that across the adjoining resistor **16** by the ratio of substantially 10 to 1 and a slightly lesser ratio to the resistance of the remainder of the unit. The lightning is hence attracted to this unit and the charge flows along resistor **15** toward resistor **16**. When it reaches resistor **16**, the same divi-

sion occurs, the next resistor being one-tenth of the former. The charge hence follows the diverter and reaches shank 29 and mounting 11 and from which it is dispersed to the structure on which the diverter is mounted.

The advantages of the invention are manifest. The diverter may be attached to a dispersing structure adjacent an object to be protected and when so disposed diverts the lightning and protects the object. The instant invention will cause the lightning charge to enter the diverter at the free end of the whip and to flow throughout the length of the diverter and to be dispersed by the dispensing structure. The device can be constructed at a nominal expense and is simple and easy to install. The diverter will not cause radio interference and will not cause precipitation static interference and functions as a static discharger for quietly discharging electrical charges collected on the metal skin of an aeroplane. The diverter may be used on transonic aircraft.

Changes in the specific form of the invention, as herein described, may be made within the scope of what is claimed without departing from the spirit of the invention.

Having described the invention, what is claimed as new and desired to be protected by Letters Patent is:

1. A lightning diverter comprising an elongated core of insulating material, a conducting mounting to which one end of said core is attached, the other end being free, means for attaching said mounting to conducting means adjacent the object to be protected and a solid resistor mounted on said core and extending throughout the length thereof and being connected to said base, the resistance of said resistor, progressively varying from one end of said core to the other.

2. A lightning diverter comprising an elongated core of insulating material, a conducting mounting to which one end of said core is attached, the other end being free, means for attaching said mounting to conducting means adjacent the object to be protected and a solid resistor mounted on said core and extending throughout the length thereof and connected to said base, the resistance of said resistor progressively varying from one end of said core to the other and being greatest for a given distance at the free end, said resistor being divided into a number of sections greater than two each having a different value of resistance, the values of the successive sections forming a geometrical progression.

3. A lightning diverter comprising an elongated core of insulating material, a conducting mounting to which one end of said core is attached, the other end being free, means for attaching said mounting to conducting means adjacent the object to be protected and a solid resistor mounted on said core and extending throughout the length thereof and connected to said base, the resistance of said resistor progressively varying from one end of said core to the other and being greatest for a given distance at the free end, said resistor being divided into a number of sections greater than two each having a different value of resistance, the valves of the successive sections forming a geometrical progression and in which the section having the highest resistance is at the free end of the core.

4. A lightning diverter comprising a mounting for attachment to conducting means adjacent the object to be protected, an elongated resistor connected to, supported by and issuing outwardly from said mounting, said resistor being divided into a number of sections greater than two each having a different value of resistance, the values of the successive sections forming a geometrical progression with the section having the highest value of resistance outermost.

5. A lightning diverter comprising a mounting for attachment to conducting means adjacent the object to be protected, an elongated resistor connected to, supported by and issuing outwardly from said mounting, said resistor being divided into sections each having a different value of resistance, the values of the successive sections forming a geometrical progression, the value of the resistance of each section being ten times or more the value of the resistance of the adjacent outermost section.

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