Jan. 12, 1960 G. RISK 2,921,307

LEAD THROUGH ANTENNA MAST BODY CONSTRUCTION

Filed Dec. 13, 1955 2 Sheets-Sheet 1

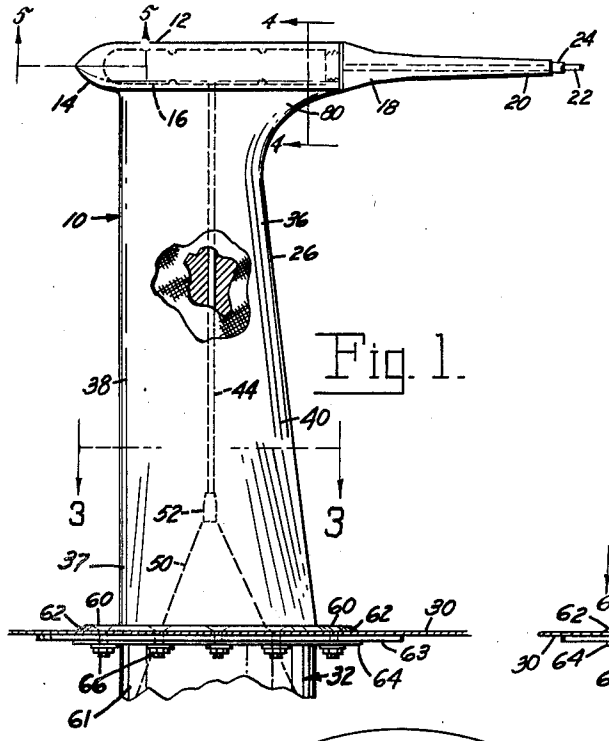


Fig. 1.

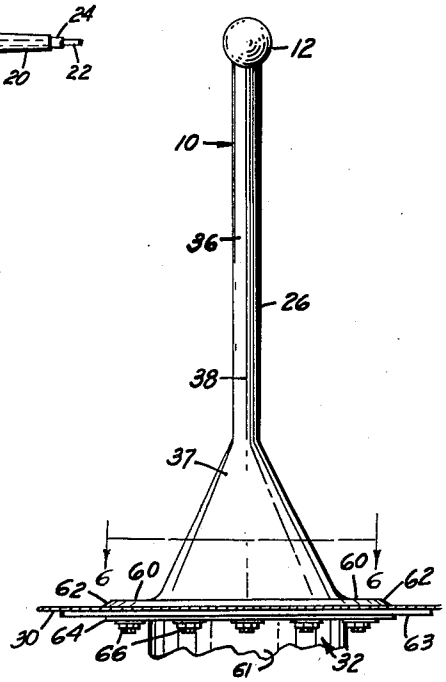


Fig. 2.

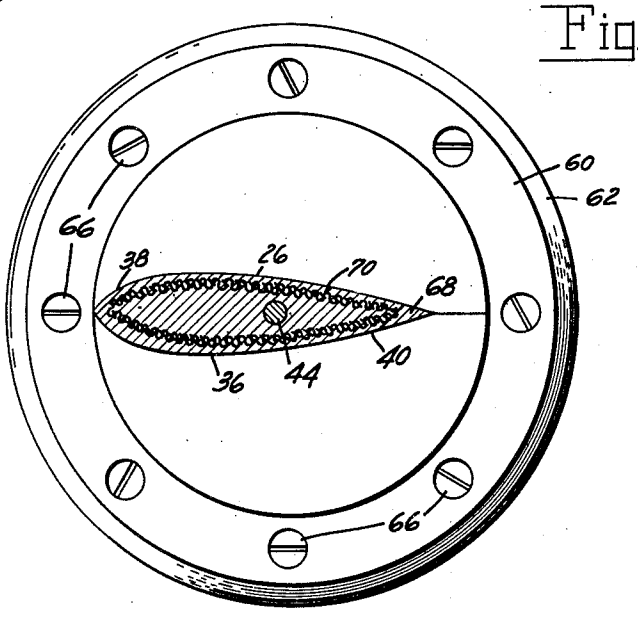


Fig. 3.

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LEAD THROUGH ANTENNA MAST BODY CONSTRUCTION

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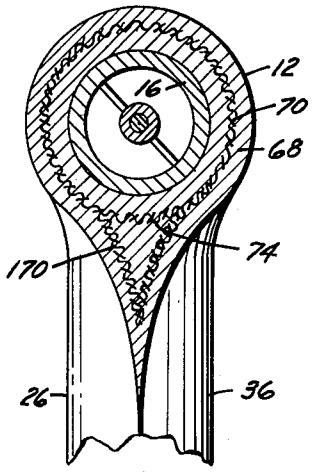


Fig. 4.

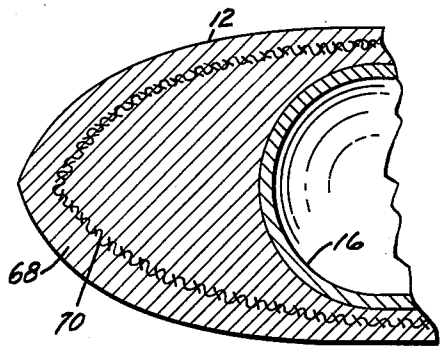


Fig. 5.

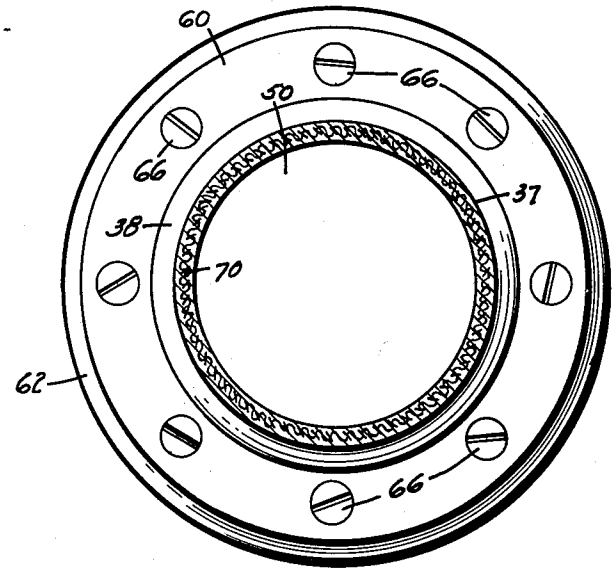


Fig. 6.

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LEAD THROUGH ANTENNA MAST BODY CONSTRUCTION

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Application December 13, 1955, Serial No. 552,798

6 Claims. (Cl. 343—705)

This invention relates to aircraft antenna masts and more particularly it is an object of the invention to provide an antenna mast of greater strength and superior electrical characteristics.

Strength is particularly important in an aircraft antenna inasmuch as antenna wire exerts a constant load on the mast of approximately 500 pounds. In addition there are impact loads, for example, those caused by objects hitting the antenna wire or caused by turning of the aircraft at high speeds. Turbulent air also causes heavy loads on an antenna mast.

It is also necessary to construct an antenna mast in as streamlined a shape as possible. These factors have caused antenna masts of the prior art to have been formed of such materials as are capable of enduring these heavy loads even though such materials have not had the best of electrical characteristics.

Antenna masts which extend downwardly through the outer skin of aircraft are called feed-through masts for the reason that they feed electrical energy downwardly from the antenna wire through the aircraft skin to the interior of the aircraft.

One of the electrical factors most important to antenna mast construction is the formation of the mast in a manner best adapted to carry the electrical energy without a corona problem. Corona is an electrical arcing effect which can cause the destruction of the antenna mast. Such arcing tends to occur at places where sharp points occur along the conductor rod leading down through the antenna mast. Corona and dielectric heating losses are particular problems at places along the conductor rod which are spaced apart from di-electric covering material leaving air spaces.

It is therefore an object of my invention to provide an antenna mast having a downwardly extending conductor embedded in plastic material in which the plastic material is particularly of a type having a characteristic of bonding to the metal of the conductor rod and filling the pores of the metal so as to prevent corona, and dielectric heating losses. The plastic material is preferably epoxy resin although other plastics have this characteristic.

Epoxy resin and other such plastics when used alone do not have the most desirable physical characteristics for antenna masts. Epoxy resin is normally brittle and a long thin piece would break under bending stress. With woven glass filamentary material generally known in the trade as "Fiberglas" the mast takes bending loads from all directions. It is therefore a further object of my invention to provide in combination with such plastics, the use of woven glass filamentary material bonded into plastic so as to reinforce the molded plastic and to provide it with these desired physical characteristics so as to make its use possible.

Other and further objects and advantages of the present invention will be apparent from the following detailed description, drawings and claims, the scope of the invention not being limited to the drawings themselves as

the drawings are only for the purpose of illustrating a way in which the principles of this invention can be applied.

Other embodiments of the invention utilizing the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and purview of the appended claims.

In the drawings:

Fig. 1 is a side elevation of an antenna mast shown as attached to the outer surface of an aircraft, a portion of the mast which extends downwardly from the outer surface of the aircraft being broken away, and certain parts of the surface of the antenna mast being broken away for showing the construction of the interior thereof;

Fig. 2 is a frontal elevation of the antenna mast and as it would be seen from the left hand side in Fig. 1;

Fig. 3 is a view in cross-section taken along the lines 3—3 of Fig. 1;

Fig. 4 is a view in cross-section taken along the line 4—4 of Fig. 1;

Fig. 5 is a view in cross-section taken along the line 5—5 of Fig. 1;

Fig. 6 is a cross-sectional view taken along the line 6—6 of Fig. 2.

I have herebefore referred to a woven glass filamentary material. While such a product is generally called "Fiberglas," "Fiberglas" is a trade name of a product manufactured and sold by the Owens-Corning Corporation. Such material, known as "Fiberglas" is of strand formation and in this invention I weave the same into a woven cloth member.

The antenna mast of this invention is generally indicated at **10** in Fig. 1. The mast **10** has an upper body portion **12** of an approximately cylindrical cross-section as best seen in Fig. 2, the forward end thereof being tapered to a point as shown at **14**. The purpose of the upper body portion **12** is to receive what is called a chuck barrel **16** which latter is embedded in the material from which the upper body portion **12** of the mast is made. All of these parts are not a part of this invention and also old is an antenna support sleeve **18** which tapers from the rearward end of the cylindrical upper body portion **12** outwardly to a narrower end **20**, the sleeve **20** being for further support of the antenna wire **22** having insulation **24** thereon.

A main body portion **26** of the mast is integral with the cylindrical upper body portion **12** and extends downwardly therefrom through the outer cover **30** of the aircraft and extends therebeneath in a portion **32** which is suitably anchored to the aircraft by means not shown.

The main body portion **26** as shown is divided into two parts, which are integral with each other. The first part is what can be called the central body portion **36** and the second part can be called the lower body portion or base portion **37**.

As best seen in Fig. 3 the central body portion **36** is approximately a teardrop shape in cross-section having a wider forward end **38** tapering to a point and having a narrower rearward end **40** tapering to a sharper point. A conductor rod **44** is attached to the chuck barrel **16** and extends downwardly through the main body portion **26** of the mast, terminating at the lower end of the central body portion **36** thereof and at that point joining a conically shaped cavity **50**, shown in dotted lines in Fig. 1.

The function of the conically shaped cavity **50** and of the part **52** disposed between the conically shaped cavity **50** and the connecting rod **44** will not be discussed herein, these parts not having a bearing on the subject matter of this invention.

However, it is because of the conical shaped cavity **50**

that the outer surface of the lower portion **37** of the main part of the mast **26** has a conical shape as seen in frontal elevation in Fig. 2.

An upper ring shaped flange **60** is disposed above and against the skin **30** of the aircraft. The flange **60** forms an upper part of an antenna mast sleeve **61** inset into the mast. The flange **60** has a bevelled outer edge **62**. A nut-ring assembly having rings **63** and **64** and bolts **66** is disposed below the skin **30** with the bolts **66** extending through the flange **60**, the skin **30** and the rings **63** and **64** to fasten the skin **30** to the sleeve **61**.

The main body portion **26** of the mast, as well as the outer housing of the upper cylindrical body portion **12** thereof, are formed of a thermosetting plastic material of the type adapted to bond well with the metal of the conductor rod **44** and with the metal outer surfaces of the chuck barrel **16** for prevention of corona. Epoxy resin **68** is the plastic material I prefer for this purpose, as forms a part of this invention.

It is possible to have the Fiberglas embedded at almost all points in the epoxy resin but when a lesser amount of Fiberglas is used I prefer that the Fiberglas be disposed in certain positions. These positions are illustrated in the drawings. It is desirable that the Fiberglas be disposed inside of the epoxy resin and be disposed preferably covering the entire mast just inwardly from all exterior surfaces.

For example, from the cross-sectional view of Fig. 3, it will be seen that the central body portion **26**, is of a somewhat teardrop shape being larger at a forward end and tapering to a smaller rearward end. Therefore, the Fiberglas **70** is preferably disposed also in a teardrop arrangement and at a uniform distance from the outer surfaces of the central body portion **26**.

Also in the lower or base portion **37**, the Fiberglas is arranged in a circular shape in cross-section, as best seen in Fig. 3, and is disposed a uniform and slight distance inwardly from the outer surface of the Fiberglas **70** in the base portion **37**, the Fiberglas being in a conical configuration complemental to the base portion **37** itself.

In the upper cylindrical body portion **12** of the mast the Fiberglas **70** is in a circular shape surrounding and spaced from the previously mentioned chuck barrel **16** and uniformly spaced inwardly from the outer surface of the portion **12**.

A somewhat triangularly shaped portion **80** of the mast joins the upper rearward end of the central body portion **36** of the mast with the under rearward portion of the cylindrical body portion **12** of the mast. This is best seen in **80** in Fig. 1 and in this portion of the mast the Fiberglas is in a triangular configuration as shown in **70** in Fig. 4, with the Fiberglas disposed the uniform distance inwardly from the exterior surfaces.

A Fiberglas segment **74** exists as seen in cross-section in Fig. 4, forming a part of the circularly arranged Fiberglas disposed about the chuck barrel **16**.

As best seen in Fig. 5, the forward end of the cylindrical body portion **12** of the mast is tapered to a point and in this portion the Fiberglas **70** likewise tapers to a point and is spaced preferably a uniform distance inwardly from the outer surface of the epoxy resin **68**.

As thus described it will be seen that this description has disclosed principles fulfilling the objectives hereinabove set forth.

From the foregoing description it is thought to be obvious that a lead through antenna mast constructed in accordance with my invention is particularly well adapted for use, by reason of the convenience and facility with which it may be assembled and operated, and it will also be obvious that my invention is susceptible of some change and modification without departing from the principles and spirit thereof, and for this reason I do not wish to be understood as limiting myself to the precise arrangement and formation of the several parts herein shown in carrying out my invention in practice, except as claimed.

I claim:

1. In an antenna mast for aircraft, a metal conductor rod, an elongated aircraft antenna wire extending exteriorly of said mast, means electrically interconnecting said antenna wire and said conductor, a body portion of a molded plastic material, said body portion being substantially rigid for supporting an elongated aircraft antenna wire at its upper end, said body portion being bonded to said conductor rod and the material of said body portion sticking to said conductor rod and filling the pores of the metal of said conductor rod to prevent corona discharge at the surface of said conductor rod, and bonded to the metal for expanding and contracting with the metal, the plastic material being epoxy resin, and a woven glass filamentary member bonded into and imbedded in said plastic for providing a mast having good electrical characteristics and capable of withstanding the constant loads and the impact loads of high speed aircraft.

2. In an antenna mast for aircraft, a metal conductor rod, an elongated aircraft antenna wire extending exteriorly of said mast, means electrically interconnecting said antenna wire and said conductor, a body portion of a molded plastic material, said body portion being substantially rigid for supporting an elongated aircraft antenna wire at its upper end, said body portion being bonded to said conductor rod and the material of said body portion sticking to said conductor rod and filling the pores of the metal of said conductor rod to prevent corona discharge at the surface of said conductor rod, and bonded to the metal for expanding and contracting with the metal, the plastic material being of a type adapted to do this, and a woven glass filamentary member bonded into and imbedded in said plastic for providing a mast having good electrical characteristics and capable of withstanding the constant loads and the impact loads of high speed aircraft.

3. In an antenna mast for aircraft, a metal conductor rod, an elongated aircraft antenna wire extending exteriorly of said mast, means electrically interconnecting said antenna wire and said conductor, a body portion of a molded plastic material, said body portion being substantially rigid for supporting an elongated aircraft antenna wire at its upper end, said body portion being bonded to said conductor rod and the material of said body portion sticking to said conductor rod and filling the pores of the metal of said conductor rod to prevent corona discharge at the surface of said conductor rod, and bonded to the metal for expanding and contracting with the metal, the plastic material being of a type adapted to do this, and a woven glass filamentary member bonded into and imbedded in said plastic for providing a mast having good electrical characteristics and capable of withstanding the constant loads and the impact loads of high speed aircraft, said woven glass filamentary member being arranged in a closed configuration on all sides of and spaced from said conductor rod as seen in cross-section transversely of said conductor rod.

4. In an antenna mast for aircraft, a metal conductor rod, an elongated aircraft antenna wire extending exteriorly of said mast, means electrically interconnecting said antenna wire and said conductor, a body portion of a molded plastic material, said body portion being substantially rigid for supporting an elongated aircraft antenna wire at its upper end, said body portion being bonded to said conductor rod and the material of said body portion sticking to said conductor rod and filling the pores of the metal of said conductor rod to prevent corona discharge at the surface of said conductor rod, and bonded to the metal for expanding and contracting with the metal, the plastic material being of a type adapted to do this, and a woven glass filamentary member bonded into and imbedded in said plastic for provid-

ing a mast having good electrical characteristics and capable of withstanding the constant loads and the impact loads of high speed aircraft, said body portion being generally of a tear-drop shape in cross-section and said woven glass filamentary member being arranged in a closed configuration on all sides of and spaced from said conductor and said configuration being of a cross-sectional shape complemental to the shape of said body portion and spaced inwardly therefrom a uniform distance on all sides of said body portion.

5. In an antenna mast for aircraft, a metal conductor rod, an elongated aircraft antenna wire extending exteriorly of said mast, means electrically interconnecting said antenna wire and said conductor, a body portion of a molded plastic material, said body portion being substantially rigid for supporting an elongated aircraft antenna wire at its upper end, said body portion being bonded to said conductor rod and the material of said body portion sticking to said conductor rod and filling the pores of the metal of said conductor rod to prevent corona discharge at the surface of said conductor rod, and bonded to the metal for expanding and contracting with the metal, the plastic material being epoxy resin, and a woven glass filamentary member bonded into and imbedded in said plastic for providing a mast having good electrical characteristics and capable of withstanding the constant loads and the impact loads of high speed aircraft, said body portion being generally of a tear-drop shape in cross-section and said woven glass filamentary member being arranged in a closed configuration on all sides of and spaced from said conductor and said configuration being of a cross-sectional shape complemental to the shape of said body portion and spaced inwardly therefrom a uniform distance on all sides of said body portion, the plastic material being epoxy resin, and a woven glass filamentary member bonded into and imbedded in said plastic for providing a mast capable of withstanding high speed aircraft constant and impact loads and having good electrical characteristics, said body portion being generally of a tear-drop shape in cross-section and said woven glass filamentary member being arranged in a closed configuration on all sides of and spaced from said conductor and said configuration being of a cross-sectional shape complemental to the shape of said body portion and spaced inwardly therefrom a uniform distance on all sides of said body portion.

6. The antenna mast of claim 1 in which said conductor rod is straight for best electrical characteristics.

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