April 12, 1966 F. C. BETCHER ETAL 3,246,077

FITTING FOR WIRE ANTENNAS

Filed May 23, 1962 2 Sheets-Sheet 1

FIG.1.

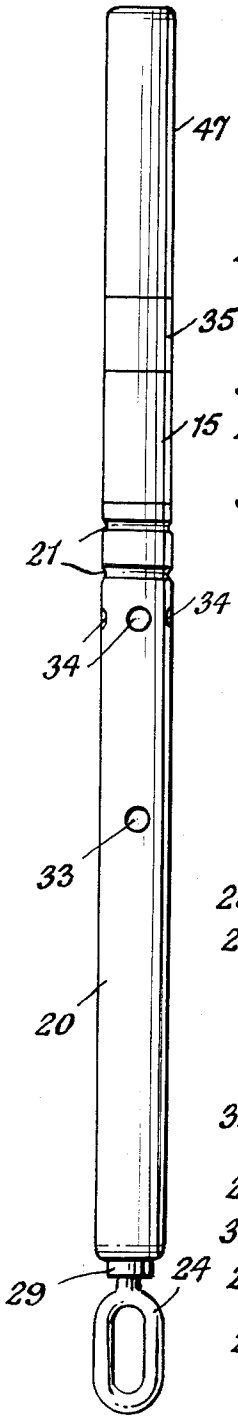


FIG.2.

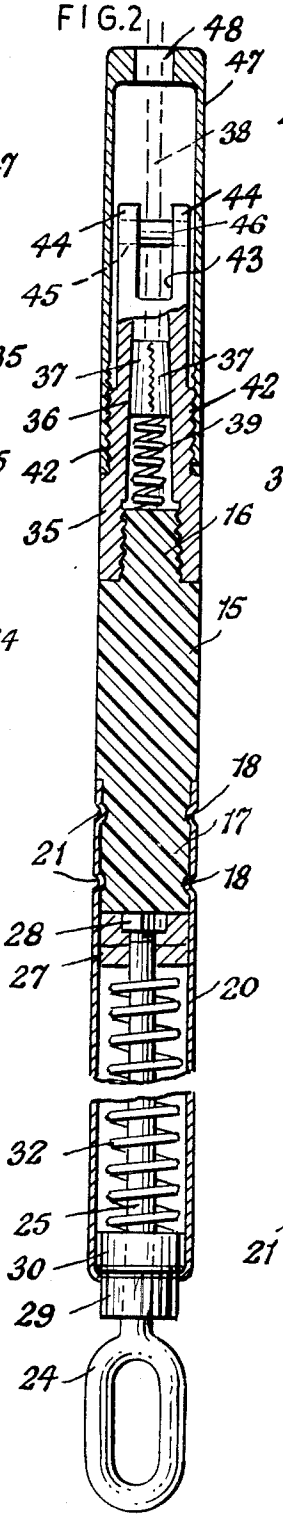


FIG.3.

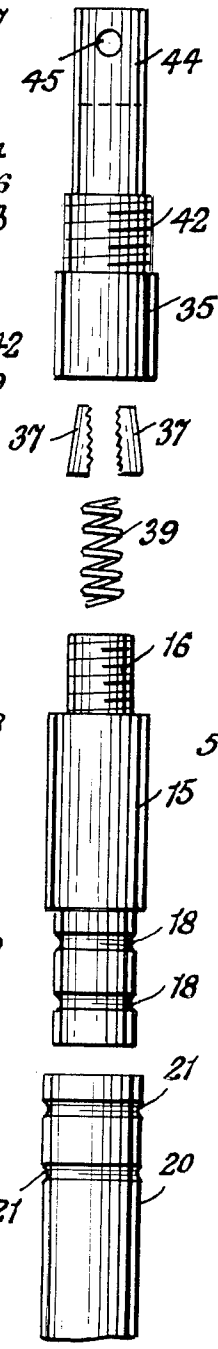


FIG.4.

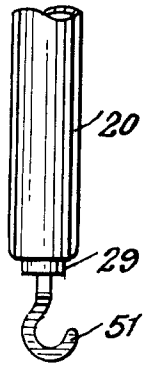
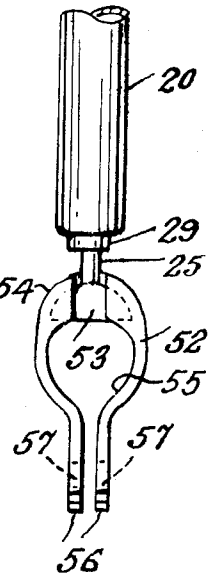


FIG.5.



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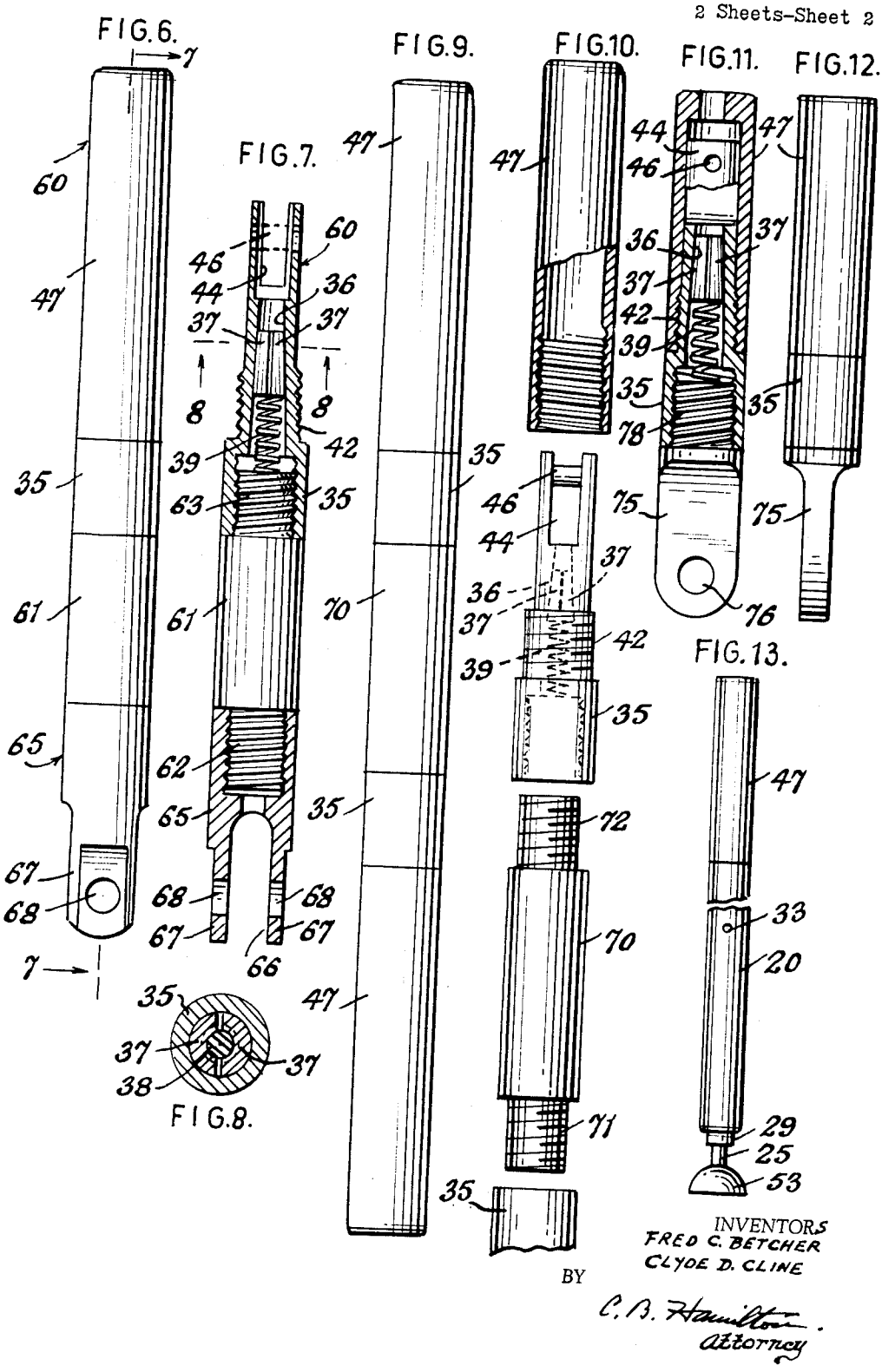
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April 12, 1966 F. C. BETCHER ETAL 3,246,077

FITTING FOR WIRE ANTENNAS

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2 Sheets-Sheet 2



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FITTINGS FOR WIRE ANTENNAS

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8 Claims. (Cl. 174—177)

This invention pertains to antenna hardware for aircraft communication systems and more particularly to miniature antenna fittings.

It is well known that under adverse atmospheric conditions, corona discharge from an airplane may completely obscure or blank out radio signals to render the radio set of the aircraft useless when it is urgently needed for navigational guidance to prevent disastrous crashes.

The minature fittings of the present invention, which are much thinner, much lighter in weight, and more efficient than those presently available on the market, are designed to practically eliminate dangerous radio antenna corona, reduce precipitation static interference to a minimum, and are also designed to lessen wind drag appreciably while aircraft is in flight and thus permit faster flight speed than otherwise attainable without such miniature fittings.

Accordingly, an object of this invention is to provide miniaturized antenna hardware, otherwise referred to as fittings, of improved design having very high electrical and structural strength characteristics.

Another object is to provide durable couplings or fittings that are constructed to be lightweight and compact to reduce "wind-drag" to a minimum.

Another object is to provide highly-polished, corrosion resistant, simplified antenna hardware of improved miniaturized contour to practically eliminate radio interference involving corona discharge and precipitation static.

Still another object is to provide various types of antenna hardware, such as tension units with various attachment terminations, strain insulators, shackles and guy fittings, each having dual wire-fastening means for securely retaining either a single strand or multi-strand antenna.

Other objects and advantages of this invention will become apparent from the following detailed descriptions when considered in conjunction with the accompanying drawings in which:

FIG. 1 is a side elevation of an insulated resilient coupling or tension unit or fitting having an eye link at one end and disclosing one embodiment of the invention incorporating the features thereof;

FIG. 2 is an enlarged longitudinal sectional view of the tension unit of FIG. 1 showing the dual wire-fastening means adaptable for securely holding either a single strand or multi-strand antenna wire;

FIG. 3 is a fragmentary exploded view of the structure of the tension unit shown in FIG. 2;

FIGS. 4 and 5 are partial longitudinal views of the lower end of the tension unit of FIG. 1 showing a hook and a swivel, respectively, for replacement of the eye of FIG. 1 as desired for attachment to an antenna support;

FIG. 6 is a longitudinal view of an insulated shackle coupling, or otherwise referred to as fitting, having a removably threaded cap part on one end and a shackle on the other end for securing an antenna wire, such as, for example, to a mast on an aircraft;

FIG. 7 is a longitudinal sectional view of the shackle unit of FIG. 6 turned through 90 degrees to show the bifurcated shackle end, and with the cap part removed to disclose the dual wire-fastening means for securely-

holding either a single strand wire or multi-strand antenna wire;

FIG. 8 is a cross sectional view taken along line 8—8 looking in the direction of the arrows on FIG. 7 to show the gripping position of the chuck jaws;

FIG. 9 is a longitudinal side view of an antenna strain insulator of the invention having a threaded middle insulator portion and cap part at each end thereof, with dual wire-fastening means under each of the caps to grip or secure wires extending therein;

FIG. 10 is a fragmentary exploded view of the upper half of the strain insulator fitting of FIG. 9 showing one of the two dual wire-fastening means for holding either single strand wire or multi-strand wire antenna;

FIG. 11 is a longitudinal sectional view of an antenna guy fitting disclosing another embodiment of the invention, having at one end a cap part covering the dual wire-attachment means for securely holding either a single strand wire or a multi-strand antenna wire, and an eye link at the other end for attaching the secured antenna wire to an existing support of the airplane;

FIG. 12 is a plan view of the guy fitting of FIG. 11 turned through 90 degrees, and

FIG. 13 is a partial longitudinal plan view of the tension fitting shown in FIGS. 1 and 5 with the insulator block removed, which insulator block may be omitted from each of the fittings or couplings disclosed in FIGS. 1 through 7 and FIGS. 11 and 12, as desired.

Referring now to the drawings, wherein like reference characters designate the same or corresponding parts through out the several views, there is shown in FIGS. 1–5 a miniaturized tension unit having a cylindrical insulating block **15** of high dielectric quality which has a reduced threaded portion **16** at one end and a slightly-reduced portion **17** at the other end with two spaced circular grooves **18** in the periphery of the insulating block. Manifestly many other connecting means may be used in place of the threaded connections. Slidable over the end portion **17** of the insulating block **15** is an elongated highly-polished member, such as a stainless steel cylinder **20**, which fits snugly over the block portion **17** to provide an uninterrupted continuous smooth surface of approximately the same diameter as the larger part **15** of the insulator block. The member or tube **20** is then rolled down at **21** to fit tightly into the well-rounded circular grooves **18** in the block portion **17** to avoid any sharp projections.

A link eye **24** positioned on the outside of the left end of the cylinder **20** has an integral shaft **25** extending through the center of this cylinder. On a threaded inner end of the shaft **25** within the cylinder **20** is a washer **27** of corrosion resistant material which is held in place by a nut **28**, or other means, threaded onto the end of the shaft **25**. Secured in the left end of the cylinder **20** is a wear-resisting plastic guide bushing **29** for the shaft **25** and having an enlarged integral portion **30** securely-held within the end of cylinder **20** by the spun-over rounded end portion **30** thereof. These plastic plugs, or bushings **29**, are far superior to the stainless steel bushings now in use which wear out quickly because of friction with the shaft **25**. Disposed between the plastic bushing **29–30** and the washer **27** is a compressed coil spring **32**. The eye link **24**, shaft **25** and nut held washer **27** may be moved to the left by pulling on eye link **24** to compress the coil spring **32**. After the nut **28** on the inner end of the shaft **25** has been pulled to the left past a hole **33** in the cylinder **20**, a pin (not shown) may be inserted to hold the eye link **24** in its left extending position until a desired antenna wire connection is made therewith, whereupon the pin is removed to release the spring **32** thereby applying proper tension to the antenna. A series of holes

34 are provided in the cylinder 20 adjacent the left end of the insulator block 17 to adequately-drain away any water and thus prevent formation of ice.

The reduced threaded end 16 of the block 15 is coated with a suitable cement, such as an epoxy, and then threaded into a hollow member 35 such as stainless steel, which member is provided with a conical internal tapered portion 36 for receiving a pair of semi-cylindrical gripping or chuck jaws 37 having roughened or serrated inner surfaces for receiving and gripping a single conductor 38 such as shown in dotted lines in FIG. 2. The wire gripping chucks 37 are made to provide a serrated opening therebetween to receive and securely-grip the conductor 38. The pair of gripping chuck jaws 37 are biased together along the tapered portion 36 in the hollow cylindrical member 35 by a coil spring 39 so that the harder the pull, the greater the gripping action.

This hollow cylindrical member 35 has an integral reduced portion threaded at 42 and a diametrical slot or bifurcation 43 at its outer end to provide two legs or bifurcations 44 having holes 45 for receiving a removable cross pin 46 about which may be secured the end of an antenna wire by wrapping the wire about the pin and then securely fastening it by winding the end portion of the wire back upon itself. A threaded, open ended cap 47 is then screwed onto the threaded portion 42 of the cylindrical member 35 with the antenna wire 38 (FIG. 2) extending through the rounded open end 48 of the cap 47. This cap 47 may be made of plastic, anodized aluminum, stainless steel or any other suitable material.

Thus, all of the fittings of the miniaturized antenna hardware of this invention having uniform smooth, highly-polished surfaces without any sharp bends, provides a novel dual wire-fastening means capable of quickly-securing either a single strand antenna wire by easily-removing the cross pin 46 and thence pushing such single conductor wire into the chuck jaws 37 to be securely held thereby; or of quickly securing a multi-strand antenna wire in any of the miniaturized fittings by leaving the cross pin in position and then looping the stranded antenna wire about the pin 46 and then winding such wire around the remaining bare portion of this wire to secure it to any one of the fittings herein disclosed.

The exterior end of tension shaft 25 may be provided with an eye 24 as shown in FIGS. 1 and 2, or a hook termination 51 as shown in FIG. 4, or a hemispherical ball and swivel as shown in FIG. 5. In the swivel connection as shown in FIG. 5, the shaft 25 terminates in a hemispherical ball shape 53. The socket 54 for the ball 53 has an opening 55 to permit easy assembly of the ball 53 inside the socket which terminates in two lugs 56 having holes 57 to receive a bolt, or screw, for fastening to an antenna support on the aircraft.

An additional function of the opening 55 is to permit the fitting and antenna wire to fall free from the aircraft in the event the wire breaks along its length while the aircraft is in flight since the opening 55 is sufficiently large to permit the hemispherical ball 53 to readily escape from its socket 54.

The fittings or couplings shown in FIGS. 1 through 5 may be provided with the insulator block 15 or it may be omitted depending upon the use intended for the particular fitting.

The improved antenna shackle fitting 60 provided with an insulator, shown in FIG. 6, is of miniaturized construction, being approximately only ⅜ of an inch in diameter and about 3 and ¾ inches long. This shackle fitting 60 comprises an insulator block 61 having reduced threaded portions 62–63 (FIG. 7) at each end thereof. A highly polished hollow member 35 is threaded onto the threaded portion 63 (FIG. 7) and a shackle is threaded over the other portion 62 to provide a smooth continuous outer surface. The shackle end 65 is bifurcated at 66 and each projecting bifurcation 67 is provided with a hole 68 for securing the antenna wire, for example, to a mast on the airplane.

The member 35 is of the same dual wire-fastening construction as that shown at the right end of the tension unit or coupling shown in FIG. 2; i.e. the spring urged jaws or chucks 37 are provided to grip a single strand antenna wire, and the two bifurcations 44 with cross pin 46 therein are provided to securely hold a multi-stranded antenna wire as previously described.

Likewise, the shackle fitting or coupling 60 may have the insulator 61 or it may be omitted depending on its use.

The miniaturized strain insulator shown in FIGS. 9 and 10, embodying the features of the present invention, is only approximately ⅜ of an inch in diameter and approximately 5 and ⅛ inches in length and is far superior in electrical and mechanical strength characteristics than those now available, since, for example, it provides greater protection from interference due to corona discharge by adequate electrical shielding of the antenna wire connection. This improved miniaturized strain insulator has a solid middle cylindrical insulator block 70 of high dielectric quality with two reduced threaded ends 71–72. Threaded onto each of these ends, 71 and 72, is the same dual wire-fastening means 35, 37, 39, 44–46 shown in FIGS. 2, 3 and 7, whereby a single strand antenna wire or a multi-strand antenna wire may be quickly and selectively-secured to the strain insulator of FIGS. 9–10 which is a complete self-contained unit. Highly-polished hollow caps 47 are screwed onto the threads 42 of each of the members 35 to electrically-shield and protect the dual wire-fastening means 37 and 44 against corona.

Any suitable connecting means may be substituted for the threaded connections as desired.

The miniaturized non-insulated guy fitting or coupling unit shown in FIGS. 11–12, comprises an eye link 75 having an eye opening 76 for securing the link to an existing support on the aircraft structure. This link has a flange 77 and an integral reduced threaded part 78 for receiving thereon (FIG. 1) the dual wire-fastening means 35, 37, 39, 44–46, shown in FIGS. 2, 3, 7 and 10, for selectively and quickly holding either a single strand antenna wire or a multi-strand antenna wire.

In FIG. 13 is shown a tension unit of FIGS. 1–5 without the insulator block 15. It will be understood that each and every one of the fittings shown in the drawings may be manufactured with or without the insulator block.

The miniaturized antenna hardware is particularly characterized in having a spring-urged set of chuck jaws, and a pin and coupling within each removable cap to provide a dual selective wire-fastening means; and the use of improved materials and ingenuous cooperation between every part in a complete self-contained unit to provide utmost protection of the antenna wire connections against corona. Thus, all these features have made it possible to greatly reduce the size of the fittings to provide versatility, ruggedness and streamlining to reduce "wind drag" or air friction at high speeds.

The miniaturization of the fittings reduces their diameters and weights to such extents providing the desirable advantages of minimizing icing, reducing flutter or vibration of the antenna thus eliminating wire breakage due to metal fatigue or crystallization thereof, reducing considerably the "wind-drag" on the antenna to improve speed efficiency, thereby prolonging the efficient life of the antenna.

The miniaturized fittings of the present invention are so thin and streamlined that they weigh only approximately one-fourth as much as previous fittings and are far superior to fittings now available on the market. Caution should be used to protect the high polished finish of the fittings against nicking or marring, and this protective caution may, for example, be achieved through the placement of removable tape over the exterior surfaces of the end caps.

Although the present invention has been described with

reference to several embodiments, it is to be understood that various modifications may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. In a fitting for antenna wires, a body of insulation material having threaded extensions at at least one end thereof, dual wire holding means screwed onto said threaded extension and having spring pressed chuck jaws for holding a single strand of wire and a bifurcated member having a cross pin for securing a wire thereabout, and hollow elongated cap means removably attached to the said dual wire holding means and covering the said dual wire holding means and permitting the connected wire to extend therefrom, and means secured to the other end of the insulating body for securing the said fitting to a support.

2. The fitting as defined in claim 1 wherein said securing means includes a tubular extension secured to said body at an end thereof remote from said dual wire holding means, a shaft having one end slidably received in said extension and having attaching means on the other end, a spring on said shaft in said extension in compression between said shaft one end and the end of said extension tending to retract said shaft into said extension, and means in said extension forming an opening intermediate the ends thereof adapted to receive a tool for holding said shaft in a predetermined partially-extended position against said spring so that connections may be made with the fitting where said spring is partially compressed providing for the attainment of a desired tension in the antenna wire upon the removal of such tool from said opening.

3. An aircraft antenna support fitting adapted for selectively supporting single strand and multiple-strand antenna wires comprising an elongated body having means adjacent one end thereof defining a bore opening at one end of said body, said bore being tapered over at least a portion of its axial length, cooperating chuck jaws received in said body at said taper and having inner surfaces for gripping the end of a single strand antenna wire extending into said body through said bore, means urging said jaws into coacting relation with said tapered portion and into closing relation with such wire end, said body further having bifurcations spaced from said chuck-jaws defining a slot in intersecting relation with said bore adjacent said open end, and pin means in said bifurcations extending transversely across said slot for receiving a multiple-strand antenna wire thereabout.

4. The fitting as defined in claim 3 further comprising a tubular extension secured to said body at an end thereof remote from said bore, a shaft having one end slidably received in said extension and having connection means formed on the other end thereof, a spring on said shaft in said extension in compression between said shaft one end and an end of said extension tending to retract said shaft into said extension, and means in said extension forming an opening intermediate the ends thereof adapted to receive a tool for holding said shaft in a predetermined, partially-extended position against said spring so that connections may be made with said fitting while said spring is partially compressed providing for the attainment of a desired tension in the antenna wire upon the removal of such tool from said opening.

5. An aircraft antenna support fitting adapted for selectively supporting single strand antenna wire and multiple-strand antenna wire comprising an elongated body having means adjacent one end thereof defining a bore opening at one end of said body, said bore being tapered over at least a portion of its axial length, cooperating chuck jaws received in said body at said taper and having cooperating inner surfaces for gripping the end of a single strand antenna wire extending into said body through said bore, means urging said paws into coacting relation with said tapered portion and into closing relation with such wire end, said body further having bifurcations spaced from said chuck jaws defining a slot in intersecting relation with said bore adjacent the open end thereof, means in said bifurcations adapted to support a pin extending transversely across said slot for receiving a multiple-strand antenna wire thereabout, and a cap removably received in telescoping relation to said body forming a closure for said slot and bore and having an aperture at one end thereof aligned with said bore for receiving such antenna wire therethrough.

6. An aircraft antenna wire support fitting for use selectively with single strand antenna wire and multiple-strand antenna wire comprising an elongated generally cylindrical body formed of insulator material, a member secured to said body and forming an extension thereof and being essentially hollow to form a bore axially aligned with said body, means in said bore defining a tapered portion, cooperating chuck jaws received in said bore at said portion and having cooperating inner surfaces for gripping the end of a single strand antenna wire extending into said member through said bore, spring means urging said jaws outwardly into coacting engagement with said taper, means in said member forming a slot in intersecting relation with said bore, and a pin removably supported on said member transversely of said slot adjacent the open end of said bore for receiving a multiple-strand antenna wire thereabout.

7. An aircraft antenna wire support fitting for use selectively with single strand antenna wire and multiple-strand antenna wire comprising an elongated, generally cylindrical body, a wire support member secured to said body and forming an extension thereof and having means defining a bore axially alligned with said body, means in said bore defining a tapered portion adjacent an inner end thereof, a pair of chuck jaws received in said bore at said portion and having cooperating inner surfaces for gripping the end of a single strand antenna wire extending into said member through said bore, a spring positioned to urge said jaws into coacting engagement with said tapered bore, means in said member forming a slot at an end thereof spaced from said jaws in intersecting relation with said bore, means on said member removably supporting a pin transversely of said slot and generally adjacent the open end of said bore adapted to receive a multiple-strand antenna wire thereabout, and a generally cylindrical cap having an external diameter which substantially coincides with the diameter of said body and being received in telescopic relation over said member for closing said slot and said bore and having means defining an opening in one end thereof axially aligned with said bore for receiving such antenna wires therethrough.

8. An aircraft antenna wire supporting fitting for use selectively with single strand antenna wire and multiple-strand antenna wire comprising an elongated generally cylindrical body formed of dielectric material, a metallic member secured to said body and forming an extension thereof and being essentially hollow and having a tapered bore axially aligned with said body, a pair of chuck jaws removably received in said bore and having outer tapered surfaces engageable with said member at said bore and cooperating inner surfaces for gripping the end of a single strand antenna wire extending into said member through said bore, a compression spring positioned in said bore between said chuck jaws and said body urging said jaws outwardly into coating engagement with said bore, means in said member forming a slot at an end thereof spaced from said body and said jaws in intersecting relation with said bore, means on said member removably supporting a pin transversely of said slot and generally adjacent the open end of said bore adapted for receiving a multiple strand antenna wire thereabout, a generally cylindrical metallic cap having an external diameter which substantially coincides with the diameter of said body and being threaded in telescopic relation over said member for closing said slot and said bore, said cap having means defining

an opening in one end thereof axially aligned with said bore for receiving such antenna wires therethrough, and the diameter of said cap opening being substantially the same as the diameter of said bore at said slot.

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