Aug. 18, 1964 A. C. NUTTLE 3,145,384

ELECTRICAL MOUNTING FOR SUPPORTING AN ANTENNA AND COUPLING CIRCUIT

Filed Jan. 16, 1962

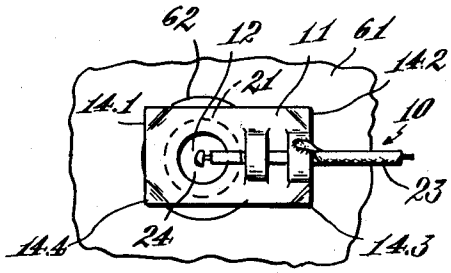

Fig. 1

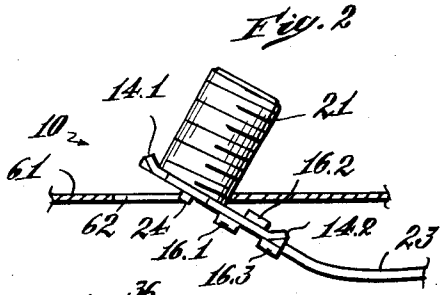

Fig. 2

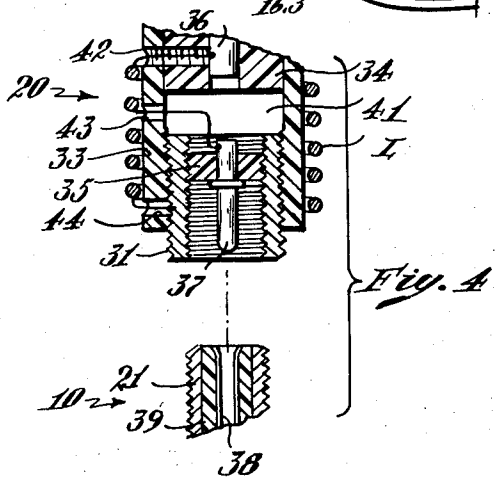

Fig. 4

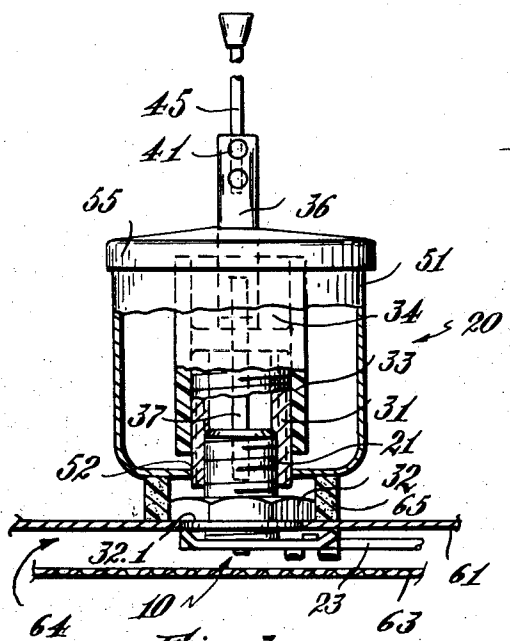

Fig. 3

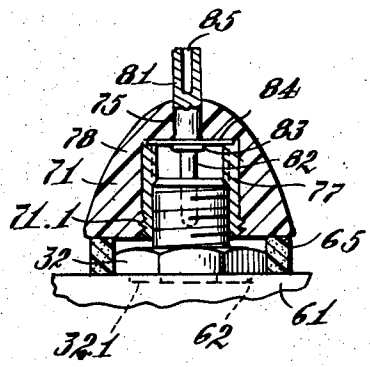

Fig. 5

INVENTOR.

Andrew C. Nuttle

BY

Roberts, Cushman & Grover,

ATT'YS.

United States Patent Office 3,145,384 Patented Aug. 18, 1964

3,145,384

ELECTRICAL MOUNTING FOR SUPPORTING AN ANTENNA AND COUPLING CIRCUIT

Andrew C. Nuttle, Manchester, N.H., assignor to Gam Electronics, Inc., Manchester, N.H., a corporation of New Hampshire

Filed Jan. 16, 1962, Ser. No. 166,550
8 Claims. (Cl. 343—749)

The field of the present invention is that of mounting electrical apparatus on flat supports which are for practical purposes inaccessible on one side, and more particularly it is that of rod antenna mounts for such use on sheet metal portions of vehicles.

Mountings of the above-mentioned general type must conform to various practically important requirements with regard to manufacture, assembly, installation, use and appearance. With regard to manufacture, the parts of such mountings which are intended for widespread use should be simple, so far as possible of standard pattern, few in number, and suitable for mass production and assembly. Assembly and installation should be as speedy and simple as possible without requiring special tools and skills and if the antenna mountings are intended for the roofs of automobiles or boats they must lend themselves to easy introduction of a supply wire or wires between the metal sheet of the roof proper and the inside lining or upholstery; it should be possible to complete the installation simply by drilling a hole in the roof, by inserting the wire, and by then fastening the antenna base firmly and permanently with a minimum of operations, and without marring or otherwise disturbing the roof and lining. During use such antenna mountings should be water and shockproof and have favorable electrical characteristics. In appearance they should be functionally graceful and attractive to the average user.

Objects of the invention are to provide such mountings which incorporate at least the above requirements to a high degree, with particular emphasis on simplicity of design, reliability, favorable electrical characteristics including a good radiation pattern and electrical connections which are permanently trouble-free regardless of weather, wear, and vibration, and ease of assembly particularly for installation on the roof of a car with a conduit threaded between the car roof and the lining; to provide such mountings which are of pleasing appearance, which due to the simplicity of construction and ease of assembly involve initial and installation costs which are low for a device of this quality, which assure permanently reliable performance, and which are adaptable to a great variety of support; and to provide the possibility of adding to such mounts electrical components such as a matching inductance without necessitating structural changes.

The substance and nature of the invention can be briefly summarized in its principal aspects as achieving the above and other objects as follows. A pre-assembled backing subassembly includes an oblong, such as approximately rectangular, plate forming a metal surface engaging means, the shorter dimension of which permits its threading through a circular aperture whereas its longer dimension prevents it from slipping through such an aperture once it is placed flatly thereacross. The subassembly further includes, fixed to one face of the backing plate, the female part of an electrical screw connector with an outside threaded connector sleeve or nipple containing a contact means such as a pin. The plate face from which this connector nipple extends has means for firmly gripping a surface. This backing subassembly is combined with a front subassembly on an insulating tube or shell which forms, or engages at one end the male part for the above-mentioned screw connector such as with an inside threaded metallic connector sleeve and a pin therein,

and which tube is at the other end equipped to carry an antenna. In one practical embodiment, the connector sleeve screws into a tapped hole at the bottom of a housing or shield which is closed at the top with an insulating cover sealed thereto. The connector pin is fastened to the insulating tube or shell such as by way of insulating plug or washer means, and it can be conductively connected directly to an antenna socket leading through and sealed against the tube or cover, or the pin can end within the insulating tube or shell to form a gap where electrical elements can be connected.

On assembly, a sheet engaging means such as a nut is placed on the nipple of the backing assembly which upon tightening firmly presses the backing plate against the sheet. The front assembly is then applied by means of the screw connector. Between the supporting apertured sheet and the housing or shell bottom is inserted a gasket of elastic insulating material encompassing the nut and pressed down by the housing as it is screwed on the inner connector sleeve or nipple, thereby providing in very simple manner a waterproof seal at the roof. The outside of the insulating tube with the screw connector can be used for carrying an electrical component such as matching inductor.

In a preferred embodiment, the above-mentioned essentially rectangular backing plate has sharp turned up corners for gripping the underside of a sheet such as a roof and a perforation leading into the outside threaded jack nipple into which is press-fitted the jack portion of the screw connector.

In a simplified embodiment, the front subassembly has an insulating dome shaped body which, forming a shell, replaces both insulating tube, shield, and cover, which holds the antenna and the pin of the screw connector, and has oppositely to the antenna a threaded axial bore with which it is screwed to the jack nipple of the screw connector, thus connecting the pin and the jack receptacle.

These and other objects and inventive aspects and advantageous results of the invention will appear from the following detailed description of two practical embodiments thereof illustrating its novel characteristics.

The description refers to a drawing in which

FIG. 1 is a bottom view of the backing subassembly according to the invention;

FIG. 2 is a side elevation of the subassembly and illustrates the step of its insertion into the hole of a sheet of metal on which the device is to be assembled;

FIG. 3 is a side elevation with parts in axial section of the completely assembled antenna mounting;

FIG. 4 is a detail longitudinal section similar to FIG. 3 of the screw connector; and

FIG. 5 is a longitudinal section similar to FIG. 3 of a simplified embodiment of the invention.

The backing subassembly **10** shown in FIGS. 1 and 2 consists of a rectangular backing plate **11** having adjacent to one of its shorter sides an aperture **12** and on one face provisions for gripping a metal surface. The sharp, turned up gripping corners indicated at **14.1**, **14.2**, **14.3**, **14.4** are easy to form, fully effective and hence preferred for this purpose. Adjacent to the other short side of the backing plate are means for attaching an insulated electric conductor, and in this instance these consist of three transverse cuts, and three oppositely expanded strip portions between these cuts and the short edge, as indicated at **16.1**, **16.2**, **16.3** of FIG. 2. Suitably fastened to the backing plate preferably by means of threading and subsequent soldering, or by welding, is a connector jack nipple **21** having an outside thread and containing, as will be described hereinbelow, the jack portion of the screw connector component of mountings according to the invention. It will be noted that both, the gripping corners and the nipple extend from the same face of the backing plate.

As shown in FIGS. 1 and 2, an electric lead 23 can be threaded between the strips 16 and fastened, such as soldered, to the jack portion at 24 and secured to the backing plate 11 by slightly compressing the strips 16 or merely by providing a secure frictional fit between the insulation of the antenna lead wire and the backing plate strips. If the lead 23 is a coaxial cable, its shield may be soldered or otherwise electrically connected to the backing plate 11 and thus to all shielding components of the entire device.

The front subassembly 20 of mounts according to the invention is particularly shown in FIG. 3 and consist in this embodiment of a connector sleeve 31, a nut 32 and a connector tube 33. The sleeve 31 is threaded on both sides, the inside thread fitting the outside thread of the nipple 21 of the backing assembly. The nut 32 has a shoulder portion 32.1 which fits the perforation 12 of the backing plate 11. The connector tube 33 is made of rigid insulating material, press fitted at one end over the outside thread of sleeve 31 and closed at its other end by an insulating plug 34 of similar material into which is press-fitted an antenna socket 36. At the nipple end, the sleeve 31 holds a washer 35 into which is press-fitted the pin portion 37 (FIG. 4) of the screw connector. This pin 37 fits a jack portion 38 which is press-fitted by means of an insulating lining 39, into the connector jack nipple 21. The antenna socket 36 has an axial bore and means such as set screws 41 for fastening the antenna structure proper such as the antenna 45.

The complete assembly is protected by a shielding pot shaped housing 51 of metal having at its bottom a threaded perforation 52 which fits the outside thread of the connector sleeve 31. The top of the shield is closed by a cap 55 of suitably weatherproof insulating material which tightly fits the top of the pot 51 and also the antenna socket 36. Both joints can moreover be sealed by suitable now easily available permanently cementing techniques.

The pin 37 can be directly connected to the antenna socket 36 as indicated in FIG. 3 or, as shown in FIG. 4, a gap is provided at 41 which can be simply bridged or used for purposes of a matching inductor indicated at L of FIG. 4. Such an impedance can be connected at one end to the antenna by means of a screw through the tapped hole 42, to the jack pin and hence to the antenna lead by a wire through the hole 43, and similarly by a wire through hole 44 and soldered to the connector sleeve 31 forming a shield with the nipple 21 and the metal parts connected thereto.

The present antenna mount is especially practical and useful for the purpose of mounting antennas on metal sheets which are easily accessible only from one side, such as the roofs of automobiles or other vehicles which have on the inside a lining such as upholstery material. Such a structure is indicated in FIGS. 1 to 3 where 61 is the roof sheet of a vehicle and 63 a lining with a comparatively narrow space 64 therebetween. The roof sheet 61 has a circular hole 62 which can be easily made by means of conventional generally available tools.

As shown especially in FIG. 2, the backing subassembly can be easily threaded into the hole 62 by first pushing the lead wire 23 into the space 64, it being noted that in FIG. 2 the inclination of the subassembly is somewhat exaggerated such as better to distinguish the hole from the subassembly during insertion. Due to the smaller dimension of the backing plate 11 being narrower than the diameter of the hole 62, the plate can be easily slipped into the hole, the lead wire 23 and the wire holding strips 16 going in first and the outer narrower side of the plate, opposite the wire, following. The backing plate is then slightly moved laterally towards the left side of FIGS. 1 and 2, such as to reach with its gripping corners 14.1, 14.4 under the sheet 61, making electrical as well as mechanical contact. Thereupon the nut 32 is tightened with its shoulder 32.1 filling the hole 62. The nut can be threaded to the outer end of the nipple 21 prior to assembly in order to faciliate handling and prevent slipping of the backing assembly through the hole. After the nut has been tightened, as indicated in FIG. 3, a waterproof sealing washer 65 preferably with a hexagonal inside recess fitting the nut is slipped over the latter. Thereupon the connector sleeve 31 of the front assembly 20 as above described is screwed on to the outer thread of the jack nipple 21 until the plug 37 is fully inserted into the jack socket 38. The bottom of the housing 51 with sleeve 31 is thereby pressed against the gasket 65, perfecting the waterproof seal at this region. The antenna supporting front subassembly 20 within housing 51 having been preassembled, this finishes the mounting of the antenna on the roof 61, without the lining 63 having been disturbed and the wire 23 having been easily threaded to a point where it is desired to emerge.

It will be noted that the outside of the insulator tube 33 is unincumbered, and reaches from the screw connector towards the antenna proper within a space protected by the housing 51. This space can be utilized for mounting an electrically effective component such as a matching transformed coil L wound around the connector tube 33 and inserted between antenna socket 36, jack 38, and nipple 21, by means of connections mentioned above with reference to the holes 42, 43, 44 shown in FIG. 3.

Another embodiment of the invention is shown in FIG. 5, which embodiment is somewhat simpler and therefore less expensive than that of FIGS. 1–4, although it does not provide the interior space available in the first described embodiment. In FIG. 5, the backing subassembly is the same as that above described with reference to FIGS. 1 to 3, including the nut 32 reaching with its shoulder 32.1 into the hole 62 of the roof sheet. The sealing gasket 65 likewise is the same as above described. Instead of the front assembly however a single insulating body 71 is provided which has a metal lining 77 threaded on the inside and molded, preferably with the aid of a few threads 77.1 at its end, into the body 71. The metal lining or bushing 77 corresponds to the connector sleeve 31, in the fashion described above with reference to insulating tube 33 which is here replaced by the body 71. Also molded into the body 71 is the antenna socket 81 which is inserted into and conductingly fastened to a standard connector pin 82 fastened into the axial bore 85 of the antenna socket. Between the rim 83 and the shoulder of the socket 81 is an insulating washer 84 which closes the recess containing the pin 82. Assembly of this embodiment is similar to that described above with reference to FIGS. 1 to 4, namely the backing subassembly 10 is slipped into the hole of the roof sheet, the nut 32 is tightened, the gasket 65 applied and the connector sleeve 77 with pin 82 is then screwed onto nipple 21 with jack 38, thereby making electrical contact at 82, 38 and compressing the gasket 65 thus perfecting the mechanical seal around the roof of the vehicle. In both embodiments, the nipple 21 and the female portion 38 of the jack component on the backing subassembly are standard so that it is easily possible to perform electrical tests on the sender or receiver connected to the antenna, simply by unscrewing the housing 51 or the body 71 while leaving the nut 32 undisturbed, and by then coupling a standard male component of the test equipment to the jack portion.

While the above described mountings according to the invention are especially suitable for attaching antennas to the roofs or similar structural portions of it will be understood that such mountings can be easily adapted for use with other electrical apparatus such as lamps or signaling devices such as sirens. It will be evident that for example a lamp socket can be easily mounted on the tube 33 or housing 51 of FIG. 3, or on the body 71 of FIG. 5, providing the above pointed out advantages especially

of convenient insertion and mounting of the backing subassembly and disengagement of the front assembly simply by separating the outer screw connector component.

It will now be evident that antenna mounts according to the invention offer the following advantages and appreciably improved results among others similarly appearing from or inherent in the above exposition of the substance and nature of the invention and from the description of several embodiments thereof.

Due to the double duty performed by several components such as the backing plate, the connector jack nipple, to connector pin sleeve and the connector tube, the number of parts is appreciably reduced as compared to previous constructions.

The peculiar shape of the backing plate provides in simplest manner firm adherence to the inside of the roof, for easy threading of the backing assembly through the opening, and for easy fishing of the lead within a narrow space between roof and lining.

The parts of the mount are of simplest configuration for mass production on automatic machine tools, and some of them are staple articles.

There is a minimum of regions to be sealed, and the sealing is accomplished by simply and permanently reliable means.

The tube of the front assembly within the shielding pot can be used for applying a matching inductor in very simple manner and the mechanical structure is equally simple and sturdy with or without inductor.

The backing subassembly can be used with various forms of front assemblies, as exemplified by the two modifications herein disclosed.

The general construction of the present mounting permits easy and advantageous adaptation for use with electrical devices other than antennas, such as lamps or sirens.

The dimensions of the mounting are particularly favorable for the purpose intended; in a practical embodiment incorporating the sealed matching transformer, the outer assembly extends less than 2¼" above the roof, and the backing assembly extends ⅜" inside the roof through a ⅞" hole.

The easy accessibility and standard configuration of the permanently attached jack portion of the screw connector permits convenient radio frequency testing of equipment inside the vehicle which is in circuit with the antenna, without necessitating removal from, and remounting of any parts once attached to the roof or other sheet portion of the vehicle.

While, as described, the present invention lends itself particularly well for mounting antennas on metal sheets with its lead concealed between the sheet and a lining, it is easily adaptable for the mounting of various electrical apparatus not only on metal supports but also on sheets or panels of any material of sufficient strength, when one side of the supporting structure is not, or only with difficulty accessible.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. A device for mounting electrical apparatus on the outside of a perforated sheet with connection through the perforation to electrical conductor means on the other side where only restricted space is available, comprising:
- an oblong backing plate;
- an inner connector sleeve fastened to said plate adjacent to one end thereof and extending transversely from one face of the backing plate;
- first connector contact means within said inner connector sleeve;
- conductor holding means extending substantially in the plane of said plate towards the other end thereof;
- means on said plate face adapted for engaging a metal surface;

- an outer connector sleeve for engagement with said inner connector sleeve;
- second connector contact means within said outer connector sleeve and matching said first contact means, said sleeves and contact means together constituting a shielded connector;
- shell means of insulating material for engaging on one side said outer connector sleeve and adapted for holding electrical apparatus on the other side; and
- nut means for engaging said inner connector sleeve and the outside of the sheet for forcing the backing plate against the sheet;
- whereby the backing plate and a conductor can be threaded from the outside of the sheet through the perforation with the inner sleeve remaining therein, the nut means tightened firmly to engage the sheet with the backing plate, and the two sleeves and contact means can be interengaged to complete an electrical connection.

2. Device according to claim 1 wherein said backing plate has an opening leading into said inner conductor sleeve and receiving an end of said first connector contact means,
- whereby a conductor on the conductor holding means can be connected to the first contact means.

3. Device according to claim 1 wherein said surface engaging means include sharp corners of said plate which extend from said face in the direction of said inner contact sleeve,
- whereby the sheet can be engaged with firmly gripping contact.

4. Device according to claim 1 wherein said shell means include an insulating tube into which said outer connector sleeve means is inserted and which provides a space between said second connector contact means and the electrical apparatus.

5. Device according to claim 4 further comprising
- a matching inductor coiled around said insulating tube and electrically connected to said electrical apparatus, said inner connector sleeve and said first contact means, constituting a matching transformer.

6. Device according to claim 1 wherein said shell means is contained within a metallic housing whose bottom contacts said outer connector sleeve inside of said sealing means and whose top is sealed against the electrical apparatus.

7. Device according to claim 1 wherein said nut means has a shoulder which forms with the adjacent nut face an annular recess that fits the edge of said perforation.

8. A device for mounting an antenna on one side of a perforated sheet with connection through the perforation to electrical conductor means on the other side where only restricted space is available, comprising:
- an essentially rectangular backing plate having an opening near a shorter edge, conductor holding means extending substantially in the plane of said plate, and sharp corners bent up to project from one face of the plate;
- an outside threaded nipple fastened to said plate around said opening and extending from said face of the backing plate;
- a connector jack within said nipple;
- an inside and outside threaded connector sleeve fitting said nipple with the inside thread;
- an insulating washer carrying a connector pin within the intermediate region of said sleeve;
- antenna supporting shell means of insulating material fastened to the outside of said connector sleeve at one end and being at the other end closed by an insulating plug;
- an antenna socket axially fastened to said plug;
- a pot shaped metal shield having a threaded opening in its bottom which is screwed to said connector sleeve, the rim of the shield extending beyond said shell means;

insulating cover means for sealing the annular area between said shield rim and said antenna socket;

a nut for engaging said nipple; and

a sealing gasket around said nut and nipple between the shield bottom and the sheet;

whereby the backing plate and a conductor can be threaded from the outside of the sheet through the perforation with the nipple remaining therein, the nut can be tightened firmly to hold the sheet between the nut and the backing plate, and the shell means with the shield can be screwed to the nipple

for contacting the jack with the pin and for sealingly compressing the gasket between the shield bottom and the sheet.

References Cited in the file of this patent

UNITED STATES PATENTS

2,468,391	Cejka	Apr. 26, 1949
2,476,407	Eriksen et al.	July 19, 1949
2,509,563	Grashow	May 30, 1950
2,524,534	Morris et al.	Oct. 3, 1950
2,593,474	Meier et al.	Apr. 22, 1952