

Jan. 2, 1951

E. J. LAWTON
 DEVICE FOR REDUCING RADIO NOISE PRODUCED BY THE
 DISCHARGE OF ELECTROSTATIC ACCUMULATIONS
 Filed Oct. 26, 1945

2,536,818

Fig. 1.

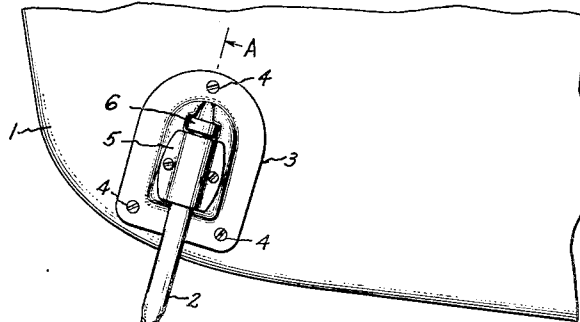


Fig. 2.

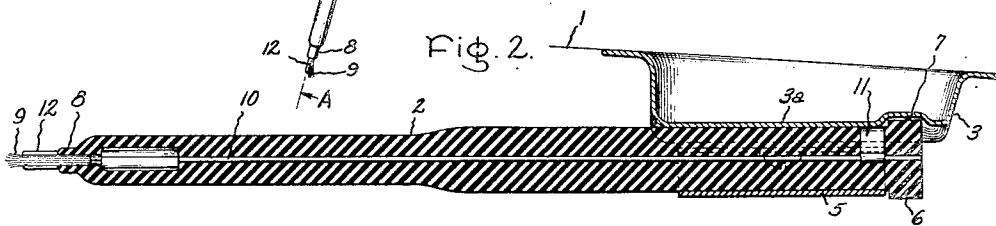


Fig. 6.

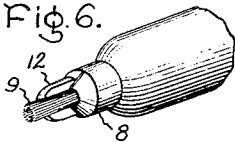


Fig. 4.

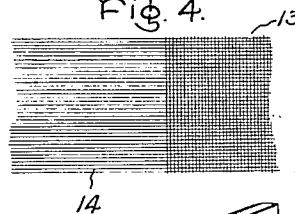


Fig. 5.

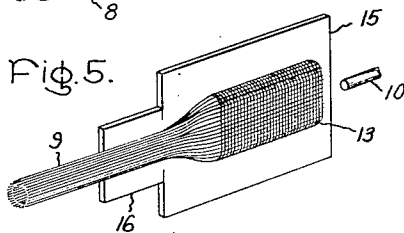
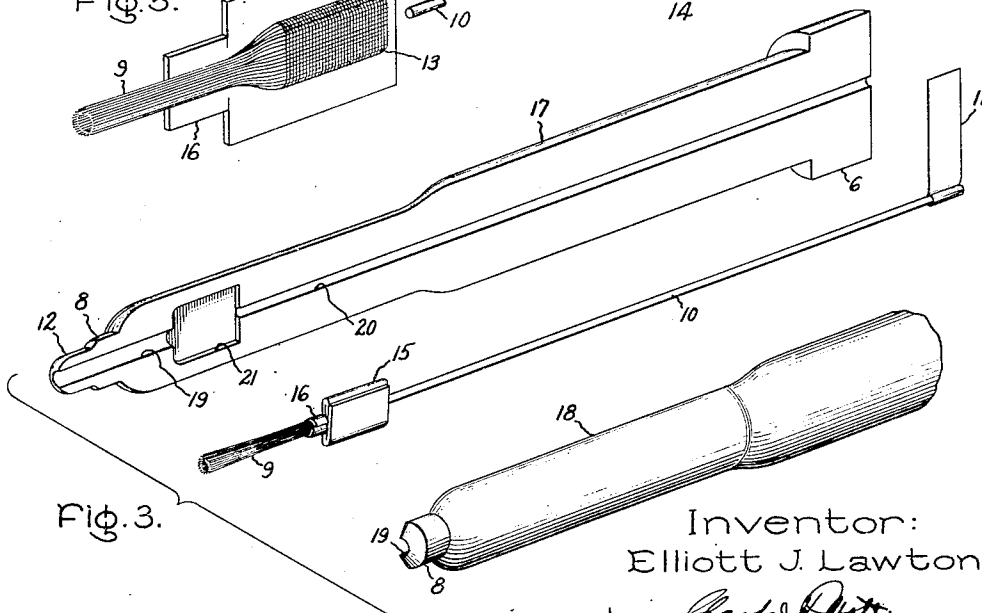


Fig. 3.



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UNITED STATES PATENT OFFICE

2,536,818

DEVICE FOR REDUCING RADIO NOISE PRODUCED BY THE DISCHARGE OF ELECTRO-STATIC ACCUMULATIONS

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Application October 26, 1945; Serial No. 624,778

2 Claims. (Cl. 175-264)

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The present invention relates to a device for discharging electricity from charged bodies. While not limited thereto the discharging device of the present invention is particularly well suited for quietly discharging static electricity accumulating on aircraft in flight so that interference with radio reception is prevented.

Aircraft, when flying through precipitation areas become charged to potentials sufficiently high with respect to space as to cause corona discharge from various projecting parts of the aircraft. Such discharges are of the so-called blunt-point type which, if permitted cause severe radio interference which hampers and sometimes completely precludes use of radio receiver equipment on board the aircraft. In order to prevent this difficulty attempts have been made to discharge static electricity from the aircraft by means of relatively silent type discharge points mounted at the extremities of the aircraft. Such points, because of their characteristic non-linear increase in current with increasing voltage, tend to maintain the charging potential at a value below that to cause corona from the ship's noisy blunt-points.

At the present time fairly good results are obtained by using a static discharger which comprises a cotton wick extending from a metallic retaining tube. The tube is arranged so that the wick projects into the air-stream, the wick being made electrically conducting by filling it with ethylene glycol. However, this type of discharger has the disadvantage that the ethylene glycol evaporates so that the wick must be refilled from time to time, thereby giving rise to a maintenance problem. Also the wick collects dirt which tends to interfere with its discharge properties. A further difficulty with this type of discharger is that while it is relatively quiet when discharging at a negative potential relative to the surrounding space, it is noisy when discharging at a positive potential. It has been found that aircraft may accumulate either a positive or negative charge while flying through space depending upon atmospheric conditions and therefore it is apparent that to be completely satisfactory from the standpoint of reducing radio interference, a static discharger should be relatively quiet when discharging potentials of either positive or negative polarity.

An object of my invention is to provide an improved static discharge device and a method for making the same.

Another object of my invention is to provide a static discharge device for aircraft which will

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quietly discharge accumulated charges on the aircraft of either polarity.

Another object of the invention is to provide a static discharge device which requires very little maintenance.

Further objects and advantages of my invention will become apparent and my invention will be better understood from the following description referring to the accompanying drawing and features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

In the drawing

Fig. 1 shows my improved static discharge device mounted on the wing of an aircraft.

Fig. 2 is a longitudinal cross-sectional view of the device taken along the line A-A of Fig. 1.

Fig. 3 is an exploded view showing the arrangement of parts prior to assembly.

Fig. 4 shows a woven tape used in making the device.

Fig. 5 shows the manner in which the tape is wrapped.

Fig. 6 is an enlarged view of a part of the device shown in Fig. 1.

I have found as a result of extensive investigation that a bundle of glass threads, when specially treated to make the threads electrically conducting, acts as an excellent discharger for discharging static electricity from the charged bodies in that the discharge occurs with production of a very small amount of radio noise. Also for reasons not thoroughly understood, I have found that a bundle of conducting glass threads projecting into an air stream will discharge static electricity equally well when charged to a positive or negative potential relative to the surrounding atmosphere.

According to the present invention the unique discharge properties of specially treated glass threads, which I have discovered, are used to advantage in providing a new and improved static discharge device for aircraft and other moving vehicles. Also, according to the invention I provide a method whereby a glass thread type of discharger suitable for use on aircraft can be manufactured in a simple and relatively inexpensive manner.

Referring to Fig. 1 of the drawing, I have shown a typical installation of my improved static discharger mounted adjacent the trailing edge and near the tip of an aircraft wing 1. As shown the discharger comprises a supporting rod 2 one end of which is clamped to a metallic

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bracket 3 which is in turn fastened to the surface of the aircraft wing in any suitable manner as by screws 4. A clamp 5 holds the rod 2 in position on the bracket 3 and to further insure against axial movement of the rod under the force of the air stream the inner end of the rod is provided with a head portion 6 which is received in a complementary depression 7 in the raised surface 3a of the bracket 3.

The outer end of the rod 2 which projects into the air stream is provided with a reduced portion 8 from which extends a bundle of glass fibers or threads 9. The glass threads 9, which are rendered electrically conducting by a process which will subsequently be described, are electrically connected to the body of the aircraft through a wire 10 which runs through the supporting rod 2. Electrical contact between the body or skin of the aircraft and the wire 10 may be made as shown by means of a metal tab 11, one end of which is fastened to the wire 10 while the other end extends through the rod and is clamped against the metallic support 3. Electric charges accumulating on the aircraft in flight are therefore conducted to the bundle of glass threads 9 from which they are discharged into the air stream from the tips of the threads which constitutes a multiplicity of fine discharge points. As shown in Fig. 1 the supporting rod 2 is preferably mounted so that it extends from an extremity of the aircraft such as the wing tip and points towards the rear. Also to aid in the diffusion of the electric charges from the glass threads into the air stream, the rod 2 is preferably cocked at an angle relative to the line of flight so that the outer extremity of the rod carrying the glass threads projects to some extent sideways into the air stream. In order to protect the glass threads from undue vibration and oscillation in the air stream a protective shield or tip 12 is provided which extends outwardly on the windward side of the discharge threads.

A method by means of which the glass threads may be made electrically conductive and may be conveniently embodied in a structure of the type shown in Figs. 1 and 2 of the drawing will now be described.

Woven glass tape formed of fine threads of glass suitable for use in my discharger is now commercially available. For example, tape which I have found satisfactory is supplied in rolls 1 inch wide, the tape having a thickness of .003 inch. In making my improved discharger I have used a piece of this tape which is indicated by the numeral 13 in Figs. 4 and 5 of the drawing.

As a first step in the process a section of glass tape of suitable dimensions is treated by a known process to make the glass threads or fibers electrically conducting. One way in which this can be done is to heat the section of glass tape in the presence of tin chloride vapor and a small amount of water vapor. When this is done metallic tin combines with the glass and forms a thin conducting layer. In carrying out this process care should be used not to heat the glass tape beyond 300 degrees C. as otherwise the glass threads may become brittle so that they break off easily when subjected to a high velocity air stream. An atmosphere of tin chloride vapor can be produced by simply heating crystals of stannic or stannous chloride in the oven used to heat the tape.

After the glass tape has been treated, a section of the tape is frayed by removal of the cross

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threads as indicated by the numeral 14 in Fig. 4 of the drawing. As a means of supporting the glass tape and also for providing means for making electrical contact with the conducting glass threads, a sheet 15 of conducting material, such as copper, is wrapped and crimped about the unfayed portion of the glass tape. The sheet 15 is shown prior to wrapping and crimping in Fig. 5 of the drawing and after wrapping and crimping in Fig. 3 of the drawing. Prior to the wrapping operation the glass tape may be folded over one or more times in order to more nearly approach the desired circular cross-section. In order to provide additional support for the glass threads in the frayed section of the tape, the sheet 15 is provided with a forwarding extending tab 16, which is crimped around the glass threads as shown. Also, the end of the conducting wire 10 is conveniently attached to the conducting sheet 15 by the crimping operation as shown.

The supporting rod 2 may be conveniently formed from two semi-circular moldable sections 17 and 18 which may be formed of a suitable molding material such as a condensation product of phenol and formaldehyde. Also a semi-flexible material which retains a certain degree of flexibility at low temperatures such as polyvinyl chloride may be used to advantage for some applications. The assembly comprising the contact tab 11, the wire 10, the crimped conducting sheet 15 and the glass threads 9 is then placed between the two moldable sections 17 and 18 and the entire assembly subjected to heat and pressure to mold the integral structure shown in Figs. 1 and 2 of the drawing. Preferably preformed grooves 19 and 20 and recesses 21 are provided in the sections 17 and 18 to receive and centralize the encased conductor assembly. As best shown in Figs. 2 and 6 the arrangement is such that after the molding operation the glass threads 9 project beyond the reduced tip 8 so that when the device is mounted as shown in Fig. 1 the glass threads extend into the air stream. One of the molded sections such as 17 is provided with an extension 12 which, as mentioned before, provides a shield on the windward side to prevent violent oscillation of the glass threads in the air stream.

From the foregoing it will be apparent that I have provided an improved static discharge device for aircraft which is simple and inexpensive to manufacture. Flight tests have indicated that static dischargers built in accordance with the above description are very effective in reducing radio noise regardless of the polarity of the charges accumulating on the aircraft. Especially in the case of large aircraft improved results may be obtained by employing several dischargers located at the extremities of the aircraft such as at the wing-tip, on the tail, etc. A very important advantage of my improved discharge charger is that it is dry and for that reason it does not deteriorate from evaporation, as in the case of the cotton-wick type discharger mentioned above.

Although I have shown and described particular embodiments of my invention, I do not desire to be limited to the particular embodiments described, and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A method of making a static electricity discharge device comprising the steps of subjecting a heated woven glass tape to tin chloride vapor

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in the presence of a small amount of water vapor to make the majority of the individual fibers within said glass threads of the tape electrically conducting, the removal of cross threads from one end of said tape, and then wrapping the other end of said tape so that a bundle of unidirectionally running threads projects from the wrapping.

2. A device for discharging static electricity from aircraft comprising a glass tape which is electrically conductive by reason of the presence in the surface of the glass of a reaction product of moist tin chloride and glass, one end of said tape being without cross threads, the remaining threads being divergent and affording a plurality of electrically conductive glass threads comprising a multiplicity of fine, individually electrically conducting glass fiber discharge points and means for connecting said tape to a body to be discharged.

ELLIOTT J. LAWTON.

REFERENCES CITED

The following references are of record in the file of this patent:

Number
1,093,491
1,419,261
1,553,087
2,118,795
2,293,918
2,302,003
2,309,584
2,318,340
2,320,146
2,333,144
2,341,219
2,429,420
2,466,024
2,466,311

Number
547,481
581,695

6

UNITED STATES PATENTS

Name	Date
Smith -----	Apr. 14, 1914
Howard -----	June 13, 1922
Lehmann -----	Sept. 8, 1925
Littleton -----	May 24, 1938
Planiol -----	Aug. 25, 1942
Cadwell -----	Nov. 17, 1942
George -----	Jan. 26, 1943
Thacher -----	May 4, 1943
Leake -----	May 25, 1943
Bennett -----	Nov. 2, 1943
Jones -----	Feb. 8, 1944
McMaster -----	Oct. 21, 1947
Hall -----	Apr. 5, 1949
Hall -----	Apr. 5, 1949

FOREIGN PATENTS

Country	Date
Great Britain -----	Aug. 28, 1942
France -----	Dec. 3, 1924