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TRAILING ANTENNA

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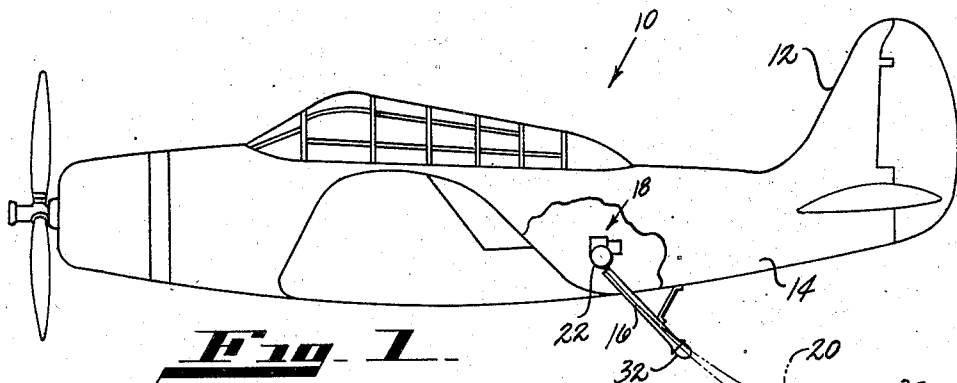


Fig. 1

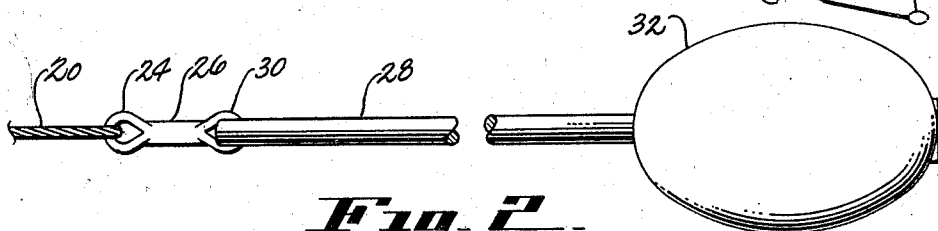


Fig. 2

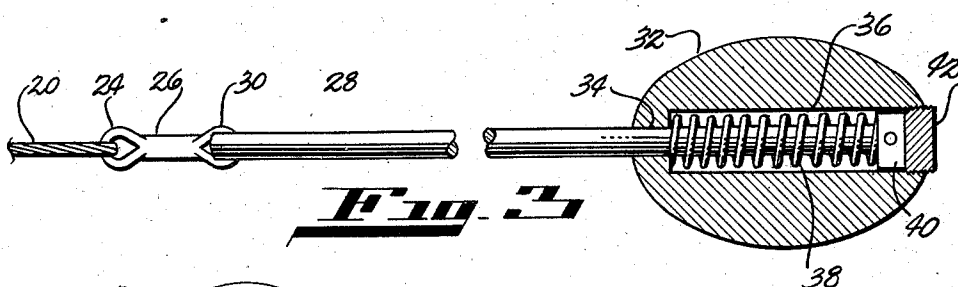


Fig. 3

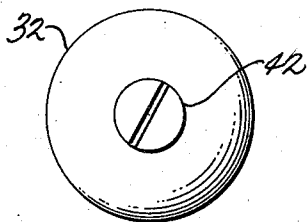


Fig. 4

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TRAILING ANTENNA

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2 Claims. (Cl. 250-33)

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This invention relates to an improved trailing antenna for use in an airplane, which provides means extensible beyond the surface of the airplane fuselage to prevent gyrations of the antenna weight and keep it from striking the fuselage while the antenna is being reeled inwardly or outwardly therefrom.

In all airplanes it is highly advantageous to have an exterior trailing wire antenna since a fixed wire antenna, attached rigidly at each end to some portion of the airplane, is necessarily limited in physical length. Since most airplanes are of such size as to prevent the use of a fixed antenna having dimensions approximately equal to even a quarter wave antenna at currently established aviation radio frequencies, the most satisfactory antenna is in the form of a weighted wire or cable which may be paid out from a reel into the airstream varied distances depending upon the radio frequency used and the distance between sender and receiver. It is necessary to reel such an antenna into the airplane before landing in order to avoid entanglement of the antenna and weight on trees or other objects as the airplane is approaching the runway.

Considerable difficulty has been experienced in developing a trailing antenna for airplanes which can be reeled in or out of the fuselage without becoming entangled with adjacent projecting parts of the airplane such as marker lights, landing gear and even the control surfaces of the empennage. A trailing antenna consisting of a weighted flexible cable or wire will develop oscillatory and gyratory movements of excessive amplitude when its outer weighted end is brought close to the airplane fuselage at air speeds of one hundred and thirty miles per hour or more. As the speed of the airplane increases and/or the weighted end is brought in closer proximity to the airplane, the gyrations increase in intensity. Such gyratory movements cause the lead weight attached to the end of the antenna to violently strike the fuselage and projecting objects sometimes resulting in serious damage. Continued swinging of the weight at the end of the flexible cable antenna also may result in breaking of the cable at the connection to the weight, dropping the weight to the ground. Experiments carried on in an effort to eliminate gyration of the antenna and directed to the design of a properly streamlined antenna weight have met with little success.

The provision of a fairlead extending well below the fuselage of the airplane to hold the antenna weight at a distance from the fuselage where it is beyond the zone of air turbulence near the airplane does not solve the problem since a fairlead of a length to fulfill this purpose would project below the ground line of the landing gear and would objectionably increase the drag of the airplane.

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This invention comprises a flexible trailing antenna cable and a rod secured to the outer end thereof to which a lead weight is attached. The antenna is slidable through a fairlead which projects from the lower portion of the airplane fuselage in a rearwardly inclined position so the cable may be passed upwardly or downwardly therethrough by a reel provided in the fuselage. Although the fairlead is shown fixed to the fuselage in the preferred embodiment, it may be made telescopic in order that the antenna and fairlead may be drawn into the fuselage when not in use, eliminating the drag caused thereby.

One object of this invention is to provide a means for eliminating oscillatory and gyratory movements of the weight of a flexible trailing antenna.

Another object of this invention is to provide a rod at the end of the flexible antenna retractable upwardly through the fairlead, which substantially eliminates movements of the weight fixed thereto when the weight is close to the fuselage and which damps the weight movements at more remote positions sufficiently to cause the rod and weight to be practically unaffected by air turbulence.

Further objects and advantages of the invention will be brought out in the following description taken in connection with the accompanying drawings and appended claims.

Referring now to the drawings,

Figure 1 is a side elevation of an airplane with a portion of the fuselage cut away showing the antenna in two extended positions in dotted lines and in fully retracted position in solid lines.

Figure 2 is a side elevation of the rod and weight.

Figure 3 is a section taken through the weight to show method of attaching the weight to the rod.

Figure 4 is an end view of the weight.

As best shown in Figure 1 of the drawings, an airplane 10 is shown having empennage 12 and a fuselage 14. A fairlead 16 is secured to the fuselage and set in a rearwardly inclined position with respect thereto. A reeling mechanism 18 is placed immediately above and in line with the fairlead so that a flexible antenna 20 wound around a reel 22 on the reeling mechanism may pass through the fairlead 16.

As may be seen in Figures 2, 3 and 4, the flexible antenna is secured to a loop 24 on an attachment sling 26. Secured to a second loop 30 on the outer end of attachment sling 26 is a rod 28 preferably of a material of relatively low specific gravity and relatively high rigidity, structural strength and fatigue qualities. The cross sectional area of the rod is as small as may be without sacrificing rigidity and strength. To the outer end of the rod 28 is secured a weight 32.

The weight 32 is bored at 34 to slidably receive the rod 28 and counter-bored at 36 to receive a spring 38 which is seated under compression between the inner end wall of the counterbore and a collar 40 on the outer end of the rod 28. A threaded plug 42 closes the outer end of the counterbore 36 and limits outward movement of the collar 40 under the action of spring 38.

In operation as shown in Figure 1 of the drawings, the pilot manually or by motor causes the antenna to be paid outwardly into the airstream through the fairlead 16, lowering the rod 28 and weight 32 by gravity. The rod 28 is guided by the fairlead 16 which holds the weight attached thereto against lateral movement caused by the turbulent airstream outside the fuselage.

The zone of air turbulence adjacent the fuselage comprises an inner zone of greater turbulence and an outer zone of turbulence which, while markedly less violent than that of the inner zone, is yet sufficiently strong to cause movements of the weight of dangerous amplitude. The rod 28 and projecting portion of the fairlead 16 are sufficiently long to place the weight 32 outside of the inner turbulent zone when the inner end portion of the rod is disposed in the outer end portion of the fairlead, just sufficiently to have a telescopic overlying relationship. Thus, if the fairlead projects 22 inches from the fuselage and the rod is 28 inches long, the rod holds the weight substantially rigid against air turbulence as long as the weight is not over approximately 44 inches from the fuselage since at that distance the telescopic overlap of rod and fairlead is 6 inches which may be sufficient to enable the fairlead to hold the rod in fixed longitudinal alignment therewith. As the inner, more violently turbulent zone may not be more than 36 inches in depth, the weight is held against oscillatory and gyration movements as it passes therethrough during reeling in or paying out of the antenna.

When the rod 28 is entirely outside the fairlead, it and the weight 32 may swing about the outer end of the fairlead as a center. However, the effect of the stiff rod 28 is to damp and slow the swinging movements caused by the air turbulence, reducing their amplitude to a safe value which may be 36 inches or less in an approximately vertical plane. The outer turbulent zone of relatively less violence may extend ten feet from the plane. As the weight passes through this zone either in reeling in or paying out the antenna, its oscillatory movements are reduced to such a low amplitude that the weight will not strike the fuselage or objects projecting therefrom in view of the distance of the weight from the fuselage after the rod leaves the fairlead.

The outer end of the fairlead 16 is bell shaped at 44. When the antenna is reeled into completely retracted position, the rod 28 passes entirely within the fairlead, the weight seats itself in the bell 44 and the tension created in the cable and rod by the reel compresses the spring 38, resiliently holding the weight from lateral play against the bell. Any lateral play of the weight in the bell will deform the bell and develop structural weakness in the rod at the end of the weight with the possibility of breaking the bell from the fairlead or breaking the rod from the weight.

After the weight on the antenna rod has passed downwardly and rearwardly thru the turbulent area, the weight is acted upon only by gravity and rectilinearly acting air resistance, the latter

force causing the antenna when paid out to assume a trailing position relative to the airplane as shown in dotted lines, Figure 1. In this manner, it is possible to reel the antenna in or out without danger of its becoming fouled on the empennage or other parts of the airplane.

The lighter and more rigid the rod, the greater the damping effect when the rod is entirely outside the fairlead and the less apt will the rod be to vibrate within and damage the fairlead when it is in telescopic relation therewith but not entirely retracted. The greater the rigidity and strength of the material of the rod, the smaller and lighter it may be and yet meet the load requirements attendant upon its use and have the rigidity which enhances its ability to perform its function. High fatigue qualities decrease the probability of fracture after extended use.

I claim:

1. In a trailing antenna for an aircraft for use with a reel mounted at the inner end of a fairlead projecting downwardly from the aircraft, the combination of: a flexible antenna for winding at its inner end upon the reel; a relatively non-flexible and relatively light weight rod of a substantial length connected to the outer end of the antenna; and a weight connected to the outer end of the rod, the length of the rod being substantially the same as the length of the fairlead, the fairlead receiving the inner end of the rod as the antenna is wound upon the reel and confining the rod therein, thereby damping the oscillatory and gyratory movements of the weight resulting from air turbulence as the weight is drawn up toward the aircraft.

2. In an antenna device for an aircraft, the combination of: a fairlead carried by the fuselage of the aircraft and projecting outwardly therefrom; a reel mounted to the fuselage of the aircraft at the inner end of said fairlead; a flexible antenna passing through said fairlead and having its inner end secured to said reel; a rigid rod of a length substantially equal to the length of the fairlead connected to the outer end of the flexible antenna; and a weight of a diameter greater than the diameter of the rod connected to the outer end of the rod, the length of the weight being substantially less than the length of the rod; said fairlead receiving and confining the inner end of the rod therein as the antenna is wound upon the reel, thereby holding the rod and the weight carried thereby against lateral movements resulting from air turbulence as the antenna is wound upon the reel and the weight is drawn toward the aircraft.

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