Oct. 5, 1965 P. R. JONES 3,210,765

ANTENNA ELEMENT DAMPING DEVICE

Filed June 12, 1961

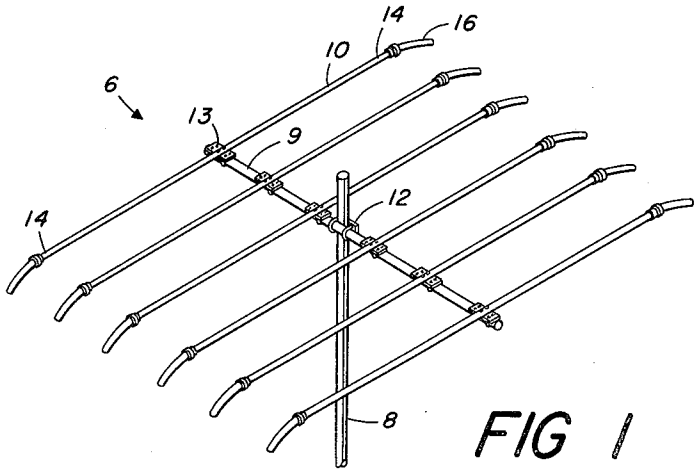


FIG 1

FIG 2

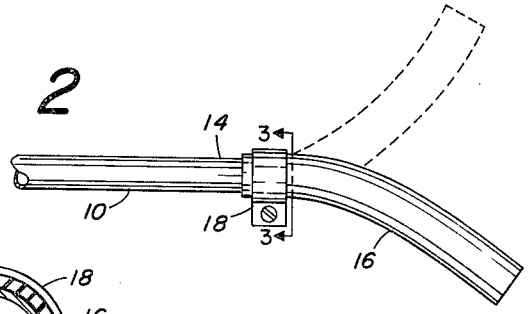


FIG 3

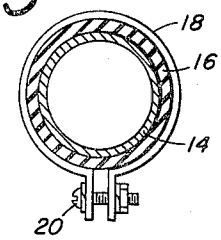


FIG 4

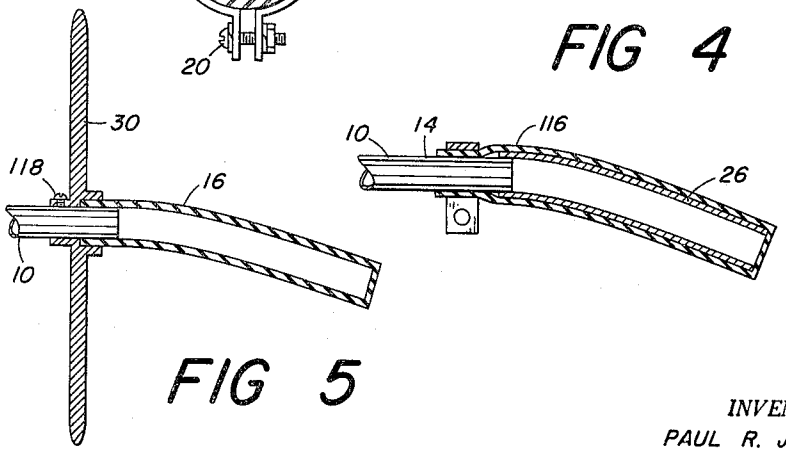


FIG 5

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United States Patent Office 3,210,765 Patented Oct. 5, 1965

3,210,765

ANTENNA ELEMENT DAMPING DEVICE

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Filed June 12, 1961, Ser. No. 116,377
8 Claims. (Cl. 343—720)

This invention relates to an antenna structure, and more particularly, to a device for substantially eliminating vibration caused by external forces acting on an antenna element.

Antenna structures are commonly subject to various vibration producing forces, particularly wind forces, that have heretofore greatly shortened the life of the conventional antenna structure by causing the antenna elements to snap or break, usually near the crossbar supporting the element.

Many devices have heretofore been proposed, or utilized in attempting to solve this vibration problem, but none of these devices have been completely successful. While vibration of an antenna element could conceivably be eliminated by disrupting the vortices, it has been found that absorbing the energy of vibration by mechanical damping is preferable, and accordingly, mechanical damping has been utilized in this invention to provide a relatively simple and inexpensive means, requiring no deformation or reconstruction of the antenna element itself, for absorbing the energy transferred to the antenna element by the vibration producing forces.

It is therefore an object of this invention to provide an improved antenna structure having simple, yet reliable, means for damping out and substantially eliminating vibration in an antenna element due to vibratory forces acting thereon.

It is another object of this invention to provide an antenna structure having damping means that may be adjustably secured to the antenna elements without deforming or reconstructing the element.

It is a further object of this invention to provide an improved antenna structure including an antenna element and a readily flexible member secured to a portion of said antenna element subject to vibratory forces whereby said flexible member substantially eliminates vibration in said antenna element.

Still more particularly, it is an object of this invention to provide an antenna structure having a readily flexible damping member attached to the free end of a cantilever antenna element as an extension thereof, said readily flexible member oscillating out of phase with said antenna element to thereby absorb the energy transferred to the antenna element by vibratory forces acting thereon.

With these and other objects in view which will become apparent to one skilled in the art as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiments of the herein disclosed invention may be submitted as come within the scope of the claims.

The accompanying drawing illustrates two complete examples of the embodiments of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

FIGURE 1 is a perspective view of an antenna structure constructed according to this invention;

FIGURE 2 is a side view showing the free end portion of a cantilever antenna element with the damping means of this invention attached thereto;

FIGURE 3 is a cross-section view taken through the line 3—3 of FIGURE 2;

FIGURE 4 is a side view of a second embodiment of this invention with the damping means shown in section for illustrative purposes; and

FIGURE 5 is a side view of another embodiment of this invention illustrating the use of the damping means and a corona shield.

Referring now to the drawings in which like numerals have been used for like characters throughout, the numeral **6** refers generally to an antenna structure having an upright mast **8**, usually of relatively large cross-section, and a crossarm, or boom, **9** to which a plurality of antenna elements **10** may be attached. Crossbar **9**, which, like mast **8** is usually tubular and of relatively large cross-section, may be attached to mast **8** in any conventional manner such as, for example, by clamp **12**. In addition, antenna elements **10** may likewise be attached to boom **9** in any conventional manner, such as, for example, by clamps **13**. Antenna elements **10** are preferably tubular and of relatively small diameter, and, as shown in FIGURE 1, may be connected to crossbar **9** so that each element has a free or unmounted end portion **14**. The antenna elements are therefore readily susceptible to vibration due to external vibratory forces, principally wind forces, that frequently cause vibration of the elements which soon causes them to break. However, by addition of lossy members **16** to the end of each antenna element, as taught by this invention, this deficiency in antenna structures may be overcome.

It is to be realized, of course, that two or more of the antenna elements might be connected near their free ends and this would not obviate the need for a damper as taught by this invention since the structure formed would still be essentially cantilever mounted and therefore still subject to destructive vibrations.

As shown best in FIGURE 2, lossy member **16**, which is preferably of readily flexible, electrically nonconductive material such as, for example, plastic, may be attached to the end of each antenna element by means of a conventional fastening means, such as, for example, clamp **18**. As shown in FIGURE 3, flexible member **16** is preferably tubular and has a diameter slightly larger than that of antenna element **10** so as to slide over the free end **14** thereof and thereafter be easily maintained in place by clamp **18**, which clamp may be readily adjusted by means of a conventional tightening device **20**.

Flexible member **16** acts to absorb the energy transferred to the antenna element by the vibratory force acting thereon by vibrating, often quite violently, as illustrated by the dotted lines in FIGURE 2. To effectively accomplish its purpose, the length of the flexible member must be such that when the antenna element starts to vibrate the flexible member oscillates out of phase with the antenna element to damp out vibration in the element. For maximum effectiveness, the length of the flexible member **16** should vibrate with one and one-half modes or three-fourths standing wave. The antenna element can, of course, be adjusted by moving the damper along the antenna element until the damper is of the proper effective length.

Although shown and described hereinabove as a flexible member of tubular construction, it is to be appreciated, of course, that the flexible member **16** might be solid and could, for example, fit inside antenna element **10** and be connected to the free end portion conventionally.

The antenna element may also be reduced in effective length, without physical deformation, by modifying flexible member **16** to provide electrical end loading. As shown in FIGURE 4, the modified damping or flexible

member may include a readily flexible, electrically non-conductive portion **116** of tubular construction surrounding and enclosing a readily flexible, electrically conductive, cylindrical insert **26** of slightly smaller diameter, which diameter, however, is slightly greater than that of the antenna element. The flexible member may be attached to the free end **14** of an antenna element in the same manner as described hereinabove in connection with the first embodiment shown. However, as shown in FIGURE 4, the electrically conductive insert **26** engages free end **14** of antenna element **10** and, by adjusting the positioning the flexible member along the end portion **14**, the effective length of the antenna element may be varied as desired.

In addition, and as shown in FIGURE 5, a disc **30** projecting normally outwardly from the antenna element may be provided to serve as a corona shield. Disc **30** is preferably relatively thick and the periphery of the disc is rounded to avoid sharp edges. As is well known in the art, such a shield is preferably of electrically conductive material and is electrically attached to the antenna element at its end portion by any conventional means, and may be formed as an integral part of clamp **118**, as shown in FIGURE 5, since the damper **16** is of electrically non-conductive material.

From the foregoing, it will be appreciated by those skilled in the art that the improved antenna structure of this invention provides a relatively simple, yet reliable, means for eliminating undesirable vibration in antenna elements.

What is claimed as my invention is:

1. In an antenna structure, the combination of: a substantially rigid antenna element a portion of which is subject to vibratory forces; and a hollow readily flexible tube connected to the remote end of said antenna element subject to vibratory forces, flexing of said flexible member substantially eliminating vibration in said antenna element.

2. In an antenna structure, the combination of: a substantially rigid antenna element a portion of which is subject to vibratory forces; damping means including a hollow readily flexible tube and an electrically conductive member connected to said tube, said electrically conductive member being constrained to movement with at least one portion of said tube; and means for connecting said tube to the portion of said antenna element subject to vibratory forces to substantially eliminate vibration in said antenna element.

3. In an antenna structure, the combination of: a substantially rigid cantilever antenna element the free end portion of which is subject to vibratory forces; damping means including a hollow readily flexible tube and an electrically conductive member connected to and constrained to movement with said tube; and means for connecting said tube to the free end portion of said antenna element whereby said damping means absorbs the energy of vibrations transferred to said antenna element by said vibratory forces.

4. The combination of claim **3** wherein said electrically conductive member is flexible and engages said free end portion to electrically end load and thereby determine the overall effective length of said antenna element.

5. In an antenna structure, the combination of: a substantially rigid antenna element subject to vibratory forces and having a free end portion; a hollow readily flexible tube having a cross section substantially the same as that of said antenna element; and fastening means for fastening one end of said tube to the free end portion of said antenna element so that the flexing of said tube substantially eliminates vibration in said antenna element.

6. The combination of claim **5** including an electrically conductive member inside said tubular member engaging said antenna element to electrically end load the same and thereby determine the effective overall length of said antenna element.

7. The combination of claim **6** wherein said tube is of plastic material and said electrically conductive member is of metal.

8. The combination of claim **5** including a corona shield extending radially from and in electrical contact with the end portion of said antenna element.

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