

- [54] **AUTOMOTIVE-VEHICLE WINDSHIELD WITH BUILT-IN ACTIVE-ANTENNA SYSTEM**
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- [51] Int. Cl..... **H01q 1/32**
- [58] Field of Search ..... 343/711, 712, 713, 701
- [56] **References Cited**  
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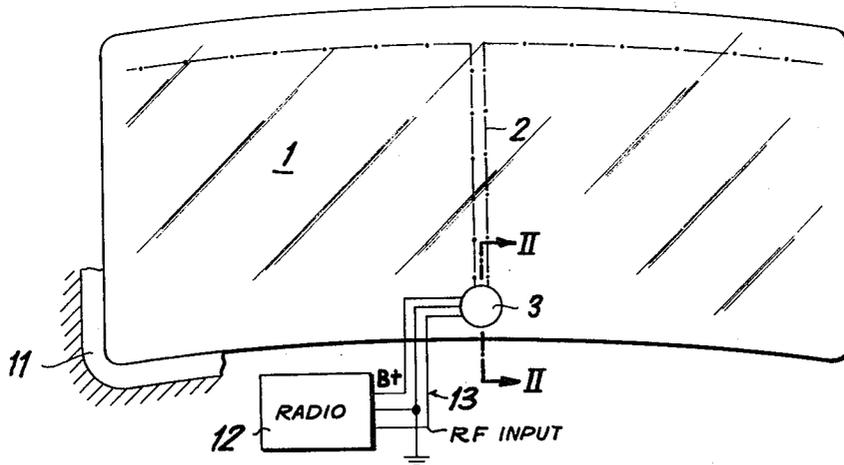
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[57] **ABSTRACT**

A safety-glass windshield has at least one antenna wire imbedded in its plastic core layer. One of the glass lamina is formed with a tapered throughgoing hole having a narrow mouth on the inside surface of the windshield. The antenna wire terminates at the recess formed by this hole and has its end there imbedded in a mass of conductive lacquer. An active-circuit capsule shaped as short cylinder is connected via leads to the car radio and has a plurality of spring feet which fit snugly into the recess while the face of the capsule lies against the windshield over this recess. The feet diverge away from the capsule and have bent-over ends so that the capsule can be plugged into the recess, at least one of the feet forming a connection between the conductive lacquer mass and electronic components within the capsule.

**10 Claims, 3 Drawing Figures**



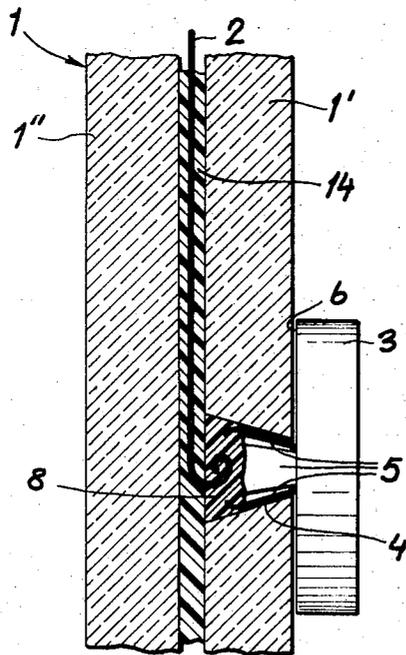
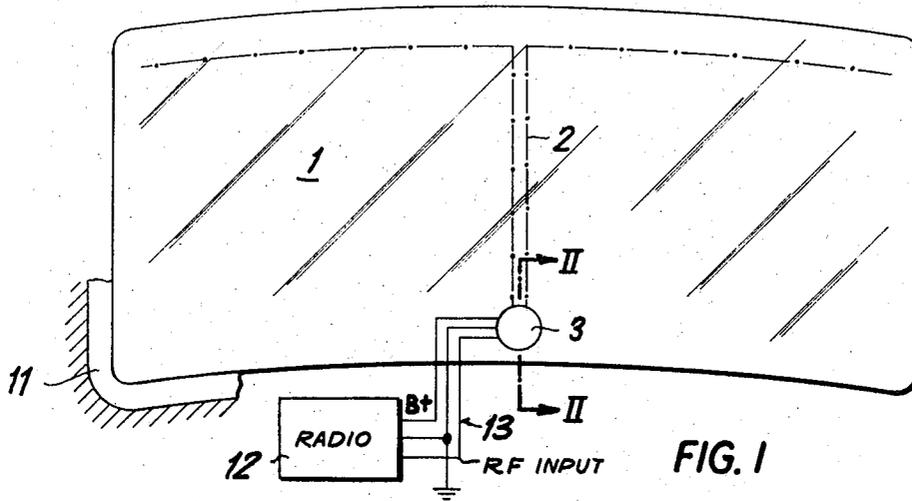


FIG. 2

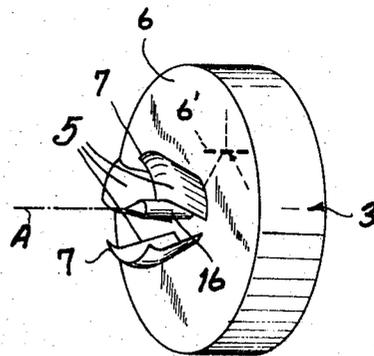


FIG. 3

## AUTOMOTIVE-VEHICLE WINDSHIELD WITH BUILT-IN ACTIVE-ANTENNA SYSTEM

### CROSS-REFERENCE TO RELATED APPLICATION

This application is related to the subject matter of commonly assigned patent application Ser. No. 365,078 filed May 30, 1973 by Paul Derner now abandoned.

### FIELD OF THE INVENTION

The present invention relates to a windshield antenna system. More particularly this invention concerns an active-antenna arrangement for an automotive vehicle having a radio.

### BACKGROUND OF THE INVENTION

The use of an antenna built right into the vehicle windshield solves the problems of damage to an external antenna as well as improving the vehicle's appearance by eliminating this element which usually breaks up the lines of the vehicle. Such an antenna is usually a fine wire bonded to or imbedded in the front windshield along an upper or lower edge thereof.

One of the difficulties of such an antenna is that the signal output is relatively weak, and the antenna is rarely properly tuned for a particular band. Thus resort has been had as described in the above-identified application to an active antenna which has an antenna element connected to an active circuit that tunes and/or amplifies the signal output. The active circuit must be provided right at the antenna, so that this circuit is according to the earlier application built right into the windshield and is connected to an electric power source usually derived from the radio.

This active circuit is often tuned to a particular radio so that it cannot be used if the radio is changed. In addition it occasionally fails so that it must either be replaced or a new antenna mounted on the vehicle.

### OBJECTS OF THE INVENTION

It is therefore an object of the present invention to provide an improved windshield antenna system.

Another object is the provision of an active antenna arrangement for a motor vehicle having a radio.

A further object is to provide such an active antenna which overcomes the above-given disadvantages.

### SUMMARY OF THE INVENTION

These objects are attained according to the present invention in an antenna arrangement comprising an antenna element or wire imbedded in the windshield or other window of the vehicle. The active circuit is formed of electronic circuit components encapsulated in a body which overlies a recess formed in the window at the end of the antenna element with a foot on the body snugly received in the recess. Thus this encapsulated active circuit plugs into the window glass. Means is provided to connect the electronic components of the active circuit to the antenna element.

In accordance with further features of this invention the foot which is retained in the recess to hold the circuit body on the inside face of the window is formed of a plurality of resilient members which are elastically deformed inwardly by the recess. This recess according to another feature of this invention is outwardly tapered so that it is narrower at its mouth than in its inter-

rior. Thus, the resilient members expand within the recess to secure the body snugly to the windshield.

Accordingly to yet another feature of this invention the recess is filled with a conductive lacquer and at least one of the resilient members is a conductor connected to one of the electronic components so that when imbedded in the lacquer it forms a good electrical connection between that component and the antenna element whose end is also imbedded in the lacquer.

The window glass or windshield according to a further feature of the present invention is of the so-called safety-glass type having a pair of glass layers sandwiching a synthetic-resin sheet that adheres strongly to both sheets but which is plastically deformable so that when broken the glass layers do not fly apart. The recess is formed as a hole in the inside glass layer and the antenna element is a wire imbedded in the synthetic-resin intermediate layer.

### DESCRIPTION OF THE DRAWING

The above and other objects, features, and advantages of the invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is an elevational partly diagrammatic view of a windshield assembly according to the present invention;

FIG. 2 is a section taken along line II — II of FIG. 1; and

FIG. 3 is a perspective back view of the active-circuit capsule in accordance with the present invention.

### SPECIFIC DESCRIPTION

FIG. 1 shows a window 1, here a windshield, mounted in a motor vehicle having a frame indicated schematically at 11. The windshield 1 is formed of a pair of glass sheets 1' and 1'' separated by a layer 14 of plastically deformable synthetic resin in which is imbedded a pair of antenna wires 2 each having a horizontal stretch 2' extending along and parallel to the upper edge of the windshield, and an upright stretch 2'' which drops vertically down in the center of the windshield 1 and terminates in a hole 4 of frustoconical shape formed in the inner plate 1' as shown in FIG. 2.

The vehicle has a radio 12 which is connected via leads 13 to an active-circuit capsule 3 formed as a short cylinder and having a back face 6 adapted to overlie the outer narrow mouth of the recess 4. This capsule includes electronic circuit components as shown at 6' in FIG. 3 and has an axis A about which are spaced on its back 6 three feet 5 which are angularly equispaced and outwardly spread and formed with inwardly bent ends 7. These feet are adapted to engage in the hole 4 as shown in FIG. 3 to retain the capsule 6 flat against the fact of sheet 1'. Each foot 5 is formed of a short spring steel strip and one of the feet at least is coated with copper and connected to one of the elements 6'.

The ends 10 of the conductors 2 are bent up on the recess 4 and imbedded in a mass 8 of a conductive lacquer. In this manner the foot or feet constitute an electrical connector between the antenna elements 2 and the circuit elements 6'. The capsule 3 is either pressed into place before the lacquer 8 hardens, or a lacquer is used which remains sufficiently soft to be pierced by the feet 5. A small axially protruding point 16 can serve as electrical connector in addition to or instead of the feet 5.

The arrangement according to this invention is extremely simple and inexpensive to manufacture. The active circuit capsule 3 is easily applied to the windshield for hookup of the built-in antenna, and this capsule can even be changed without replacing the windshield.

I claim:

- 1. In a motor vehicle having a radio the improvement comprising the combination of:
  - a window glass formed with a recess;
  - an antenna element bonded to said window glass and having an end at said recess;
  - an active-circuit capsule having active electronic circuit components connectable to said radio and having at least one formation resiliently engageable and form-fitting in said recess with said capsule lying on said window glass over said recess; and means between said components of said capsule and said end of said antenna in said recess for connecting same together.
- 2. In a motor vehicle having a radio the improvement comprising the combination of:
  - a window glass formed with a recess;
  - an antenna element bonded to said window glass and having an end at said recess;
  - an active-circuit capsule active electronic circuit components connectable to said radio and having at least one foot resiliently engageable in said recess with said capsule lying on said window glass over said recess; and means between said components of said capsule and said end of said antenna in said recess for connecting same together,

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- dow glass and is tapered toward said mouth.
- 3. The improvement defined in claim 2 wherein said capsule has a plurality of such feet inwardly elastically deflectable toward one another when fitted into said recess.
- 4. The improvement defined in claim 3 wherein said window glass comprises a pair of glass layers and a plastic layer sandwiched therebetween, one of said glass layers being formed with a throughgoing hole constituting said recess, said antenna element being a wire imbedded in said plastic layer.
- 5. The improvement defined in claim 4 wherein said end of said element projects from said plastic layer into said recess.
- 6. The improvement defined in claim 5, further comprising a conductive mass at least partially filling said recess and in electrical contact with said end.
- 7. The improvement defined in claim 6 wherein said means includes at least one of said feet, said one foot being electrically conductive and being connected on one side to said components and being imbedded on the other side in said mass.
- 8. The improvement defined in claim 7 wherein said feet are angularly equispaced about and equispaced from an axis centered on said recess, said capsule having a flat face engageable with said window glass over said recess and said feet projecting from and diverging away from said face.
- 9. The improvement defined in claim 8 wherein said feet are bent inwardly toward each other at their ends remote from said face.
- 10. The improvement defined in claim 9 wherein said feet are formed of elastically resilient metal strips.

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