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FIG. 1

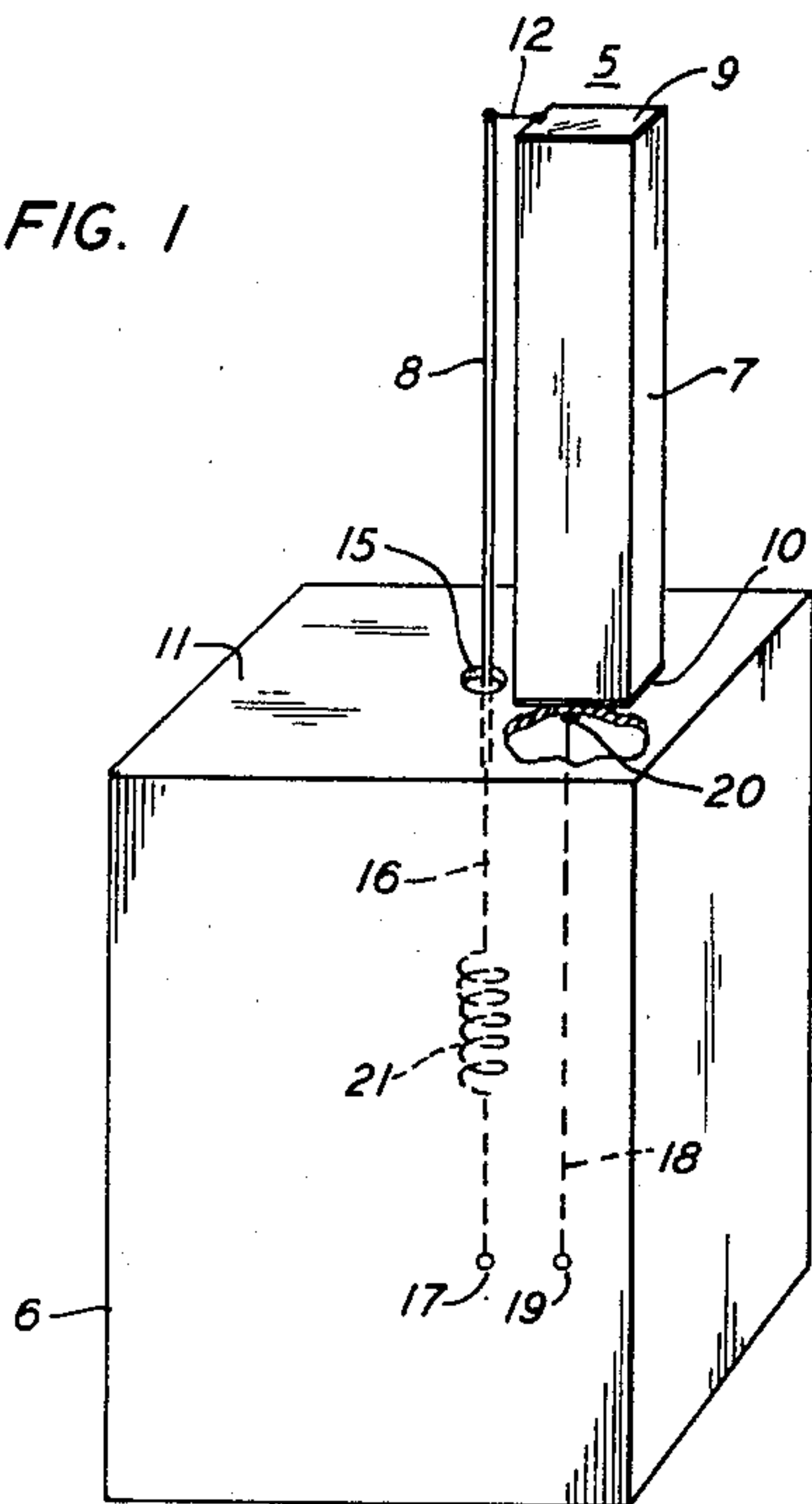


FIG. 2

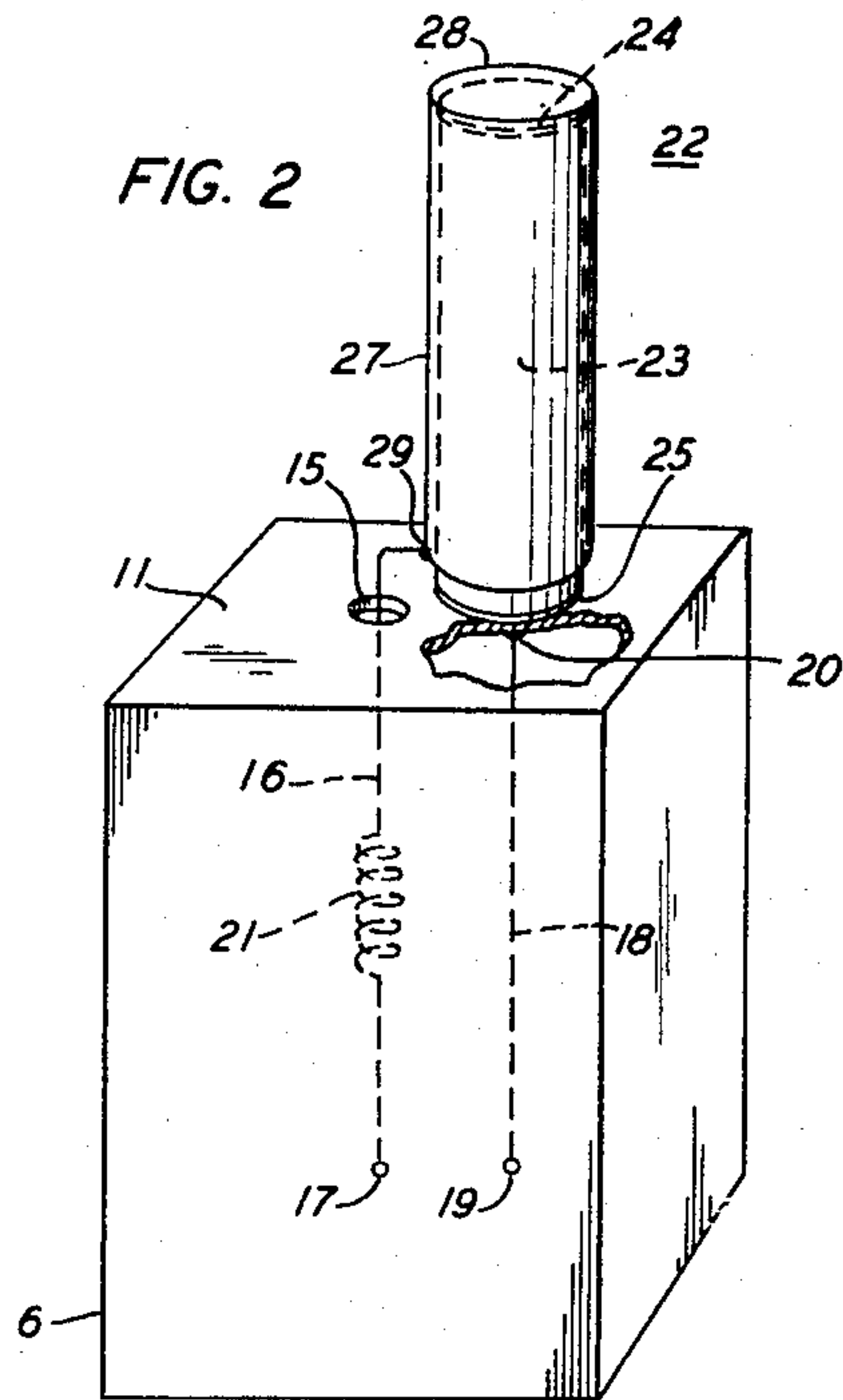
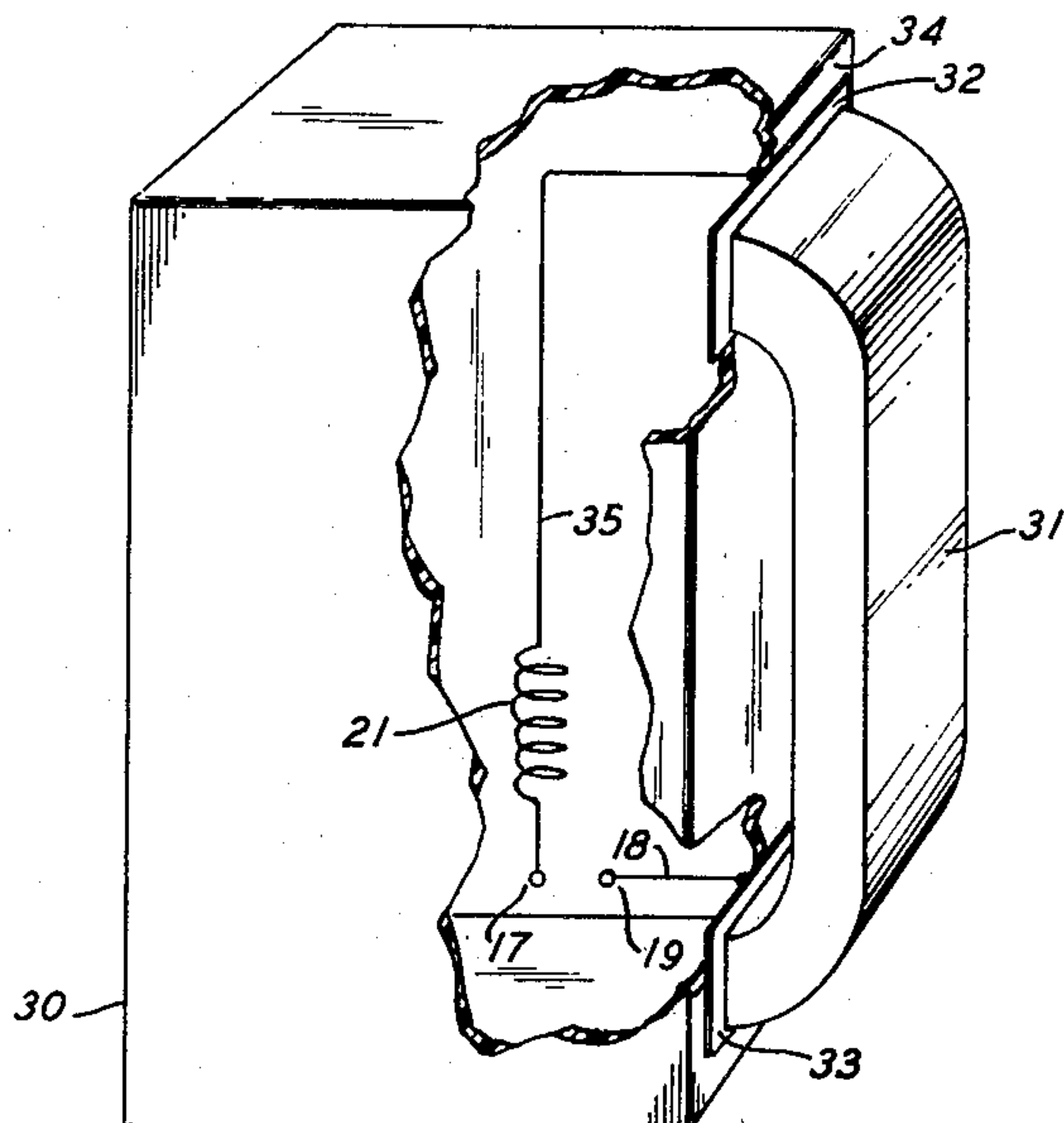


FIG. 3



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2 Claims. (Cl. 343—702)

This invention relates to antennas and more particularly to those of the short-wire type for use with portable radio apparatus.

An object of the invention is to decrease the size of a radio antenna of the short-wire or rod type. Other related objects are to increase the effective height and the efficiency of such an antenna.

In portable radio receivers and transmitters and other radio translating devices, especially those of the pocket type, it is obviously desirable to have the antenna as small as possible. The antenna in accordance with the present invention can be greatly shortened without a corresponding reduction in the effective height or the efficiency.

The antenna includes an elongated element having a high dielectric constant and low loss at radio frequencies, with electrodes at the ends. One of the electrodes is connected to the associated radio apparatus by means of a conductor which is of substantially the same length as the element and is arranged alongside but separated from the element. This conductor may be a wire or rod. Alternatively, it may be a hollow shield surrounding the sides of the element. To lower the operating frequency of the antenna, a loading coil may be inserted in series with the conductor. The case of the radio may be made of metal or of non-conducting material. When made of metal, the antenna is placed outside. If the case is non-conducting, the dielectric element may be placed outside and the conductor inside, if desired. There is thus provided a rod-type antenna which is effectively top-loaded with a large, low-loss capacitance. The elongated form of the dielectric element, however, avoids the necessity of a second, paralleling conductor which would greatly reduce the effectiveness of the antenna wire or make the antenna undesirably directive.

The nature of the invention and its various objects, features, and advantages will appear more fully in the following detailed description of the typical embodiments illustrated in the accompanying drawing, of which

Fig. 1 is a perspective view, partly cut away, of radio apparatus with a dielectric antenna in accordance with the invention;

Fig. 2 shows a modified form of the antenna in which the conductor shields the dielectric element; and

Fig. 3 shows a dielectric antenna associated with a non-metallic case.

The apparatus shown in Fig. 1 comprises an antenna 5 vertically mounted on top of a metallic case 6 which may contain a portable radio receiver or transmitter or other apparatus. The antenna 5 includes an elongated dielectric element 7 and a metallic rod or wire 8 of approximately the same length arranged side by side but separated from each other. Each of the elements 7 and 8 ordinarily has a length equal to only a small fraction of a wavelength in air at an operating frequency. The element 7 has metal platings 9 and 10 at the ends. The lower plating 10 is secured to the top 11 of the case 6 and makes electrical contact therewith. A short metallic

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strap 12 connects the top of the rod 8 to the plate 9. The lower end of the rod 8 passes through a hole 15 in the top 11 into the interior of the case 6. A wire 16 connects the lower end of the rod 8 to a terminal 17. Another wire 18 connects a second terminal 19 to the inside of the case 6 at the point 20. A loading coil 21 may be inserted in series with the wire 16, if desired, to increase the electrical length of the antenna 5 and thus reduce the operating frequency. The radio circuit, not shown, may be connected to the antenna terminals 17 and 19. The element 7 comprises material having a high dielectric constant and low loss at radio frequencies. A suitable material is barium titanate, strontium titanate, calcium titanate, or potassium niobate.

It is seen that the plates 9 and 10 and the dielectric material 7 constitute a capacitor which provides low-loss, top capacitive loading for the antenna rod 8. This type of loading causes a more uniform value of current to flow throughout the entire length of the rod 8, thus increasing its effective height and the efficiency. Because the length of the element 7 is substantially the same as that of the rod 8, no other wire physically parallel to the rod 8, and external to the case 6, is required.

The radio apparatus shown in Fig. 2 is similar to that of Fig. 1 except for the antenna 22. The antenna 22 comprises a solid, cylindrical, dielectric element 23, which may be any of the materials mentioned above, with metallic end plates 24 and 25. The lower plate 25 is electrically connected to the top 11 of the metallic case 6. The element 23 is partly surrounded and shielded by a hollow metallic cylinder 27 which is closed at the top 28 and open at the bottom. The top 28 rests upon and is electrically connected to the top plate 24. The inner diameter of the cylinder 27 is larger than the diameter of the element 23 so that there is an air space between the elements. The wire 16 is connected to the cylinder 27 at a point 29 near the open end thereof. The cylinder 27 serves the same purpose as the rod 8 in Fig. 1. The capacitance between the plates 24 and 25, with the element 23 as the dielectric, provides low-loss, top loading for the antenna 22.

Fig. 3 shows radio apparatus comprising a non-metallic case 30 with a dielectric element 31, which may be any of the above-mentioned materials, attached to a side thereof. The ends of the element 31 are bent at right angles and provided with the metallic plates 32 and 33, which are secured to a side 34 of the case 30. A wire 35, which passes through a hole in the side 34, connects the upper plate 32 through a loading coil 21 to the terminal 17. The lower plate 33 is connected to the terminal 19 by the wire 18. In Fig. 3, the wire 35 functions in substantially the same manner as the external rod 8 in Fig. 1. The wire 35 may be placed within the case 30 because the case is made of non-conducting material, such as plastic. Thus, the wire 35 constitutes a rod-type antenna which is top-loaded by the capacitor formed by the plates 32, 33 and the dielectric material 31.

Even with the coil 21 omitted, each of the antennas shown in Figs. 1, 2 and 3 can be designed to resonate at a lower frequency than is possible with other types of low-loss top loading. For example, the structure shown in Fig. 1 has been made to resonate at 70 megacycles with a barium titanate element 7 having a length of four inches and transverse dimensions of one-half inch. The same element used as the core 23 in the antenna 22 of Fig. 2, with a shield 27 of approximately the same length and one inch in inside diameter, provided a resonance at 80 megacycles. A lower operating frequency may be obtained by increasing the transverse area of the dielectric element or by adding the loading coil 21.

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It is to be understood that the above-described arrangements are only illustrative of the application of the principles of the invention. Numerous other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention. 5

What is claimed is:

1. An antenna for a portable radio translating device comprising an elongated body having a high dielectric constant and low loss at radio frequencies, a hollow metallic cylinder of approximately the same length as the 10 body surrounding the body on the sides but being separated therefrom, electrodes at the ends of the body, an electrical connection from one end of the cylinder to one of the electrodes, and means for making electrical connections to the other end of the cylinder and 15 to the other electrode.

2. In portable radio apparatus, an antenna comprising an elongated, hollow conductor, a barium titanate

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element approximately as long as the conductor positioned therein and insulated from the sides thereof, electrodes at the ends of the element, an electrical connection between one end of the conductor and one of the electrodes, and means for making electrical connections to the other end of the conductor and to the other electrode.

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