

April 5, 1960

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2,932,027

ANTENNA

Filed March 9, 1955

2 Sheets-Sheet 1

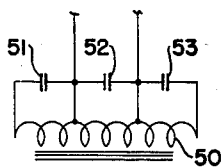


FIG. 5

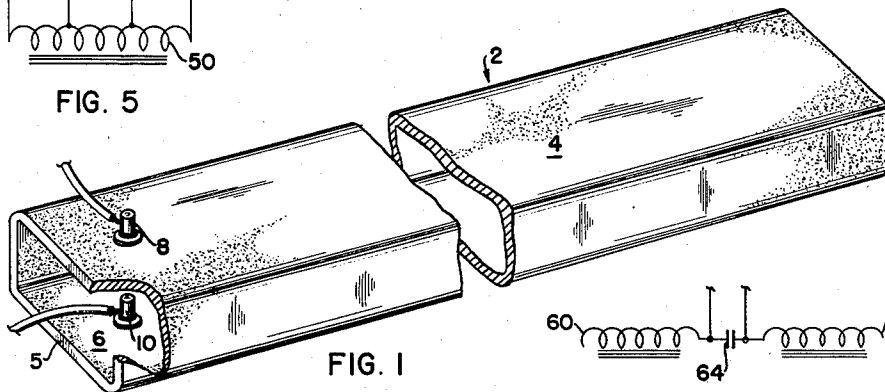


FIG. 1



FIG. 6

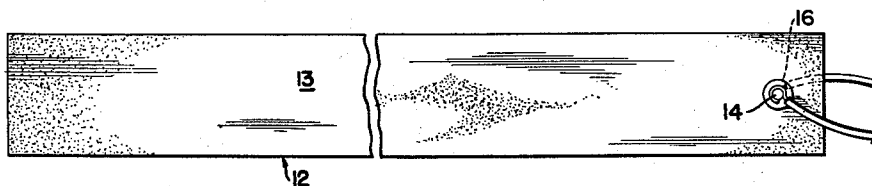


FIG. 2

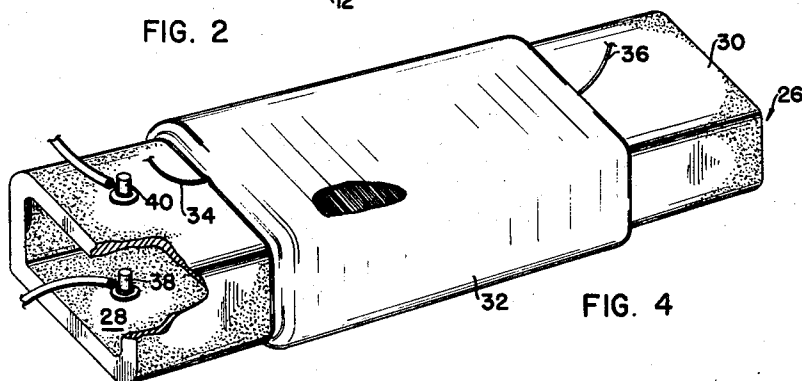


FIG. 4

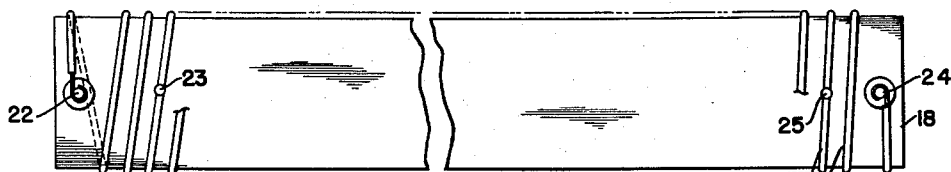


FIG. 3

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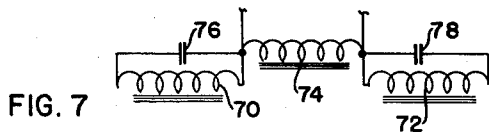


FIG. 7

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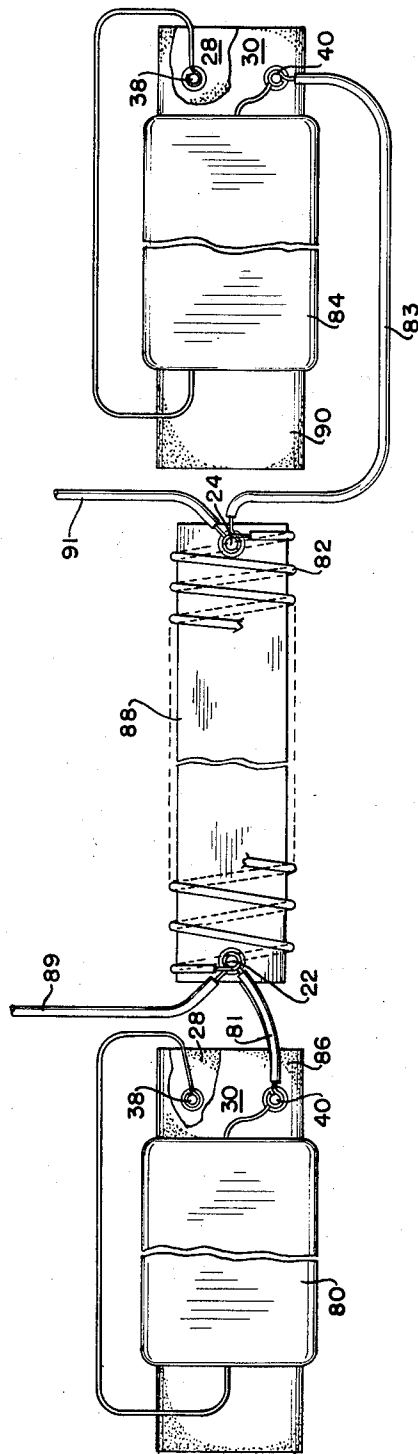
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2 Sheets-Sheet 2

FIG. 8



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Application March 9, 1955, Serial No. 493,180

1 Claim. (Cl. 343—788)

This invention relates to antennas for the reception of radio signals and more particularly to television receiving antennas, i.e. to the reception of signals of a frequency of the order of 100 megacycles or more.

According to the present invention a television receiving antenna is made up of elements employing ferrite cores and conductors of either sheet or filamentary type. Antenna elements according to the invention of one type comprise either flat plates or tubes of ferrite material bearing electrically separate conducting metallic coatings on their two principal faces or surfaces. Two terminals connect one with each of these two coatings, which are electrically distinct from each other, and these terminals serve to connect the elements together and, via a suitable transmission line, to a television receiver to be served therewith. Antenna elements of another type according to the invention comprise a bar or slab of ferrite material on which are wound a coil or coils of wire to which two terminals connect. An antenna according to the invention comprises one or more such elements, preferred embodiments of the antennas of the invention including at least one element of each type. The elements of the first type are believed to be predominantly capacitive in reactance while those of the second type are believed to be predominantly inductive in reactance.

The invention will now be further described with reference to the accompanying drawings in which:

Fig. 1 is a perspective view of a tubular capacitive antenna element according to the invention;

Fig. 2 is a plan view of a flat plate capacitive antenna element according to the invention;

Fig. 3 is a plan view of a ferrite-cored inductive antenna element according to the invention;

Fig. 4 is a perspective view of a combined capacitive-inductive antenna element according to the invention;

Figs. 5, 6 and 7 are schematic diagrams of typical antennas according to the invention made up of combinations of the elements shown in Figs. 1, 2 and 3; and

Fig. 8 is a perspective view of another antenna according to the invention as schematically illustrated in Fig. 7.

The receiving antenna element of Fig. 1 comprises an extruded ferrite tube, generally indicated at 2, having a conducting coating on each of its cylindrical faces, the two coatings 4 and 6 being electrically distinct from each other, i.e. the conducting coating does not extend across either the end face 5 shown in the figure or the end face at the opposite end of the tube 2. Terminals 8 and 10 connect one with each of the coatings 4 and 6. While the terminals may penetrate into the material of the core, each must contact only one of the coatings 4 and 6.

The tubular member 2 is made of a ferrite material having high electrical resistivity together with high permeability and low losses. For example this material may be a mixed ferrite of nickel, zinc and cobalt and may be processed advantageously in accordance with applicant's copending application Serial No. 230,706, filed June 8, 1951, now Patent No. 2,736,708. Inclusion of

2

cobalt oxide in the mixture from which the mixed ferrite is prepared has been found to be advantageous in antennas for use at the higher or so-called UHF television frequencies which are above 400 megacycles.

5 A typical antenna element of the type illustrated in Fig. 1 which has been successfully employed by applicant was of the order of 14 inches long with outer cross-sectional dimensions of approximately 2 by 1½ inches, the wall thicknesses of the tube being approximately ⅜ of an inch. The conductive coatings 4 and 6 were silver platings. Electrical separation of the two metallic coatings may be maintained by masking the ends of the tube during the plating process or by removing the plated material from those end surfaces after the plating process is completed.

15 Another capacitive type of antenna element according to the invention is illustrated in Fig. 2. The element of Fig. 2 comprises a flat plate of ferrite generally indicated at 12, which may be of the same composition and general properties as that described above in conjunction with Fig. 1. The ferrite plate 12 of Fig. 2 has a metallic coating on each of its principal faces, and the coatings are maintained electrically distinct from each other. One coating 13 may be seen in the figure. Terminals 14 and 16 are connected one to each of the metal coatings on the two principal faces of the plate. Applicant has successfully used antenna elements of the type illustrated in Fig. 2 having lengths of either 6 or 12 inches, widths of approximately 1½ inches and thicknesses of approximately ⅜ inch and employing silver platings as the conductive coatings on opposite faces of the ferrite core.

25 An inductive antenna element according to the invention is shown in Fig. 3. It comprises an elongated bar-shaped core 18 of a ferrite material having high resistivity, high permeability and low loss factor, and a coil 20 thereon. A material suitable for the bar-shaped core 18 of Fig. 3 is described in applicant's issued Patent No. 2,575,099 and may be produced from an initial mixture of 65% Fe₂O₃, 20% ZnO and 15% NiO, these being weight percents. The number of turns in the coil 20 may be varied over wide limits according to circumstances. In addition to terminals 22 and 24 at the ends of the coil, additional taps such as 23 and 25 may be provided at intermediate points on the coil.

30 An antenna element according to Fig. 3 constructed by applicant included a core approximately 12 by 2 by 1½ inches, on which was wound a coil of approximately 50 turns of wire.

40 Fig. 4 is a perspective view of a combined capacitive and inductive antenna element according to the invention. The element of Fig. 4 comprises a tubular core, generally indicated at 26, which may be of a ferrite material similar to that employed in the core of Fig. 1. Conductive metallic coatings 28 and 30 are provided on the opposite inner and outer cylindrical surfaces of the core 26, electrically insulated from each other by the end surfaces of the core. In addition the antenna element of Fig. 4 includes a coil 32 wound on the core, and having terminals 34 and 36. Terminals 38 and 40 provide connections to the conducting surfaces 28 and 30.

45 The antenna elements described can be combined in various ways to form the antennas of the invention. The element of Fig. 1 indeed may function as an antenna by itself, and when so employed exhibits directive properties which are advantageous in television reception in metropolitan areas where numerous transmitting stations are located. Best reception has been obtained when the long dimension of the element is oriented parallel to the direction joining the locations of the transmitting and receiving stations.

The antennas of the invention however preferably comprise combinations of capacitive and inductive elements of the types hereinbefore described, and a number of preferred embodiments of the antenna of the invention are schematically illustrated in Figs. 5-7.

The antenna of Fig. 5 includes an inductive element 50, of the type illustrated in Fig. 3 and three capacitive elements 51, 52 and 53 of the type illustrated in Fig. 2, element 53 having a core approximately twice as long as either of the elements 51 and 52. The antenna leads 54 and 55 connect to taps intermediate the ends of the coil on the inductive element 50. The capacitive elements are connected into the antenna at the terminals of their electrically conductive coatings, element 53 being thus connected across the antenna leads while the elements 51 and 52 are connected one between each of these antenna leads and an end of the coil of element 50.

Fig. 6 illustrates another antenna according to the invention including separate inductive elements 60 and 62 of the form shown in Fig. 3 and a single capacitive element 64 of the type shown in Fig. 2. The three elements 60, 62 and 64 are connected in series as shown in the drawing, the antenna leads connecting to the two terminals of the capacitive element 64.

Fig. 7 illustrates a further antenna according to the invention comprising three inductive elements 70, 72 and 74 all connected in series and two capacitive elements 76 and 78 of the type shown in Fig. 2, one connected across each of the extreme inductive elements 70 and 72. The antenna leads connect to the terminals of the central inductive element 74. An antenna of the general type illustrated in Fig. 7 is shown in perspective in Fig. 8. It comprises three coils 80, 82 and 84 connected in series by means of leads 81 and 83. The coils 80, 82 and 84 are wound on ferrite cores 86, 88 and 90 respectively. Of these cores two, identified at reference characters 86 and 90, are of the type shown at 26 in Fig. 4 and possess each two electrically distinct metallic conductive coatings or layers 28 and 30 on opposite surfaces thereof. Coil 80 is connected at one end to a terminal 38

on core 86 and thereby to the coating 28 of that core. The opposite coating 30 of core 86 is electrically continuous with the terminal 40 on that core, to which are conducted both the lead 81 and the end of coil 80 opposite that connected to coating 28.

The ends of coil 82 are defined by terminals 22 and 24 on core 88. The terminal 24 opposite terminal 22 is connected by means of lead 83 to terminal 40 on core 90, with which coating 30 on that core is electrically continuous. One end of coil 84 also connects to terminal 40 on core 90. The opposite end of coil 84 connects to a terminal 38 on core 90, which terminal is electrically continuous with the coating 28 on that core. The antenna leads, to terminals 22 and 24 of coil 82, are shown at 89 and 91.

By means of these connections there is provided a television receiving antenna comprising three series-connected coils with a ferrite core in each of those coils, two of those cores having electrically distinct conductive layers on opposite surfaces thereof, and separate leads connecting each end of the coil on each of those two cores to a separate one of the conductive layers of the core in that coil.

I claim:

25 A television receiving antenna comprising three series-connected coils, a ferrite core in each of said coils, two of said ferrite cores having each two electrically distinct conductive layers on opposite surfaces thereof, and separate means connecting each end of the coil on each of said two ferrite cores to a separate one of the layers on the core in that coil.

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