343-902 CROSS REFERENCE SEARCH ROOM

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ANTENNA STRUCTURE

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Fig. 1

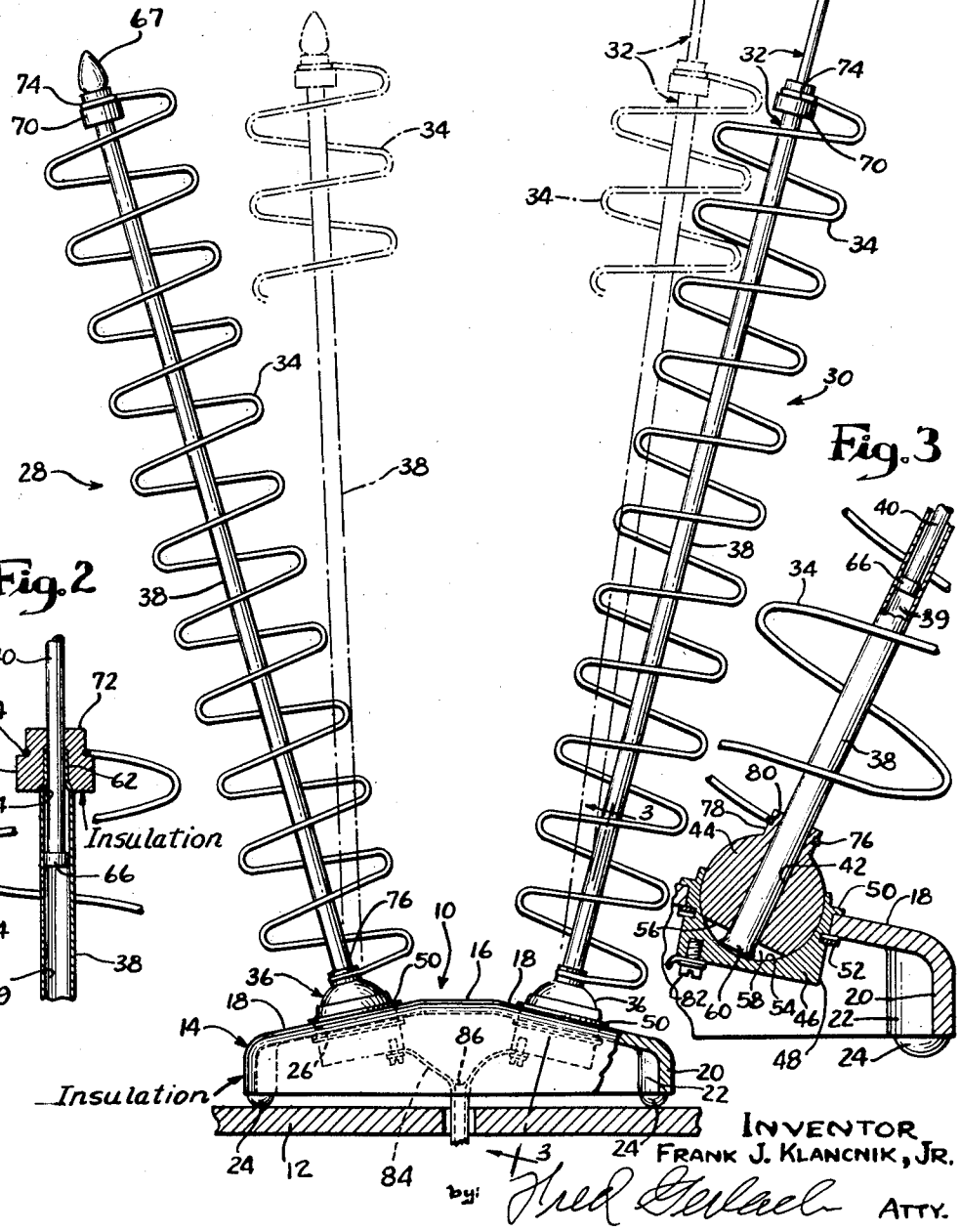


Fig. 2

Fig. 3

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ANTENNA STRUCTURE

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3 Claims. (Cl. 343—805)

The present invention relates to antenna structures and more particularly to such structures which are designed for use in the reception of short wave electrical radiation of unlike frequency in the broad high frequency radiation area of television reception.

The present invention is specifically concerned with antenna structures of the general type set forth in United States patent to Klancnik et al., No. 2,495,579, dated January 24, 1950, for "Antenna" and over which structures the present antenna is an improvement.

The antenna shown and described in the above mentioned patent is designed primarily for use as an indoor antenna in connection with television receivers which are installed in the home, for example, in dwelling houses, apartment buildings, and the like. It is essentially of the dipole variety and its principle of operation is predicated upon the use of a principal antenna component having a resonant frequency responsive to radio waves of a selected frequency and an auxiliary antenna component responsive to radio waves of a different selected frequency, the two components being inductively coupled and electrically isolated from each other, and only one of them being operatively connected to the transmission line leading to the television receiver. Signals of a frequency capable of being received by the component which is connected to the receiver through the transmission line are, of course, fed directly to the receiver while signals of a frequency capable of being received by the other component, and to which the first component ordinarily is not responsive, are induced in the first component and are thereafter transmitted or fed to the receiver. In this manner the antenna structure as a whole is responsive to the entire range of signals of both selected frequencies, these frequencies covering the high frequency range and the low frequency range allotted to commercial television broadcasting stations in the United States. This principle of operation has come to be known as the "Hi-Lo" operating principle, and, in the present antenna structure, it has been preserved with certain modifications as will be pointed out presently.

It is among the principal objects of the invention to provide an antenna structure which operates upon the basic principle briefly outlined above and having associated therewith novel means whereby the average impedance at the take-off terminals of the antenna structure may be varied over a considerable range. In carrying out this object, the invention contemplates the construction of the principal antenna component in the form of a split dipole element of rod-like design, each section or leg of which has individually associated therewith an inductively coupled coil element, the two coil elements constituting, in combination, the secondary or auxiliary antenna component. To vary the impedance matching effects of the overall antenna structure, the electrical reception characteristics of the various antenna components may be varied either by varying the angle of acceptance of one or both composite dipole sections, in the manner shown in my co-pending application mentioned above, or by varying the effective length of one or both principal dipole sections to produce tuning effects which will be explained as the following description ensues. Either or both of these expedients may be resorted to attain a more satisfactory reception to broadcast channel frequencies in the allotted high frequency radiation area of television reception than has hitherto been attainable with present day indoor antenna structures.

The provision of an antenna structure of the character briefly outlined above being among the principal objects of the invention, a further and more specific object is to provide an antenna structure comprised of composite dipole sections as outlined above wherein the adjustments for attaining a desired angle of acceptance by either or both composite dipole sections may be made independently of the adjustments for varying the effective length of either principal dipole component section. In this manner, the number of manipulations invariably involved in the trial-and-error tuning procedure attendant upon all indoor type antenna structures having tuning facilities is reduced to a minimum.

The provision of an antenna structure which is relatively simple in its construction and which, therefore, may be manufactured at a low cost; one which, although it is capable of physical adjustment, is comprised of a minimum number of moving parts and which, therefore, is unlikely to get out of order; one which is rugged and durable and which, therefore, will withstand rough usage; one which is attractive in its appearance and pleasing in its design; and one which otherwise is well adapted to perform the services required of it, are further desirable features which have been borne in mind in the production and development of the present invention.

Other objects and advantages of the invention, not at this time enumerated, will become more readily apparent as the following description ensues.

In the accompanying single sheet of drawing forming a part of this specification a preferred embodiment of the invention has been shown.

In this drawing:

Fig. 1 is a side elevational view, partly in section, of an antenna structure constructed in accordance with the principles of the present invention;

Fig. 2 is an enlarged sectional view taken substantially along the line 2—2 of Fig. 1 in the direction indicated by the arrows, and

Fig. 3 is a fragmentary enlarged sectional view substantially along the line 3—3 of Fig. 1.

Referring now to the drawings in detail, an antenna structure manufactured in accordance with the principles of the present invention has been designated in its entirety at **10** and is of the "indoor" type capable of being mounted on the top wall **12** of a television receiver or on any other suitable supporting surface in the vicinity of the receiver. The structure **10** involves in its general organization a base member **14** which may be formed of a suitable insulating material such as Bakelite or other similar durable plastic material having the necessary strength and rigidity to perform its supporting function in the antenna assembly. The base member **10** is in the form of a shallow inverted cup-shaped body which is preferably of generally rectangular design in horizontal cross section and is formed with an upper dome-like portion having a narrow flat apex portion **16** from which there slopes downwardly and outwardly a pair of flat inclined portions **18**. A depending apron **20** extends around the base structure and constitutes the side walls thereof. At the four corners of the base structure there are provided internal ribs **22** which may be drilled to accommodate reception therein of the shank portion of

conventional rubber or other anti-friction foot members 24.

Formed substantially centrally in each of the two flat portions 18 of the base member 14 is a circular hole or opening 26 and supported on the base member 14 within the openings 26 are a pair of composite antenna assemblies 28 and 30, respectively, the two assemblies being substantially identical in construction and design but being separately designated for facility of description. Since the two assemblies are identical, it is thought that a description of one will suffice for the other.

The antenna structure proper comprises a principal two-part dipole component consisting of two composite rod-like elements 32, the effective length of which may be varied by means subsequently to be described, an auxiliary antenna component consisting of two helical spring wire coils 34, one of which is associated with each of the assemblies, together with a ball and socket connection 36 whereby each assembly is operatively mounted on the base member 16 for independent limited universal swinging movement relative to the latter.

Each part or section of the principal antenna component includes a hollow tubular inner or proximate rod-like member 38 having a central bore 39 formed therein and an outer or distal member 40 which may be in the form of a solid rod and which is telescopically slidable within an end of the inner member 38 so as to be adjustably extensible therefrom. The inner end of the hollow tubular member 38 extends through and is slidable in a radially extending bore 42 provided in a frusto-spherical ball member 44 carried in a metal socket member 46 fixedly supported within the opening 26. The socket member 46 is in the form of a cup-shaped casing having a cylindrical outer wall 48 fitting snugly within the opening 26 and having an annular flange 50 formed thereon adjacent the upper rim thereof. A split wave spring washer 52 is seated within an annular groove 53 formed in the socket member 46 beneath the flat portion 18 of the base member 14 and serves to retain the flange 50 seated on the base member so as to fixedly secure the socket member 46 within the opening 26. The socket member is formed with a hollow spherical socket 54 in which the ball member 44 is snugly disposed for limited universal turning movement therein. The socket 54 encompasses a major portion of the ball member so that the latter is permanently retained within the socket against dislodgment.

The retaining ball member 44 is truncated in the lower regions thereof as indicated at 56, thus providing a clearance space or pocket 58 at the bottom of the socket. The extreme lower end of the inner tubular rod 38 is formed with an enlargement 60 thereon which may be formed by a flaring operation on the rod at its lower end. The overall diameter of the flared portion 60 is greater than the diameter of the bore 42 in the ball member in order that the rod 38 may not be pulled outwardly from the bore 42, the lower rim of the bore serving as a limit stop to prevent such outward pulling of the rod.

As shown in Figs. 2 and 3, the outer or distal end of the inner tubular rod 38 is reduced as at 62, thus providing an internal shoulder or limit stop 64 designed for engagement with a cylindrical enlargement 66 formed on the lower end of the outer rod 40 when the latter reaches the limit of its outward sliding movement relative to the tubular rod 38. The diameter of the enlargement 66 is such that it will have a sliding frictional fit within the inner bore 39 of the tubular rod to prevent shifting thereof under the influence of its own weight when the same is moved to any selected position of adjustment on the rod 38. Inward telescopic sliding movement of the outer rod 40 within the bore 49 is limited by the provision of a cap member 67 which may be press-fitted on the outer end of the rod 40.

The auxiliary component of the antenna structure which comprises the two helical coils 34 has each section or coil thereof inductively coupled to its respective primary component section or tubular rod 38. Each coil 34 consists of a few coil turns of the wire material, eleven such turns being disclosed herein purely for illustrative purposes. It will be understood that a greater or a lesser number of such turns may be employed if desired.

The opposite ends of the coil 34 are connected to the outer free end of the rod 38 and to the ball member 44 respectively in such a manner that the rod is at all times normally biased downwardly or inwardly of the ball structure and so that the flared end 60 is caused to frictionally bear against the wall of the socket 54 and establish good fricional and electrical engagement therewith. Accordingly, a cup-shaped cap member 70 (Fig. 2) of insulating material such as Bakelite or other suitable plastic is telescopically received over the outer end of the rod 38 and fits snugly around this end. The cap member 70 is formed with a reduced outer end 72 around which the outer end of the coil 34 is looped as at 74. The lower end of the coil 34 is similarly looped as at 76 around a protruding neck portion 78 formed on the ball member 44 and the looped portion thereof is seated within an annular groove 80 formed in the neck portion. The normal condition of the helical coil 34 is such that it is completely collapsed and, since the coil is formed of spring wire material, the coil, when in position on the rod 38, will serve to normally urge the latter inwardly of the socket member as previously described.

I is to be noted that since the cap member 70 is formed of an insulating material, the outer end of the coil 34 is effectively electrically insulated from the rod 38. The ball member 44 may be formed of metal or it may, alternatively, be formed of an insulating material. In either event, the cage-like helical coil 34 will be inductively coupled to the rod 38 inasmuch as in the former instance it is completely insulated therefrom and in the latter instance it is electrically connected thereto only at its extreme inner region where there is practically no voltage differential between the parts.

The socket members 46 of the two composite antenna sections 28 and 30 are each provided with a terminal screw 82 on the underneath side thereof whereby the same may be directly connected to the input of a television receiver or other receiving apparatus by means of electrical conductors 84 which may be embedded in the conventional flat lead-in tape conductor cable 86.

The ball and socket connection 36 per se described herein forms the subject matter of my co-pending application, Serial No. 630,636, filed on December 26, 1956, and entitled "Antenna Structure." Reference may be had to such application for a full detailed description of the operation of the same, it being deemed sufficient to state that the frictional engagement attained between the flared end 60 of the rod 38 and the wall of the socket 54 not only insures good electrical contact between the socket member and rod, but it also presents sufficient resistance to universal turning or swinging movement of the two sections 28 and 30 of the antenna proper that these sections will remain in any desired positions of adjustment despite the influence of gravitational forces acting thereon.

In the installation and use of the present antenna structure, the base member 14 may be positioned in the vicinity of the television receiver or other receiving apparatus with which it is associated, preferably on the top or table portion of the receiver cabinet. The terminal screws 82 are connected as hereinbefore described through the conductor cable 86 to the receiver input in the usual manner of connecting such antenna structures. With the two outer or distal primary component rods 40 fully received within the inner or proximate primary component rods 38, the structure will function substantially in the same manner as the antenna structure of my co-pending application wherein the rods 38 have a resonant frequency which is responsive to radio waves or signals in the high frequency range of signals allotted to commercial television broad-

cast stations and will receive such signals and transmit them directly to the receiver input through the transmission line to which they are electrically connected. The coils 34 which are inductively coupled to the rod 38 and which have a resonant frequency which is responsive to radio signals in the low frequency range of television broadcast signals will receive such signals and cause them to be induced in the rod 38 for transmission to the receiver input.

Inasmuch as the ball and socket mounting for the composite primary and secondary component sections of the antenna structure will permit limited swinging movements of the sections throughout relatively wide solid angles, limited tuning whereby the overall response of the antenna structure may be varied is made possible by the expedient of varying the angle of acceptance of either or both composite sections 28 and 30 between horizontal and vertical positions of the sections so that more accurate impedance matching in either the high or low frequency range may be attained. Directional tuning effects may be attained by causing the composite sections 28 and 30 to move through movements of horizontal swinging motion about respective vertical axes. Additional tuning effects may be attained by varying the effective length of either or both of the composite extensible rod-like elements 32. Such tuning effects may be accomplished by the simple expedient of engaging the end caps 67 manually and moving the distal rods 40 to any desired telescopic position of reception within the proximate tubular rods 38. Increasing or decreasing the effective length of the primary antenna elements 32 serves to vary the resonant frequency of the primary antenna component to render the same more responsive to reception of signals in the high frequency range. Changing of the length of the primary antenna elements 32 also has a limited effect on the inductance of the surrounding coils 34 and, as the inductance of these coils is increased or decreased, as the case may be, their resonant frequency is also altered so that the auxiliary antenna component may likewise be rendered more responsive to low frequency signals.

The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawings or described in this specification as various changes in the details of construction may be resorted to without departing from the spirit of the invention. Only insofar as the invention has particularly been pointed out in the accompanying claims is the same to be limited.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

1. Antenna structure comprising in combination a base member formed of electrically insulating material, a pair of tubular rods forming a principal dipole antenna component, means supportingly connecting said rods to the base member at spaced points thereon for horizontal components of swinging movement about respective vertical axes whereby the rods may be moved relatively to each other between positions large and small of angular divergence, a helical wire coil encompassing each rod axially and through which the rod extends centrally, means for securing the outer end of each coil to the free end of its

respective rod, means for securing the proximate end of each coil to the proximate end of its respective rod whereby the coil and rod are maintained in fixed relationship relative to each other against relative axial shifting movement and whereby the coil is constrained to move bodily with the rod and follow the swinging movements of the latter, said coils constituting an auxiliary antenna component, means for electrically connecting the inner proximate ends of said rods to the terminals of a transmission line, and a rod extension for each of said tubular rods electrically connected to and slidable within the rod between a retracted position wherein it is contained substantially wholly within the confines of said tubular rod and its surrounding coil and an extended position wherein it is disposed substantially exteriorly of the tubular rod and its surrounding coil and constitutes a linear extension of the tubular rod.

2. Antenna structure comprising in combination a base member formed of electrically insulating material, a pair of tubular rods forming a principal dipole antenna component, means swivelly connecting the inner ends of each rod to the base member whereby the rods may be swung through respective solid angles between positions of wide divergence and positions of parallelism, a helical wire coil encompassing each rod axially and coextensively and through which the rod extends centrally, a tubular end cap of insulating material on the free end of each tubular rod, means for securing the outer end of each coil to the cap on its respective tubular rod, means for fixedly securing the inner end of each coil to the inner end of its respective rod whereby the coil is constrained to move bodily with the rod and follow the swinging movements of the latter, said coils being inductively coupled to their respective rods and constituting an auxiliary antenna component, means for electrically connecting the inner ends of said rods to the terminals of a transmission line, and a rod extension for each of said tubular rods slidable within the rod and passing through the end cap between a retracted position wherein it is contained substantially wholly within the confines of said tubular rod and its surrounding coil and an extended position wherein it is disposed substantially exteriorly of the tubular rod and its surrounding coil and constitutes a linear extension of the tubular rod.

3. Antenna structure as claimed in claim 2 including additionally a second end cap on the free end of each rod extension said second end cap being engageable with the tubular end cap to limit inward sliding movement of the rod extension and thus define the retracted position of the rod extension.

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