March 30, 1965 W. E. NETTLES 3,176,298

ATTACHMENT FOR ANTENNAS TO REDUCE OPERATING FREQUENCIES

Filed June 11, 1962 2 Sheets-Sheet 1

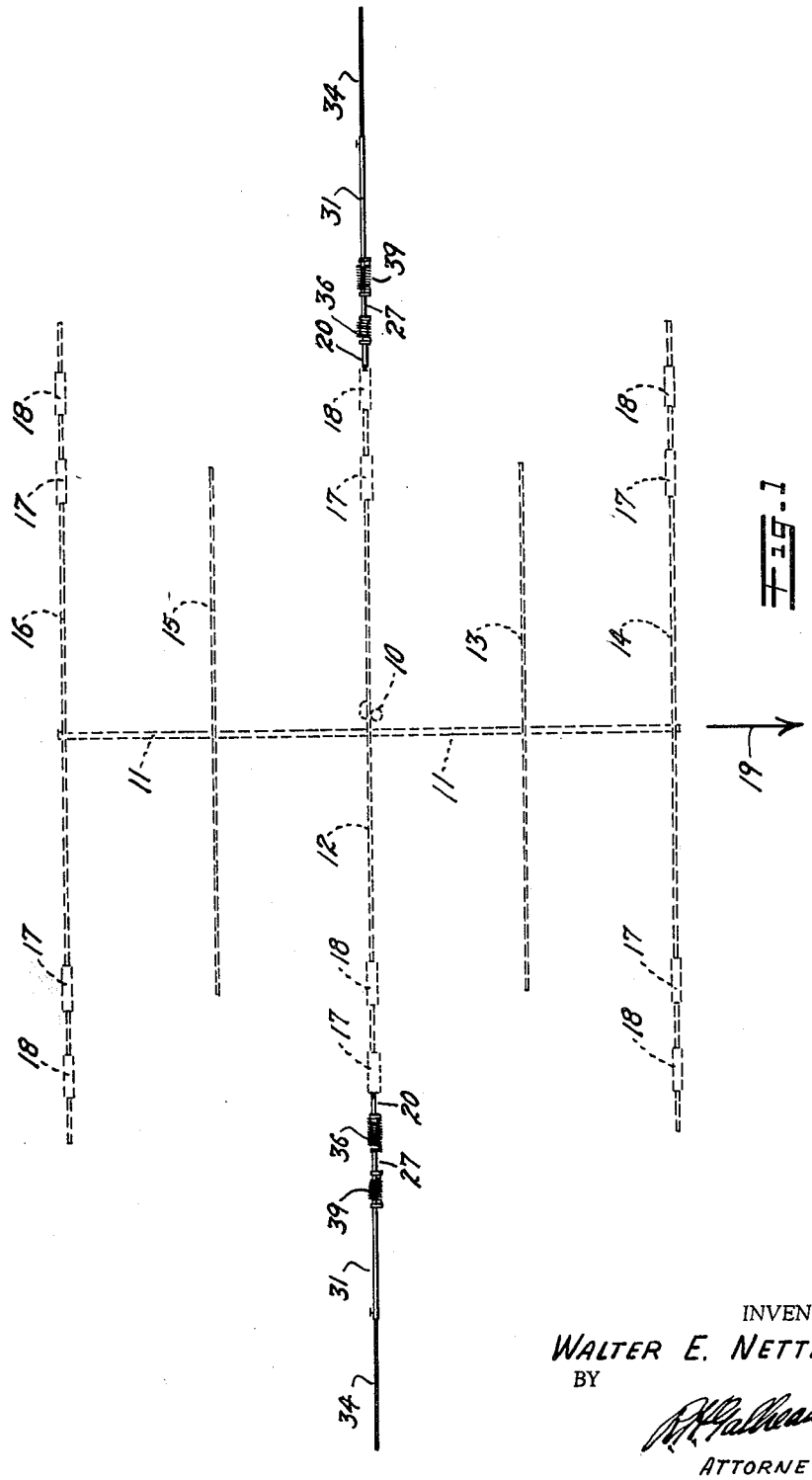


FIG. 1

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Filed June 11, 1962 2 Sheets-Sheet 2

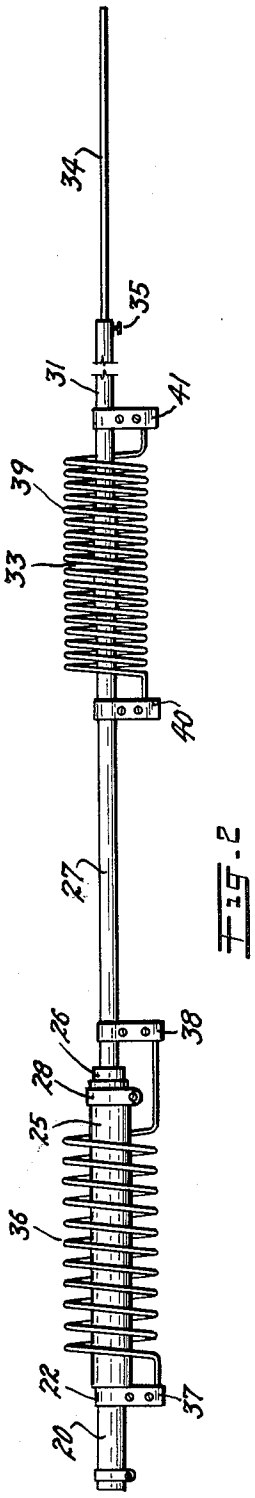


FIG. 2

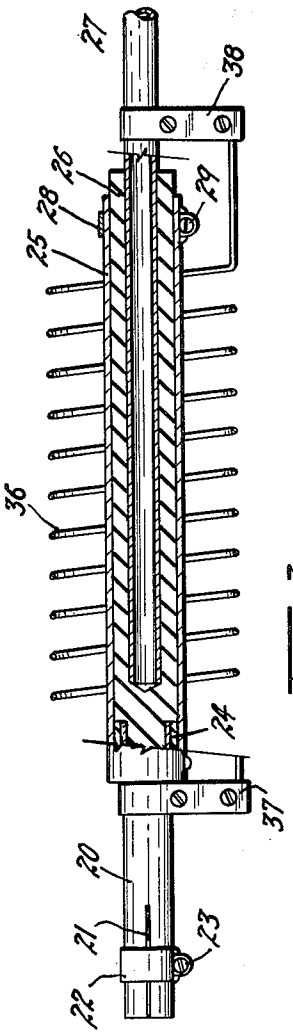


FIG. 3

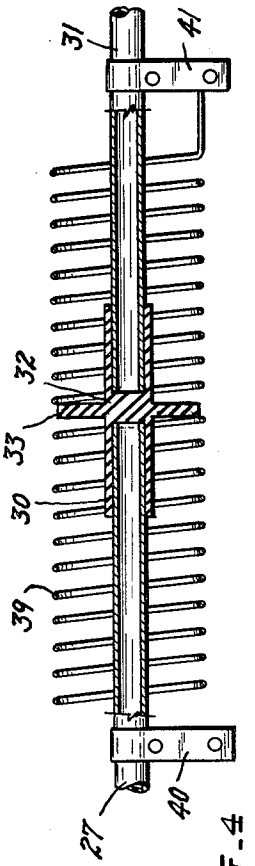


FIG. 4

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3,176,298

ATTACHMENT FOR ANTENNAS TO REDUCE OPERATING FREQUENCIES

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1 Claim. (Cl. 343—722)

This invention relates to an attachment for radio receiving and sending antennae for reducing the operating frequency of the antenna.

A conventional amateur radio station, usually referred to as "ham" stations, will usually employ a rotary directive, multi-band antenna designed to selectively operate on the ten meter, fifteen meter or twenty meter bands. During the eleven year sun spot cycle, there are intervals which after dark the ten, fifteen and twenty meter bands become inoperable except for ground wave and unusual skip operation. In such instances it is necessary to work at a lower frequency such as, for instance, in the forty, eighty, and one hundred and sixty meter bands preferably the forty meter band. The cost and the space required for an additional directional antenna for the occasional longer wave operation is usually prohibitive for the average radio "ham."

The principal object of the invention is to provide an attachment, two of which can be applied to a present multibrand antenna to enable the present antenna, to be operated on an additional lower frequency band without interfering with the antenna's operation on the former bands and without change in or addition to the present single feed line.

Another object is to so construct the attachments that they can be quickly and easily applied to or removed from a present antenna without changing or disturbing the mechanical construction or normal electrical characteristics of the latter in any way.

Other objects and advantages reside in the detailed construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention, reference is had to the accompanying drawing which forms a part hereof. Like numerals refer to like parts in all views of the drawing and throughout the description.

In the drawing:

FIG. 1 is a plan view of a conventional, rotary directional 10, 15, 20 meter antenna showing the attachments in place thereon to enable the antenna to operate on 40 meters;

FIG. 2 is an enlarged side elevational view of one of the attachments, partially broken away to reduce the length of the view;

FIG. 3 is a still further enlarged longitudinal section through a wave trap as employed in the attachment; and

FIG. 4 is a similarly enlarged, longitudinal section through a loading coil as used on the improved attachment.

In FIG. 1, the elements of a typical multi-band rotary directional antenna are designated by numeral as follows: mast 10, boom 11, driven element 12, ten meter director 13, ten, fifteen and twenty meter director 14, ten meter reflector 15 and ten, fifteen and twenty meter reflector 16. The driven element 12, the director 14 and the reflector 16 are provided with conventional ten meter traps 17 and with conventional fifteen meter traps 18. The energy is beamed in the direction of the arrow 19 in FIG. 1, for sending and will best receive beamed energy from the direction toward which the arrow points.

The extremities of the driven element 12 project oppositely outward from the traps 18 and it is to these outwardly projecting extremities that the attachments of the invention are attached.

For descriptive purposes, the attachments will be described for adapting the conventional ten, fifteen and twenty meter antenna to also operate on forty meters.

The attachments are similar and each, see FIGS. 2 and 3, is formed with a tubular connecting sleeve 20 adapted to slip over the extremity of the driven element 12. The sleeve 20 is split, as indicated at 21, so that it may be contracted and clamped on the extremity of the driven element by means of a clamp strap 22 and clamp screw 23. The outer extremity of the sleeve 20 is surrounded by a metallic bushing 24 over which a metallic capacitance tube 25 is tightly and rigidly fitted so as to project outwardly in axial alignment with the sleeve 20.

An insulating core 26 is tightly fitted within the tube 25 and the core is axially drilled to receive the inner extremity of a first tubular antenna element 27. The tube 25 is preferably split so that they may be contracted about the core 26 by means of a second clamp strap 28 and clamp screw 29.

The first tubular antenna element 27, see FIG. 4, terminates in an insulating sleeve 30 from which a second tubular antenna element 31 axially projects. The sleeve 30 is internally blocked, as indicated at 32, to prevent electrical contact between the elements 27 and 31. A circular flange 33 of insulative material, as indicated, and which may be integral with the sleeve 30 and blocking portion 32, surrounds the sleeve 30. A third, tunable antenna element 34, see FIG. 2, is slidably mounted in the outer extremity of the second antenna element 31 and can be set at any desired projection therefrom by means of a suitable set screw 35.

It will be noted that the metal tube 25 surrounding the inner extremity of the first antenna element 27 forms a capacitor as well as a support for the first antenna element. The capacitor is shunted by an open, coaxial, inductance coil 36 which is electrically connected at its inner extremity to the sleeve 20 by means of a connector 37 and at its outer extremity to the first antenna element 27 by means of a second connector 38.

For forty meter operation, the capacitance and the inductance are so designed as to provide a wave trap of low impedance to the forty meter frequency and infinite impedance to the twenty meter frequency of the driven element 12. At the twenty meter frequency, the trap will resonate and the first antenna element 27 will be divorced and insulated from the driven element 12 so that the latter will operate conventionally on the ten, fifteen and twenty meter bands as though the attachment were not present.

An open loading coil 39 surrounds the insulating sleeve 30 and is electrically connected at its inner extremity to the first antenna element 27 by means of a connector 40 and at its outer extremity to the second antenna element 31 by means of a suitable connector 41. The inductance coil 39 fits over and is physically supported by the circular flange 33 on the insulating sleeve 30. The loading coil is such as to provide the approximate inductance to cause the attachment to resonate in the forty meter band at any desired frequency between 7.000 kc. and 7.300 kc. The final tuning is accomplished by adjustment of the effective length of the third antenna element 34. All this has been accomplished by an extension of the driven element 12 of only a few feet, thus, keeping cost, weight and wind resistance to a minimum. The total added length is only approximately six feet.

Installation of the attachments is a relatively simple matter. It is only necessary to slip the sleeves 20 over the extremities of the driven element, director 14 and re-

flector **16**, and tighten them thereon by means of the clamp screws **23**. No other attachment is required.

The described antenna can then selectively operate on the ten, fifteen, twenty and forty meter bands. On the forty meter band, the driven element operates independently without reflection on a figure "8" pattern which is highly desirable in most instances on forty meters because of the so called "round-table" type of operation that is quite prevalent on forty meters as well as the other low frequency amateur bands of eighty and one hundred and sixty meters. By changing the loading coil inductance it is feasible to convert existing tri-band antennae, fed directly with co-axial cable and not using any sort of a match such as the so called "gamma match," "T match," etc., to operate as a shortened dipole and still maintain a reasonable standing wave ratio on conventional 52 ohm nominal impedance co-axial cable such as "RG–8/U," etc. The most practical application is for forty meters where the "Q" of the antenna, even though shortened, is such as to allow an impedance that permits almost unity coupling to the commonly used, commercially available "RG–8/U" feedlines as used by amateur radio operators.

As an example for forty meter operation, an inductance coil of 11 turns in parallel with the co-axial capacitor acts as a resonant circuit offering infinite impedance at the frequency of the twenty meter band. This infinite impedance is primarily resistive and therefore acts as an insulator for the twenty meter frequencies of the conventional antenna. A loading coil **39** of twenty-one turns offers additional reactance on forty meters requiring only relatively short first and second antenna elements **27** and **31** to resonate on forty meters.

The above invention converts existing high frequency antenna systems for use as shortened dipoles of ½-wave length on the lower frequency bands.

While a specific form of the invention has been described and illustrated herein, it is to be understood that the same may be varied within the scope of the appended claim, without departing from the spirit of the invention.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

Attachments for application to the two extremities of the driven element of a multi-band radio antenna to enable said antenna to be operated on an additional lower frequency band without interference with the antenna's

operation on its former bands, each of said attachments comprising: a connecting sleeve adapted to receive one of said extremities; an elongated metallic capacitance tube forming an axial extension of said sleeve; an antenna element positioned within and insulated from said tube and forming an axial extension from said tube, said element and said tube forming a capacitance; an inductance coil surrounding said capacitance and shunting the latter between said sleeve and said antenna element, said inductance coil having clamping terminals attached to the connecting sleeve and the antenna element, said capacitance and inductance providing high impedance to said former bands and low impedance to said additional lower frequency, each of said attachments having a second antenna element in coaxial alignment with the first antenna element and insulated from the latter and a loading coil shunted between and surrounding the adjacent extremities of both antenna elements and providing an inductance to cause said attachment to resonate at said additional lower frequency; and an insulating member in the form of a sleeve with a wall dividing the sleeve into two cylindrical recesses, one antenna element being seated in one recess and the other antenna element being seated in the other recess, said loading coil surrounding the antenna element in spaced relation thereto and being connected at its ends respectively to said antenna elements, said sleeve having a flange integral therewith and supporting an intermediate portion of the loading coil.

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HERMAN KARL SAALBACH, *Primary Examiner.*