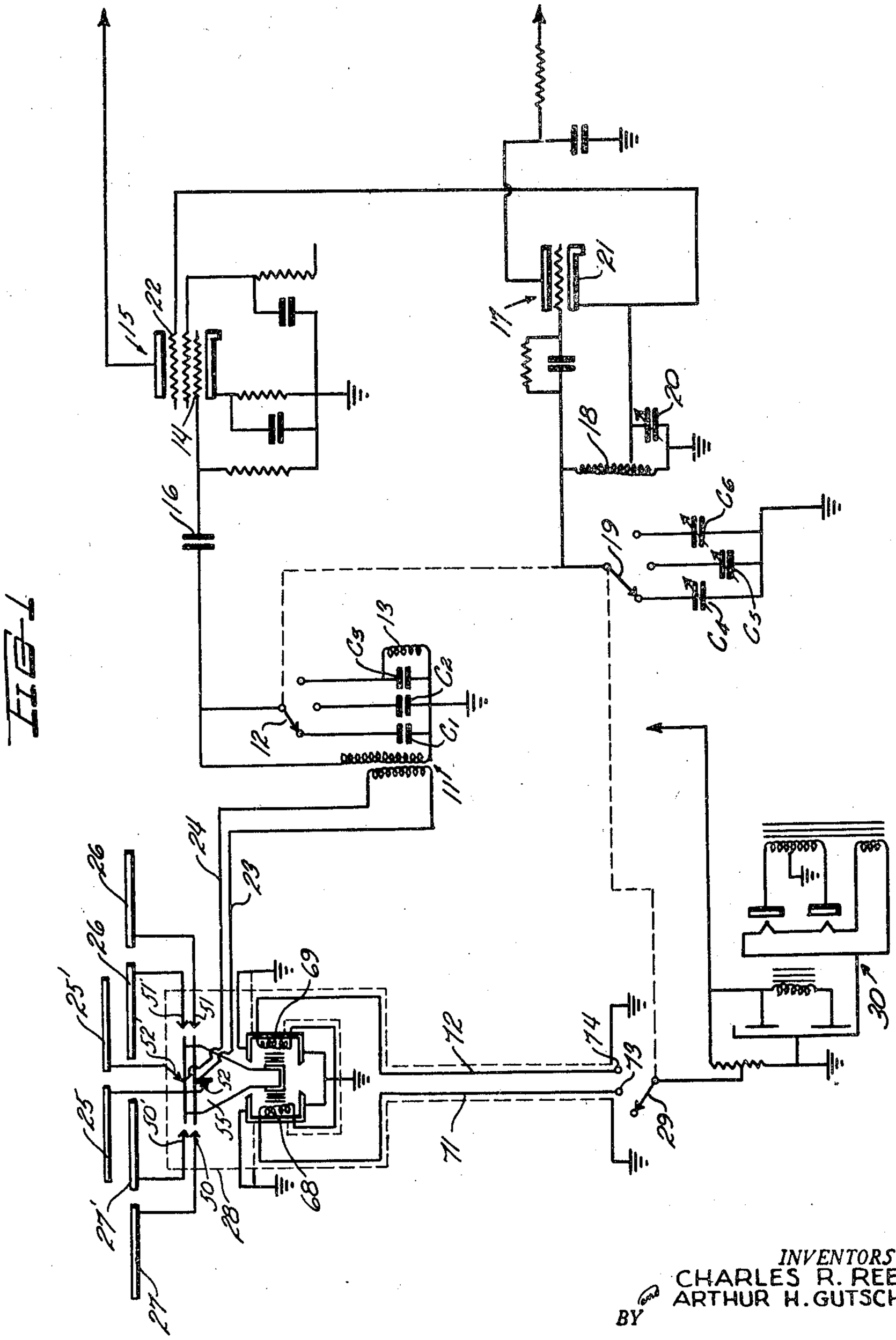
Oct. 4, 1949. A. H. GUTSCHOW ET AL 2,483,504

TRIPLE ELEMENT AUTO DIRECTIONAL ANTENNA SYSTEM

Filed July 13, 1948 3 Sheets-Sheet 1



INVENTORS
CHARLES R. REESE
ARTHUR H. GUTSCHOW

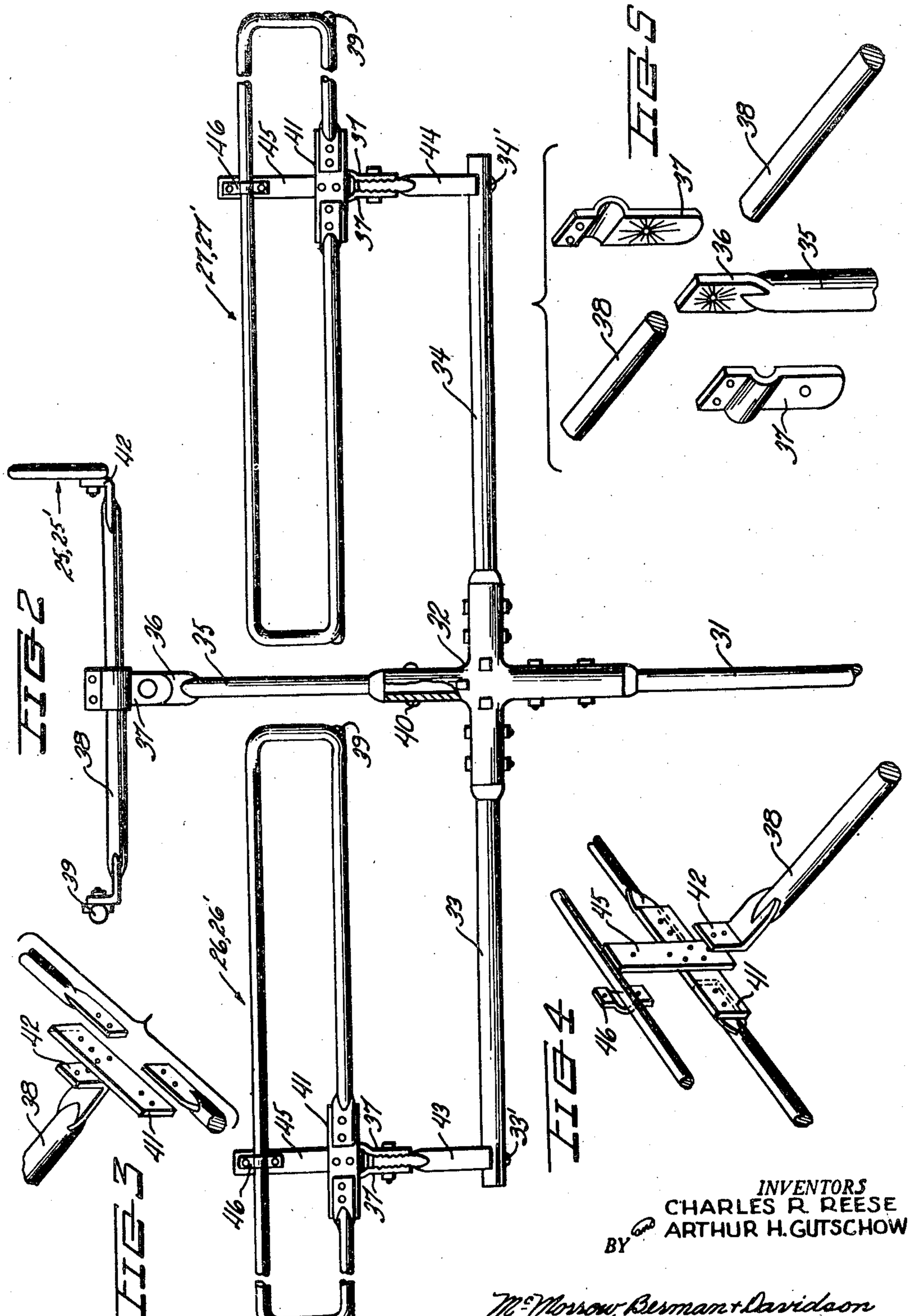
BY

McMorrow, Berman & Davidson
ATTORNEYS

Oct. 4, 1949. A. H. GUTSCHOW ET AL 2,483,504

TRIPLE ELEMENT AUTO DIRECTIONAL ANTENNA SYSTEM

Filed July 13, 1948 3 Sheets-Sheet 2



Oct. 4, 1949. A. H. GUTSCHOW ET AL 2,483,504

TRIPLE ELEMENT AUTO DIRECTIONAL ANTENNA SYSTEM

Filed July 13, 1948 3 Sheets-Sheet 3

FIG 1

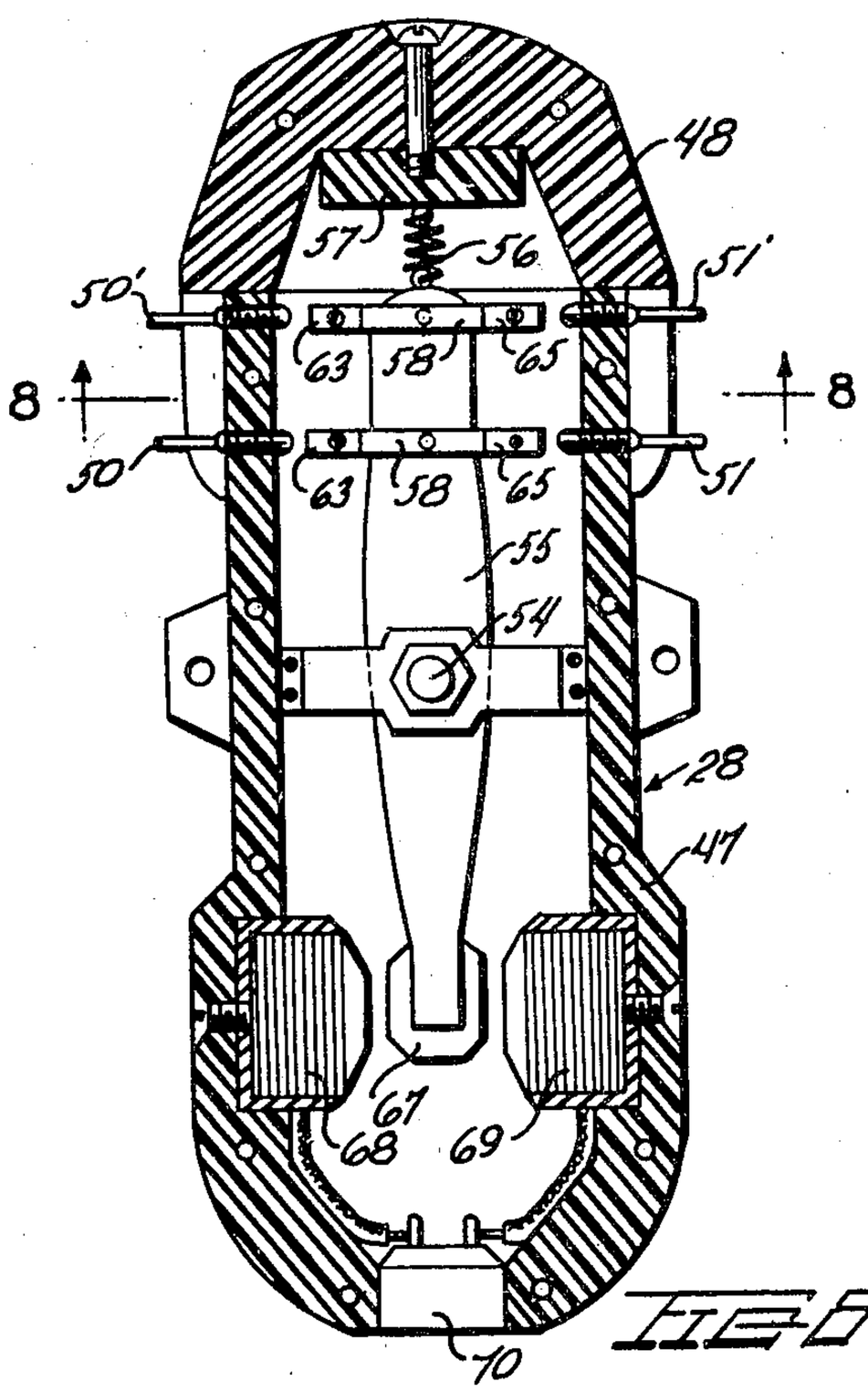


FIG 8

FIG 6

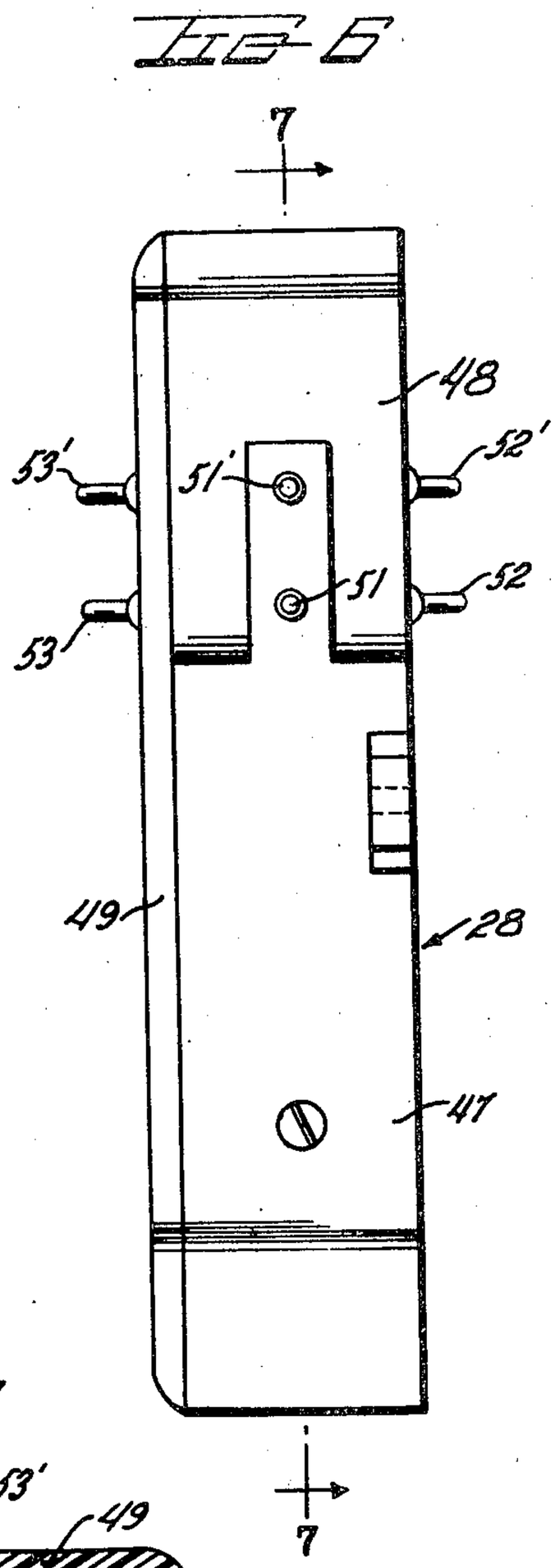
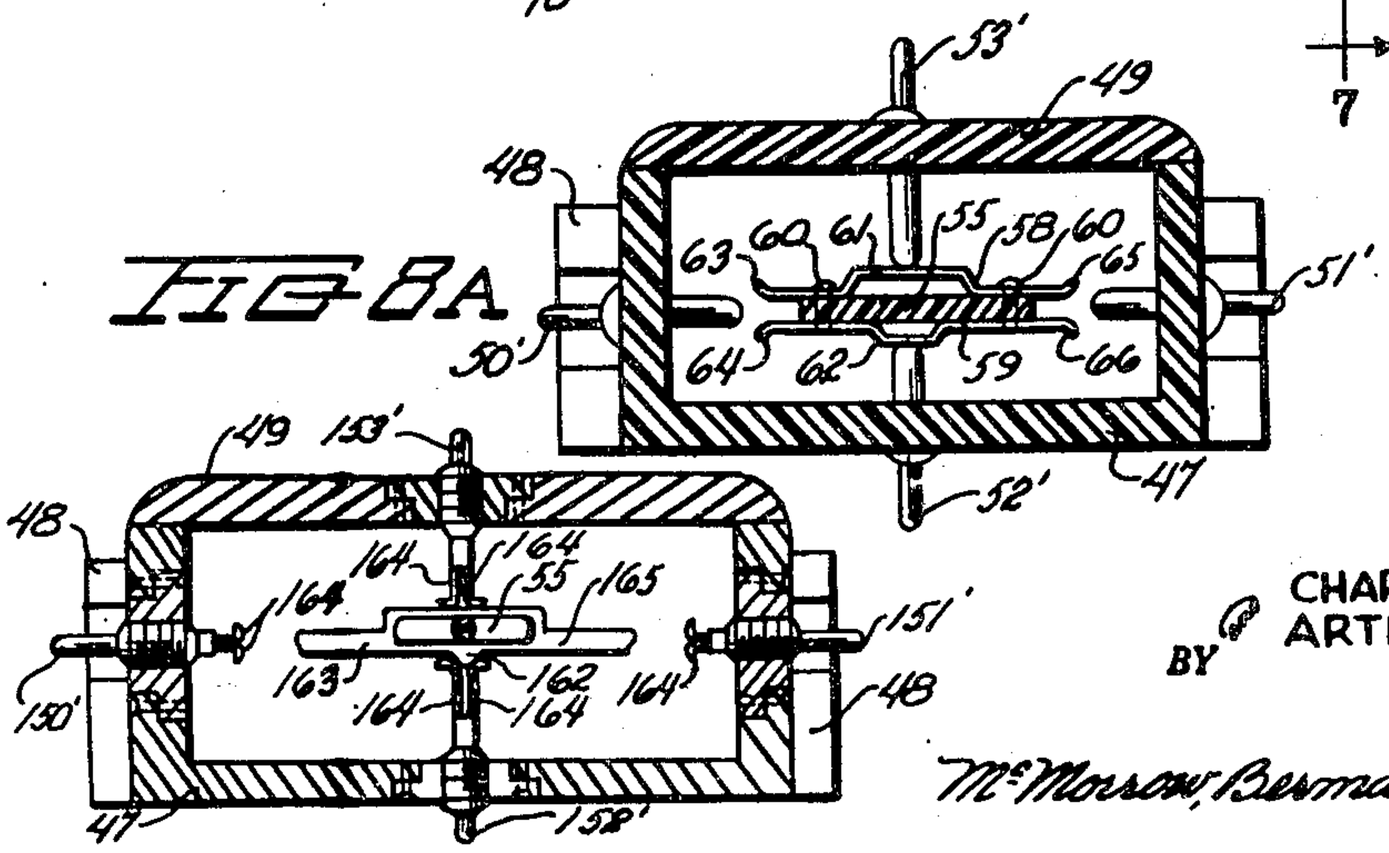


FIG 8A



INVENTORS
CHARLES R. REESE
ARTHUR H. GUTSCHOW
BY

McMorrow, Berman & Davidson
ATTORNEYS

Patented Oct. 4, 1949

2,483,504

UNITED STATES PATENT OFFICE

2,483,504

TRIPLE ELEMENT AUTODIRECTIONAL ANTENNA SYSTEM

Arthur H. Gutschow, Oswego, N. Y., and
Charles R. Reese, Ghent, Ky.

Application July 13, 1948, Serial No. 38,484

3 Claims. (Cl. 343—100)

1

This invention relates to television antenna systems, and more particularly to television antenna systems of the multiple element type.

A main object of the invention is to provide a novel and improved television antenna system wherein individually tuned and oriented antenna elements are provided for the various television channels to be received, whereby each channel may be received with maximum efficiency, instead of limiting the maximum efficiency of reception to one channel or adopting a compromise antenna arrangement as is done where a single antenna element is employed for receiving all channels.

A further object of the invention is to provide an improved multiple-element antenna system for use with television receivers, providing individually tuned and oriented antenna elements for the respective channels to be received, and wherein a novel and efficient switching arrangement is employed for automatically changing from one antenna element to another as the receiver is switched from one channel to another, and wherein the antenna lead-in connections are very simple, making the antenna system easy to install and to maintain in correct adjustment.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

Figure 1 is a schematic wiring diagram of the signal input portion of a television receiver employing an improved multiple-element antenna arrangement in accordance with the present invention.

Figure 2 is an elevational view, partly in cross-section, of a multiple-element television antenna assembly employed in the improved system of the present invention.

Figure 3 is a perspective exploded detail view showing the method employed for connecting the dipole terminals to a cross-bar supporting member in the antenna assembly of Figure 2.

Figure 4 is a perspective exploded detail view showing the method employed for supporting a folded dipole in a desired plane in the assembly of Figure 2.

Figure 5 is a perspective exploded detail view showing the method employed for clamping a cross-bar to a vertical support in the assembly of Figure 2.

Figure 6 is a side elevational view of a relay switch employed in the system of Figure 1.

Figure 7 is a cross-sectional view taken on line 7—7 of Figure 6.

2

Figure 8 is a cross-sectional view taken on line 8—8 of Figure 6.

Figure 8*a* is a cross-sectional view similar to Figure 8 but illustrating a modified relay switch suitable for use with the system of Figure 1.

At the present time, public television broadcast facilities in the United States are licensed by the Federal Communications Commission to operate on 13 channels, each channel being 6 megacycles wide. The 13 authorized channels are divided into two groups. The first group, of six channels, are located in a band extending from 44 to 88 megacycles and the second group, of seven channels, extend from 174 to 216 megacycles.

Although at present regular operation on all the available television channels is not yet being carried on, many of the larger cities in the country have at least one television broadcast station in operation and some have as many as three stations engaged in regular commercial broadcasting. It is expected that within a few years, most of the geographical areas in the country where television receivers may be employed will have service available from at least three different television broadcast stations. These stations will, of course, be located at different distances from a given receiver and probably will be located at different directions from the receiver.

The practice heretofore, has been to employ a single antenna, generally of the dipole or of the folded dipole type, with the television receiver. In the early stages of development of the art, the authorized television broadcast band extended merely from about 44 to 88 megacycles and the antenna therefore was designed for maximum efficiency at a mean frequency in this band. Also, the orientation of the antenna was such that if more than one station was available for reception, and if the stations were at different directions from the receiver, the antenna could not be directed so as to receive all stations with optimum efficiency. In general, a compromise orientation of the antenna was employed.

It can readily be seen that where some of the broadcast stations are in the upper band extending from 174 to 216 megacycles, an antenna designed for maximum efficiency at the mean frequency of the lower band would not provide satisfactory reception except in cases where the receiver was located fairly close to the higher frequency stations.

The present invention aims to provide an antenna system employing individual elements, each designed and directed for optimum recep-

tion of a particular station serving the area in which the receiver is located. The present invention contemplates that three such elements will be sufficient to insure satisfactory reception for a receiver located in any area where television service is available.

Referring now to the drawings, Figure 1 illustrates schematically the input circuit of a conventional television receiver. Designated at 11 is the input transformer of the receiver. The input circuit of the receiver may be tuned at the secondary of transformer 11 by means of a plurality of fixed capacitors C1, C2, C3 which may be selectively connected across the secondary by means of a movable switch arm 12 in a manner well known in the art. Connected across the condenser C3 is a shunt coil 13 for substantially increasing the resonance frequency of the input circuit, as where it is desired to tune the receiver to a channel in the upper television band. The signal is fed to the grid 14 of a mixer tube 15 through a coupling condenser 16.

Designated at 17 is the oscillator tube, the tube being grid-tuned by a coil 18 across which may be connected any one of a plurality of adjusted capacitors C4, C5, C6 by means of a movable switch arm 19 mechanically linked to switch arm 12 in a well-known manner. A fine tuning condenser 20 is connected across a portion of coil 18. The cathode 21 of tube 17 is connected to a grid 22 of tube 15, whereby the output signal of oscillator tube 17 may be mixed in tube 15 with the input radio frequency energy derived from the input coil 11.

The circuit heretofore described is entirely conventional and forms no part of the present invention.

The antenna lead-in wires are shown at 23 and 24 and are connected to the primary of the input transformer 11. Designated generally at 25, 25', 26, 26' and 27, 27' are the respective dipole elements of three different antenna assemblies subsequently to be described in detail.

A relay switch, shown generally at 28, is provided at the antenna to selectively connect the lead-in wires 23 and 24 to the different antenna assemblies. Switch 28 is remotely controlled at the receiver by a movable switch arm 29 which is mechanically linked to the channel-selecting switch arms 12 and 19. As shown in Figure 1, switch arm 29 is connected to the hot side of a conventional low voltage power supply 30 provided at the receiver, which may be part of the regular receiver power supply system.

For simplicity of presentation in Figure 1 the antenna assemblies are illustrated as ordinary dipoles. However, in actual practice, it is preferable to employ antenna assemblies of the folded dipole multiple-element type, such as are disclosed in Figures 2 to 5.

Referring now to Figures 2 to 5, 31 designates the main antenna supporting mast. Designated at 32 is a four-way coupling bracket secured to the top of mast 31. Secured to the horizontal arms of bracket 32 are horizontal supports 33 and 34 and secured to the top arm of bracket 32 is a vertical support 35 having a flattened top end 36. Secured to said top end 36 are opposing clamping brackets 37, 37 and clamped between the brackets 37, 37 is a cross-bar member 38. Secured to one end of crossbar member 38 is the folded dipole, designated at 25, 25' of conventional construction. Secured to the other end of bar 38 is the conventional reflector 39. If desired, a director may be employed in place of

reflector 39, in which case cross-bar 38 will be suitably shortened in length. The orientation of the folded dipole 25, 25' may be adjusted in a horizontal plane by rotating support 35 to move the dipole to a broadside position normal to the direction of the transmitter to be received and securing support 35 in this position by means of a set screw 40 on the top arm of bracket 32. The antenna assembly 25, 25' may be adjusted in a vertical plane by angularly adjusting the clamping brackets 37, 37 around the axis of the bolt which secures them to the flattened top end 36 of vertical support 35.

The ends of the folded dipole element itself are secured to a bar 41 of di-electric material, said bar being secured at its intermediate portion to a flattened upstanding lug 42 formed at the end of cross-bar 38, as shown in Figure 3.

Secured to the end portions of horizontal supports 33 and 34 by vertical axial securing bolts 33' and 34' and rotatably adjustable thereon around the axes of said securing bolts are short upstanding post members 43 and 44 having flattened top portions to which are adjustably secured opposing pairs of clamping brackets 37, 37 clamping the cross-bars of the respective antenna assemblies 26, 26' and 27, 27'. The general structural features of the antenna assemblies 26, 26' and 27, 27' and 25, 25' are similar except that each antenna assembly is dimensional in accordance with the wave length of the channel to be received so as to provide optimum efficiency of reception thereof. The length of each folded dipole will be approximately nine tenths of the length of one half a wave length taken at the center frequency of the desired channel. The design of the antenna assemblies per se is well-known in the art.

As shown in Figures 2 and 4, the folded dipole elements may be braced at their central portions by vertical di-electric strips 45 secured between the horizontal di-electric tie strips 41 and the cross-bar end lugs 42. The upper arms of the folded dipole elements are clamped to the top portions of the vertical strips 45 by brackets 46.

It is thus apparent that each of the folded dipole assemblies 25, 25', 26, 26', and 27, 27' is dimensioned in accordance with the mean frequency of the channel to be received and may be oriented in accordance with the direction and polarization of the individual television transmitters to be received.

Referring now to Figures 6, 7, and 8, the relay switch 28 comprises an elongated housing 47 of suitable di-electric material having a removable end portion 48 and provided with a removable cover plate 49. Secured in the side walls of the housing 47 are opposed pairs of contact prongs 50, 50' and 51, 51'. Secured in the bottom wall and in the cover plate 49 are opposed pairs of contact prongs 52, 52' and 53, 53'. The prongs 50, 51, 52 and 53 are in a common transverse plane and the prongs 50', 51', 52' and 53' are also in a common transverse plane.

Pivoted at 54 in the intermediate portion of housing 47 is an armature 55 of di-electric material. One end of armature 55 is connected by a coiled spring 56 to a di-electric block 57 secured within the housing end portion 48, biasing the armature 55 to the centered position shown in Figure 7.

Secured to armature 55 in the plane of each set of contacts 50, 51, 52 and 53 and 50', 51', 52' and 53' are a pair of contact members 58 and 59 connected together by their securing rivets 60.

The contact members 58 have intermediate raised portions 61 of substantial length, said raised portions being constantly respectively engaged by the inner ends of the respective contact prongs 53, 53'. The contact members 59 have intermediate depending portions 62 of reduced length, said depending portions 62 being respectively engaged by the inner ends of the respective contact prongs 52, 52' only when the armature 55 is in its centered position. At their left end, as viewed in Figures 7 and 8, the contact members 58 and 59 have spaced resilient fingers 63 and 64 and at their right ends have spaced resilient fingers 65 and 66. When the armature 55 is rotated counter-clockwise, as viewed in Figure 7, the respective pairs of contacts 58, 59 engage the inner ends of the respective prongs 50 and 50', establishing connections respectively between prongs 53' and 50' and between 53 and 50. Similarly, when the armature 55 is rotated clockwise, connections are established between contacts 53' and 51' and 53 and 51. In the center position of the armature, connections are established between contacts 53' and 52' and between 53 and 52.

The lead wires from dipole 25, 25' are connected by suitable plug connectors to the prongs 52, 52'. The lead wires from dipole 26, 26' are similarly connected to prongs 51, 51' and the lead wires from dipole 27, 27' are similarly connected to prongs 50, 50'. The lead-in wires 23 and 24 are connected in a similar manner to the prongs 53, 53'.

At its opposite end, armature 55 carries a soft iron cap 67. Secured in the housing 47 on opposite sides of cap 67 are suitably shielded electromagnets 68 and 69. One terminal of each of said electromagnets is grounded to the shield thereof. The other terminals of the electromagnets are connected to the jacks of a dual female plug 70 secured in the end wall of housing 47. A suitable shielded two-conductor cable is provided having a male plug received in female plug 70. The wires of said cable, shown at 71 and 72 are connected to respective stationary contacts 73 and 74 in the receiver engageable by the switch arm 29. The cable shield is connected to the shields of electromagnets 69 and 68 and is grounded at the receiver.

With the channel-selecting switch arms 12 and 19 in the positions shown in Figure 1, switch arm 29 does not engage either of the contacts 73 or 74. The electromagnets are therefore both deenergized and armature 55 is in its centered position. Dipole 25, 25' is therefore connected to the lead in wires 23 and 24 in this first position of switch arms 12 and 19. When switch arms 12 and 19 are moved to their next channel-selecting positions, switch arm 29 engages contact 73, causing electromagnet 68 to be energized from the power supply 30. Armature 55 is therefore rotated clockwise, as viewed in Figure 7, opening the lead-in circuit at the contact depending portions 62 but closing a new circuit by the engagement of the resilient fingers 65, 66 with the respective prongs 51, 51'. This connects dipole 26, 26' to the lead-in wires 23, 24. When switch arms 12 and 19 are rotated to their third channel-selecting position, switch arm 29 engages contact 74, causing electromagnet 69 to become energized. This rotates armature 55 counterclockwise, as viewed in Figure 7, engaging the respective pairs of resilient fingers 63, 64 with the respective prongs 50, 50', and thereby connecting the dipole 27, 27' to the lead-in wires 23, 24.

It is thus seen that the action of selecting a channel at the receiver automatically operates the three-position relay armature 55 to connect the associated antenna element to the receiver lead-in wires.

Figure 8a shows a modified form of the three-position antenna selecting relay wherein the prong elements, shown respectively at 150', 151', 152' and 153' are removable, so as to be readily replaceable in case of wear. The armature 55 has secured thereto solid contact bars having respective end fingers 163 and 165. Said contact bars have upper raised portions 161 of substantial length and central depending contact lugs 162. The respective prongs are provided at their inner ends with resilient contact springs 164, 164. As shown in Figure 8a, the contact springs carried by prong 153' engage the raised portion 161. In the centered position of armature 55, the contact springs carried by prongs 152' engage the contact lug 162. When the armature is rotated by the energization of one or the other electromagnet, as above described, the circuit is broken at lug 162 and is closed either at fingers 165 or 163 by engagement with the springs 164, 164 carried by either prong 151' or prong 150'. The operation of the modification shown by Figure 8a is otherwise similar to the previously described form of the invention.

While certain specific embodiments of a multiple-element television antenna system and selector means therefor have been disclosd in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. In combination with a television receiver having a multi-position channel selector, an antenna system comprising a plurality of individual antenna elements, each element being associated with one of the channels selected by said channel selector, an electromagnetically-operated selector switch at said antenna system having a pair of movable contact members and respective pairs of stationary contacts connected to the respective antenna elements, a pair of lead-in conductors connecting said movable contact members to the input circuit of the receiver, and means at the receiver mechanically coupled to said channel selector for selectively energizing said selector switch responsive to the actuation of the channel selector.

2. In combination with a television receiver having a three-position channel selector, an antenna system comprising three individual antenna elements, each element being formed and arranged to receive with maximum efficiency one of the channels selected by said channel selector, a selector switch at the antenna system comprising a pair of movable contact members and three spaced pairs of stationary contacts selectively engageable by said movable contact members and connected to the respective antenna elements, means connecting the movable contact members to the input circuit of the receiver, means biasing said movable contact members into engagement with one set of stationary contacts, electromagnetic means for selectively moving said movable contact members into engagement with the remaining pairs of stationary contacts, and means at the receiver mechanically

coupled to said channel selector for selectively energizing said electromagnetic means.

3. In combination with a television receiver having a three-position channel selector, an antenna system comprising three individual dipoles, each dipole being formed and arranged for optimum reception of one of the channels selected by said channel selector, a three-position relay at said antenna system, the respective dipoles being connected to respective pairs of stationary contacts of said relay, the relay armature carrying a pair of contact elements selectively engageable with said pairs of stationary contacts, means connecting the said contact elements to the input circuit of the receiver, means biasing said armature to a position wherein said contact elements engage a first set of stationary contacts, a first magnet coil in said relay, a second magnet coil in said relay, and means at the receiver for selectively energizing said magnet coils, said latter means including a movable switch arm mechanically coupled to the channel selector and stationary contacts in the energizing circuits of the respective coils and engageable by said switch arm, the armature being movable responsive to the energization of the first magnet coil into a position wherein said pair of contact elements engage a second set of stationary contacts of the relay, and being movable responsive to the energization of said second magnet coil into a position wherein said pair of contact elements engage the third set of stationary contacts of the relay.

ARTHUR H. GUTSCHOW.
CHARLES R. REESE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,338,984	Hill	May 4, 1920
1,424,365	Loftin et al.	Aug. 1, 1922
1,450,038	Hill	Mar. 27, 1923
1,458,466	Crossley	June 12,1923
2,264,850	Koch	Dec. 2, 1941
2,272,431	Rankin	Feb. 10, 1942
2,438,116	Dodds et al.	Mar. 23, 1948

FOREIGN PATENTS

Number	Country	Date
568,747	Great Britain	Apr. 18, 1945

OTHER REFERENCES

"Radio" June 1939, pp. 9–13, 74 and 75; ibid., October 1938, pp. 42–44 and 76.