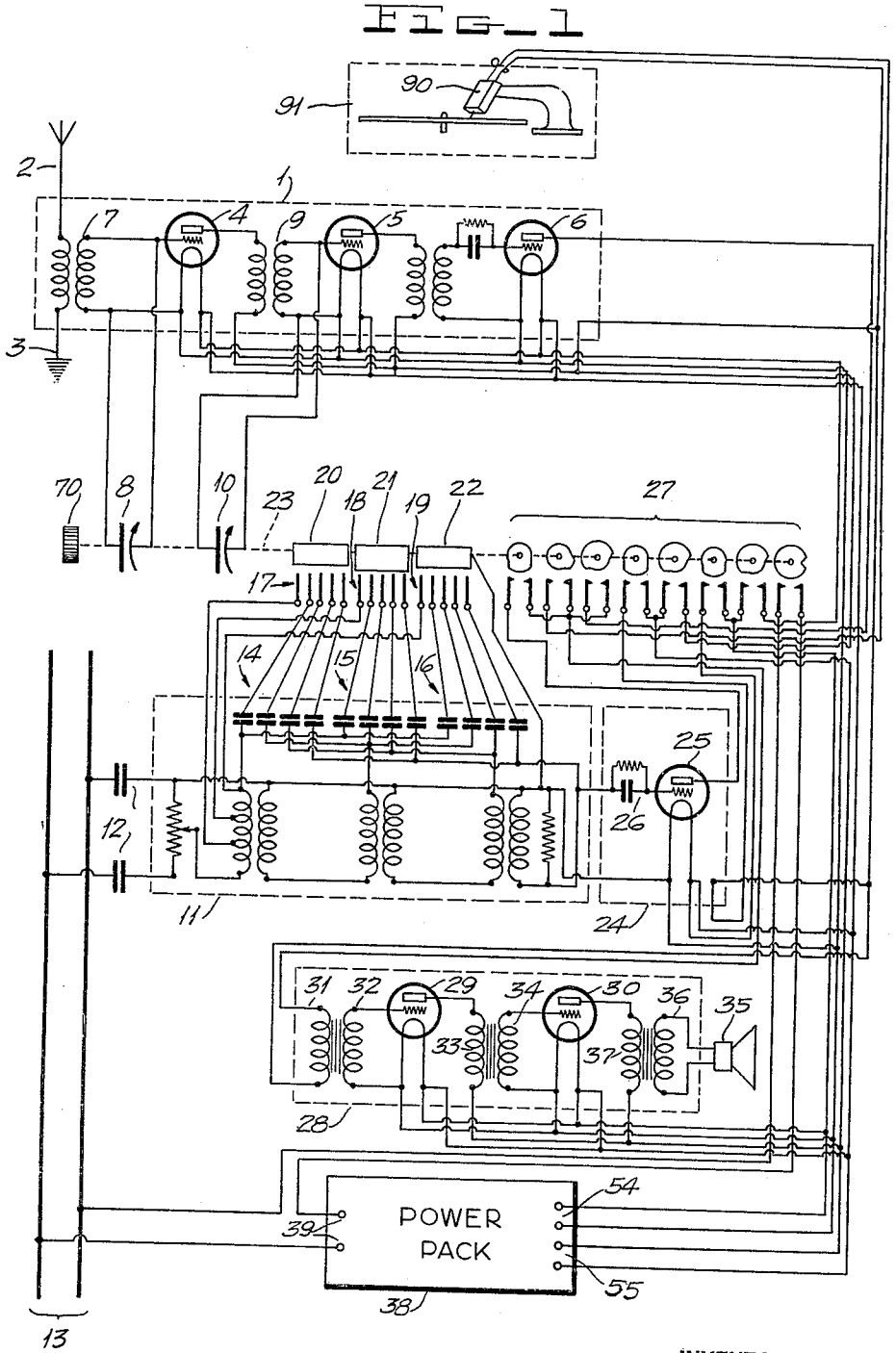
May 30, 1933. C. W. HOUGH 1,912,140

RADIO RECEIVER SYSTEM

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Fig. 1



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Fig. 2

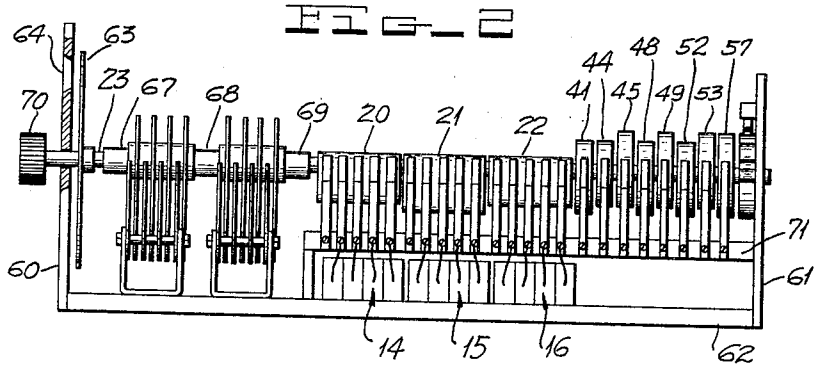


Fig. 3

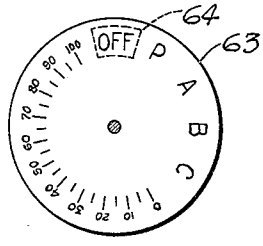


Fig. 4

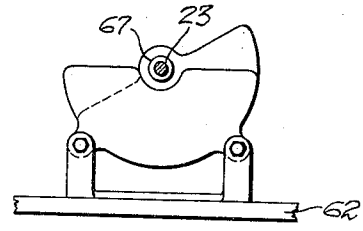


Fig. 5

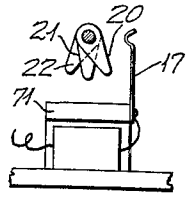


Fig. 6

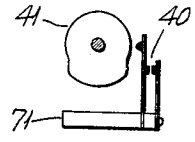


Fig. 7

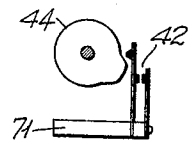


Fig. 8

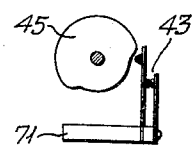


Fig. 9

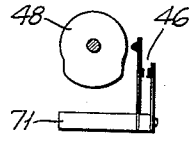


Fig. 10

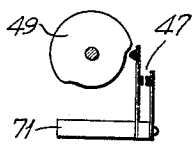


Fig. 11

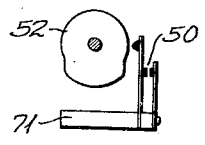


Fig. 12

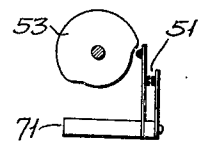


Fig. 13

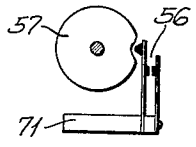
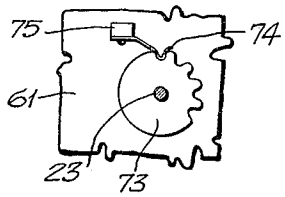


Fig. 14



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RADIO RECEIVER SYSTEM

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Fig. 15

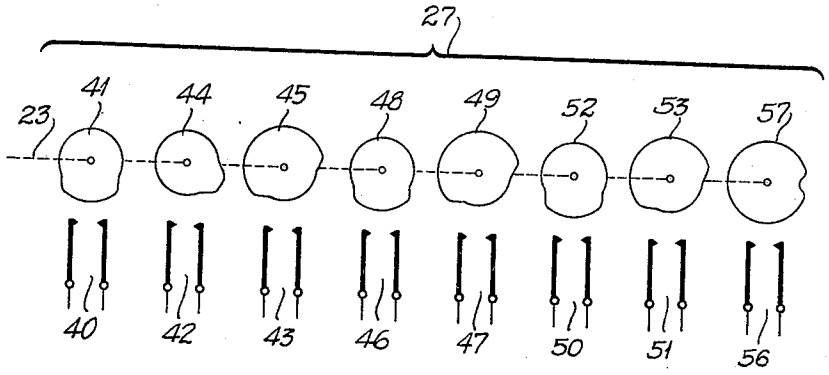


Fig. 16

DIAL READING	OFF	P	A	B	C	0 10 20 30 40 50 60 70 80 90 100						
DIAL POSITION	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°
CONTACTS 17												
" 18												
" 19												
" 40												
" 42												
" 43												
" 46												
" 47												
" 50												
" 51												
" 56												

PHONOGRAPH → WIRED RADIO ← SPACE RADIO →

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Patented May 30, 1933 1,912,140

UNITED STATES PATENT OFFICE

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RADIO RECEIVER SYSTEM

Application filed July 14, 1931. Serial No. 550,664.

My invention pertains in general to radio receivers and specifically relates to a radio receiver in which program signals can be derived from a plurality of sources.

The principal object of my invention consists in providing a radio receiver system for reproducing programs from a multiplicity of program sources.

Another object comprises providing a radio receiver system in which a space radio tuner, a wired radio filter, and an electrical phonograph pick-up device can all be selectively connected to a common audio frequency system.

A further object consists in producing a radio receiver system having a single movable element for effecting the entire control of an electrical organization for the selective reception of programs from a multiplicity of different sources.

I accomplish the above desirable objects in a novel radio receiver system having a single shaft upon which are mounted the rotor plates of a space radio tuning condenser system, the switch elements of a wired radio filter system, and the switching elements for selectively connecting an audio frequency amplifier system to a space radio tuner, to a wired radio filter, or to the electrical pick-up unit of a phonograph.

In the drawings which accompany and form a part of this specification and in which like reference numerals designate corresponding parts throughout:

Fig. 1 is a schematic diagram of the electrical organization of my radio receiver system;

Fig. 2 is an elevation of the mechanical arrangement of the control organization of my radio receiver system;

Fig. 3 is a view of an indicating dial employed in the organization of Fig. 1;

Fig. 4 is a view of condenser plates as employed in the organization of Fig. 1;

Fig. 5 is a view of the relative position of cams employed in the organization of Fig. 1;

Figs. 6 to 13 are views of different switches employed in the organization of Fig. 1;

Fig. 14 is a view of a clicker arrangement also employed in the organization of Fig. 1;

Fig. 15 is an enlarged view of a part of the diagram of Fig. 1; and

Fig. 16 is a graphical representation of the sequential relation of the switching operations in the control of the radio receiver system of my invention.

My invention is directed to providing a radio receiver system employing a centralized control for reception of space radio signals, wired radio signals, or for reproducing programs from recordings. According to my invention, I provide a single control unit in the form of a shaft having a multiplicity of elements mounted thereon for effecting the entire control of a radio organization for reproducing wired radio signals, space radio signals, or program recordings. In the system of my invention a single audio frequency amplifier system and loud speaker serves for the purpose of amplifying and reproducing programs from any of the before-mentioned sources.

Referring to the drawings in detail and particularly to Fig. 1, a space radio receiving organization 1 is provided with an antenna 2 and ground 3 for reception of space radio signals. The space radio receiving organization 1 includes space discharge amplifier tubes 4 and 5 and a space discharge detector tube 6. The input to the space discharge amplifier tube 4 includes a resonant circuit comprising the inductance 7 and variable condenser 8. The input to the space discharge amplifier tube 5 includes a resonant circuit comprising an inductance 9 and variable condenser 10. The variable condensers 8 and 10 have their rotor plates mounted upon a common shaft 23 described later. These condensers 8 and 10 can be adjusted to render the space radio receiving organization 1 responsive to a desired space radio program at any frequency. The high frequency signals amplified by the space discharge tubes 4 and 5 are demodulated by the space discharge detector tube 6.

A wired radio selective filter system 11 is capacitively connected, through coupling condensers 12, to power lines 13 which carry

commercial power and wired radio programs at a plurality of different carrier frequencies. The selective filter system 11 is of a type disclosed in the co-pending application of Robert D. Duncan, Jr., Serial Number 495,823, filed November 15, 1930, and patent of Arthur M. Trogner, 1,894,645, issued Jan. 17, 1933. The filter system 11 includes a plurality of inductively coupled resonant circuits each having a plurality of different values of capacitances which can be selectively rendered effective to make the filter system, as a whole, responsive to a predetermined carrier frequency. The related values of these capacitances are arranged in groups 14, 15, and 16 which have connections to groups of contact brushes 17, 18, and 19, respectively. These groups of contact brushes 17, 18, and 19 are adapted for engagement with metallic rams 20, 21, and 22, respectively. The cams 20, 21, and 22 are all electrically connected to one side of the filter circuit as shown. These cams are mounted upon the shaft 23 and are angularly displaced from one another so that the cams 20, 21, and 22 sequentially engage with their respective groups of contact brushes 17, 18, and 19. The output of filter 11 is directed to a demodulation device 24 comprising a space discharge detector tube 25 and grid leak and condenser 26.

An audio frequency amplifier 28 is provided including space discharge amplifier tubes 29 and 30. An iron core transformer is provided having a primary winding 31 and a secondary winding 32 which is connected to the input of the space discharge tube 29. Another iron core transformer comprising a primary winding 33 and a secondary winding 34 is provided between the two space discharge tubes 29 and 30 as shown. A translating device comprising a loud speaker 35 is connected to the secondary winding 36 of another iron core transformer having a primary winding 37 which is connected in the output circuit of the space discharge amplifier tube 30.

A power pact 38 is provided with input connections. from terminals 39, to the power lines 13. The power pact 38 comprises means for deriving anode voltage and filament current, for the operation of space discharge tubes, from commercial power lines and includes a thermionic rectifier associated with a suitable transformer in a well known arrangement. Filament current is available at the terminals 54 and anode voltage is available at the terminals 55. It will be understood that in the operation of my system negative grid biasing voltage is provided for the operation of the amplifier tubes. The biasing voltage connections, which are well known, are omitted for sake of simplicity in the figure.

Switching means 27 are provided under control of the shaft 23 and have a mechanical arrangement more fully described later. Fig. 15 is an enlarged view of the switching means 27 of Fig. 1. Referring to Fig. 15, the contact pair 40 is positioned for operation under control of a cam 41 mounted upon the shaft 23. The contact pairs 42 and 43 are positioned for operation under control of cams 44 and 45, respectively, also mounted upon the shaft 23. Contact pairs 46 and 47 are positioned for operation under control of cams 48 and 49 mounted on the shaft 23, while contact pairs 50 and 51 are positioned for operation under control of cams 52 and 53 mounted on the shaft 23. Another contact pair 56 is positioned for operation under control of another cam 57 mounted on the shaft 23.

The imput circuit to the terminals 39 of power pack 38 has connections to the contact pair 56 whereby cam 57, in effect, controls the operation of the power pack 38. One of the terminals 54 is connected to one contact of each of the contact pairs 50 and 51. The other of the terminals 54 is connected to all of the filaments of the space discharge tubes of my system. The remaining contact of contact pair 50 is connected to space discharge detector tube 25, while the remaining contact of contact pair 51 is connected to space discharge tubes 4, 5, and 6. It will be evident, then, that the contact pair 50 controls the filament current supply to space discharge detector tube 25, while the contact pair 51 controls the filament current supply to the space discharge tubes 4, 5, and 6.

One of the terminals 55 of the power pack 38 is connected to one contact each of the contact pairs 46 and 47. The other terminal 55 is connected to all of the space discharge tubes in my system. The remaining contact of the contact pair 46 is connected to the anode circuit of space discharge detector tube 25, while the remaining contact of the contact pair 47 is connected to the anode circuits of the space discharge tubes 4, 5, and 6. It will be evident, then, that the contact pair 46 controls the anode voltage to the space discharge tube 25, while the contact pair 47 controls the anode voltage to the space discharge tubes 4, 5, and 6.

The space discharge amplifier tubes 29 and 30 derive filament current and anode voltage directly from the power pack 38 as shown.

The anode of space discharge detector tube 25 is connected to one of the contacts of contact pair 40, while the anode of space discharge detector tube 6 is connected to one of the contacts of contact pair 43. The electrical pick-up device 90, of an automatic phonograph 91, has a connection to one of the contacts of the contact pair 42. The remaining contacts of the contact pairs 40, 42,

and 43 are all connected to one side of the primary winding 31 of the input transformer in the audio frequency amplifier system 28. The other side of the primary winding 31 is commonly connected to the anode or output circuits of the space discharge detector tubes 25 and 6, and also to the electrical pick-up device 90. It will now be evident that the contact pair 40 serves to connect the output circuit of space discharge detector tube 25 to the audio frequency amplifier system 28, while the contact pair 43 serves to connect the output circuit of the space discharge detector tube 6 to the amplifier 28, and the contact pair 42 serves to connect the electrical pick-up device 57 to the amplifier system 28.

The mechanical construction of the switching elements of my radio receiver system will now be considered.

The shaft 23 is journaled between the panel 60 and end support 61 mounted upon the base member 62. A dial 63 is rigidly mounted on the shaft 23 at a point adjacent the panel 60. An aperture 64 is provided in the panel 60 which registers with indicia engraved on the dial 63. This indicia comprises the designations "Off", "P", "A", "B", "C" and a plurality of radial lines extending approximately 180° around the dial as shown in Fig. 3. Fig. 4 is an end view of the rotor and stator plates of the variable condensers 8 and 10. Insulating bushings 67, 68, and 69 in the shaft 23 electrically separate the rotor plates of the variable condensers 8 and 10. A knob 70 is provided on the shaft 23 for effecting manual rotation thereof.

The metallic cams 20, 21, and 22 are mounted in tandem on the shaft 23 but are angularly displaced from each other for sequential engagement with the contact brushes 17, 18, and 19 as shown in Fig. 5. These contact brushes 17, 18, and 19 are secured to an insulating panel 71 mounted on spacers secured to the base member 62. The groups of condensers 14, 15, and 16 are positioned on the base member 62 directly below their respective contact brushes of the groups 17, 18, and 19.

The cams 41, 44, 45, 48, 49, 52, 53, and 57 are all composed of insulating material and mounted in tandem on the shaft 23 between the cam 22 and end support 61. These cams are all of special configuration for causing their respective contact pairs to close and open at predetermined times with respect to the rotation of the dial 63.

Fig. 6 shows the construction of cam 41 and the contact pair 40 mounted on insulating panel 71. The contact pair 40 comprises spring members, one of which presses against the periphery of the cam 41. When the projecting portion of the cam 41 engages with the aforementioned spring member, the contact pair 40 is electrically closed. The Figs. 7 to 13 show the construction of cams 44, 45, 48, 49, 52, 53, and 57 and the contact springs 42, 43, 46, 47, 50, 51, and 56, respectively, and are similar to the showing of Fig. 6 except for the configuration of the cams. In the position shown in Figs. 6 to 13 all of the contact pairs are open. This corresponds to a position of the dial 63 in which the designation "Off" registers with the index aperture 64 in panel 60. The exact time relation of the operation of all the elements mounted upon the shaft 23 with respect to the dial 63 may be ascertained from Fig. 16. The table of Fig. 16 shows the time relation of the switching operations for one rotation of the dial 63. The hatched portions of the table indicate the relative period during which a particular element operates to perform an electrical function in the circuits of my system. It will be understood that the configuration or formation of the cams 41, 44, 45, 48, 49, 52, 53, and 57 is such as to produce the operations as indicated in the table of Fig. 14.

A clicker disk 73 is rigidly mounted upon the shaft 23 adjacent the end support 61 and is provided with five peripheral indents corresponding to the position "Off", "P", "A", "B", and "C" of the dial 63. A detent spring 74 is mounted on a pillar 75 secured to the end support 61 and engages with the indents of the disk 73.

The base member 62 is intended to be incorporated in a radio cabinet which houses the electrical components diagrammatically depicted in Fig. 1. The entire operation of the radio receiver system as described in the foregoing can then be effected by the single manual control knob 70 in the following manner.

When the dial 63 is in a position showing the designation "Off" at the aperture 64, the power supply to the power pack 38 will be interrupted by the contact pair 56 under control of cam 57. If the dial 63 is rotated in a counter-clockwise direction to a position such that the designation "P" registers with the aperture 64, the cam 57 will cause the contact pair 56 to complete the input power supply circuit to the power pack 38 thereby energizing the audio frequency amplifying system 28. Simultaneously, the cam 44 will cause the contact pair 42 to connect the electrical pick-up device 90 to the audio frequency amplifier 28 whereby the translating device 35 will reproduce a desired program from a recording of the phonograph 91.

When the dial 63 is further rotated in a counter-clockwise direction until the designation "A" registers with the aperture 64, the cam 48 will cause the contact pair 46 to complete a circuit from the terminals 55 of the power pack to the anode circuit of the

space discharge detector tube 25 to supply anode voltage thereto. At the same time, the cam 52 will close the contact pair 50 to supply filament current to the space discharge detector tube 25. Simultaneously with the preceding operation, the cam 41 will close contact pair 40 which connects the output circuit of space discharge detector tube 25 to the input of the audio frequency amplifier 28. The cam 20 will engage with the group of contact brushes 17 whereby the wired radio filter system 11 will be responsive to a wired radio program at a predetermined carrier frequency which, demodulated by the space discharge tube 25, will be amplified by the audio frequency amplifier 28 and reproduced by the loud speaker 25.

Further movement of the dial 63 in a counter-clockwise direction will cause the designation "B" to register with the aperture 64 whereby the cam 20 will move out of engagement with the group of contact brushes 17 and the cam 21 will engage with the group of contact brushes 18 and the wired radio filter system 11 will then be responsive to a different program at another carrier frequency. The other circuit conditions in the immediately preceding steps will still prevail.

The dial 63 may be further moved in a clockwise direction to cause designation "C" to register with the aperture 64 whereby cam 22 will engage with the group of contact brushes 19 to cause the wired radio filter system 11 to be responsive to a still different wired radio program at another carrier frequency.

When the dial 63 is rotated into position such that the radial lines thereon begin to register with the aperture 64, the cam 41 will cause the contact pair 40 to move into an open position thereby disconnecting the output circuit of the space discharge detector tube 25 from the input of the audio frequency amplifier system 28. At the same time, the cam 48 will be moved into a position to open the contact pair 46, and the cam 49 will be in a position to close contact pair 47 thereby completing a circuit from the anode voltage terminals 55 to the anode circuits of the space discharge tubes 4, 5, and 6 to supply anode voltage thereto. Similarly, the cam 52 will open contact pair 50, and cam 53 will close contact pair 51 to complete a circuit to supply filament current to the space discharge tubes 4, 5, and 6. Simultaneously with the foregoing operations the cam 45 will close the contact pair 43 to complete a circuit from the output of space discharge detector tube 6 to the audio frequency amplifier system 28. The rotor plates of the variable condensers 8 and 10 will now be in mesh with the stator plates whereby the shaft 23 may be rotated for approximately 180° to tune the resonant circuits 7—8, and 9—10 to any desired space radio broadcast frequency, while maintaining the proper circuit conditions for the operation of the space radio receiver organization 1. Space radio signals at any selected frequency will then be amplified by the space discharge amplifier tubes 4 and 5 and demodulated by the space discharge detector tube 6. The output of space discharge detector tube 6 is directed through the audio frequency amplifier system 28 and thence to the loud speaker 35 for program reproduction. The dial 63 can now be rotated to any desired position for space radio reception, wired radio reception, or for reproduction of programs from recordings, or the entire radio receiving system can be shut down by turning the dial to the "Off" position.

It will now be obvious that the system of my invention provides a unified radio receiver in which a single manual knob effects the control of an electrical organization for the reception and reproduction of programs from a plurality of different sources. Although I have shown a preferred embodiment of my invention I do not wish to be limited thereto except insofar as may be pointed out in the appended claims.

What I claim as new and original and desire to secure by Letters Patent of the United States is:

1. A radio receiver system comprising, a space radio receiving organization having variable condensers therein, a wired radio receiving organization having fixed condensers therein, a plurality of switches for rendering selected ones of said fixed condensers effective in said wired radio receiving organization, and a single mechanical element for controlling said variable condensers and said switches.

2. A radio receiver system comprising, a space radio receiver organization having variable condensers, a wired radio filter system having a plurality of fixed condensers, a plurality of switching elements for rendering selected groups of said fixed condensers effective in said filter, and mechanical means for simultaneously moving said variable condensers and said switching elements.

3. A radio receiver system comprising, a radio receiving organization having variable condensers therein, a second radio receiving organization having fixed condensers therein, switching elements for rendering said fixed condensers effective in said second radio receiving organization, a translating device and circuit connected thereto, a switch for connecting said circuit to either of said radio receiving organizations, and common mechanical means for controlling the operation of said variable condensers, said switching elements, and said last mentioned switch.

4. A radio receiver system comprising, a

space radio receiving organization having condenser plates mounted upon a shaft, a wired radio filter system having fixed condensers controlled by means mounted upon said shaft, an amplifier system and a switch controlled by said shaft for connecting said amplifier system to said space radio receiving organization or to said wired radio filter.

5. A radio receiver system comprising, a space radio receiving organization having variable condensers mounted on a shaft, a wired radio filter system having contact members operated by cams mounted in tandem on said shaft, an electrical pick-up device, an audio frequency circuit, switching means for connecting said audio frequency circuit to said pick-up device, to said space radio receiving organization, or to said wired radio receiving organization, and cams mounted on said shaft for operating said switching means.

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