

June 25, 1940.

J. C. BATCHELOR  
ENTERTAINMENT RECEIVER

2,205,461

Filed Aug. 13, 1937

2 Sheets-Sheet 1

Fig. 1

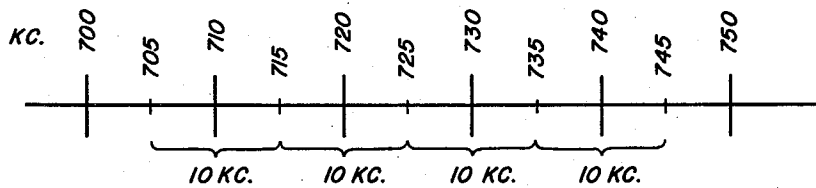
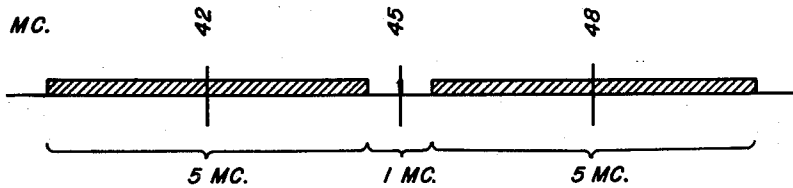


Fig. 2



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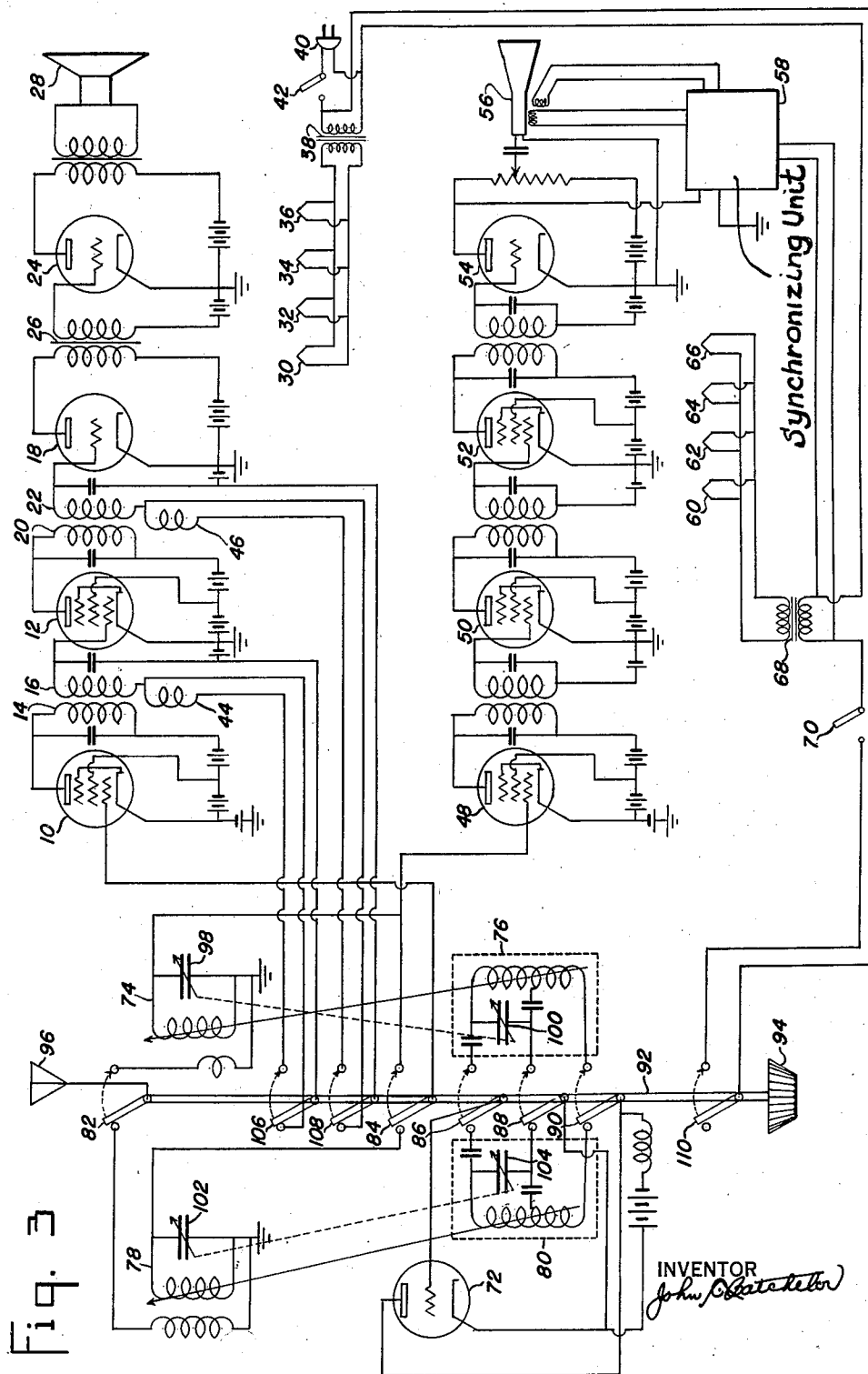
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2 Sheets-Sheet 2



## UNITED STATES PATENT OFFICE

2,205,461

## ENTERTAINMENT RECEIVER

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Application August 13, 1937, Serial No. 158,868

3 Claims. (Cl. 250—20)

My invention relates to improvements in methods of communication.

An object of my invention is the provision of an improved method of communication particularly useful in connection with television reception, whereby, for example, it is possible to use the same sound receiver for reception at the receiving station of only the sound programs transmitted over a long wave or broadcast band of frequencies, as is used for reception of the television sound accompaniment when the television receiving apparatus is being used, the action being such that high fidelity reproduction of the television sound accompaniment is obtained when the television apparatus is being used, without the occurrence of objectionable cross-talk in the common sound receiver when the latter is adjusted to receive only broadcast sound entertainment.

Other objects and advantages will hereinafter appear.

For the purpose of illustrating my invention, an embodiment thereof is shown in the drawings, in which

Figures 1 and 2 are simplified, graphical illustrations explanatory of the principle underlying my improved method; and

Figure 3 is a simplified, diagrammatic showing of combined television and sound receiving apparatus constructed and operating in accordance with my improved method.

In Figure 1 is shown a portion of the present radio broadcast spectrum from 700 to 750 kilocycles, the longer vertical lines designating a series of radio broadcast stations separated by a frequency spacing of 10 kilocycles. Assuming, for example, that the station having a carrier frequency of 720 kilocycles has its carrier modulated by a maximum audio frequency of 5,000 cycles per second, the portion of the radio frequency spectrum which will be occupied by that station will be the range from 715 to 725 kilocycles, and will have a width, as indicated by the bracket, of 10 kilocycles. Similarly, the station whose carrier-frequency is 730 kilocycles, will occupy the upper adjacent band of 10 kilocycles, and consequently, for satisfactory reception, a receiver must embrace completely the 10 kilocycle channel whose center is at 720 kilocycles, but must exclude substantially completely frequencies in the channel whose center is at 730 kilocycles. Thus, the band to be accepted for satisfactory performance is constrained to a band width of 10 kilocycles, corresponding to a modulation-frequency of 5,000 cycles per second.

The allocation provided for by the Federal Communications Commission, however, permits a measure of departure from the requirements as indicated by this arrangement of the spectrum. For example, a station will be assigned the frequency of 720 kilocycles in a given location, and the adjacent channels of 710 and 730 kilocycles will be assigned only to stations geographically remote from the station having the 720 kilocycle carrier, so that the stations at 710 and 730 kilocycles will not deliver a high-intensity signal in the service area of the 720 kilocycle station. For this reason, experience has shown that the 720 kilocycle station may successfully use modulation frequencies up to 8,000 cycles per second, and this entire band of frequencies may be received successfully in its principal service area. Even in this instance, however, serious monkey-chatter will exist in receivers which lie in the marginal zone of the service area of the 720 kilocycle station, and consequently, constraint of the accepted channel to a width of approximately 10 kilocycles, corresponding to a modulation frequency of 5,000 cycles per second, is desirable.

From this discussion, it will be evident that in my improved entertainment receiver, which I shall describe in detail later, the most satisfactory results will be realized when the receiver is designed to accept, in the portion of the spectrum indicated in Figure 1, a channel which is limited to a width of not more than 16 kilocycles, corresponding to a maximum modulation frequency of 8,000 cycles per second.

In a second mode of operation of my receiver, it is desirable to have a tuning range covering a band of frequencies in the television spectrum, a portion of which is indicated in Figure 2. With a station separation in this region of 6 megacycles, two representative carriers are indicated by the longer vertical lines at 42 megacycles and 48 megacycles. With a maximum image frequency of 2.5 megacycles, the width of the video channels will be 42 plus or minus 2.5 megacycles and 48 plus or minus 2.5 megacycles. Thus, the upper side band of the 42 megacycle carrier will approach the lower side band of the 48 megacycle carrier to within one megacycle of frequency spacing, leaving a clear one megacycle channel for service as a guard band, in the center of which may be located the audio frequency carrier at 45 megacycles. Having an available channel of one megacycle in which to place the sound transmission, and this channel having as its only other function the provision of sufficient spacing between stations to allow adequate discrimination

between adjacent stations by the receiver tuning circuits, it may be seen that it is relatively immaterial whether side bands about the 45 megacycle channel are 5 kilocycles or 20 kilocycles; in the first instance, the percentage of the guard band used is only one percent, and in the second instance it is four percent. Either of these values represents a relatively insignificant encroachment upon the guard band.

In view of this disposition of the carriers in the television spectrum, it may be seen that the entire audible range of frequencies up to, for example, 20,000 cycles per second, may be used to advantage in the transmission of sound accompaniment for television transmission. For this reason, the accepted channel of audio frequencies will to advantage have a width as great as 40 kilocycles or, in the example of Figure 2, may occupy the spectrum at 45 megacycles plus or minus 20 kilocycles.

In Figure 3 of the drawings is shown, in a simplified way, a complete receiving station for television accompanied by sound, and which operates in accordance with my improved method to obtain the advantage explained.

In the drawings, the sound receiver at the receiving station is shown as comprising a first detector tube 10, an intermediate-frequency amplifier tube 12 coupled to the first detector tube through a transformer comprising a primary winding 14 and a secondary winding 16, a second detector tube 18 coupled to the preceding stage through a transformer comprising a primary winding 20 and a secondary winding 22, an audio frequency amplifier tube 24 coupled to the second detector stage through a transformer 26, and a loud speaker 28 supplied from the output circuit of the audio stage. The cathode heaters for the tubes 10, 12, 18 and 24 are designated by the reference numerals 30, 32, 34 and 36, respectively, and are supplied from a power transformer 38 which is energized from a power line through a plug 40 when the main switch 42 is closed.

In the sound receiver, the transformer coils 14 and 16 are loosely coupled with respect to each other, and the transformer coils 20 and 22 are loosely coupled with respect to each other to render the sound receiver capable of sharp tuning over the long wave band of frequencies substantially embracing the broadcast band from 500 to 1500 kilocycles.

For the purpose of expanding the width of the audio frequency band utilized by the sound receiver, auxiliary coils 44 and 46 may be used, in which case the coil 44 is connected in series with the secondary coil 16 and the coil 46 is connected in series with the secondary coil 22, in the manner hereinafter explained. The coil 44 is tightly coupled with respect to the primary coil 14 and the coil 46 is tightly coupled with respect to the coil 20. With the coils 44 and 46 connected in circuit and being thereby effective, the width of the audio frequency band utilized by the sound receiver is substantially greater than 8,000 cycles per second.

The television receiver is shown as comprising a first detector tube 48, the output circuit of which is coupled to the two-stage intermediate-frequency amplifier including the amplifier tubes 50 and 52, a second detector tube 54 coupled to the output of the intermediate-frequency amplifier, and a cathode ray tube 56 and associated synchronizing unit 58 controlled from the output circuit of the second detector stage.

The cathode heaters of the tubes 48, 50, 52 and 54 are designated by the reference numerals 60, 62, 64 and 66, respectively, and are supplied from a power transformer 68 which also supplies power to the synchronizing unit 58 as shown. The input circuit to the transformer 68 is controlled by a switch 70.

The reference numeral 72 designates an oscillator. For reception of television and the accompanying sound, a tuner 74 and an oscillating circuit 76 are used. For reception only of sound transmitted over the long wave or broadcast band of frequencies from 500 kilocycles to 1500 kilocycles per second, a tuner 78 and an oscillating circuit 80 are used. To provide for selection between the two tuners, single-pole double-throw switches 82, 84, 86, 88 and 90 are used, the movable elements of these switches being fixed on a common shaft 92 which is rotated by a control knob 94.

From the foregoing description, it will be seen that for television and sound reception on the short-wave band, the control knob 94 is rotated to throw the switches to their right-hand position, whereby the short-wave tuner 74 is connected to the antenna 96 and the oscillating circuit 76 is associated with the oscillator 72. The tuning condenser 98 of the tuner 74 and the tuning condenser 100 of the oscillating circuit 76 are mechanically connected through a common shaft, as represented, and the oscillating circuit 76 is coupled to the tuner 74, as also represented.

For reception of sound only over the long wave or broadcast band from 500 to 1500 kilocycles, the control knob 94 is rotated to move the switches to their left-hand position, whereby the broadcast tuner 78 is connected to the antenna 96 and the oscillating circuit 80 is associated with the oscillator 72. The tuning condenser 102 of the tuner 78 and the tuning condenser 104 of the oscillating circuit 80 are mechanically connected through a common shaft, as represented, and the oscillating circuit 80 is coupled to the tuner 78, as also represented.

Fixed also on the common control shaft 92 are the poles of single-pole double-throw switches 106 and 108 which operate through the connections shown, and when in the left-hand position for reception of sound only over the long wave or broadcast band of frequencies, to connect in the circuit only the transformer secondaries 16 and 22, the auxiliary windings 44 and 46 being out of circuit and ineffective. The width of the audio frequency band utilized by the sound receiver will now be limited to substantially less than 8,000 cycles per second.

With all the switches in the right-hand position for reception of television and the accompanying sound, the switches 106 and 108 will operate through the connections shown to connect the auxiliary coils 44 and 46 in circuit. In this way, the width of the audio frequency band utilized by the sound receiver for reproduction of the sound transmitted over the short-wave band, is expanded to substantially greater than 8,000 cycles per second.

Also associated with the common control shaft 92 is a single-pole single-throw switch 110 connected in series with the control switch 70 and which is closed only when the knob 94 is turned to the right for combined television and sound reception. It will therefore be seen that in the left-hand position of the switches for sound reception over the broadcast band, the power supply

to the television receiver is automatically disconnected.

From the foregoing example, it will be seen that as a result of my improved method of operation, it is possible to use the same sound receiver for satisfactory reception at the receiving station of only the sound programs transmitted over the long wave band of frequencies, as is used for reception of the television sound accompaniment when the television receiving apparatus is being used. The action is entirely automatic, and is such that high fidelity reproduction of the television sound accompaniment is obtained when the television apparatus is being used, without occurrence of objectionable cross-talk in the common sound receiver when the latter is adjusted to receive only broadcast sound entertainment.

While but one specific example of a way to practice my invention has been disclosed, it will be understood that the desired operating action for the purpose explained can be obtained in other ways without departing from the spirit of my invention or the scope of the claims.

I claim as my invention:

1. The method of communication utilizing a common receiver for selective reproduction at a receiving station of sound transmitted over a long-wave band of frequencies substantially embracing the band from 500 kilocycles per second to 1500 kilocycles per second and over a short-wave band of frequencies embracing frequencies over 40 megacycles per second, which comprises limiting to substantially less than 8,000 cycles per second the width of the audio frequency band utilized by the common receiver for reproduction at the receiving station of the sound transmitted over the long-wave band, and expanding to substantially greater than 8,000 cycles

per second the width of the audio frequency band utilized by the common receiver for reproduction at the receiving station of the sound transmitted over the short-wave band.

2. The method of communication utilizing a common receiver for selectively reproducing sound transmitted over a relatively low frequency band containing sound signals only, said sound signals having uniformly spaced carrier waves, and over a relatively high frequency band containing both sight and sound signals, which comprises limiting the width of the audio frequency band utilized by said receiver to a frequency substantially less than the spacing between said carriers of said sound signals in the low frequency band when said receiver is used on said low frequency band, and expanding the width of the audio frequency band utilized when said receiver is used on said high frequency band to a width substantially greater than said carrier spacing frequency.

3. An entertainment receiver comprising a sound reproducing system and an image reproducing system, selector means for selectively rendering said sound reproducing system operative in a first band of frequencies containing sound signals only and for rendering said sound reproducing system and said image reproducing system operative in a second band of frequencies containing both sound and image signals, and fidelity controlling means combined with and adapted to be actuated with said selector means to constrain the audio frequency band utilized by said sound reproducing system when said selector means is adjusted to said first band to a value substantially less than that utilized when said selector means is adjusted to said second band.

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