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PUSH BUTTON TUNER FOR RADIO RECEIVERS

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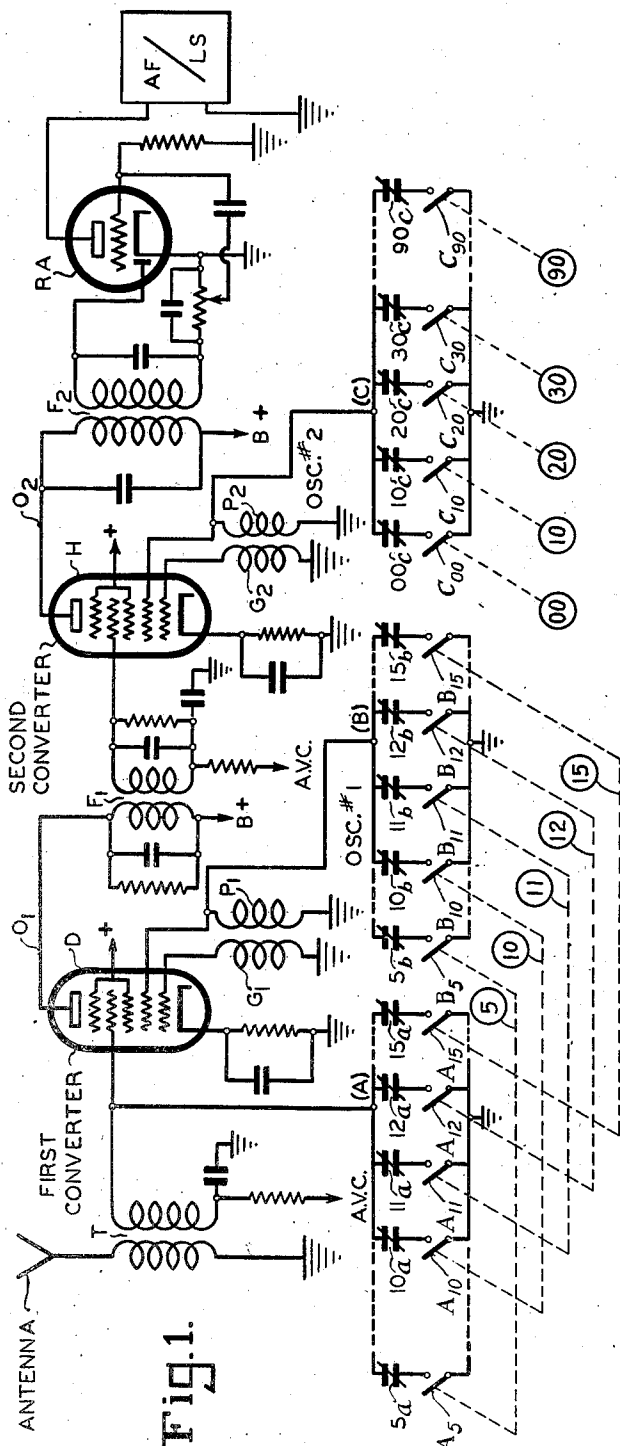


Fig. 1.

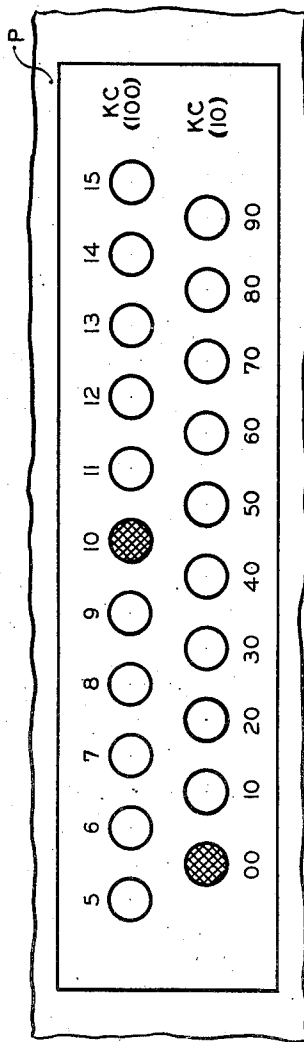


Fig. 2.

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PUSH-BUTTON TUNER FOR RADIO
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11 Claims. (Cl. 250—40)

The present invention relates in general to a push-button tuner for radio receivers.

More specifically, it relates to a push-button operated receiver which permits the selection of any 10 kc. channel in a given band by means of push-buttons, the total number of which is considerably less than the number of channels contained in the band. For example, any 10 kc. channel in the broadcast band, 550 to 1550 kc., which contains 100 such channels, may be selected by means of only 21 push-buttons.

With present day push-button receivers there are usually provided from about five to ten push-buttons for tuning in the more popular stations and an additional button for conditioning the receiver to be under control of the variable tuning condenser whereby other desired stations may be tuned in.

In accordance with the present invention the customary variable tuning condenser is dispensed with, as are also the tuning indicator dial and the parts associated with the condenser and dial for actuating the same. The tuning operation in the receiver according to the invention is accomplished by the selective connection of one of a plurality of semi-fixed condensers across a coil, or the selective connection of one of a plurality of coils across a condenser, or by the selective connection of both a coil and a condenser simultaneously.

It is therefore one of the objects of the invention to provide a receiver which is operated solely by push-buttons to select any 10 kc. channel in the broadcast, short-wave or other bands.

Another object of the invention is to provide a receiver the circuit of which utilizes a plurality of frequency converters, the oscillator portions of which and the input to the receiver being tuned by the selective connection therein of a capacitor, a coil, or both.

Another object of the invention is to provide a receiver utilizing, for example, a double conversion superheterodyne circuit in which the number of "hundreds" kc., that is, 5 to 15, for the broadcast band, is determined by the band of frequencies to which the receiver input is tuned and by the frequency to which the oscillator of the first converter is tuned and by the band of frequencies passed by the tuned circuits between the 1st and 2nd converters, and the number of kc. in "tens" from 0 to 90 is determined by the frequency to which the oscillator of the 2nd converter is tuned and by the frequency to which the circuits following the 2nd converter are tuned.

Other objects of the invention are to improve

generally the simplicity and efficiency of push-button receivers so that not only would they be reliable in operation but capable also of economical manufacture and assembly.

The novel features characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and mode of operation together with further objects and advantages thereof, will best be understood by reference to the following description taken in connection with the accompanying drawing in which

Fig. 1 is a diagrammatic showing of the receiver circuit, and Fig. 2 is a view showing the push-button arrangement in the front panel of the receiver.

Referring now particularly to Fig. 1 the circuit for illustrative purposes is shown to be of the double-heterodyne or double-conversion type. Radio signals picked up by the antenna Ant. are transferred through the radio frequency transformer T to the signal input grid of the first converter tube D which may be a pentagrid or other suitable type. If amplification is desired before conversion a suitable amplifier may be interposed between transformer T and the converter. Connected across the secondary of the input transformer T is a bank (A) of semi-fixed condensers numbered 5a to 15a, each of which has one of its terminals connected to the high potential end of the transformer secondary and to the signal grid of the converter, the other terminals of said condensers being connected each by way of a separately actuated switch, shown at A₅, A₁₀, A₁₁, etc., to ground or the low potential end of the transformer secondary. The values of the several condensers of this bank are so chosen that each thereof in conjunction with the transformer secondary will constitute a tuned circuit which will pass a band of frequencies occupying a range of approximately 100 kc. at different spectrums of the received band. Hereinafter this frequency range as well as others utilized in other parts of the receiver will be referred to as 100 kc. wide. It should be understood, however, that this range is approximate and may be more or less than 100 kc.

The first and second grids of the first converter are coupled in the conventional manner by the grid coil G₁ and the feed-back coil P₁ to constitute the first oscillator. In shunt to the feed-back coil there is connected a second bank (B) of semi-fixed condensers numbered 5b to 15b, each of which has one of its terminals connected to the high potential end of the coil P₁,

the other terminals of said condensers being connected each by way of a separately actuated switch, shown at B₅, B₁₀, B₁₅, etc., to ground or the low potential end of the feed-back coil. The values of the several condensers of bank (B) are so chosen that the oscillator will produce a series of frequencies, with a 100 kc. separation between adjacent oscillator frequencies.

The corresponding switches of the banks A and B, as for example, A₅—B₅, A₁₀—B₁₀, etc., are adapted to be uni-controlled as indicated by the dotted lines connecting them. The uni-controlled connections are identified by the numbers 5 to 15 enclosed in circles, the circle signifying in each case that the corresponding pair of uni-controlled switches is adapted to be controlled by a push-button and the number representing the channel frequency in "hundreds" of kc. that the receiver will be tuned to upon operation of a particular push-button.

As shown in the table below, the selective operation of the switches in bank A to connect one of the condensers 5a to 15a will tune the input to the first converter to allow in each case a pass band of 100 kc. to be transmitted. For example, operation of the switch A₅ connects the condenser 5a into circuit and the carrier-frequencies from 500 to 590 kc. will be passed to the input grid of the first converter. Since the modulation frequencies of the first carrier-frequency of 500 kc. included in the band for switch A₅ extend on either side of said carrier, between 495 and 505 kc., and the modulation frequencies of the last carrier-frequency of 590 kc. of this band extend on either side of said carrier, between 585 and 595 kc., the entire band of frequencies that will be passed by the input circuit to the first converter will be from 495 to 595 kc. or a band of frequencies 100 kc. wide. Operation of the switch A₁₀ connects the condenser 10a into circuit and the carrier-frequencies from 1000 to 1090 kc. or a frequency band 100 kc. wide will be passed to the first converter, etc. Similarly, the selective operation of the switches B₅ to B₁₅ in the bank B will tune oscillator #1 of the first converter in steps of 100 kc. from 3500 kc. for switch B₅ to 4500 kc. for switch B₁₅.

	(A)		(B)	O ₁		(C)	O ₂
	Kc.		Kc.	Kc.		Kc.	Kc.
A ₅ ----	500-590	B ₅ ----	3,500	2,910-3,000	C ₀₀ ----	2,545	365-455
A ₆ ----	600-690	B ₆ ----	3,600		C ₁₀ ----	2,535	375-465
A ₇ ----	700-790	B ₇ ----	3,700		C ₂₀ ----	2,525	385-475
A ₈ ----	800-890	B ₈ ----	3,800		C ₃₀ ----	2,515	395-485
A ₉ ----	900-990	B ₉ ----	3,900		C ₄₀ ----	2,505	405-495
A ₁₀ ----	1,000-1,090	B ₁₀ ----	4,000		C ₅₀ ----	2,495	415-505
A ₁₁ ----	1,100-1,190	B ₁₁ ----	4,100		C ₆₀ ----	2,485	425-515
A ₁₂ ----	1,200-1,290	B ₁₂ ----	4,200		C ₇₀ ----	2,475	435-525
A ₁₃ ----	1,300-1,390	B ₁₃ ----	4,300		C ₈₀ ----	2,465	445-535
A ₁₄ ----	1,400-1,490	B ₁₄ ----	4,400		C ₉₀ ----	2,455	455-545
A ₁₅ ----	1,500-1,590	B ₁₅ ----	4,500				

As mentioned above corresponding switches for banks A and B are controlled in unison so that in each case the resulting intermediate frequency, the range between 2910 and 3000 kc., will appear in the output circuit O₁ of the converter D.

It is to be noted that only the tuned circuit or circuits ahead of the 1st converter determine what band of frequencies reaches the converter and this band is 100 kc. wide. The particular 100 kc. band of frequencies reaching the 1st converter will be determined by which push-button is depressed to tune the R. F. circuits, and the signal frequency it is desired to receive will be included in the band so selected. The 1st con-

verter simply increases the frequency of all signals reaching its grid by an amount determined by the oscillator frequency which is in turn determined by the push-button depressed. By design, the band of frequencies passed from the 1st converter to the 2nd converter is 100 kc. wide and is the same band of frequencies for all push-buttons.

The band-pass filter F₁ in the output of the first converter is of known construction and is effective to pass the entire band of intermediate frequencies from 2910 to 3000 kc. to the signal control grid of the second converter H which may also be of the pentagrid type.

The first and second grids of this converter, as in the first converter, are coupled by way of coils G₂ and P₂ to constitute oscillator #2. Connected in shunt across the oscillator feed-back coil P₂ is a third bank C of condensers numbered 00c, 10c, 20c to 90c each of which has one of its terminals connected to the high potential end of the coil P₂, the other terminals of said condensers being connected each by way of a separately actuated switch, shown at C₀₀, C₁₀, C₂₀, etc., to ground or the low potential end of the feed-back coil. The values of the several condensers of this bank are so chosen that the second oscillator is adapted to operate at the frequencies indicated in the above table, from 2545 kc. for condenser 00c to 2455 kc. for condenser 90c, there being a 10 kc. separation between adjacent oscillator frequencies.

The beat frequencies resulting from the interaction between any one of the frequencies generated by oscillator #2 and the first intermediate band of frequencies 2910 to 3000 kc. will appear in the output O₂ of the second converter, the values being indicated in the column under O₂, it being noted that the beat frequencies in each case occupy a band 100 kc. wide. Connected between the output of the second converter and the demodulator of the diode-triode tube RA is a second I. F. transformer F₂ tuned to an intermediate frequency of 455 kc., the value commonly chosen as the I. F. frequency in receivers of the superheterodyne, although any other I. F. frequency may be chosen if desired. As a consequence only a frequency of that value will be transmitted to the demodulator and audio amplifier tube RA, it being noted that the 455 kc. intermediate frequency is common to the several I. F. frequency ranges. If desired the audio frequency may be further amplified and then reproduced in the usual way through a loudspeaker, the block AF/LS representing the latter elements.

In Fig. 2 there is shown the front panel P of the receiver and a possible arrangement of the push-buttons, the push-buttons 5 to 15 in one row being adapted to control the switches A₅ to A₁₅ and B₅ to B₁₅ in banks A and B, respectively, and the push-buttons indicated 00 to 90 in another row being adapted to control respectively the switches C₀₀ to C₉₀ in bank C.

Assuming now that it is desired to tune in a station operating at the channel frequency of 1000 kc., the button 10 in the top row representing the number of "hundred" kc. and the button 00 in the lower row representing the number of kc. in "tens" would be depressed. As a result the condenser 10 associated with the switch A₁₀ in bank A will be connected across the input transformer secondary to tune the same so that it will accept a frequency band between 1000 and 1090 kc. Simultaneously therewith the condenser

10_b associated with the switch B₁₀ in bank B will cooperate with the feed-back coil of oscillator #1 to produce a frequency of 4,000 kc. The intermediate frequency resulting therefrom, as will be the case for any of the other buttons 5 to 15, will be the range of frequencies between 2910 and 3000 kc. The condenser 00c connected across the feed-back coil of oscillator #2, as a result of the operation of button 00, will cause the oscillator portion of the second converter to operate at a frequency of 2545 kc. The mixing of this frequency with the band of frequencies passed by the band-pass filter F₁ will result in the frequency range from 365 to 455 kc. being present in the output of the second converter. However, since the second I. F. network F₂ is tuned to pass only a frequency of 455 kc., the selected value for the intermediate frequency of the receiver, the other frequencies in the band will be attenuated, so that only the carrier-frequency of the desired station, namely, 1000 kc., will be demodulated and then amplified in the remaining portion of the receiver. Similarly, any combination of push-buttons in the first and second rows will produce the desired signal frequency in the output of the receiver. It will be understood of course that only one push-button in each row may be operated at any one time, the usual arrangement in push-button receivers being employed to effect a release of a previously operated push-button upon actuation of a different push-button.

While the above described embodiment of the invention involves the selective switching in of condensers in each of the banks A, B and C, it will be understood of course that the same result is obtainable by the selective switching in of coils, preferably permeability tuned, or of a coil and condenser combination.

Although the invention has been described with reference to the broadcast band, it is to be understood that the invention may be applied to cover other bands, such as short-wave Mc bands, by utilizing a third converter and a third row of push-buttons for tuning the circuits associated therewith in a manner similarly to that described in connection with the first converter.

While there have been shown and described certain preferred embodiments of the invention, it will be understood that modifications and change may be made without departing from the spirit and scope of the invention, as will be understood by those skilled in the art.

What I claim is:

1. The method of operating a radio receiver to select any 10 kc. carrier modulated channel within a given band of signal modulated radio carrier frequencies, which consists in receiving a narrow band of said frequencies which contains a plurality of 10 kc. channels including the desired channel, mixing said band of frequencies with a locally produced frequency to produce a narrow band of intermediate frequencies, which latter band is the same for any selected 10 kc. channel in the given band of frequencies, mixing said band of intermediate frequencies with a second locally produced frequency to produce a second narrow band of intermediate frequencies, which second band is the same for certain groups of 10 kc. channels and different for certain other 10 kc. channel groups, and selecting from said second band of frequencies a single frequency which contains the signal modulations of the desired 10 kc. channel.

2. The method of operating a radio receiver to

select any 10 kc. carrier modulated channel within a given band of signal modulated radio carrier frequencies, such as the broadcast band, by means of several banks of push-buttons, one bank representing the number of "hundred" kc. and another bank representing the number of kc. in "tens," which consists in the selective operation of one of the push-buttons of the "hundred" kc. bank and the selective operation of one of the push-buttons in the "tens" bank, said first selective operation resulting in the reception of a narrow band of frequencies which contains a plurality of 10 kc. channels including the desired channel and in the mixing of said band of frequencies with a locally produced frequency to produce a narrow band of intermediate frequencies, which latter band is the same for any selected 10 kc. channel in the given band of frequencies, the second selective operation resulting in the mixing of said band of intermediate frequencies with a second locally produced frequency to produce a second narrow band of intermediate frequencies, which second band is the same for certain groups of 10 kc. channels and different for certain other 10 kc. channel groups, and selecting from said second band of frequencies a single frequency which contains the signal modulations of the desired 10 kc. channel.

3. A radio receiver comprising a first frequency converter, a first set of reactors selectively operated to impress upon the input of said converter a narrow range of modulated radio carrier frequencies, a second set of reactors selectively operated to tune the oscillator portion of the first converter to a frequency such that the latter will mix with said frequency range applied to the converter input to produce a narrow range of intermediate frequencies, a second frequency converter, means for impressing said range of intermediate frequencies onto the input of the second converter, a third set of reactors selectively operated to tune the oscillator portion of the second converter to a frequency which will mix with the range of intermediate frequencies to produce a band of frequencies of substantially constant width, adjacent such bands being in overlapping relation and the several bands containing a common frequency, means for selecting said common frequency, and means for demodulating, amplifying and reproducing said common frequency.

4. A receiver according to the invention defined in claim 3 wherein the several sets of reactors are constituted by condensers.

5. A receiver according to the invention defined in claim 3 wherein the several sets of reactors are constituted by coils.

6. A receiver according to the invention defined in claim 3 wherein the several sets of reactors are constituted by coil and condenser combinations.

7. A radio receiver comprising first and second frequency converters, a first set of selectively operated reactors each of which is adapted to tune the input of the first converter to accept a different frequency range, a second set of selectively operated reactors each of which is adapted to tune the oscillator portion of the first converter to a frequency such that the latter will mix with each different frequency range applied to the converter input to produce the same range of intermediate frequencies, means for impressing said range of intermediate frequencies onto the input of the second converter, a third set of selectively operated reactors each of which is adapted to tune the oscillator portion of the sec-

ond converter to a frequency which will mix with the range of intermediate frequencies to produce a band of frequencies of substantially constant width, adjacent such bands being in overlapping relation and the several bands containing a common frequency, means for selecting said common frequency, and means for demodulating, amplifying and reproducing said common frequency.

8. A radio receiver as defined in claim 7 wherein the several sets of reactors are constituted by condensers and wherein a push-button controls the operation of corresponding condensers of the first and second sets, and another push-button controls the operation of each condenser in the third set.

9. A radio receiver as defined in claim 7 wherein the several sets of reactors are constituted by permeability-tuned coils and wherein a push-button controls the operation of corresponding coils of the first and second sets, and another push-button controls the operation of each coil in the third set.

10. A radio receiver comprising first and second frequency converters, a first set of semi-fixed condensers which are adapted to be selectively switched to tune the input of the first converter to accept different frequency ranges, a second set of semi-fixed condensers which are adapted to be selectively switched to tune the oscillator portion of the first converter to a frequency such that the latter will mix with each different fre-

quency range applied to the converter input to produce the same range of intermediate frequencies, means for impressing said range of intermediate frequencies onto the input of the second converter, a third set of semi-fixed condensers which are adapted to tune the oscillator portion of the second converter to a frequency which will mix with the range of intermediate frequencies to produce a band of frequencies of substantially constant width, adjacent such bands being in overlapping relation and the several bands containing a common frequency, means for selecting said common frequency, and means for demodulating, amplifying and reproducing said common frequency.

11. A radio receiver operated solely by push-buttons comprising a first row of push-buttons representing "hundreds" of kc. and a second row of push-buttons representing "tens" of kc., a first converter network under the control of the selective operation of any one of the push-buttons of the first row, and a second converter network under the control of the selective operation of any one of the push-buttons of the second row, said networks being so constructed and arranged that the frequency desired to be received is determined by the operation of one of the buttons in the first row and one of the buttons in the second row.

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