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Smith

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[54] **SWITCHABLE BAND PASS-BAND REJECT FILTER APPARATUS**

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[52] **U.S. Cl.** ..... **333/76**, 333/79, 333/28 T

[51] **Int. Cl.** **H01h 7/10**

[58] **Field of Search** ..... 333/28 T, 76, 79

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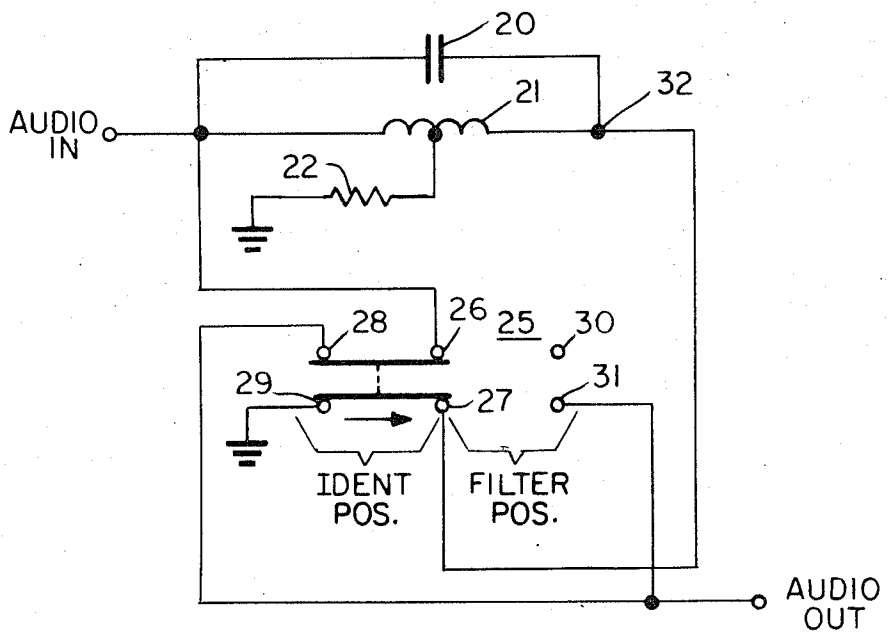
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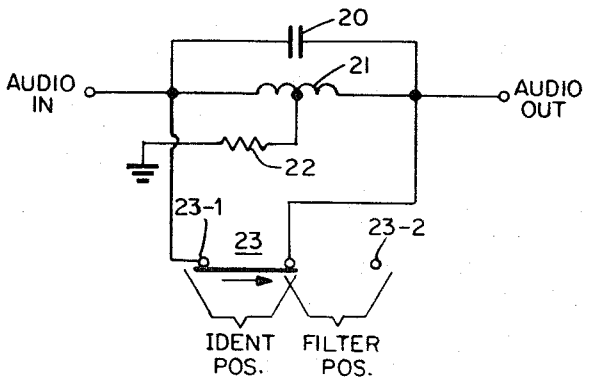
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[57] **ABSTRACT**

A frequency selective circuit switchable to provide alternately a band reject or band pass response, comprising a filter circuit connected to a double pole double throw switch so that in a first position a frequency band is attenuated while frequencies above and below the center of the band are passed, and in a second position a band about the same center is passed with a sharp drop-off in response both above and below the pass-band.

3 Claims, 3 Drawing Figures





PRIOR ART

Fig. 1

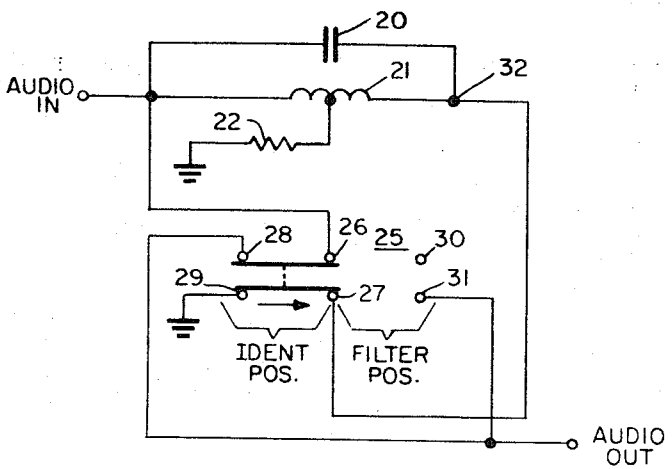
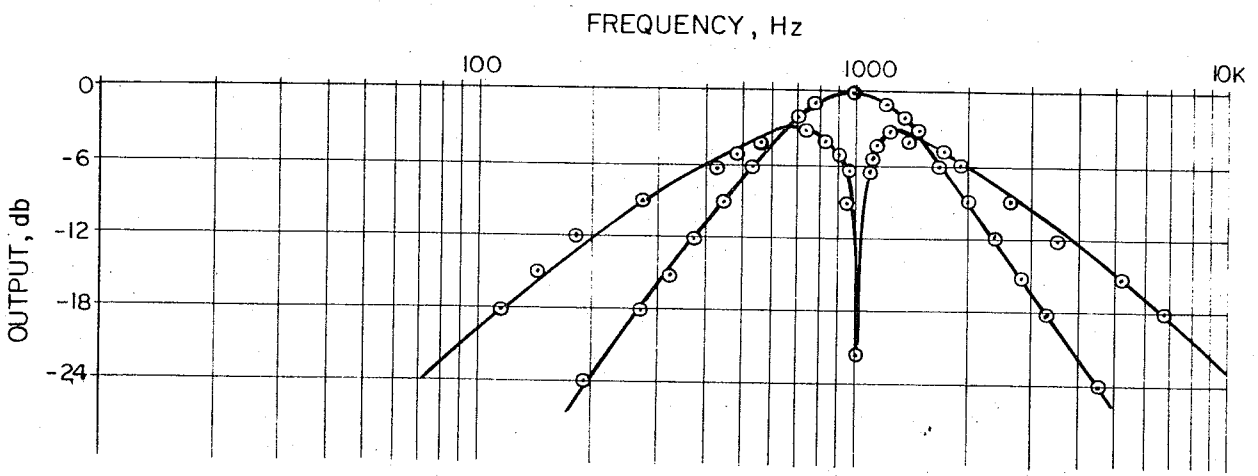


Fig. 2

Fig. 3



SWITCHABLE BAND PASS-BAND REJECT FILTER APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention lies in the field of frequency selective circuits and, more particularly, a switchable band reject - band pass arrangement providing sharp high frequency drop-off when in the band pass mode.

2. Description of the Prior Art

There is a great need in navigation receivers for a simple, reliable and inexpensive arrangement for passing an omni IDENT signal while rejecting interfering high frequencies, and alternately rejecting the IDENT signal while passing audio voice signals. In conventional omni aircraft navigation, omni bearing information is transmitted at 30 Hz and 9,960 Hz, an IDENT signal identifying the station is transmitted at 1,020 Hz, and voice communication is transmitted approximately within the range of 350 to 2,500 Hz. The 30 Hz and 9,960 Hz bearing signals are each at 30 percent carrier modulation, as is the voice signal, while the IDENT signal is at 5 percent modulation. The 30 Hz and 9,960 Hz signals are filtered out and processed to provide bearing information. The IDENT signals and voice signals are passed through an audio amplifier and are used to drive a suitable electrical/audio transducer, so that the pilot may hear the IDENT signal and thus identify the omni station, or hear any voice communication being broadcast simultaneously with the bearing information. However, having once identified the station, the pilot normally desires to suppress the IDENT signal, and for this reason there is generally provided a notch type filter which can be switched in or out of the audio path, to reject or pass the IDENT signal.

The problem with this above arrangement is that when the notch filter is not in, such that the IDENT signal comes through, the high frequency signal from the 9,960 subcarrier also gets through, and even though it is attenuated relative to the IDENT signal, since it carries 6 times as great a modulation, it produces considerable interfering noise. This problem has persisted for many years, to the constant irritation of pilots. The technology of radio circuits has, of course, developed to the point where a great number of different solutions to this problem can be presented. However, what is desired is not just any uneconomical solution, but a simple solution involving a minimum change of the present design to achieve the improved performance. A simple solution is one which would require a minimum number of additional components, and which would not necessitate design changes in the preceeding or following portions of the overall circuitry. Further, it would be of great advantage if the achievement could be accomplished by merely changing or replacing a single component, since this would enable quick and inexpensive modification of existing apparatus.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a two position circuit switchable to provide alternately a band pass response centered about a given center frequency and having sharp attenuation of higher frequencies, and a band reject filter suitable for passing frequencies on each side of such center frequency.

It is a further object of this invention to provide the circuit as stated above, and which is accomplished with a minimum modification of the prior art arrangement, and which is simple and reliable.

In accordance with the above objectives, there is provided a T filter having frequency selective components, the input and output of such T filter being connected to the input terminals of a double pole double throw switch, such arrangement providing a band pass filter with sharp high frequency roll-off, or rate of attenuation, when the switch is in a first position, and a band reject filter when the switch is in a second position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a circuit diagram of a typical IDENT filter as used in the prior art.

FIG. 2 shows a circuit diagram of the switchable filter arrangement of this invention.

FIG. 3 shows a graph representing the output frequency response of the arrangement of this invention corresponding to the two positions of the switch, as derived from test data obtained by passing a modulated omni carrier through a receiver containing said arrangement.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The circuit of this invention can best be understood by first making reference to the prior art arrangement as shown in FIG. 1. A simple T filter is shown, having a capacitor 20 and inductor 21 connected in parallel between the audio input terminal and the audio output terminal. The parallel combination is resonant at the desired frequency, which is 1,020 Hz for the IDENT signal. The inductor 21 is center tapped and connected therefrom through a resistance 22 to ground. A single pole double throw switch is used, having the center pole terminal connected to the audio output. Terminal 23-1 is connected to the audio input terminal, and terminal 23-2 is unconnected. In the IDENT position, the pole terminal of the switch is connected to terminal 23-1, such that the capacitor is short circuited, and the IDENT signals are passed from the input terminal to the output terminal. However, when in the filter position, there is no switch connection modifying the filter performance, such that the center frequency is attenuated. It is to be noted that in this arrangement, when in the IDENT position, the filter arrangement as such provides essentially no drop-off in response for frequencies above the IDENT frequency, such that the 9,960 omni subcarrier is passed appreciably unattenuated. In receivers using this prior art arrangement the high frequency roll-off is the same whether in the IDENT or filter position.

Referring to FIG. 2, it is seen that the prior art circuit is modified by the simple but novel and highly effective change of replacing the single pole switch with a double pole IDENT switch 25, which in the circuit of this invention is connected as illustrated. The same T filter is used, with the audio input terminal being tied to a first pole terminal 26 of switch 25, and the opposite filter terminal 32 being connected to the other pole terminal 27. Terminal 31 and terminal 28 are both connected to the audio output terminal; terminal 29 is connected to ground; and terminal 30 is unconnected.

For the arrangement of the circuit of this invention as described above and illustrated in the drawings, it is seen that when switch 25 is placed in the filter position, the basic T filter comprising elements 20, 21 and 22 is

unaffected by the switch, and the notch response labeled F in FIG. 3 is attained. This is the same response as is obtained by the circuit of FIG. 1, when in the filter position. Substantial attenuation is obtained at the center frequency with the response arising very quickly on each side of the center frequency. Further, it is seen that, except for the notch, the response is down less than 6 db between the frequencies of 350 to 2,500 Hz, corresponding to the voice frequencies. Thus, with the switch 25 in the filter position, the voice frequencies are passed with little attenuation, whereas the IDENT signal is greatly attenuated. The drop-off, or roll-off for frequencies lower and higher respectively than this range is not great, but it is sufficient since there is little interference from the 30 Hz and 9,960 Hz signals due to the fact that the voice modulation is as high as that of the bearing signals.

When switch 25 is placed in the IDENT position, it is seen that terminal 26 is connected to terminal 28, and the audio input terminal is connected directly through the audio output terminal. However, as contrasted to the arrangement of FIG. 1, the filter output (terminal 32) is connected to ground, such that there is a high frequency path to ground through capacitor 20. For this reason, there is an increased roll-off of high frequency signals, as compared to the roll-off when in the filter position. This is illustrated in FIG. 3, as seen in the slope of the IDENT curve, marked I, as compared to the filter curve. In comparison with the prior art circuit of FIG. 1, the 9,960 Hz output signal is reduced by 15 db or more when the switch is in the IDENT position. Thus, when listening to the IDENT, there is substantially improved high frequency rejection, enabling the listener to more quickly, easily and accurately identify the station which has been tuned in by the receiver. It is to be noted that this has been accomplished with a minimum change in the circuit and minimum number of additional parts. In fact, the novel improvement incorporates simply replacing a single pole switch with a two pole switch, and making the proper connections to and from the two pole switch as illustrated in FIG. 2.

While the circuit as described above has been illustrated as having particular use in navigation receivers, it is understood that it may, within the scope of this invention as claimed, be employed in any application where the characteristics as shown in FIG. 3 are useful.

I claim:

1. A switchable filter circuit, for providing a band rejection response and a band pass response, comprising:
   a. a frequency selective circuit, having an input terminal and an output terminal, which frequency selective circuit has a band reject characteristic;
   b. a double pole double throw switch, having a pair of input terminals connected to said frequency selective circuit input and output terminals respectively;
   c. an audio input terminal connected to said frequency selective circuit input terminal, and an audio output terminal; and
   d. when said switch is in a first position said frequency selective circuit output terminal is connected to said audio output terminal, and when said switch is in said second position said frequency selective circuit output terminal is connected to a ground reference and said frequency selective circuit input terminal is connected to said audio output terminal.

2. A switchable frequency selective circuit, for providing a band rejection response and a band pass response, comprising:
   a. a band rejection frequency selective circuit having an input and an output;
   b. an input terminal connected to said frequency selective circuit input, and an output terminal;
   c. switch means, connected to said frequency selective circuit, and having a first position where said switch means connects said frequency selective circuit to said output terminal such that the overall circuit response is that of the frequency selective circuit, and a second position wherein said switch means connects said output of said frequency selective circuit to a ground reference so as to provide a band pass response with a high frequency roll-off.

3. The apparatus as described in claim 2, wherein said switch means is a double pole double throw switch.

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