May 24, 1960 J. H. VOGELMAN 2,938,177

APPARATUS FOR SEPARATING A LARGE FREQUENCY BAND INTO A PLURALITY OF SUB-BANDS

Filed June 9, 1958

FIG. 1.

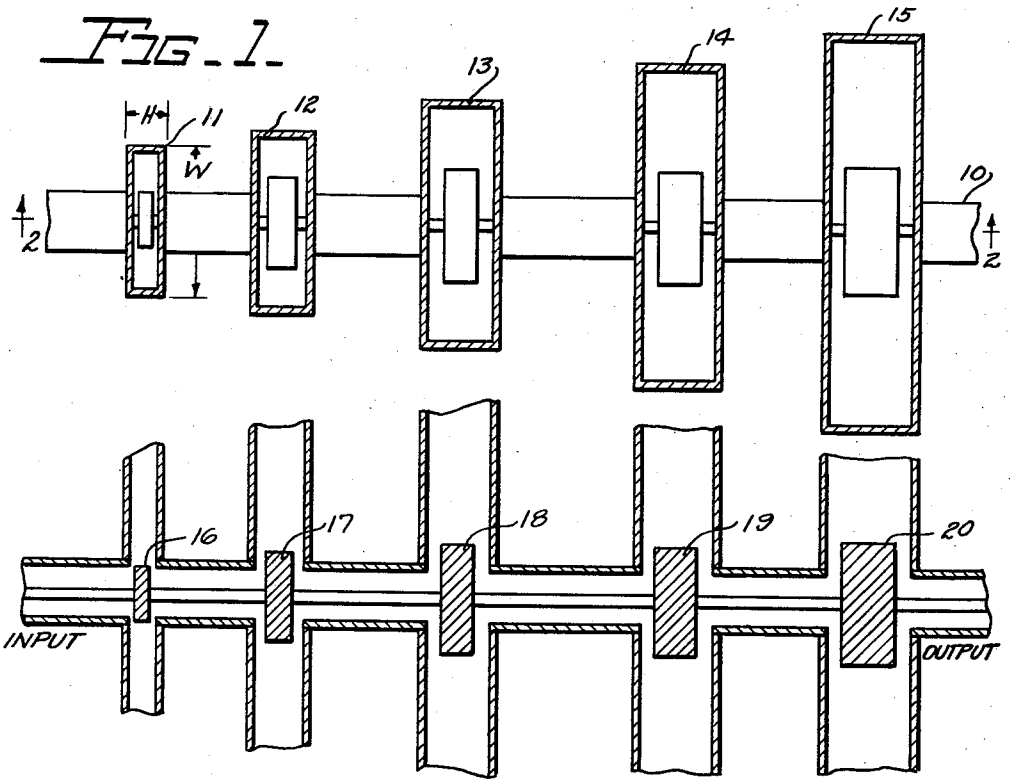


FIG. 2.

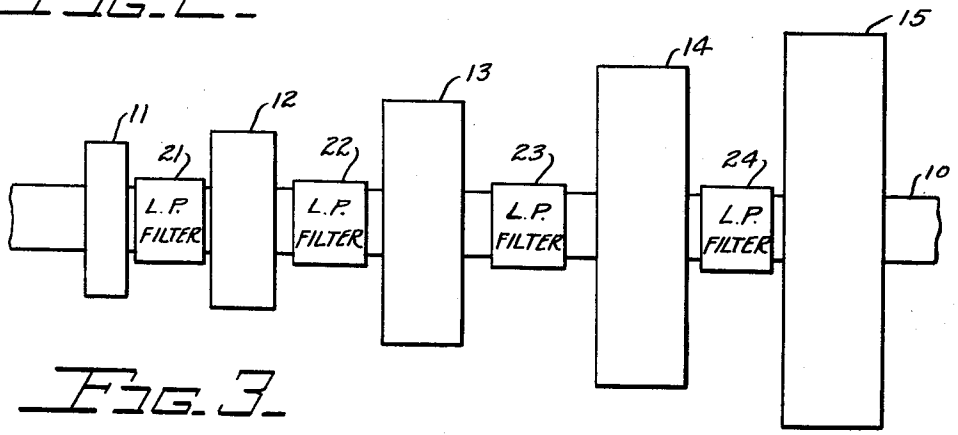


FIG. 3.

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United States Patent Office 2,938,177 Patented May 24, 1960

2,938,177

APPARATUS FOR SEPARATING A LARGE FREQUENCY BAND INTO A PLURALITY OF SUB-BANDS

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Filed June 9, 1958, Ser. No. 740,981

4 Claims. (Cl. 333—9)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the United States Government for governmental purposes without payment to me of any royalty thereon.

This invention relates to an apparatus for separating a large frequency band into a plurality of sub-bands.

One object of the invention is to provide an apparatus, for separating a large frequency band into discrete sub-bands, with a low insertion loss.

A further object is to provide an apparatus, for separating a large frequency band into a plurality of sub-bands, which requires fewer elements than prior art devices.

These and other objects will be more fully understood from the following detailed description taken with the drawing wherein:

Fig. 1 shows a coaxial transmission line having a plurality of output wave guides coupled thereto.

Fig. 2 is a sectional view along the line 2—2 of Fig. 1.

Fig. 3 shows the system of Fig. 1 with low pass filters inserted between the wave guides.

Referring more particularly to Fig. 1 of the drawing, reference numeral **10** refers to a coaxial transmission line having a plurality of wave guides **11–15** coupled thereto. The height H of the wave guide is selected for impedance matching and power handling capacity and the width W is selected to provide an appropriate cutoff wave length for the sub-bands to be separated from the large frequency band. Each of the wave guides **11–15** is constructed to have a different cutoff in accordance with the particular desired sub-band widths. Impedance matching elements **16–20**, consisting of either a dielectric or metallic disk are provided in each wave guide. Each of the matching structures is designed to couple maximum energy of the sub-band into the wave guide in which it is inserted. The spacing between the wave guides is adjusted so that a match is seen at the input of the coaxial line structure for all frequencies in the total band and a match is seen between wave guides **11** and **12** in the coaxial line for all frequencies of the over-all band excluding those in the sub-band of wave guide **11** and this is repeated for each wave guide coaxial combination. The wave guides are arranged so that the cutoff frequency for wave guide **11** is higher than for wave guide **12**, wave guide **12** is higher than for wave guide **13**, etc., then signals above the cutoff **11** will be received at the output of wave guide **11**, signals above cutoff at wave guide **12** will be received at the output of wave guide **12**, etc., and signals below the cutoff frequency of the last wave guide will be received at the output of the coaxial transmission line.

To sharpen the cutoff conditions between the wave guides, low pass filters **21–24** may be included in the coaxial line between the wave guides, as shown in Fig. 3. These filters may be of the type shown in the patent to Reed, 2,762,986. Impedance matching structure may also be included within the sections to improve the over-all performance.

There is thus provided an apparatus for separating a large frequency band into a plurality of sub-bands with a low insertion loss and which requires fewer elements than prior art devices.

While certain specific embodiments have been described in some detail, it is obvious that numerous changes may be made without departing from the general principles and scope of the invention.

I claim:

1. An apparatus for separating a large frequency band into a plurality of sub-bands, comprising: a coaxial transmission line; a source for supplying said large frequency band; a plurality of wave guides spaced along said coaxial transmission line, each having a different width, to thereby provide a different cutoff wave length; said wave guides being coupled to said transmission line progressively in order of increasing width away from said source; the height of each of said wave guides being selected for impedance matching and power handling capacity; said wave guides having an impedance matching section of said transmission line located between each pair of wave guides to thereby provide an impedance match at the input of said transmission line for all frequencies in the total band and means within each of said wave guides for matching the impedance of the transmission line with that of the wave guide.

2. An apparatus for separating a large frequency band into a plurality of sub-bands, comprising: a coaxial transmission line; a source for supplying said large frequency band; a plurality of wave guides spaced along said coaxial transmission line, each having a different cutoff wave length, coupled to said transmission line progressively in order of increasing cutoff wavelength away from said source; the height of each of said wave guides being selected for impedance matching and power handling capacity and the width being selected for the appropriate cutoff wave length; said wave guides being spaced along said transmission line to provide an impedance match at the input for all the frequencies in the total band; means within each wave guide for matching the impedance of the transmission line with that of the wave guide; and a low pass filter located in the coaxial transmission line between each pair of wave guides; said filters having a bandpass for all frequencies below that which is coupled to the preceding wave guide.

3. An apparatus for separating a large frequency band into a plurality of sub-bands, comprising: a coaxial transmission line; a source for supplying said large frequency band; a plurality of wave guides spaced along said coaxial transmission line, each having a different cutoff wave length, coupled to said transmission line progressively in order of increasing cutoff wavelength away from said source; the height of each of said wave guides being selected for impedance matching and power handling capacity and the width being selected for the appropriate cutoff wave length; said wave guides being spaced along said transmission line to provide an impedance match at the input for all the frequencies in the total band and means within each wave guide for matching the impedance of the transmission line with that of the wave guide.

4. An apparatus for separating a large frequency band into a plurality of sub-bands, comprising: a coaxial transmission line; a source for supplying said large frequency band; a plurality of wave guides spaced along said coaxial transmission line, each having a different width, to thereby provide a different cutoff wave length; said wave guides being coupled to said transmission line progressively in order of increasing width away from said source; the height of each of said wave guides being selected for impedance matching and power handling capacity; said wave guides having an impedance matching section of said

transmission line located between each pair of wave guides to thereby provide an impedance match at the input of said transmission line for all frequencies in the total band; means within each of said wave guides for matching the impedance of the transmission line with that of the wave guide and a low pass filter located in the section of transmission line located between pairs of wave guides, said filters having a bandpass for all frequencies below that which is coupled to the preceding wave guide.

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