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BAND STOP FILTER FOR ELECTROMAGNETIC WAVES

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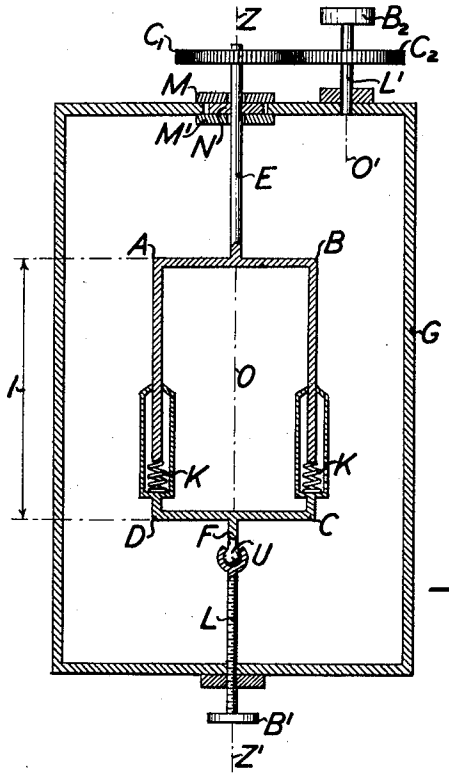


Fig. 1

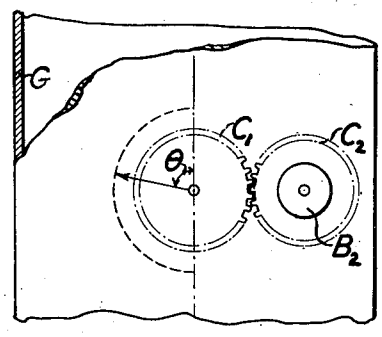


Fig. 2

Fig. 3a

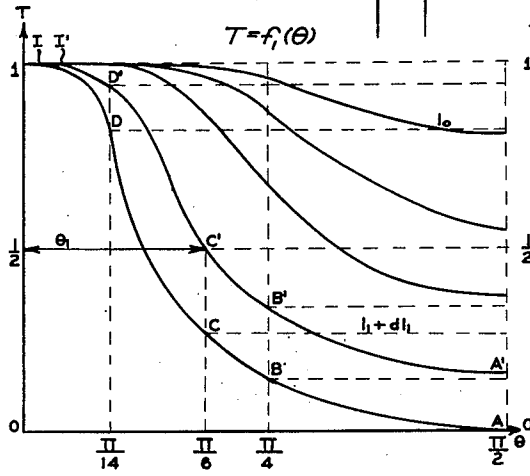
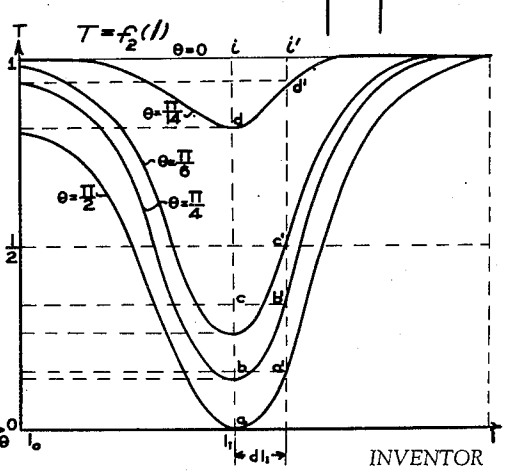


Fig. 3b



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AGENTS

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BAND STOP FILTER FOR ELECTRO-MAGNETIC WAVES

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8 Claims. (Cl. 178—44)

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This invention relates to band stop filters for electromagnetic waves propagated in the interior of a dielectric conductor and has for its object the provision of an apparatus which, arranged in a conductor of any shape traversed by a suitable wave, permits the transmission of electromagnetic waves over a definite width of band embracing a fixed frequency to be stopped, whilst fully ensuring the transmission of the other frequencies. The width of band passing through the filter determines the selectivity of the filter.

The invention consists essentially in arranging in the interior of the conductor a conductor frame the section and the angular setting or orientation of which may be modified as desired from the exterior, means for adjusting the section and the orientation being, furthermore, provided.

The invention will be readily understood by reference to the accompanying drawings which give by way of example one method of carrying the invention into effect. The example of the application of the invention described relates to the case of conductors of rectangular section traversed by a wave of the H_{01} type, but it will be appreciated by any one skilled in the art that the invention may be adapted to other types of conductors and waves.

In the drawings:

Figure 1 illustrates in elevation and in section an apparatus constructed in accordance with the present invention;

Figure 2 is a plan view of Figure 1; and

Figures 3*a* and 3*b* are are transmission curves of a conductor provided with an apparatus constructed in accordance with the invention; the curve in Figure 3*a* is drawn corresponding to the angle of orientation of the frame and the curve in Figure 3*b* is drawn corresponding to the length of the frame.

Referring to the drawings, a conductor frame of rectangular profile ABCD is arranged in the interior of the conductor G (Figures 1 and 2). The longitudinal axis of the frame is coaxial with longitudinal symmetrical axis ZOZ' of the upright section of the conductor. The frame is carried by rods E and F arranged coaxially with the said axis ZOZ'. The upper rod E is provided with a disc N, of a thickness corresponding to that of the wall, and confined, with a certain lateral play, between two other bored discs M and M' between which it can rotate and slide slightly. The lower rod F is provided with a terminal swivel joint U fitted in a spherical recess carried by the extremity of a threaded rod L constituting an extension of the rod F, and screwing into and through the wall of the conductor G where it terminates outside in a knob B_1. The length of the frame may be made variable by telescoping the lower part of the frame (which may be made of a hollow tube) over the upper fixed part. This sliding action is effected without any change in the orientation of the plane of the frame by means of the threaded screw actuated through the medium of the knob B_1. A spring K, arranged in the interior of the sliding tube, connects the lower and upper parts of the frame, and permits of a displacement corresponding to the threaded length of the screw L.

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The whole of the frame as far as the spherical head U is rotatable about the axis thereof by means of the two toothed wheels C_1 and C_2. The wheel C_2 is rotatable about an axis O' through the medium of a rod L' connected to a knob B_2 and is operable to rotate the wheel C_1 which is connected to the rod E. The angle of rotation of the knob B_1 which can be read on a scale, denotes the length l of the frame. The angle of rotation of the knob B_2, also indicated on a dial, enables the angle θ from the normal of the plane of the frame with the propagation axis of the conductor to be determined.

The indications read on the scales of the said length and angle, together with the curves of variation of the coefficient of transmission corresponding with the angle of the frame or its length, are employed to determine according to the values chosen, the corresponding coefficient and the band width or, conversely, to determine the angle and the length according to the coefficient of transmission and the width of band desired.

The value of the coefficient of transmission of a wave H_{01} of frequency N and wavelength may be determined as a function of l and of θ and there may be traced either the curves $T=f_1(\theta)$ with l as parameter, or the curves $T=f_2(l)$ with θ as parameter.

There are obtained the two groups of curves of the Figures 3*a* and 3*b*. In Figure 3*a*, θ_1, stands for the angle orientation of the frame when $l=l_1+dl_1$ and $T=\frac{1}{2}$. And in Figure 3*b*, l_0 stands for the minimum distance AD when the upper part of the frame extends as far as possible into the hollow tubes of the lower part of the frame and the springs are most compressed.

Assuming that the frame is tuned at l_1 in resonance on the frequency N of wave λ, if l is maintained at l_1 curve $T=f_1(\theta)$ will be that marked l_1 on Figure 3*a* passing through points

ABCDI. On Figure 3*b* the corresponding points will be *abcdi* all located on the line $l=l_1$.

If, however, the length of the frame varies by an amount dl_1 the frame is no longer tuned to frequency N and even for a value $\theta=\pi/2$ the wave will no longer be completely arrested and curve $T=f_1(\theta)$ will pass through points A'B'C'D'I' on Figure 3*a* marked l_1+dl_1. On Figure 3*b* the corresponding points will be *a'b'c'd'i'* all on the line $l=l_1+dl_1$.

The same procedure can be applied to each value of l giving the curves of Figure 3*a*. Furthermore, since points ABCD, A'B'C'D' etc. correspond to specific valves of θ (respectively $\pi/2$, $\pi/4$, $\pi/6$, $\pi/14$) by joining on Figure 3*b* such points as *aa'*, *bb'*, *cc'*, *dd'* etc. the group of curves obtained on this figure will also correspond to those valves of θ. The dotted lines connecting the two figures clearly show how the curves correspond. Moreover on Figure 3*b*, the curve for $\theta=0$ will of course correspond to $T=1$ since the frame offers no resistance to the wave in this position.

What we claim is:

1. In a guide for ultra-short electro-magnetic waves, a frame having the same cross-sectional shape as the guide taken in a plane perpendicular to the walls thereof, said frame being tuned to admit the frequency of a given wave among those carried by the guide, and means for varying the angular setting of said frame about an axis contained in the plane thereof and perpendicular to the wall of the guide.

2. In a guide as claimed in claim 1, means for varying the size of said frame while preserving the shape thereof.

3. In a rectangular guide for ultra-short electromagnetic waves, a rectangular frame tuned to admit the frequency of a given wave among those carried by the guide, and means for varying the angular setting of said frame about an axis contained in the plane thereof, parallel to two of the sides thereof and perpendicular to the walls of the guide.

4. In a rectangular guide as claimed in claim 3, means for varying the length of the sides of said frame parallel to said axis.

5. In a rectangular guide excited with waves of the H_{01} type, a rectangular frame comprising two substantially U-shaped members, one of said members having hollow arms adapted to accommodate telescopically the arms of the other of said members, one of said members being held against translational movement but rotatable about its own axis and having a stem rigid therewith and prolonging said axis through a wall of the guide, an adjustment knob outside the guide operatively connected to said stem to effect rotation of said one member, the other of said members being adapted for translational movement in a direction perpendicular to the walls of the guide, a threaded stem prolonging the axis of said other member through a wall of the guide opposite said first-mentioned stem, a rotary joint connecting said threaded stem to said other member, internally threaded means connected to the wall of the guide and threadedly engaging said threaded stem, an adjustment knob on the outer extremity of said threaded stem rotation of which will effect said translational movement and adjust the telescopic relationship of said members, and return springs in said hollow arms yieldably urging said members apart in all adjusted positions to prevent back-lash.

6. The guide as claimed in claim 1, wherein the said frame is free of contact with the walls of the guide except at the location therein of the means for varying the angular setting.

7. A band stop filter for a guide of ultra short electromagnetic waves propagated thereby, comprising a conductor frame of adjustable section and orientation arranged in the interior of the guide and means for modifying and adjusting, from the exterior of the guide, respectively the dimensions of said section and the said orientation, whereby the mean frequency of the band to be stopped is admitted and the curve of transmission by the guide is made more or less acute in the vicinity of the point corresponding to this frequency, according to the width of the frequency band to be stopped.

8. A band stop filter as claimed in claim 7, arranged for a rectangular guide excited in H_{01} waves comprising a rectangular frame, one of the symmetrical axes of which is arranged in a normal section of the guide and according to the axis of this section normal to the electric vector, means mounting the said frame for rotation about the said axis, the two sides of said frame which are parallel to the said axis being extensible.

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