Nov. 2, 1954 M. L. DOELZ 2,693,579

LONGITUDINAL SUPPORT OF MECHANICAL FILTER

Filed April 21, 1952

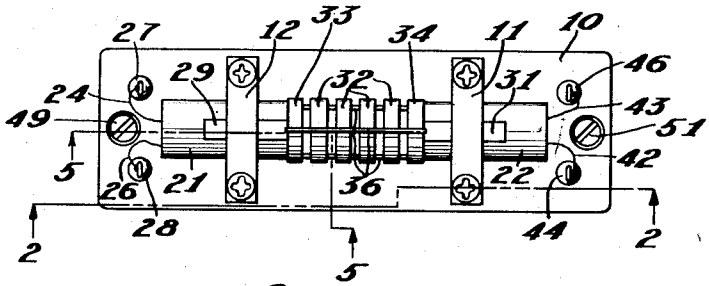

Fig 1

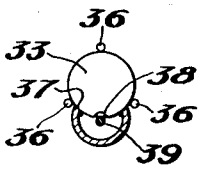

Fig 4

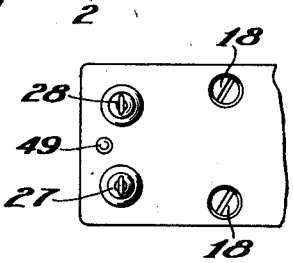

Fig 3

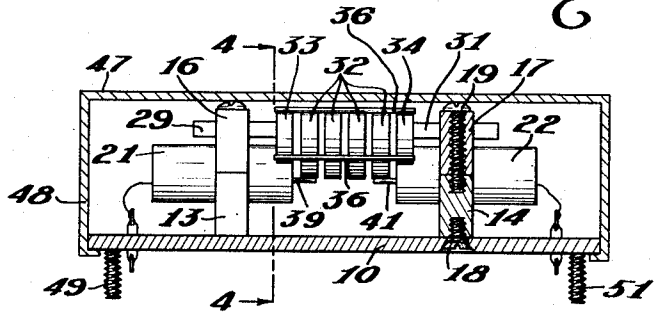

Fig 2

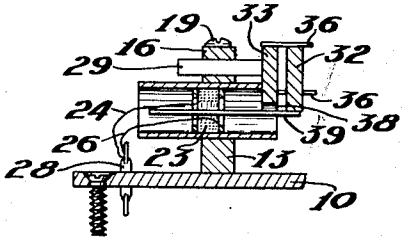

Fig 5

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United States Patent Office 2,693,579 Patented Nov. 2, 1954

2,693,579

LONGITUDINAL SUPPORT OF MECHANICAL FILTER

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Application April 21, 1952, Serial No. 283,340

5 Claims. (Cl. 333—71)

This invention relates in general to electromechanical filters and in particular to a new and novel assembly of an electromechanical filter.

The co-pending application of Melvin L. Doelz, entitled "Mechanical Filters," Serial Number 248,011, filed September 24, 1951, discloses an electromechanical filter wherein a plurality of discs are coupled together by longitudinal wires connected to their peripheries. A magnetostrictive driving wire is connected to a first disc and driven by a signal source and an output magnetostrictive wire is connected to the last disc and coupled to a magnetostrictive output means. Applicant has found that this type of electromechanical filter has very desirable characteristics in terms of high performance in a small space and ease of construction. The present invention relates to means for mechanically supporting the filter made according to the principles of the referenced application so as to minimize damping and detuning of the vibrating discs.

It is an object of this invention, therefore, to provide a mounting means for an electromechanical filter wherein the filter is mounted and held firmly without damping or interfering with the oscillations of the disc.

Another object of this invention is to provide a compact electromechanical filter which firmly supports the vibrating discs and protects the driving wires with a suitable cover member.

Further features, objects and advantages of this invention will become apparent from the following description and claims when read in view of the drawings, in which:

Figure 1 is a top view of the electromechanical filter of this invention with the top cover removed;

Figure 2 is a side elevational view taken on line 2—2 of Figure 1 and shows the cover;

Figure 3 is a partial bottom view;

Figure 4 is a sectional view taken on line 4—4 of Figure 2; and

Figure 5 is a sectional view taken on line 5—5 of Figure 1.

Figure 1 is a view of the filter with the top cover removed and illustrates a base plate **10** upon which are mounted a pair of stand-offs **11** and **12**, respectively. As best shown in Figure 2, the stand-offs **11** and **12** are each formed in two parts with lower parts **13** and **14**, respectively, and top parts **16** and **17**, respectively. The lower parts **13** and **14** are attached to the base plate **10** by set screws **18** and the top parts **16** and **17** are attached by set screws **19** to the lower parts.

At the junction between the upper and lower parts of the stand-offs **11** and **12** are formed circular openings lined with a suitable gasketing material through which cylinders **21** and **22** extend. These cylinders are clamped by the stand-offs **11** and **12**. The cylinders are hollow as shown in Figure 5 and contain therein a magnetic driving coil **23** which has output leads **24** and **26** which are attached, respectively, to output contacts **27** and **28**. Contacts **27** and **28** extend through the base plate **10**.

Polarizing magnets **29** and **31**, respectively, are supported by the stand-offs **11** and **12** immediately above the cylinders **21** and **22**. The cylinders **21** and **22** may be made of a non-magnetic material, as for example brass.

Mounted between the cylinders **21** and **22** is the vibrating filter assembly comprising a plurality of active discs **32** and a pair of end discs **33** and **34**, respectively.

The discs **32**, **33**, and **34** are connected together by longitudinal coupling wires **36** which are attached to the peripheries of the disc. The discs are spaced equidistant apart.

As pointed out in the Doelz application, Serial Number 248,011, the thickness and diameter of the discs determines the resonant frequency of the filter.

The cylinders **21** and **22** are formed with openings designated as **37** in Figure 4 and the end discs **33** and **34** are received therein. The discs are firmly attached to the cylinders by welding.

Thus, the end discs **33** and **34**, respectively, are firmly supported by the cylinders **21** and **22** and do not comprise a part of the vibrating system. The spacing between the disc **33** and the adjacent active disc is substantially the same as that between a pair of active discs. The short lengths of coupling wire joining the active filter structure and the inactive end discs act as springs interspaced between the vibrating filter structure and the fixed mounting structure. As best shown in Figure 5, an opening **38** is formed through the lower edge of the discs **33** and **34** which is supported within the confines of the cylinders **21** and **22**. A driving rod **39** extends through the opening **38** and is attached to the periphery of the active disc **32**. The rod **39** extends through the driving coil **23**.

The active disc **32** at the opposite end of the filter also has a driving wire **41** which is shown in Figure 2 that extends within the confines of the cylinder **22** and through a second driving coil contained therein. The output leads of the driving coil within the cylinder **22** are designated as **42** and **43**, respectively, and are connected to contacts **44** and **46**, respectively, which extend through the base plate **10**.

A cover member **47** is generally rectangular in shape and has downwardly extending sides **48**. It may be placed over the filter assembly and firmly attached to the base plate **10**, as for example by crimping or soldering. The filter unit may be hermetically sealed if desired.

Attached to the base plate are a pair of mounting pins **49** and **51** which may be used to attach the filter assembly to a chassis. Input and output leads may be connected to the terminals **27**, **28**, **44** and **46**.

It is seen that this invention provides a supporting means for an electromechanical filter wherein the active discs **32** are firmly supported without interfering with the mechanical vibrations of the system. The apparatus is particularly useful as a band pass filter, as for example in an intermediate frequency stage where it might be tuned to 455 kilocycles, for example. The apparatus shown in Figure 2 is substantially the same length as a cigarette at 455 kilocycles and is thus very compact. Electrical filters do not compare with the frequency characteristics of this filter because of the extremely high resonator Q which is obtainable.

Although this invention has been described with respect to a particular embodiment thereof, it is not to be so limited as changes and modifications may be made therein which are within the full intended scope of the invention, as defined by the appended claims.

I claim:

1. An electrical mechanical filter comprising, a base plate, a magnetostrictive driving means mounted on said base plate, a magnetostrictive output means mounted on said base plate, a plurality of discs, a plurality of longitudinal coupling wires connected to the edges of said discs to hold them in an assembled relationship, one of the end discs mechanically connected to said magnetostrictive driving means, the other end disc mechanically connected to the magnetostrictive output means, openings formed in the end discs, a driving rod of said magnetostrictive driving means extending through the opening in one of said discs and connected to the second disc, and an output driving wire extending from the magnetostrictive output means through the opening formed in the other end disc and connected to the disc adjacent thereto.

2. A magnetostrictive filter comprising, a base plate, a magnetostrictive driving means attached to said base plate, a magnetostrictive output means connected to said base plate, a first disc attached to the magnetostrictive input means, a second disc supported parallel to the first disc by the magnetostrictive output means, a plurality of longitudinal coupling wires extending between the edges

of the first and second discs, a plurality of discs spaced parallel between the first and second discs and attached to the coupling wires, openings formed in the first and second discs, a driving wire extending from the magnetostrictive driving means through the opening formed in the first disc and connected to the disc adjacent said first disc, and an output driving wire extending from the output magnetostrictive means through the opening formed in the second disc and attached to the disc adjacent thereto.

3. Means for supporting an electromechanical filter comprising, a plurality of discs mounted parallel to each other, a plurality of coupling wires attached to the edges of all the discs to hold them in an assembled relationship, a magnetostrictive input means, a mechanical support supporting first end disc and said magnetostrictive input means, a driving wire extending from the magnetostrictive input means and connected to the disc adjacent the first end disc, a magnetostrictive output means, a second mechanical support supporting said output means and the other end disc, and an output coupling wire extending from said output magnetostrictive means and connected to the disc adjacent the second end disc.

4. An electromechanical filter comprising, a plurality of discs mounted parallel to each other, a plurality of coupling wires attached to the edges of said disc to hold them in a predetermined assembly, first supporting means attached to one end disc, second supporting means attached to the opposite end disc, a magnetostrictive input means with a driving wire extending therefrom and connected to the disc adjacent the one end disc, and a magnetostrictive output means with an output wire extending

therefrom and connected to the disc adjacent the opposite end disc.

5. An electromechanical filter comprising, a base plate, a pair of stand-offs mounted on said base plate, a pair of cylinders supported, respectively, by said stand-offs, an input magnetostrictive coupling means mounted within said first cylinder, a magnetostrictive output means mounted in said second cylinder, a driving wire extending from said input means, a driving wire extending from said output means, a plurality of discs, a plurality of coupling wires attached to the peripheries of said discs to support them in an assembly, a first end disc connected to said first cylinder, a second end disc connected to the second cylinder, openings formed in the end discs, the input driving wire extending through the opening formed in the first end disc and attached to the edge of the second disc, the output driving wire extending through the opening formed in the other end disc and attached to the edge of the disc adjacent thereto, and a cover member attached to said base plate so as to enclose said electromechanical filter.

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