Oct. 17, 1967 L. DUBARD 3,348,172

SHEAR-WAVE STEEL ULTRASONIC DELAY LINE

Filed June 22, 1965

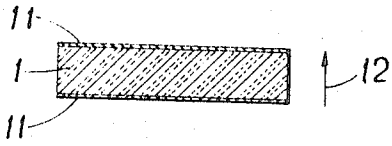

FIG. 1

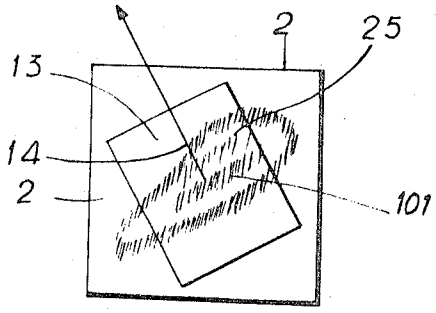

FIG. 2

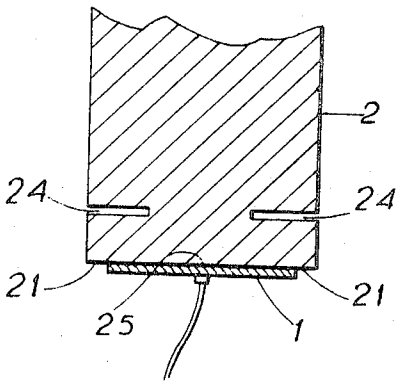

FIG. 3

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SHEAR-WAVE STEEL ULTRASONIC DELAY LINE

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3 Claims. (Cl. 333—30)

The present invention relates to ultrasonic delay lines comprising a steel ultrasonic guide, having, for example, a square section, and associated at one end with an electroacoustic transducer which excites in the guide a shear wave and at the other end with another transducer which receives this wave.

A drawback of such a delay line is that the signals propagated are damped to a great extent, due to the lack of homogeneity of the steel.

It is an object of this invention to avoid this drawback.

According to the invention there is provided an ultrasonic delay line, comprising an elongated steel guide having two ends, said steel having a non-homogeneous zone having a smaller and a greater transverse dimension; and two piezoelectric shear wave transducers respectively coupled to said two ends, having respective parallel transverse vibration axes, perpendicular to said greater transverse dimension.

For a better understanding of the invention and to show how the same may be carried into effect, reference will be made to the drawing accompanying the following description and in which:

FIG. 1 shows a piezoelectric plate which has been metallized and is subjected to a polarizing field;

FIG. 2 shows a transducer fixed to the end of a bar according to the invention; and

FIG. 3 shows in section a portion of a delay line according to the invention.

In FIG. 1, there is shown a ceramic piezoelectric plate 1, obtained for example by pressing and shown in cross-section. Its surfaces 11 are metallized.

Plate 1 is polarized by the application of an electric field 12 perpendicularly to its metallized outer surfaces 11. After polarization, plate 11 is de-metallized and cut into thinner plates whose long axis is parallel to the direction 12 of the polarizing field.

Experience shows that conventional steel bars as used for ultrasonic delay lines usually possess, substantially along their longitudinal axis, a zone of non-homogeneity where propagation of shear waves is disturbed, this resulting in a generally poor operation of the delay line and in particular in a substantial damping of the propagated wave in this zone, while in the remainder of the bar the propagation is normal and in a non-dispersive mode. This non-homogeneity zone 101 may be made apparent, as shown for example in FIG. 2, by attacking

the end of the bar with hydrochloric acid. Generally this non-homogeneity zone has in cross-section an elongated form.

According to the invention transducer 1 is applied to the end face of the bar in such a manner as to obtain a maximum of coupling with the portion of the end face which is not affected by the non-homogeneity. To this end the vibration axis 11 of transducer 13 is directed normally to the longer transverse axis of the non-homogeneous zone.

FIG. 3 shows in section one end of a delay line according to the invention. In the vicinity of transducer 1 saw cuts 24 have been formed in the end of the bar 2 so as to prevent the reflection of ultrasonic waves at the ends of bar 2 and especially at the zones 21 thereof which are not covered by the transducer.

It is to be noted that the zone 25 covered by the transducer has a very low reflectivity.

These arrangements have the object of damping and practically eliminating the undesirable effects of parasitic waves which leave the delay line ofter having propagated in the bar at least three times by being reflected from one end of the bar to the other end, that is to say, after a delay equal to $3\tau,\tau$ being the delay line time for one single passage of an ultrasonic wave through the bar.

Of course the invention is not limited to the embodiment described and shown which were given solely by way of example.

What is claimed is:

1. An ultrasonic delay line, comprising an elongated steel guide having two ends, said steel having a non-homogeneous zone having a smaller and a greater transverse dimension; two piezoelectric shear wave transducers respectively coupled to said two ends, having respective parallel transverse vibration axes, perpendicular to the greater transverse dimension of said zone.

2. An ultrasonic delay line, comprising an elongated steel guide having two ends, said steel having a non-homogeneous zone having a smaller and a greater transverse dimension; two piezoelectric shear wave transducers respectively coupled to said two ends, having respective parallel transverse vibration axes, perpendicular to the greater transverse dimension of said zone, said guide having a reduced section near each of said ends.

3. An ultrasonic delay line, comprising an elongated steel guide having two ends, said steel having a non-homogeneous zone having a smaller and a greater transverse dimension; two piezoelectric shear wave transducers respectively coupled to said two ends, having respective parallel transverse vibration axes, perpendicular to the greater transverse dimension of said zone, said guide having slots near each of said ends.

No references cited.

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