United States Patent

Van Der Woerd

[15] **3,675,529**

[45] **July 11, 1972**

[54] **ELECTROMECHANICAL TRANSDUCER FOR TUNING INDIVIDUAL STRINGS OF A MUSICAL INSTRUMENT**

[72] Inventor: **Albertus Cornelis Van Der Woerd,** Delft, Netherlands

[73] Assignee: **U.S. Philips Corporation,** New York, N.Y.

[22] Filed: **Nov. 13, 1970**

[21] Appl. No.: **89,389**

[30] **Foreign Application Priority Data**

Nov. 27, 1969 Netherlands..........................6917828

[52] **U.S. Cl.**..................................**84/455,** 84/1.15, 84/1.16, 84/DIG. 18

[51] **Int. Cl.** **G10g 7/02**

[58] **Field of Search**............84/1.14, 1.15, DIG. 18, DIG. 24, 84/454, 1.04, 1.16, 455

[56] **References Cited**

UNITED STATES PATENTS

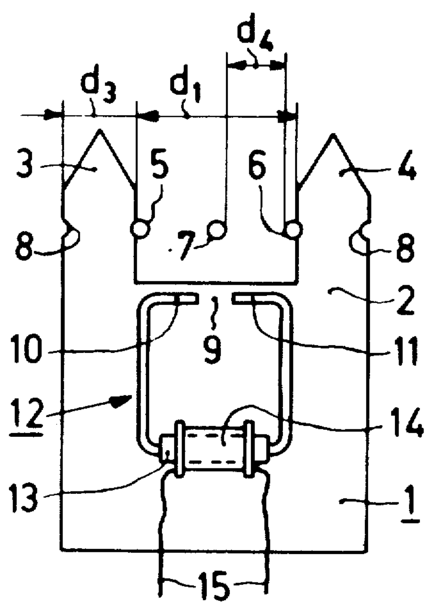
3,183,761	5/1965	Van Ooyen	84/455
2,628,343	2/1953	Murray	84/1.15 X
3,113,990	12/1963	Zanessi	84/1.16
3,265,992	8/1966	Pleasure	84/1.15 X
3,539,700	11/1970	Johnson	84/1.15 X
2,539,297	1/1951	De Lazaro	84/1.16
2,725,778	12/1955	Cronwell	84/1.16
3,018,680	1/1962	Paul	84/1.16

Primary Examiner—Lewis H. Myers
Assistant Examiner—Stanley J. Witkowski
Attorney—Frank R. Trifari

[57] **ABSTRACT**

An electromechanical transducer for converting the movements of a vibrating string into electric vibrations for use in tuning the string and provided with a forked member which may be clamped between two strings and converts the vibrations of a third string.

5 Claims, 5 Drawing Figures



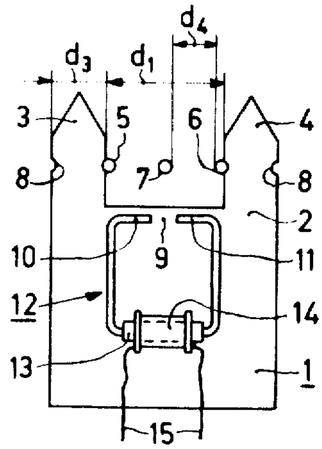


Fig.1

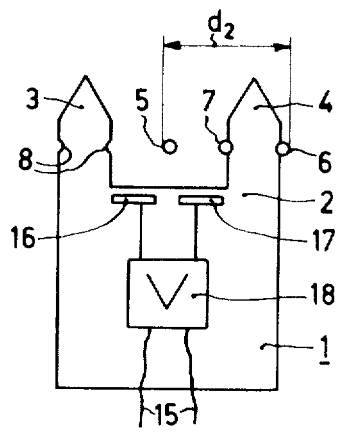


Fig.2

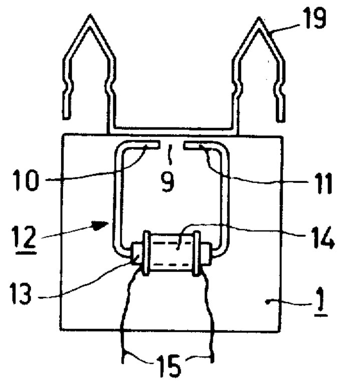


Fig.3

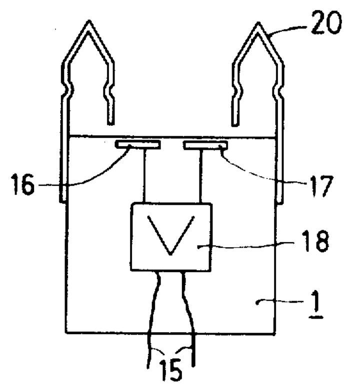


Fig.4

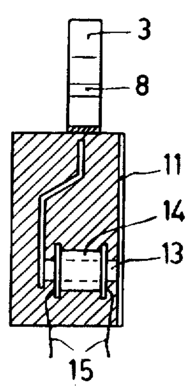


Fig.5

INVENTOR.
ALBERTUS C. VAN DER WOERD
BY
AGENT

ELECTROMECHANICAL TRANSDUCER FOR TUNING INDIVIDUAL STRINGS OF A MUSICAL INSTRUMENT

The invention relates to an electromechanical transducer for converting the movement of a vibrating string into electric oscillations, in particular for tuning the string.

Such transducers are known, for example, in electric guitars, in which the spring vibrates relative to the pole pieces of an electromagnetic system. Thus, the other strings, are not influenced by the transducer. When tuning a group of three unitonal strings in a piano, it is desirable that during the tuning of one of the strings the two remaining strings should be damped so as to prevent them from vibrating in sympathy with the string being tuned.

For this purpose, according to the invention a forked member is provided in which the spacing between the inner surfaces of the legs of the fork is equal to, or smaller than, the spacing between the outer surfaces of the outer strings group of three unitonal strings. This enables the center string to vibrate freely in the space between the legs of the fork while the outer strings are damped.

In another embodiment of an electromechanical transducer according to the invention, the width of each leg of the fork is greater than, or equal to, the spacing between the two facing surfaces of two adjacent strings. This enables one of the outer strings of a group of three to be tuned while the two remaining strings are damped.

According to still another embodiment, at least the free end of each leg is wedge-shaped, which facilitates the attachment of the transducer to the strings.

In a further embodiment of an electromechanical transducer according to the invention, the outer and inner surfaces of each leg are provided with notches extending in the direction of the length of the strings along the clamping lines thereof. This enables the legs of the forked member to be clamped more firmly between the strings, so that the transducer is less likely to twist relative to the strings.

According to still another embodiment of an electromechanical transducer according to the invention, the parts of the transducing system which cooperate with the vibrating string are located between the legs of the fork.

Embodiments of the invention will not be described, by way of example, with reference to the accompanying diagrammatic drawings, in which:

FIG. 1 shows an electromechanical transducer equipped with an electromagnetic conversion system,

FIG. 2 shows a similar transducer equipped with an electrostatic conversion system,

FIG. 3 shows a transducer in which the forked member comprises one metal spring,

FIG. 4 shows a transducer equipped with two metal springs for an electrostatic conversion system, and

FIG. 5 shows an electromagnetic transducer the conversion system of which is turned through 90° relative to that of FIG.

FIGS 1 and 2 show an electromechanical transducer 1 which is provided with a forked member 2 having two legs 3 and 4 which have wedge-shaped ends. The spacing d_1 between the inner surfaces of the legs 3 and 4 of the fork is slightly smaller than the spacing d_2 between the outer surfaces of the strings 5 and 6 of a group of three unitonal strings of 5, 6 and 7. As FIG. 1 shows, this permits clamping of the electromechanical transducer about the outer strings 5 and 6, notches 8 helping to prevent the transducer from twisting relative to the strings. The vibrations of the center string produce a field variation in an air-gap 9 between pole pieces 10 and 11 of a yoke 12 on which a coil 14 is arranged. Voltages are induced in the coil as a result of the vibrations of the center string 7, which voltages may be taken from output leads 15, if required through terminal members. The yoke comprises, in addition to the pole pieces 10 and 11, a permanent magnet 13.

FIG. 2 shows the manner in which the vibrations of an outer string 5 may be converted by clamping one leg 4 of the forked member 2 between the center string 7 and the other outer string 6 of the group of three strings 5, 6 and 7, since the width d_3 of each leg of the forked member 2 exceeds the spacing d_4 between the facing surfaces of two adjacent strings 7 and 6. In this embodiment also notches 8 prevent the transducer from twisting relative to the strings. Although the conversion system of FIG. 1 is an electromagnetic system, obviously it is also possible to use an electrostatic system of the kind shown in FIG. 2, in which the vibrating string varies the capacitance between two plates 16 and 17 which are connected to an amplifier 18 in which the capacitance variations are converted into electric voltages in known manner. This amplifier may be an integrated circuit or a simple transistor which may be accommodated in the transducer.

The legs of the fork may be made of a plastic material and may be integral with the transducer in which the electromagnetic or electrostatic system is embedded, but the legs may alternatively be U-shaped metal strings 19 having opposed arcuate portions for engaging the strings as shown, for example, in FIG. 4.

When using an electromagnetic transducer the metal must be nonmagnetic, while in an electrostatic transducer the design of FIG. 4 only can be used in which each leg of the forked member is a separate string 20 secured to the casing of the transducer 1.

In order to enable the transducer to be used for the short very tautly stretched strings for the highest tones it is desirable for the legs 3 and 4 of the forked member to be made relatively and intrinsically resilient by a suitable choice of the elasticity or compressibility of the plastics material, which term in this specification includes all elastic non-metallic materials, such as polyvinyl chloride, natural or synthetic rubber and the like, or by a suitable choice of the thickness and the nature of the metal of the springs.

The electromagnetic or electrostatic conversion system may also be turned relative to the pole piece, for example, through 90°, as is shown in FIG. 5 for the electromagnetic system.

Other conversion systems such, for example, as a Hall element may obviously be used also.

What is claimed is:

1. A device for use in tuning a group of at least three substantially equispaced parallel strings, comprising a forked member having two legs wherein the spacing between the inner surfaces of the legs of the member is at most equal to the spacing between the outer surfaces of the outer strings of the group, the legs of the member thereby restricting vibrational motion of the outer strings, and an electromechanical transducer means affixed to the forked member for converting vibrations of a single center string of the group into an electrical signal while the other strings of the group are restrained from vibration by the forked member.

2. An apparatus as claimed in claim 1, for use with more than three strings wherein the width of each leg of the forked member is at least as great as the spacing between the facing surfaces of two adjacent strings of the group.

3. An apparatus as claimed in claim 1, wherein at least the free end of each leg of the forked member is wedge-shaped.

4. An apparatus as claimed in claim 1, wherein the outer and inner surfaces of each leg are provided with notches extending approximately perpendicular to the direction toward which the legs of the fork extend.

5. An apparatus as claimed in claim 1, wherein the transducer is located between the legs of the forked member.

* * * * *