

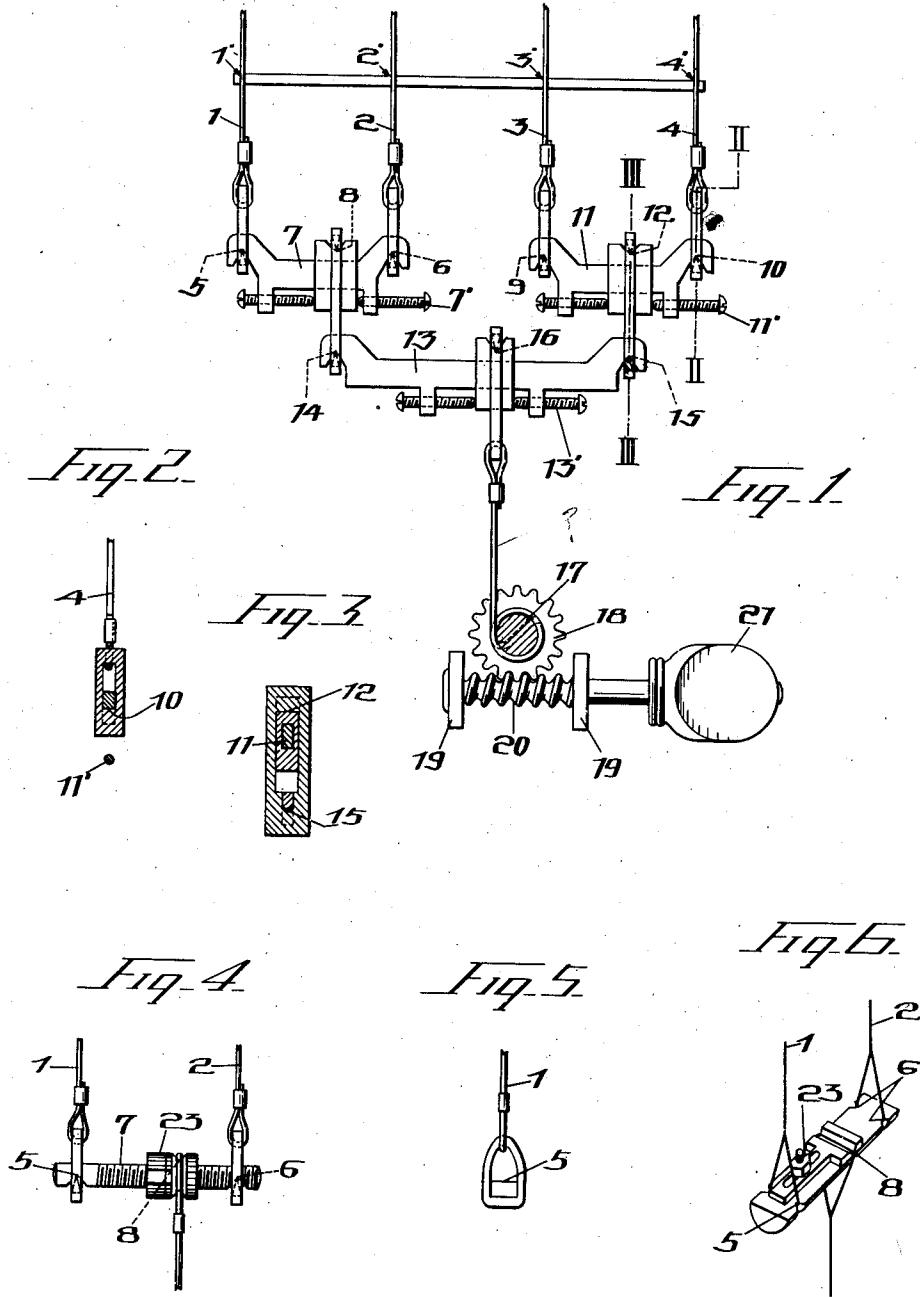
Aug. 26, 1941.

T. KUDO

2,254,012

MECHANICAL TUNING DEVICE FOR STRING MUSICAL INSTRUMENTS

Filed Jan. 11, 1940



INVENTOR
TOYOJIRO KUDO
BY Francis C. Boyce
ATTORNEY

UNITED STATES PATENT OFFICE

2,254,012

MECHANICAL TUNING DEVICE FOR STRING
MUSICAL INSTRUMENTS

Toyojiro Kudo, Koishikawa-ku, Tokyo, Japan

Application January 11, 1940, Serial No. 313,334

5 Claims. (Cl. 84-455)

The present invention relates to a mechanical tuning device for string musical instruments and more particularly to a device for determining the ratio of the tensions of the strings of a string musical instrument according to the principle of the lever, namely, the principle that the force at the fulcrum of a lever is in inverse proportion to the lengths of the arms of the lever, enabling the fulcrum of the lever or knife edge to move freely and thus to be fixed to a suitable position with a micro screw provided along the lever and tuning the instrument by the constant ratio of the numbers of the resultant vibrations of the strings. The object thereof is to tune string instruments mechanically and keep them from going out of tune.

In this invention, each set of two strings, for example, of a four stringed musical instrument is tied to either end of a lever with knife edges and the fulcrum of each lever is tied to either end of the main lever by knife edges. In turn, the fulcrum of the main lever is connected with a tuning screw by a knife edge.

Referring to the accompanying drawing which shows diagrammatically an example of performing the present invention,

Figure 1 is a side elevation of this device;

Figure 2, a section along the line II—II in Figure 1;

Figure 3, a section along the line III—III in Figure 1;

Figure 4, a side elevation of a modification of a string supporting means;

Figure 5, an end elevation of the same and

Figure 6, a perspective view of the other modification.

In the drawing 1, 2, 3 and 4 are four strings tied to the bar (not shown) which has one end fixed to a portion of the body of the instrument. The strings 1 and 2 have the lower ends tied to a lever 7 by means of knife edges 5 and 6. If the knife edge 8 which is the fulcrum of said lever is drawn in the direction as indicated by an arrow, the tension of the strings 1 and 2 will be brought into inverse proportion to the lengths 5—8 and 6—8 of the lever arms, while the number of the vibrations of the strings will become proportional to the tension, so that the desired number of vibrations may be obtained for the strings by determining the position of a fulcrum 8 properly. As shown in the drawing, if the length 6—8 of the arm is shorter than 5—8, the string 2 will have a higher tone than the string 1. With regard to the strings 3 and 4 too, the position of the fulcrum 12 of a lever 11 supported by knife edges

9 and 10 may be determined properly in the same way. The force resulting from the tension of the strings 1 and 2 acts upon a knife edge 14, while that from the strings 3 and 4 acts upon a knife edge 15.

Regulate a knife edge 16 to have these two resultant forces as the desired force, that is to say, determine lengths 14—16 and 15—16 properly, and the strings 1, 2, 3 and 4 will have the desired tension, thus rendering it possible to determine the tones of the four strings properly. To the knife edge 16 on the main lever 13 is connected a string which is wound upon a winding shaft 17 which is rotated by a toothed wheel 18 fixed to said shaft and a worm screw 20 meshing with said wheel and borne by the studs 19, 19 secured to the body of the instrument, said worm screw being rotated by a handle 21; thus increasing or decreasing the force of the fulcrum 16 and consequently the number of the vibrations of the four strings. Moreover, since the ratio of the numbers of the vibrations of the four strings, namely, the musical interval or tone, is constant and invariable, it is possible to tune the four strings with a single winding member or peg.

If the length 6—8 is shorter than 5—8, the pressure applied to the bridge 22 on a resonance plate by the strings 1 and 2 is strong at the point 2' and weak at the point 1'. In practice, if the pressure is weaker, the strings have the worse tone, whereas if it is stronger, they have the better tone. If the string 1 is the thicker and has a fulcrum 8 near it, it is possible to equalize the tensions of the strings 1 and 2. However, I have found that the best tone of the strings 1 and 2 may be obtained by regulating the thickness of the string 1 to have the fulcrum 8 at their center.

In case of three strings, tie the string 3 directly to the knife edge 15, omitting the string 4 and lever 11, and then the three strings will be tuned in the same manner. This principle is applicable to the tuning of any number of strings.

In the modification illustrated in Figures 4 and 5, a screw is threaded in the lever itself and the position of the knife edge is determined by a nut.

In the other modification shown in Figure 6, the proper position of the knife edge of the fulcrum of the lever is determined by utilizing a semi-cylindrical member made of Celluloid or bamboo, using its sharp edge as a knife edge and causing it to slide. Then, the knife edge is held in position with a stop screw 23.

Now, according to this device, the ratio of the

numbers of the vibrations of all the strings of a musical string instrument being constant, quick and accurate tuning may be obtained by using only a single screw and also the instrument may be kept from going out of tune owing to the elongation of the strings. Moreover, it may be tuned to any other musical instrument without the aid of a tuning peg.

I claim:

1. In a musical instrument having a plurality of strings, mechanical means for tuning said strings and comprising a pivoted lever having a fulcrum movable longitudinally of the lever, means connecting different strings of the instrument to opposite ends of said lever, means for adjusting said fulcrum to any position within its range of movement on the lever thereby to vary the relative tension exerted by the arms of the lever on the strings connected thereto, and means for exerting a pull on said fulcrum in the direction of the length of the strings thereby to tune all of said strings simultaneously.

2. In a musical instrument having a plurality of strings, mechanical means for tuning said strings and comprising a pivoted lever having a fulcrum movable longitudinally of the lever, means connecting different strings of the instrument to opposite ends of said lever, means for adjusting said fulcrum to any position within its range of movement on the lever thereby to vary the relative tension exerted by the arms of the lever on the strings connected thereto, a cable secured at one end to said fulcrum and at its opposite end to a rotatable shaft, gearing for transmitting motion to said shaft, and means for manually actuating said gearing to wind the cable on said shaft thereby exerting a pull on said fulcrum in the direction of the length of the strings whereby all of said strings are tuned simultaneously.

3. In a musical instrument having a plurality of strings, mechanical means for tuning said strings and comprising a pivoted main lever hav-

ing a fulcrum movable longitudinally of the lever, means for adjusting said fulcrum to any position within its range of movement on the lever thereby to vary the relative force exerted at opposite ends of the lever, identical secondary levers having similar longitudinally adjustable fulcrums pivotally connected with the opposite ends of said main lever, said secondary levers each having its opposite ends connected to individual strings of said instrument, and means for exerting a pull on the fulcrum of said main lever in the direction of the length of the strings thereby to tune all of said strings simultaneously.

4. In a musical instrument having a plurality of strings, mechanical means for tuning said strings and comprising a pivoted lever having a fulcrum movable longitudinally of the lever, means connecting different strings of the instrument to opposite ends of said lever, opposing screws threaded in depending portions of said lever, said screws abutting at their free ends the opposite sides of said fulcrum for adjusting the fulcrum to any position within its range of movement on the lever thereby to vary the relative tension exerted by the arms of the lever on the strings connected thereto, and means for exerting a pull on said fulcrum in the direction of the length of the strings thereby to tune all of said strings simultaneously.

5. In a musical instrument having a plurality of strings, mechanical means for tuning said strings and comprising a pivoted lever, a fulcrum threaded on said lever for adjustment to different positions along the lever thereby to vary the relative lengths of the portions of the lever at opposite sides of the fulcrum, means connecting different strings of the instrument to opposite ends of the lever, and means for exerting a pull on said fulcrum in the direction of the length of the strings thereby to tune all of said strings simultaneously.

TOYOJIRO KUDO.