Feb. 16, 1971 H. WÜSTL 3,564,573

TUNING DEVICE FOR STRINGED MUSICAL INSTRUMENTS

Original Filed Jan. 23, 1967

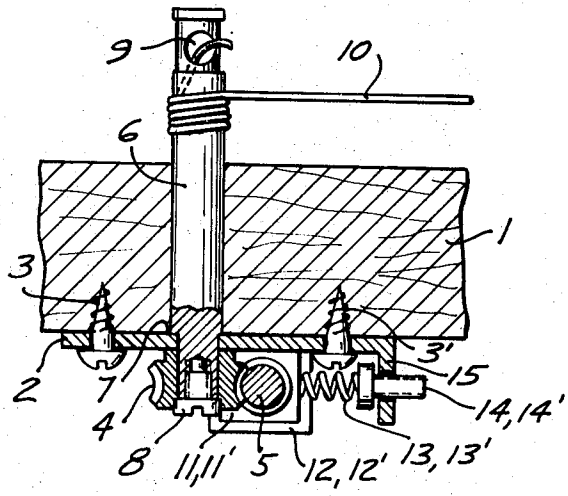


FIG. 1

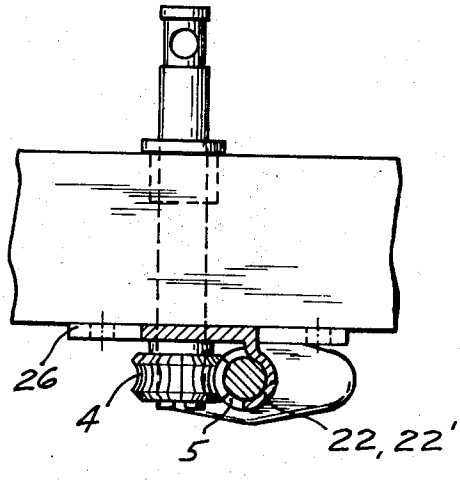


FIG. 4

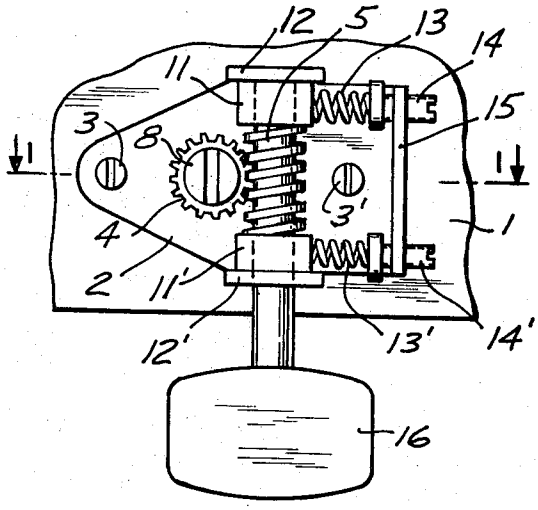


FIG. 2

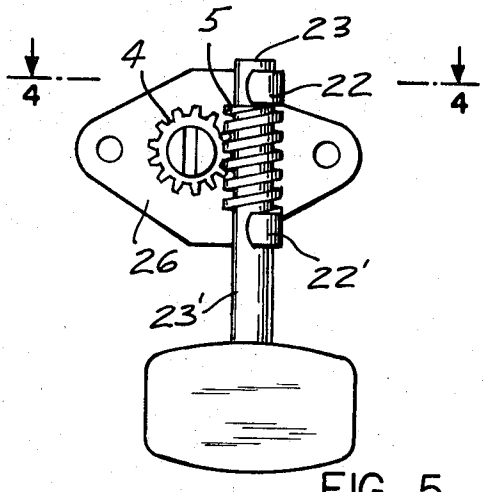


FIG. 5

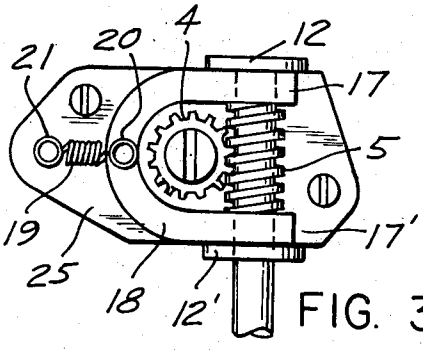


FIG. 3

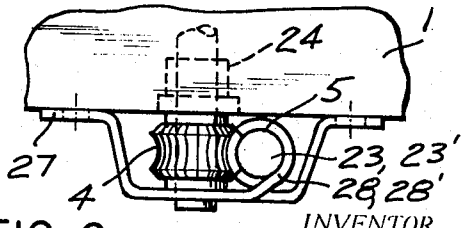


FIG. 6

INVENTOR.
HANS WÜSTL
BY Hane and Baxley
ATTORNEYS

United States Patent Office 3,564,573
Patented Feb. 16, 1971

3,564,573

TUNING DEVICE FOR STRINGED MUSICAL INSTRUMENTS

Hans Wüstl, Waldstrasse 41, Bubenreuth, near Erlangen, Germany

Original application Jan. 23, 1967, Ser. No. 610,892, now Patent No. 3,496,825. Divided and this application Aug. 7, 1969, Ser. No. 848,164
Int. Cl. G01d 3/14
U.S. Cl. 84—306 13 Claims

ABSTRACT OF THE DISCLOSURE

A tuning device for a stringed musical instrument in which a selected one of the strings of the instrument can be gradually and accurately tuned by continuously biasing a spindle into rotation-transmitting play-free engagement with a worm gear which in turn is secured to a rotary shaft having attached thereon the string to be tuned.

The present application is a divisional application divided out of my copending application Ser. No. 610,892, filed Jan. 23, 1967, now Pat. No. 3,496,825.

The present invention relates to a device for tuning strings of a musical instrument, and more particularly, to a tuning device in which a worm gear supported by a base plate is rotatable by engagement with a spindle also rotatably mounted on the base plate, said worm gear being fixedly mounted on a shaft to which one end of the string to be tuned is attachable.

BACKGROUND

Tuning devices of the general kind above referred to require that a string can be easily, accurately and rapidly tuned to the desired pitch by a musician. As is evident, accurate turning of the gear through the small angles required for fine tuning of a string and retention of the string at the correct pitch require that there is no play between the gear and the drive spindle therefor. In other words, it should be possible to turn the gear into any angular position and the gear must be fixedly retained in such position. To satisfy these requirements it is necessary that there is no play between the spindle and the gear.

It has been found that tuning devices of the general kind above referred to as heretofore known are not free of play and hence not satisfactory.

There are known tuning devices in which the worm gear and the spindle therefor are mounted on a support plate which in turn is secured to the body, and more particularly, to the neck portion of the instrument. The shaft mounting the worm gear is journalled in a bore of the plate and the spindle is supported by brackets secured to the plate. The mounting of the spindle is effected by providing on the plate protrusions including bores in which the spindle is received. It has also been proposed to make bearings for the spindle in one piece with a support plate; one-piece structures of this kind may be produced for instance, by injection or extrusion molding.

Conventional tuning devices as hereinbefore referred to assure that the distance between the rotational axes of the spindle and the worm gear remains always the same. As a result, there is no assurance that the engagement between the spindle and the worm gear is free of play. It has been found that not even precision machining of the gear assembly and the bearings and support therefor assures a play-less engagement, at least not for a prolonged period of use due to the unavoidable considerable wear at the teeth of the spindle and the gear. Moreover, precision machining and maintenance of very high tolerances in the assembly are cost-wise uneconomical. In actual

practice, the distance between the axes tends to differ from the theoretical optimal distance. If the distance is slightly less than the optimal value, the worm gear will tend to jam and in any event is subjected to heavy wear. If the distance is slightly too large there will be a correspondingly large play between the profiles of the meshing teeth of the spindle and the gear.

If, for instance, a string is tuned to a higher pitch, the teeth of the spindle will mesh with the teeth of the worm gear without appreciable play as the gear is subjected to the tensional force of the string. If, however, the string is subsequently tuned to a lower pitch, that is, if the spindle is turned in the direction for reducing the tension of the string, the worm gear will not smoothly and accurately follow such rotation of the spindle but in more or less jerky fashion until the now present play has been taken up and play-free engagement between the spindle and the gear is restored. In actual practice, fine tuning of a string generally requires repeated tuning higher and lower than the desired pitch until the musician has gradually arrived at the desired pitch. As is evident, play in the tuning device renders actual tuning difficult. Moreover, if the desired pitch happens to be located in an angular gap as caused by play between the spindle and the worm gear, precise tuning is not possible at all.

Accurate tuning is further made difficult if not impossible if there is play in the bearings for the worm gear and the spindle. Such play may be either present from the beginning, or may develop due to wear.

Play due to the relative spatial positions of the worm gear and the spindle and due to loose bearings may be automatically compensated if the factors causing the play act in opposite directions, but these factors may also act cumulatively. In any event, the presence of any play introduces a highly undesirable factor of insecurity.

THE INVENTION

It is a broad object of the invention to provide a novel and improved tuning device of the general kind above referred to in which play is eliminated not only when the device is new but also after a prolonged period of use without requiring expensive and difficult precision machining and assembly, thereby permitting rapid, accurate and easy tuning of the strings of the instrument.

The aforepointed out object, feature and advantage, and other objects, features and advantages which will be pointed out hereinafter, are obtained by supporting both the worm gear and the drive spindle therefor on a common support plate and mounting the spindle so that it is displaceable parallel to its rotational axis and in a direction normal to the rotational axis of the worm gear, and by subjecting the spindle to an elastic directional force such as a spring means continuously biasing the spindle into playless rotation transmitting engagement with the worm gear.

According to one embodiment of the invention, the spindle is journalled in brackets slidably guided on the support plate. The brackets, and thus the spindle, are continuously urged by the spring means toward the worm gear. The spring means are preferably spring means which do not exert a constant force such as compression springs, and the directional force of the spring means is preferably at least as large as the radial counter-force of the worm gear. The effective force of the spring means is preferably adjustable, for instance, by set screws acting upon the spring means via an interposed bar.

According to another embodiment of the invention, the spring means are in the form of a bent spring secured at one end to the plate and defining bearings for the spindle on the other end. The spring portions forming the bearings for the spindle may be in the form of in-

wardly rolled claws and the spring may be in engagement with an end face of the worm gear so that the entire tuning device is pressed against the neck portion of the instrument on which this device is mounted.

The invention also encompasses an embodiment in which one end of the spring means is secured to a support plate secured to the instrument and the other end encompasses the spindle from the side thereof facing away from the worm gear. The bent spring means is preferably in the form of a clip and so biased that the worm gear is pressed toward the plate, thereby further counteracting any formation of play.

In the accompanying drawing several preferred embodiments of the invention are shown by way of illustration and not by way of limitation.

In the drawing:

FIG. 1 is a sectional view taken on line I—I of FIG. 2;

FIG. 2 is a bottom view of FIG. 1;

FIG. 3 is a bottom view of a modification of the tuning device;

FIG. 4 is a sectional view taken on line IV—IV of FIG. 5 of another embodiment of the tuning device;

FIG. 5 is a bottom view of FIG. 4; and

FIG. 6 is an elevational side view of still another embodiment of the invention.

Referring first to FIGS. 1 and 2 in detail, the exemplified tuning device comprises a rigid support plate **2** which has been suitably secured, for instance, by screws **3** and **3'** to a neck portion **1** of a stringed musical instrument, for instance, of a guitar. A worm gear **4** and a spindle **5** for driving the worm gear are supported on plate **2**. The gear is secured to a shaft **6** by a screw **8**. The shaft is extended through neck **1** and secured therein against axial displacement by a shoulder **7** of the shaft and abutment of gear **4** against the side of the plate opposite to the shoulder. The portion of the shaft protruding from the top side of neck **1** has a cross-wise hole **9** by means of which a string **10** is tied to the shaft in conventional fashion.

The shaft ends of spindle **5** are supported in brackets **11** and **11'** which constitute bearings for the spindle on opposite sides of the worm gear. The brackets are slidable on plate **2** and guided thereon by fixed guide tracks **12** and **12'** which are disposed in a direction normal to the rotational axis of gear **4**. Accordingly, displacement of bearing brackets **11** and **11'** in either direction as guided by the brackets will cause displacement of the spindle toward and away from worm gear **4** normal to the rotational axis thereof.

Compression springs **13** and **13'** act upon the brackets so as to urge the spindle into a rotation-transmitting continuous and play-free engagement with the worm gear. The springs abut at one end against the brackets and at the other end against the heads of set screws **14** and **14'** which in turn are threaded into a bracket **15** extending from plate **2**.

Rotation of the spindle and thus tuning of string **10** are effected by turning a grip **16** secured to spindle **5** in one or the other direction.

The tuning device according to FIG. 3 embodies the same principle as the tuning device according to FIGS. 1 and 2. The compression springs **13** and **13'** of the first embodiment are replaced by a tension spring **19** which is secured at one end to a base plate **25** also supporting worm gear **4** and at the other end in a suitable manner, for instance by an eyelet **20**, to a horse-shoe shaped member **18**. The shanks **17** and **17'** of this member form bearings for the spindle and thus correspond functionally to brackets **11** and **11'**. The horse-shoe member is guided by guide tracks **12** and **12'** on plate **25**.

As is evident, spring **19** if suitably pre-loaded, will pull spindle **5** continuously toward the left, that is, into play-free engagement with the worm gear.

According to FIGS. 4 and 5, worm gear **4** and spindle **5** are supported by a support plate **26** which has bent-

out springy portions **22** and **22'** forming claw-like bearings for spindle portions **23** and **23'**. The bearing claws encompass the spindle from the rear and are so biased that the spindle is held in continuous play-free engagement with the worm gear.

The tuning device according to FIG. 6 is similar to that according to FIGS. 4 and 5 in that a base plate **27** has bent-out springy portions forming bearings **28** and **28'** for the spindle. As is clearly shown, bearing portions **28** and **28'** encompass spindle portions **23** and **23'** from below and are so biased that they urge the spindle into continuous play-free engagement with the worm gear and the worm gear toward a socket **24** suitably fitted in the body of neck **1** of the instrument.

What is claimed is:

1. A device for tuning strings of a stringed musical instrument having a neck portion, said device comprising in combination:

a support plate attachable to the neck portion of the instrument;

a shaft rotatably supported by said plate protruding at both ends therefrom, one protruding end of the shaft being arranged to attach thereto one end of a string to be tuned;

a gear means including a worm gear and a coacting spindle, said worm gear being secured to the other protruding end of the shaft by rotation of the spindle for rotating the shaft by rotation of the spindle;

mounting means on the support plate supporting the spindle displaceably parallel to its axis and normal to the rotatioinal axis of the worm gear; and

bias means included in said mounting means and directionally biasing said spindle into continuous rotation-transmitting play-free engagement with said worm gear;

said mounting means including bearing means for said spindle, said bias means coacting on one end with said bearing means to bias the spindle toward the worm gear, the other end of the bias means being fixedly held by the support plate;

whereby rotation of said spindle in either direction and corresponding rotation of the shaft causes a corresponding play-free tightening or slackening of the string attached to the shaft.

2. The device according to claim **1** and comprising guide means guiding said bearing means and thus the spindle in a direction normal to the rotational axis of the worm gear.

3. The device according to claim **2** wherein said guide means comprise a pair of parallel flanges protruding from said support plate and guiding said bearing means therebetween.

4. The device according to claim **1** wherein the directional force of said bias means is at least equal to the force of displacement exerted upon said worm gear by the pull of the string on the shaft mounting the worm gear.

5. The device according to claim **4** and further comprising adjustment means for varying the directional force of said bias means.

6. The device according to claim **5** wherein said adjustment means comprise screw means screwed into said support plate and having secured thereto said other end of the bias means, turning of said screw means varying the directional force of said bias means.

7. The device according to claim **1** wherein said bias means comprise a bracket fixedly secured to said support plate, and compression spring means interposed between said bracket and said bearing means thereby urging the spindle into said continuous play-free engagement with the worm gear.

8. The device according to claim **7** wherein adjustment means engage one end of said spring means for adjusting the loading of the same by the setting of said adjustment means.

9. The device according to claim 8 wherein said adjustment means are screw means positioned in said bracket.

10. The device according to claim 1 wherein said bias means comprise a generally U-shaped member displaceably supported on said support plate parallel thereto, said spindle being journalled in the branches of said member, and wherein a tension spring is secured to said support plate and said member for biasing the spindle into said continuous play-free engagement with the worm gear.

11. The device according to claim 1 wherein said bearing means comprise portions of the support plate protruding therefrom and curved to journal the spindle, said portions being springy and biased to constitute said bias means urging the spindle into said continuous rotation-transmitting play-free engagement with the worm gear.

12. The device according to claim 11 wherein said bearing portions are further biased to urge the spindle and the worm gear in mesh therewith toward the support plate.

13. The device according to claim 12 wherein said bearing portions define each a closed loop.

References Cited

UNITED STATES PATENTS

310,590	1/1885	Hyde	84—306
2,356,766	8/1944	Kluson	84—306

STEPHEN J. TOMSKY, Primary Examiner

L. R. FRANKLIN, Assistant Examiner