March 15, 1966 C. R. HEPLER 3,240,098

DEVICE FOR TUNING AND TENSIONING STRINGED MUSICAL INSTRUMENTS

Filed Jan. 5, 1965

Fig. 1.

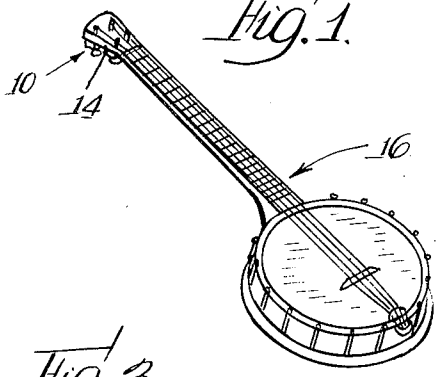


Fig. 2.

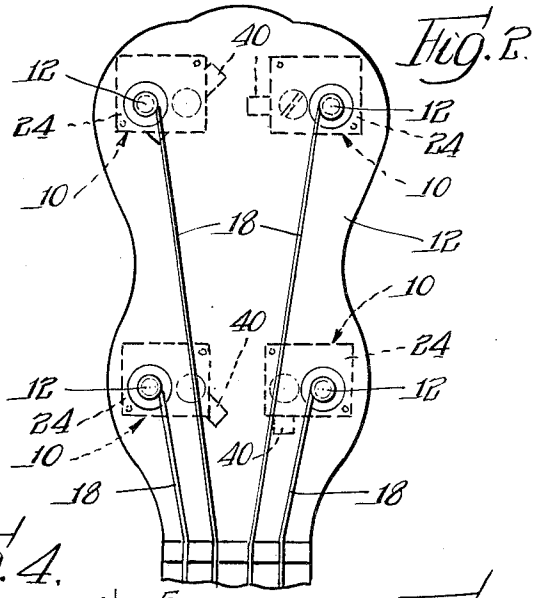


Fig. 3.

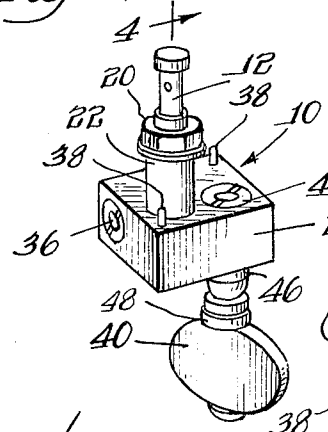


Fig. 4.

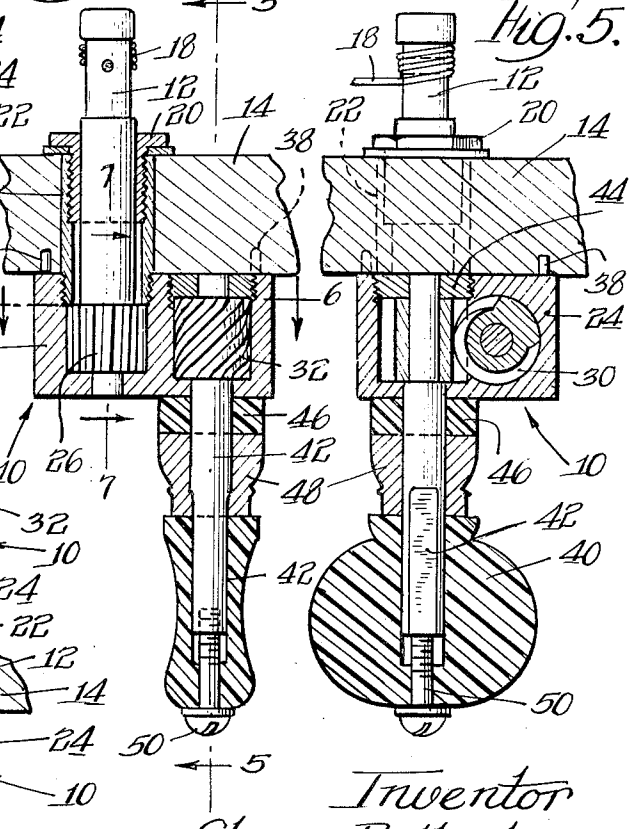


Fig. 5.

Fig. 6.

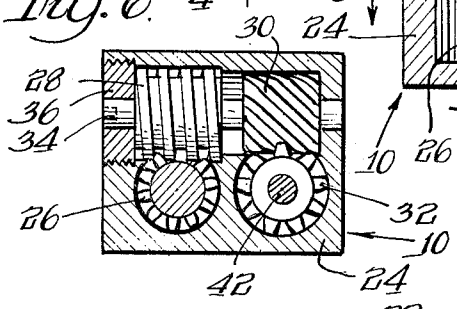
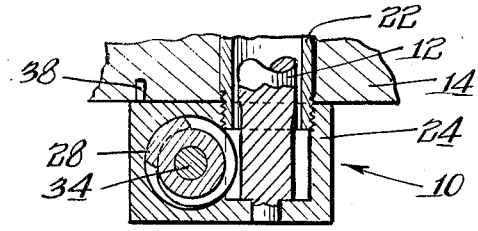


Fig. 7.



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DEVICE FOR TUNING AND TENSIONING STRINGED MUSICAL INSTRUMENTS

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This invention relates generally to devices for tuning stringed musical instruments such as banjos and the like.

Strings used on musical instruments such as banjos and the like are commonly made of metal, and hence require the application of a comparatively strong pulling force to impart the proper tuned tension to the string. Gut strings such as those used on violins do not require the application of tensioning forces as great as those necessary in the tuning of metallic strings or wires. Metallic strings or wires employed on banjos of the type known as tenor banjos as distinguished from conventional "long neck" banjos, require the application of considerably higher tension forces to obtain the required degree of tension. The A string on a tenor banjo, for example, consists of a length of single wire having a relatively high tensile strength.

The very fact that the above-mentioned forces are required to establish the proper tuned tension in the strings of a musical instrument such as a banjo increases the sensitiveness of adjusting the string tension to the required pitch. In other words, a steel string under considerable tension is more difficult to subject to fine pitch variations than a nonmetallic string. An infinitesimal variation in the tension of a steel banjo string, for example, will induce a relatively great and audibly detectable change in pitch. A gut string on a violin will permit of much greater movement of the tuning peg in order to establish the desired pitch. It is, therefore, one of the objects of the present invention to provide tuning devices for stringed musical instruments in which such strings must be subjected to relatively high tension in order to bring them into proper pitch. Devices have heretofore been employed on guitars, mandolins and the like, which were designed to reduce the turning force necessary to set up the desired degree of tension in the metallic strings thereof. These conventional tuning devices do not meet present requirements of certain stringed musical instruments, and the present invention contemplates the provision of an improved string tensioning device which will meet the inadequacies of string tuning mechanisms heretofore available.

More specifically, the present invention contemplates a device of the type referred to above which reduces greatly the turning force heretofore required in tuning metallic strings of musical instruments and which will also serve to increase the sensitivity with which such tuning may be accomplished.

It is a further object of the present invention to provide an improved string tuning device employing a novel gear train arrangement which may be produced economically by the practice of conventional machine shop or screw machine methods.

Still more specifically, the present invention contemplates an improved tuning device which may be applied to the underside of the outer extremity of a banjo neck, thus enabling the user to turn the tuning pegs in the same manner as conventional tuning pegs have heretofore been operated, and at the same time provide a mechanism whereby the effort required to turn the tuning peg or member is reduced to a minimum.

The present invention further contemplates a string tensioning and tuning device as set forth above, having a novel worm and gear construction.

The foregoing and other objects and advantages will be more apparent from the following detailed description wherein:

FIG. 1 is a perspective view of a banjo equipped with string tensioning and tuning devices of the type contemplated by the present invention;

FIG. 2 is an enlarged fragmentary plan view of the free extremity of the banjo neck showing more in detail the respective positions occupied by the aforesaid novel string tuning and tensioning device;

FIG. 3 is a perspective view of the tuning and tensioning device of the present invention detached from the neck of the instrument;

FIG. 4 is an enlarged sectional view of the tensioning device taken substantially along the line **4—4** of FIG. 3, said device being shown in operative association with the neck of the instrument;

FIG. 5 is a vertical sectional view taken along the line **5—5** of FIG. 4;

FIG. 6 is a horizontal sectional view taken along the line **6—6** of FIG. 4; and

FIG. 7 is a fragmentary sectional view taken along the line **7—7** of FIG. 4.

Referring now to the drawings more in detail, wherein like numerals have been employed to designate similar parts throughout the various figures, it will be seen that the invention is concerned primarily with a musical instrument string tensioning and tuning device designated generally by the numeral **10**. This device **10** includes a string accommodating rotary shaft **12** adapted to project through apertures provided in the neck structure **14** of the banjo, designated generally by the numeral **16** in FIG. 1. The portion of the shaft **12** which projects upwardly beyond the upper surface of the neck portion **14** is designed to accommodate coils of a musical instrument string **18**, as clearly illustrated in FIGS. 3, 4 and 5.

The shaft **12** is rotatable within a threaded bushing **20** which is in turn mounted within an internally threaded sleeve **22**. The lower extremity of the sleeve **22** makes threaded engagement with a complementary threaded aperture in a block or housing **24** (see FIG. 4). A driven gear **26** is coupled or formed integral with the lower extremity of the shaft **12**.

The block or housing **24** serves to accommodate a gear train mechanism which comprises the aforesaid gear **26**, worm **28** meshing therewith, helical gear **30** and a complementary meshing helical gear **32**. The worm **28** and helical gear **30** are drivingly mounted with a common stud or shaft **34** (FIG. 6). The housing or block **24** forms a bearing for the right extremity of the shaft **34** as viewed in FIG. 6, the opposite extremity of said shaft being mounted in a centrally apertured nut member or bearing **36**. The outer portion of this nut member **36** is slotted as shown in FIG. 3 to accommodate a screw driver for purposes of convenient assembly and disassembly. To properly locate the housing **24** upon the underside of the banjo neck **14** and to prevent lateral displacement after assembly of the housing to the neck, locating pins **38** are employed. When these are inserted within complementary apertures provided along the underside of the neck **14**, the tuning mechanism **10** will occupy its proper position.

From the foregoing, it will be apparent that if rotation is imparted to the helical gear **32**, rotation will be experienced by the helical gear **30** meshing therewith. Consequently, the worm **28** will then experience rotation, and this will cause rotation of the gear **26** meshing with the worm. This will obviously result in rotation of the string accommodating shaft **12**. Rotation to the driving gear **32** may be imparted by turning a key member **40** having a splined connection with the lower extremity

of a drive shaft **42**. The upper reduced extremity of this drive shaft **42** is mounted within an externally threaded bushing or nut member **44**. The nut member **44**, like the previously mentioned nut member **36**, is provided with suitable slots for accommodating a screw driver as illustrated in FIG. 3. Thus the shaft **42** may be assembled from the upper side of the housing **24** with the gear **32** drivingly connected with said shaft. After such assembly the bushing nut **44** may be screwed into the upper face of the housing so as to occupy the position shown in FIGS. 4 and 5. If desired, the helical gear **32** may be formed integral with the shaft **42**. After the above-mentioned assembly has been effected, a self-lubricating washer **46** made of one of the readily available self-lubricating plastic materials, such as nylon or Teflon, may be placed in position followed by the application of a spacing collar **48**. Then the key member **40** may be assembled with the shaft, the flat side of the shaft serving to make a spline coupling with the key member **40**. A screw arrangement **50** is employed to tighten the key member **40**, collar **48** and self-lubricating washer **46** in place.

From the foregoing, it will be apparent that rotation of the key member **40** causes rotation of the string accommodating shaft **12** at a very greatly reduced rate. The mechanical advantage introduced by the gear train mechanism consisting of the members **26, 28, 30** and **32** makes it possible to effect tensioning of the instrument string and subsequent tuning with the exertion of a minimum amount of force. The tuning and tensioning mechanism **10** is self-contained and may be applied as a unit to the neck of the instrument. The constituent parts are of simple construction, combining to form a very compact relatively lightweight device. It is anticipated that the various parts of the above-described tuning and tensioning mechanism may be made of metals of various types and in some instances, plastic materials may be employed. It will be obvious that in order to obtain the tensioning of the four strings shown in the drawings by rotating the key members **40** in the same direction, namely in a clockwise direction as viewed in FIG. 2, the helix of each of the worm or helical gears on one side of the neck will be reversed with respect to the corresponding parts employed in the tensioning devices on the other side. Thus, as viewed in FIG. 2, the tensioning devices or units **10** positioned to the left side of the neck will have the worm or gear helix reversed with respect to the worm or gear helix in the devices located on the right side of the neck. It will be noted that the strings on the left side of the neck as viewed in FIG. 2 are wound in a counter-clockwise direction on the shafts **12**, while the two strings on the other side of the neck are wound in a clockwise direction.

By employing the novel structural features of the gear train previously described the axes of the shafts **42** are disposed in parallelism with the axes of the string accommodating shafts **12**. It is conventional in banjos to employ turning pegs or shafts which extend normal to the plane of the banjo neck. Hence by employing applicant's tensioning device the axial disposition of the tuning keys remains the same.

It will also be understood from the foregoing description that the string accommodating shafts **12** are locked against retrograde movement or loosening due to the arrangement of the gear train. Obviously if the screw accommodating shaft **12** is subjected to forces tending to rotate it in a clockwise direction as viewed in FIG. 3, the worm **28** will cooperate with the gear **26** in preventing any clockwise movement of the shaft. The disposition of the helical gears **30** and **32** is such as to permit rotation of the shaft **42** in either direction. The arrangement of the housing and parts associated therewith is such as to render assembly or disassembly of the parts with minimum skill and effort.

While certain specific structural details have been disclosed herein, and while the invention has been described as applied to a musical instrument such as a banjo, it will be apparent that the invention contemplates other modifications and combinations without departing from the spirit and scope of the appended claims.

The invention is claimed as follows:

1. A tuning device for banjos and the like including a housing adapted for attachment to the neck of a stringed musical instrument, rotary winding means extending from said housing for accommodating the free extremity of a musical instrument string, manually operable key means extending from another side of said housing and having its axis disposed in substantial parallelism with the axis of said rotary winding means, and gear mechanism carried by said housing, coupling said manually operable key means with said rotary string winding means, said gear mechanism including worm and worm gear means.

2. A tuning device for banjos and the like including a housing adapted for attachment to the neck of a stringed musical instrument, rotary winding means extending from said housing for accommodating the free extremity of a musical instrument string, manually operable key means extending from another side of said housing, the axes of said key means and said rotary winding means being disposed in substantial parallelism, and gear mechanism for transmitting rotary motion from said key means to said rotary winding means including a first gear member driven by said key means, a second driven gear member coupled with said winding means, and gearing coupling said first and second gear members.

3. A tuning device for banjos and the like as set forth in claim **2** wherein said gear mechanism includes worm and worm gear elements.

4. A tuning device for banjos and the like as set forth in claim **2** wherein the gear mechanism includes meshing helical gears and worm and worm gear means.

5. A tuning device for banjos and the like including a housing adapted for attachment to the under surface of the neck of a stringed musical instrument, rotary winding means extending from said housing and adapted to project through and beyond the upper surface of said neck for accommodating the free extremity of a musical instrument string, manually operable key means extending from the side of said housing oppositely disposed from said rotary winding means, the axes of said manually operable rotatable key means and said rotary winding means being disposed in substantial parallelism and spaced laterally with respect to each other, and gear mechanism for transmitting rotary motion from said key means to said rotary winding means, said gear mechanism including worm and worm gear means.

6. A tuning device for bajos and the like as set forth in claim **5** wherein the gear mechanism includes a helical gear driven by said manually operable key means, a second helical gear meshing with the first mentioned gear, a worm driven from said second mentioned helical gear and a gear driven by said worm for causing rotation of said rotary winding means.

7. A tuning device for banjos and the like as set forth in claim **5**, wherein the gear mechanism is enclosed within a unitary housing designed for attachment to the under side of the neck of a stringed musical instrument.

8. A tuning device for banjos and the like including a housing adapted for attachment to the undersurface of the neck of a stringed musical instrument, rotary winding means extending from said housing and adapted to project through and beyond the upper surface of said neck for accommodating the free extremity of a musical instrument string, manually operable key means extending from the side of said housing oppositely disposed from said rotary winding means, the axes of said manually op-

erable rotatable key means and said rotary winding means being disposed in substantial parallelism and spaced laterally with respect to each other, and gear mechanism for transmitting rotary motion from said key means to said rotary winding means, said gear mechanism including a first helical gear coaxially coupled with said key means, and a second helical gear meshing with and driven by said first helical gear, a worm coaxially coupled with said second helical gear, and a gear coaxially coupled with said string winding means and meshing with said worm.

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