Aug. 22, 1950 J. B. COUSINEAU 2,519,824

STRINGED MUSICAL INSTRUMENT

Filed April 29, 1949 3 Sheets-Sheet 1

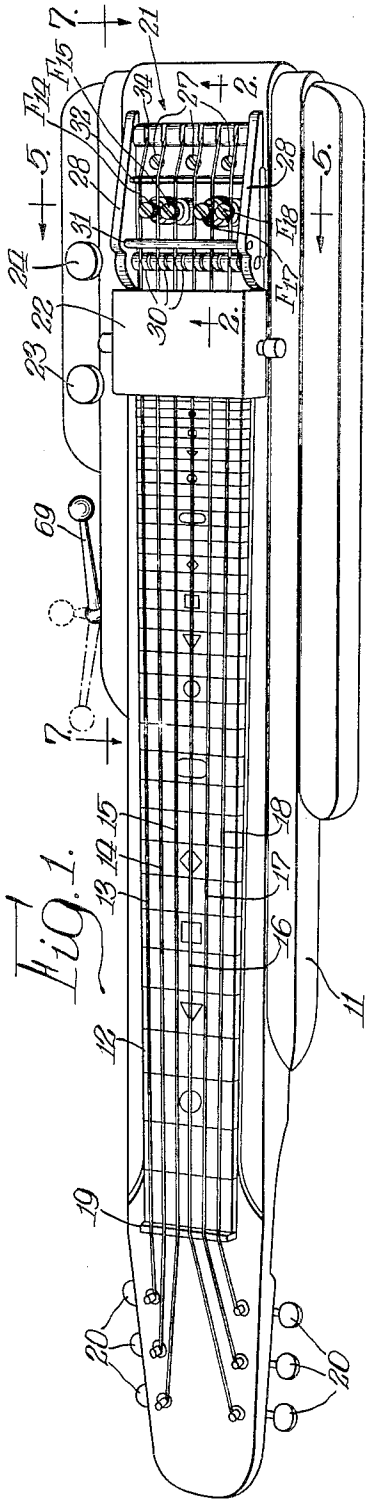

Fig. 1.

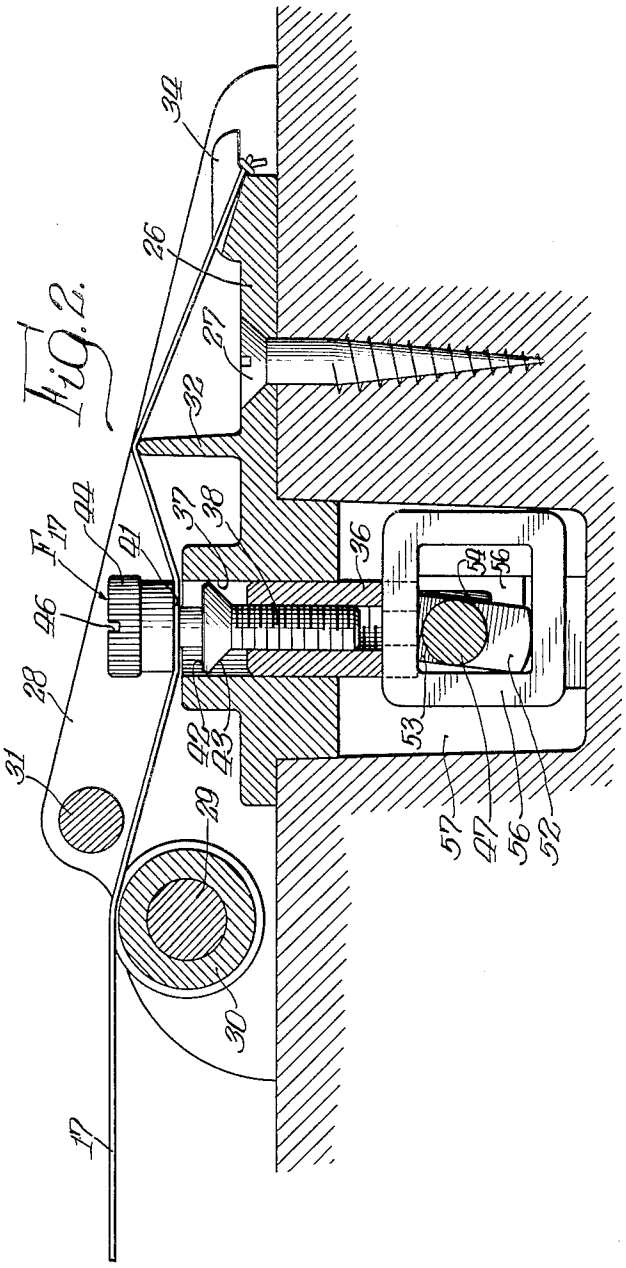

Fig. 2.

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Fig. 3.

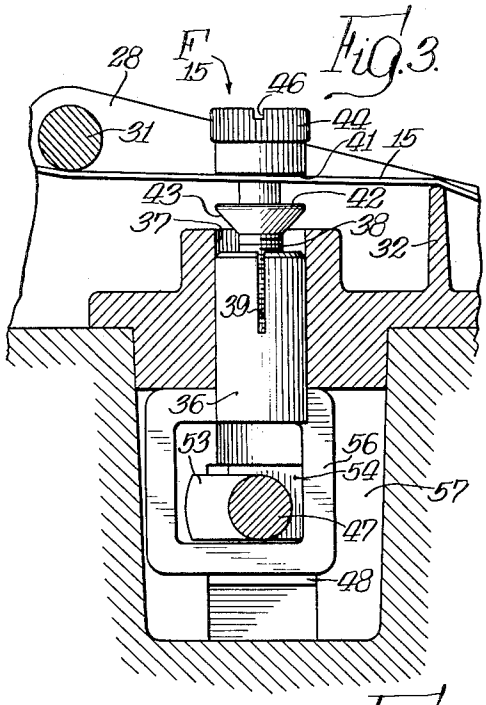


Fig. 4.

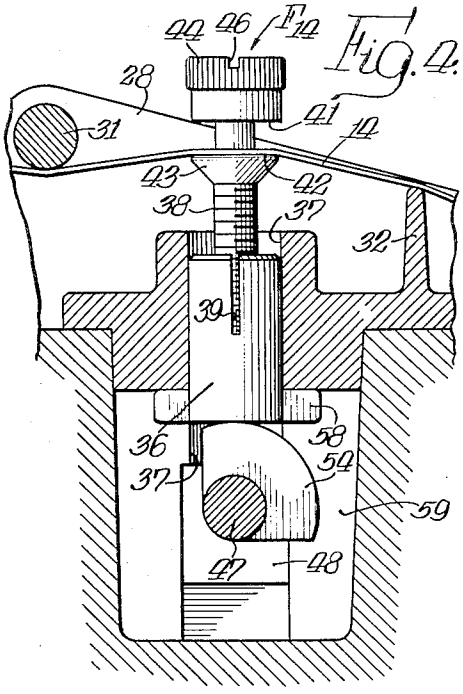
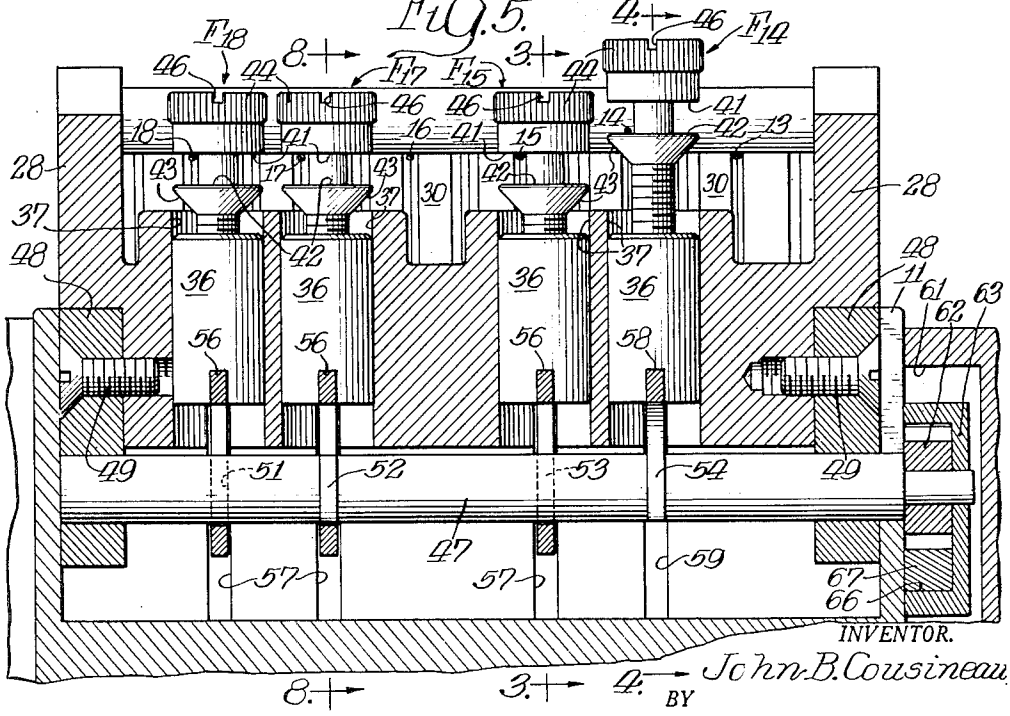


Fig. 5.



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STRINGED MUSICAL INSTRUMENT

Filed April 29, 1949 3 Sheets-Sheet 3

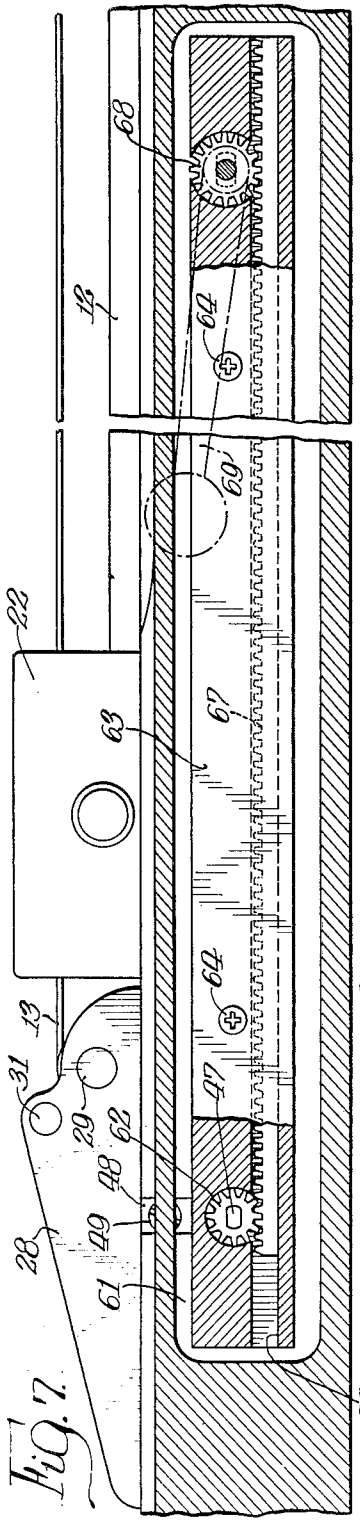

Fig. 7.

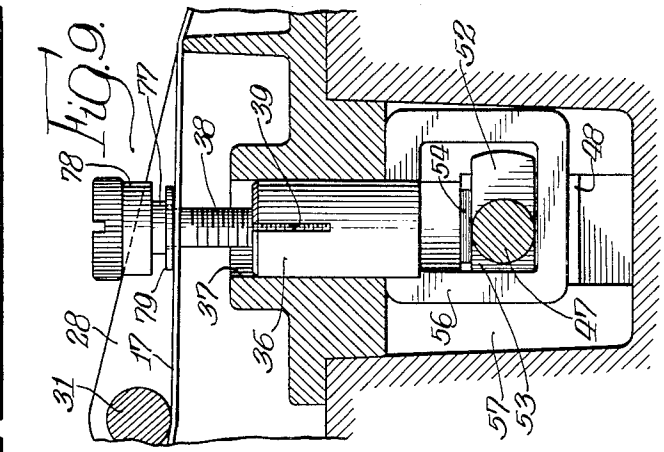

Fig. 9.

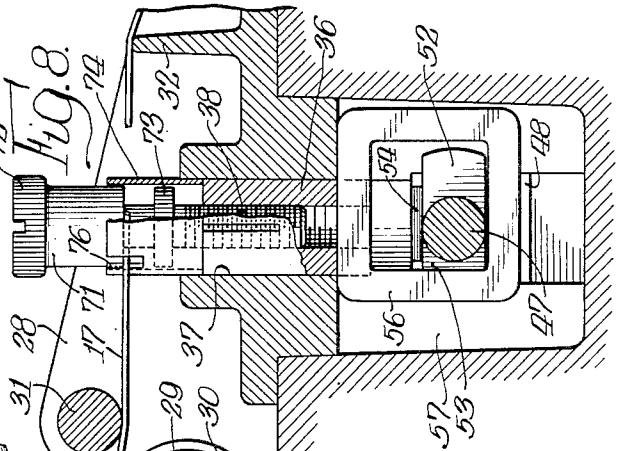

Fig. 8.

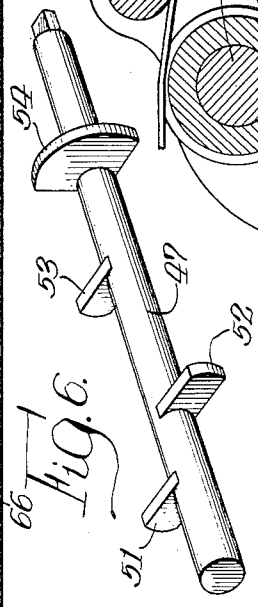

Fig. 6.

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2,519,824

UNITED STATES PATENT OFFICE

2,519,824

STRINGED MUSICAL INSTRUMENT

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Application April 29, 1949, Serial No. 90,517

15 Claims. (Cl. 84—312)

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This invention relates to stringed musical instruments, especially to instruments of the type of the electric steel guitar, and more particularly to an improved tuning mechanism for such instruments.

The utility of the conventional steel guitar, and other similar stringed instruments used with electrical amplification, is seriously limited by the fact that the strings must be adjusted to a fixed chord tuning which cannot be changed to any appreciable extent while the instrument is being played. Thus, with such an instrument there is no satisfactory means of playing chords or partial chords other than those corresponding to the initial fixed tuning of the strings. Obviously, the resultant lack of flexibility and musical range greatly restricts the popularity and adaptability of such instruments especially for use in orchestras and other musical groups.

Various tuning devices and tuning changers have been suggested for use with instruments of the foregoing character in order to permit relatively rapid changes in the string tuning. However, such of these devices as have been capable of meeting musical and playing requirements have not been altogether satisfactory both for the reason that they have been unduly complicated in structure and operation and also because they are often inaccurate and unreliable in execution of the required changes in tuning. For example, certain of these prior art devices require elaborate and bulky systems of interconnected cranks, levers, and foot pedal arrangements. Furthermore, most of the prior art devices comprise string-tensioning levers or rollers which are attached to the ends of the strings, the opposite ends of the strings being anchored to the instrument, whereby the string tension may be varied by exerting a greater or lesser pull on the strings longitudinally thereof. Such devices are generally unreliable because the levers or rollers which are attached to the ends of the strings tend to wear or become misadjusted with the result that they do not always return to their original positions and thus the initial fixed tuning of the strings is disturbed.

Accordingly, a primary object of my invention is to provide, in a stringed musical instrument of the above-mentioned type, novel means for readily effecting frequent and rapid changes in the tuning of the strings.

A further object of the invention is to provide, in a stringed musical instrument of the type described, a tuning mechanism of relatively compact and inexpensive construction which can

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be operated manually to effect rapid changes between a plurality of predetermined tuning patterns.

Another object of the invention is to provide, in a stringed musical instrument of the character described, a tuning mechanism for selectively altering the tension of the strings or predetermined groups thereof which is capable of accurate adjustment and which, even with repeated use, does not tend to disturb the original fixed tuning of the strings.

Other objects and advantages of the invention will become apparent upon reference to the subsequent detailed description and the accompanying drawings, in which:

Fig. 1 is a perspective view of an electric steel guitar provided with a tuning changer or string-tensioning device comprising one specific embodiment of my invention;

Fig. 2 is a fragmentary longitudinal sectional view such as along the line 2—2 of Fig. 1 and showing parts of the tuning changer in a position effecting a change from the fixed tuning;

Fig. 3 is a fragmentary sectional view taken along the line 3—3 of Fig. 5;

Fig. 4 is a fragmentary sectional view taken along the line 4—4 of Fig. 5;

Fig. 5 is a transverse sectional view through the tuning changer and adjacent portions of the instrument such as along the line 5—5 of Fig. 1;

Fig. 6 is a perspective view of an actuating element comprising part of the tuning changer;

Fig. 7 is a sectional view taken approximately along the line 7—7 of Fig. 1 and showing the details of the manual mechanism for operating the tuning changer;

Fig. 8 is a fragmentary sectional view such as might be taken along the line 8—8 of Fig. 5 but showing a modified structure for one element of the device; and

Fig. 9 is a view similar to Fig. 8 but showing still another modification of one element of the invention.

Referring now to Figs. 1 to 6, inclusive, of the drawings, the invention is illustrated by an electric steel guitar comprising a wood body 11 which is provided on its upper surface with a suitably fretted fingerboard 12 extending longitudinally thereof in the conventional manner. A plurality of strings, six being shown in the present case as indicated at 13, 14, 15, 16, 17, and 18, are tensioned along the body of the instrument extending over a nut 19 at one end of the fingerboard 12 and are connected to a plurality of conventional tuning keys 20. The strings are an-

chored at their opposite ends to a tuning changer unit, indicated generally at 21, which is mounted adjacent the opposite end of the body 11. The unit 21 comprises a principal feature of the present invention and will be described hereinafter in greater detail.

The instrument selected for illustration being an electric steel guitar, there is shown in Fig. 1 a hand rest 22 beneath which is mounted a suitable pick-up device (not shown) of well known type which is adapted to transmit the sound vibrations of the strings to an amplifier and loud speaker unit associated with the instrument. The pick-up device is provided with suitable volume and tone control means (not shown) which are inserted in the pick-up circuit for modifying the volume and tone of the string vibrations. These controls are adapted to be manually operated by means of a pair of control knobs 23 and 24 which are disposed at one side of the instrument and are readily accessible to the hand of the player.

In pursuance of the present invention, tuning changer or string-tensioning means of an auxiliary character is provided for selectively varying at will the pitch of predetermined groups of the strings 13 to 18. Such variation in pitch is accomplished by means of the string-tensioning unit 21 which functions independently of the tuning keys 20 or of any other string-tensioning mechanism with which an instrument of this type may be equipped.

The tuning changer or string-tensioning mechanism 21 comprises a cast one-piece base or body member 26 which is rigidly fastened by means of a plurality of screws 27 to the wooden body 11 of the instrument. Extending upwardly in spaced relation on each side of the body member 26 are upright parallel sides 28 having a roller shaft 29 extending transversely therebetween with a plurality of grooved string rollers 30 rotatably mounted on the shaft 29. A retaining bar 31 also extends transversely between the sides 28 in a slightly elevated position relative to the rollers 30 and to one side thereof. An integral bridge 32 projects upwardly from the body member 26 between the sides 28 for supporting the strings 13 to 18. The strings, as illustrated by string 17 in Fig. 2, extend over the rollers 30 and under the retaining bar 31, across the bridge 32, and thence downwardly where they are firmly anchored by means of knotted end portions or other suitable enlarged portions which are received and retained in a plurality of longitudinal slots 34 at the outer edge of the body member 26.

Disposed centrally of the body member 26 is a row of upright tuning fingers (each indicated generally by the letter F and a subscript) which are mounted for reciprocable sliding movement in the body member 26 and are adapted to engage and deflect the strings transversely for varying the tension thereof. The device illustrated in the drawings comprises four such tuning fingers designated generally as F_{14}, F_{15}, F_{17}, and F_{18} (Fig. 5) to indicate their association and coaction with strings 14, 15, 17, and 18, respectively. In the present embodiment of the invention, shown merely by way of illustration, tuning fingers are not provided for the strings 13 and 16 and the latter therefore retain their original tension as determined by the tuning keys 20.

Each of the tuning fingers comprises an internally threaded cylindrical guide portion or piston 36 which is slidably received in an upright

cylindrical bore 37 provided in the body member 26. An upwardly extending stem 38 is threaded into the upper end of the piston 36 for adjustment relative thereto, the piston 36 being provided with a pair of endwise slots 39 (Figs. 3 and 4) whereby the slotted halves of the piston may be crimped or pressed toward each other to provide a resilient and tight threaded fit with the stem 38. By providing a relatively tight threaded fit in this manner, inadvertent movement of the stem 38 relative to the piston 36 is avoided during use of the device, yet the necessary adjustments can be made when desired. The upper portion of the stem 38 is formed with an upper shoulder 41 and a lower shoulder 42, the latter having inclined side walls which slope downwardly, as at 43, to facilitate snapping the strings of the instrument upwardly into place between the shoulders 41 and 42 during assembly of the unit. Above the shoulder 41 is a knurled head or cap 44 having a slot 46 for screwing the stem 38 inwardly and outwardly relative to the piston 36.

By the above described tuning finger construction it will be seen that in each case a string extends between a pair of spaced upper and lower string-engaging shoulders which, upon vertical sliding movement of the tuning finger, are adapted to exert a vertical pull on the string and thereby deflect the same either upwardly or downwardly to increase the string tension. If a tuning finger is depressed downwardly, as in the case of finger F_{17} in Fig. 2, the corresponding string 17 is deflected downwardly by the upper shoulder 41 of the tuning finger, the string being retained at the respective sides of the finger F_{17} by the bridge 32 and one of the rollers 30. If a tuning finger is disposed in elevated or upwardly projecting position, as in the case of finger F_{14} in Fig. 4, the corresponding string 14 is deflected upwardly by means of the lower shoulder 42, the string being retained at one side thereof by the retaining bar 31 and at the other side thereof by means of its anchored connection with one of the slots 34 in the body member 26.

Thus, my invention provides for altering the tension of the strings by exerting a more or less localized transverse pull on the same intermediate their anchored or digidly held ends. By avoiding any change in the position of the fixed ends of the strings during use of the tuning changer mechanism, there is no tendency for the initial fixed tuning of the strings to be disturbed. When a tuning finger shoulder is disengaged from its corresponding string, the string tension is uniformly restored to its initial value as determined by the setting of the appropriate tuning key 20.

For actuating the tuning fingers a rotatable cam shaft 47 extends transversely of the body member 26 below the tuning fingers and is journaled at its opposite ends by means of a pair of bearing blocks 48 (Fig. 5) which are fastened to the body member 26 by means of screws 49. A plurality of radially extending cam elements 51, 52, 53, and 54 are rigidly secured to the shaft 47 for actuating the tuning fingers. As best seen in Fig. 6, the cam elements 51, 52, and 53 are in the form of projecting levers or arms, the cams 51 and 53 extending in one direction from the shaft 47 and the cam 52 extending diametrically in the opposite direction. The cam element 54 is segmental in form.

Associated with each of the tuning fingers F_{15}, F_{17}, and F_{18} is a cam follower in the form of a rectangular yoke 56 which depends from the lower end of the piston 36 and is received for sliding

movement in a vertical slot 57 in the body member 26 below the cylindrical bore 37. As seen in Fig. 5, the shaft 47 is positioned so that each of the radial cam elements 51, 52, and 53 is aligned with and disposed in camming relation within one of the surrounding yokes 56. Upon rotation of the shaft 47, each of the cam elements 51, 52, and 53 swings either upwardly or downwardly, depending upon the direction of rotation, and engages the inner edges or periphery of the corresponding yoke 56 whereby to move the associated tuning finger either upwardly or downwardly relative to the body member 26. The tuning finger F_{14} is provided with a cam follower in the form of a straight strip or bar 58 (Fig. 4) extending across the lower end of the piston 36 and having its ends slidably received in a vertical slot 59 similar to the slots 57. Upon rotation of the shaft 47 in a counterclockwise direction, as viewed in Fig. 4, the segmental cam element 54 coacts with the bar 58 to urge the tuning finger F_{14} into elevated position.

Because of its segmental form, the cam element 54 is at all times in engagement at some portion thereof with the sides of the slot 59 whereby to restrict endwise movement of the shaft 47 and to retain the same in place in the body member 26. When the arm-like cam elements 51, 52, and 53 are disposed in more or less vertical positions, it will be evident that these cam elements are clear of the slots 57 and thus it is only the coaction between the segmental cam element 54 and the slot 59 that serves to prevent axial displacement of the shaft 47 at all times. Although all of the slots 57 and 59 may conveniently be of the same width and are so shown in the drawings, I prefer to have the cam element 54 of slightly greater thickness than the cam elements 51, 52, and 53 in order to minimize the clearance between the cam element 54 and the sides of the slot 59.

For actuating the shaft 47, one end thereof extends outwardly, as seen in Fig. 7, into a longitudinal recess 61 in the wooden body 11 of the instrument and carries a pinion 62 mounted for rotation therewith. An elongated slideway 63 is fastened to the side of the instrument within the recess 61 by means of screws 64 and is provided with a slot 66 running lengthwise thereof and opening inwardly toward the body of the instrument. An elongated rack 67 is slidably disposed in the slot 66 with its teeth in engagement with the pinion 62. Another pinion 68 is mounted for rotation at the opposite end of the slideway 63 in operative engagement with the rack 67 and having an operating lever or handle 69 attached thereto. By rotary movement of the handle 69, the shaft 47 is rotated through the rack and pinion connections to effect the desired actuation of the tuning fingers. Although the tuning changer unit 21 is mounted at one end of the instrument, I am able, by means of the rack and pinion mechanism, to locate the operating handle 69 centrally of the body of the instrument immediately adjacent the playing area and thereby rendering the handle easily accessible to the hand of the player.

I prefer to have the pinion 62 somewhat smaller in size than the pinion 68, for example a gear ratio of 4:5 has been found to be suitable. As a result of this difference in the sizes of the pinions attached to the cam shaft 47 and the handle 69, the shaft 47 can be rotated through a full 180° by swinging the handle 69 through an arc somewhat less than 180°. Thus, the handle 69 when in either of its extreme positions is slightly elevated relative to the edge of the body 11 of the instrument and is, therefore, easily grasped by the hand of the player. If the handle 69 were constructed to rotate through 180°, it will be seen that in its extreme positions the grasping portion of the handle would be disposed below the top surface of the instrument body and might, therefore, be somewhat difficult to grasp when it is desired to effect a rapid operation of the tuning changer 21 during playing of the instrument.

An important feature of the operation of the tuning changer 21 resides in the means by which the cam mechanism is locked during certain positions of the tuning fingers. Inasmuch as the strings 13 to 18 are tensioned across the instrument, it will be evident that the strings when deflected by the tuning fingers will tend to urge the tuning fingers back to neutral or undeflected position. However, when any one of the cam elements 51, 52, or 53 is swung downwardly by rotation of the shaft 47, the camming action against the inner periphery of the cooperating yoke 56 carries the associated tuning finger into depressed position with the upper shoulder 41 engaging and deflecting the corresponding string downwardly. As seen in Fig. 2, as the cam element 52 completes its counterclockwise downward movement it passes through the vertical state and reaches a final position in which it is cocked slightly beyond center. In this position, the tension of the string 17 tending to urge the tuning finger T_{17} upwardly is resisted and counteracted by the locked overcenter relation of the cam element 52 coacting with and bearing against the bottom and side portions of the corresponding yoke 56. It will be evident that when the shaft 47 is in either of its extreme angular positions, at least one of the cam elements 51, 52, or 53 will coact in locked relation with its companion yoke 56 in the manner illustrated in Fig. 2. Downward pressure of an upwardly deflected string, such as the string 14 in Fig. 4, is resisted by the substantially vertical abutment of the segmental cam element 54 against the cooperating cam follower 58.

It will also be seen that the coaction of the cam arms 51, 52, and 53 with the yokes 56 limits the extent of angular rotation of the shaft 47 to approximately 180° as a result of abutment of the cam elements against the side portions of the yokes 56 when in locked position as seen in Fig. 2. Thus, it is unnecessary to provide stop members for limiting the longitudinal movement of the rack 67.

In the form of the invention shown in the drawings, the tuning changer may be operated to obtain any one of three different tuning patterns corresponding to three predetermined positions of the shaft 47 and the tuning fingers. In order to provide a complete understanding of the invention, a typical adjustment of the tuning changer 21 to obtain a representative set of tuning patterns is as follows:

(1) With the handle 69 in its forward or left-hand position as viewed in Fig. 1, the threaded stem 38 on each of the tuning fingers is adjusted relative to its associated piston 36 so that the upper and lower shoulders 41 and 42, respectively, are clear of the string. This adjustment of the tuning finger is designated as the neutral position.

(2) With all of the tuning fingers in neutral position as described above and with the handle 69 still in its forward or left-hand position as viewed in Fig. 1, each of the strings is then tuned by means of the tuning keys 20 to obtain a basic

board tuning pattern as follows: string 13—E, string 14—B, string 15—G♯, string 16—E, string 17—C♯, and string 18—G♯. This tuning pattern is a special basic tuning for adjustment purposes only and will not be retained when the instrument is completely tuned.

(3) With the handle 69 still in its forward or left-hand position as viewed in Fig. 1, the tuning finger F_{17} is adjusted by screwing its stem 38 downwardly until the string 17 is tuned to "D" with the upper shoulder 41 of the tuning finger deflecting the string 17 downwardly. With this adjustment the E7th tuning is obtained when the handle 69 is in its forward or left-hand position as viewed in Fig. 1, the tuning pattern being as follows: string 13—E, string 14—B, string 15—G♯, string 16—E, string 17—D, and string 18—G♯.

(4) Next the handle 69 is moved to its vertical position and the stem 38 on the tuning finger F_{14} is screwed outwardly until the string 14 is tuned to "C♯" with the lower shoulder 42 deflecting the string 14 upwardly. The resultant tuning pattern is the C♯ minor tuning when the handle 69 is in vertical position (Fig. 5). This tuning pattern is as follows: string 13—E, string 14—C♯, string 15—G♯, string 16—E, string 17—C♯, and string 18—G♯.

(5) The handle 69 is now moved to its back or right-hand position as viewed in Fig. 1, and the stems on each of the tuning fingers F_{15} and F_{18} are screwed downwardly until both the strings 15 and 18 are tuned to "A" with the upper shoulders 41 of each of the tuning fingers F_{15} and F_{18} deflecting the strings 15 and 18 downwardly. This arrangement comprises the A major high bass tuning with the handle 69 in its back or right-hand position as viewed in Fig. 1. The tuning pattern is as follows: string 13—E, string 14—C♯, string 15—A, string 16—E, string 17—C♯, and string 18—A.

It will be apparent that numerous variations of the above-described tuning patterns may be obtained by means of the tuning changer comprising my invention. For example, by varying both the construction and the number of cam elements and their coacting cam followers, different combinations or predetermined groups of strings may be subjected to increased or decreased tension corresponding to certain angular positions of the cam shaft. Furthermore, the number of tuning fingers employed in any given situation may be varied in order to increase or decrease the number of possible changes in the tuning pattern. In addition, it will be evident that each of the tuning fingers may be adjusted individually by means of the threaded connection of the stems 38 with the pistons 36 in order to control both the direction and extent of deflection of the strings.

In Fig. 8 there is shown a modified form of tuning finger construction which may be employed in place of the structure illustrated in Figs. 2 to 5. In this form the stem 38 is provided with an upper shoulder 71 and a slotted head 72 generally similar to the shoulder 41 and head 44 of the previous form of tuning finger. However, the lower shoulder is provided in the form of an integral flange 73 which is somewhat narrower in width than the lower shoulder 42 illustrated in Figs. 2 to 5. This decrease in diameter or width of the shoulder 73 provides greater clearance for pulling the tensioned strings upwardly into position between the shoulders 71 and 73 during assembly of the unit. In

the case of the shoulder 42 in Figs. 2 to 5, the somewhat greater width or diameter of the shoulder affords certain advantages in that there is less chance of the strings slipping off or becoming disengaged from the shoulder during use in the device. However, because of the greater width or diameter, the shoulders 42 are provided with the inclined or sloping portions 43 in order to facilitate forcing the strings upwardly into position between the spaced shoulders.

In Fig. 8 an annular collar 74 is disposed around the stem 38 adjacent the shoulder portions 71 and 73 and is supported by the upper end of the piston 36. The collar 74 is provided with a pair of endwise slots 76 (only one being shown in the drawing) through which the string, such as string 17, may extend. Thus, the collar 74 having the slots 76 serves to retain the string 17 between the shoulders 71 and 73 and accidental displacement of the string as a result of the relatively narrow width or diameter of the shoulder 73 is thereby prevented.

In Fig. 9 another modification of the tuning finger construction is shown. In the form shown the tuning finger is adapted to deflect a string in a downward direction only. To this end, an upper shoulder 77 is formed in the stem 38 below a slotted cap or head 78 which is generally similar to the head 44 shown in Figs. 2 to 5. A thrust washer 79 is loosely mounted on the stem 38 bearing against the shoulder 77 and being in engagement at its lower face with the string 17. Because of the loose mounting of the washer 79 on the stem 38, the latter may be readily adjusted relative to the piston 36 since the pressure of the string 17 will hold the washer 79 against movement while the stem 38 may be freely rotated by means of the head 78.

This provision for relative movement between the washer 79 and the stem 38 also avoids any tendency of the string to cause turning of the stem 38 in the piston 36 with repeated and continued use of the device. In addition, during use of a tuning changer mechanism such as described herein, there is often a tendency for the pressure of the strings to wear or form grooves in the abutting shoulder portions of the tuning fingers which are in engagement therewith. By means of a loose thrust washer, such as shown at 79, a readily replaceable wearing member is provided for receiving the pressure of the strings. Thus, when the washer 79 becomes grooved or worn to an undesirable extent, it may be easily removed by unscrewing the stem 38 from the piston 36 and a new washer can then be installed. In addition, the washer 79 may be formed from a special alloy or other substance which is more resistant to wear than the material from which the remainder of the tuning finger is constructed. It will be apparent that an analagous arrangement can be provided in the case where the tuning finger is designed to deflect the string upwardly.

It will be seen that the string-tensioning mechanism herein described is a compact device of relatively simple construction which is adapted to be installed on existing stringed instruments as well as in new and specially designed instruments. Because the tuning fingers engage the strings transversely intermediate the anchored ends thereof, the disadvantages inherent in certain of the prior art devices are completely avoided. By means of my device the end portions of the strings are retained in fixed position at all times once the basic or initial tuning of the

strings is established and there is, therefore, no tendency for the initial fixed tuning of the strings to be disturbed by use of the tuning changer. Furthermore, all cumbersome foot pedal arrangements and the like have been eliminated in my invention and rapid tuning changes may be executed by means of a simple hand lever located immediately adjacent the playing area and readily accessible to the hand of the player. The nature of my string-tensioning mechanism is such that innumerable variations in range and flexibility of the device may be achieved dependent upon the number and shape of cam elements and their associated tuning fingers and also dependent upon the individual adjustments of each of the tuning fingers relative to the respective strings.

Although the invention has been described in connection with one particular embodiment thereof, it will be understood that various modifications and equivalent structures may be resorted to without departing from the scope of the invention as defined in the appended claims.

I claim:

1. In a stringed musical instrument having a plurality of strings tensioned thereon, means for selectively varying the pitch of said strings comprising a plurality of slidably mounted tuning fingers adapted to engage the strings transversely intermediate the ends thereof, a rotatable shaft extending across the strings, and cam means operably connecting said shaft with each of said fingers for actuating said fingers to vary the tension of the strings in response to rotation of said shaft.

2. In a stringed musical instrument having a plurality of strings tensioned thereof, means for selectively varying the pitch of said strings comprising a plurality of slidably mounted tuning fingers each adapted to engage and deflect one of the strings intermediate its ends in a plane transverse to the plane of the strings whereby to vary the string tension, a rotatable shaft extending across the strings, a plurality of cam members carried on said shaft, and means on each of said fingers coacting with said cam members for actuating said fingers in response to rotation of said shaft.

3. In a stringed musical instrument having a plurality of strings tensioned thereon, means for selectively varying the pitch of said strings comprising a plurality of upright tuning fingers slidably mounted adjacent the strings intermediate the ends thereof, each of said fingers having a shoulder portion adjacent its upper end adapted to engage and deflect one of the strings for varying the string tension, a shaft rotatably mounted below said fingers, means for rotating said shaft, a plurality of cam members carried by said shaft, and a plurality of cam followers at the lower end of said fingers, said cam followers coacting with said cam members for actuating said fingers in response to rotation of said shaft.

4. In a stringed musical instrument having a plurality of strings tensioned thereon, means for selectively varying the pitch of said strings comprising a plurality of tuning fingers slidably mounted adjacent the strings, each of said fingers comprising a slidable guide portion and a stem portion extending therefrom, said stem portion having a shoulder for engaging and deflecting a string intermediate the ends thereof to vary the tension thereof and said stem portion being adjustable relative to said guide portion,

a rotatable shaft extending across the strings, and cam means operably connecting said shaft with the guide portions of said fingers for actuating the latter in response to rotation of said shaft.

5. In a stringed musical instrument having a plurality of strings tensioned thereon, means for selectively varying the pitch of said strings comprising a body member adapted to be mounted on the instrument and provided with a plurality of bores, a plurality of tuning fingers slidably mounted in said body member, each of said fingers having at its lower portion a piston slidable in one of said bores and an adjustable stem extending upwardly from said piston and threaded therein for movement away from and toward said piston, said stem being provided with a projecting shoulder for engaging and deflecting a string intermediate its ends whereby to vary the string tension, a rotatable shaft journaled in said body member and extending across the strings below said fingers, and cam means operably connecting said shaft with the pistons on said tuning fingers for raising and lowering the latter in response to rotation of said shaft.

6. In a stringed musical instrument having a plurality of strings tensioned thereon, means for selectively varying the pitch of said strings comprising a plurality of tuning fingers slidably mounted adjacent the strings and adapted to engage and deflect the strings transversely intermediate the ends thereof for varying the string tension, a rotatable shaft extending across the strings, a plurality of cam followers in the form of yokes depending from said tuning fingers and having said cam elements operatively disposed therein whereby said fingers are actuated to vary the string tension upon rotation of said shaft.

7. In a stringed musical instrument having a plurality of strings tensioned thereon, means for selectively varying the pitch of said strings comprising a body member adapted to be mounted on the instrument and having a plurality of openings extending therethrough, a plurality of upright tuning fingers slidably mounted in said openings in the body member and adapted to engage and deflect the strings intermediate the ends thereof for varying the string tension, a plurality of cam followers in the form of rectangular yokes depending from said tuning fingers and slidably received within slots in said body member below said openings, a rotatable shaft extending through said yokes and journaled in said body member, and a plurality of cam elements projecting radially from said shaft in operative engagement with said yokes whereby said tuning fingers are actuated in response to rotation of said shaft.

8. In a stringed musical instrument having a plurality of strings tensioned thereon, means for selectively varying the pitch of said strings comprising a plurality of tuning fingers slidably mounted adjacent the strings and adapted to engage and deflect the strings transversely intermediate the ends thereof for varying the string tension, a plurality of cam followers in the form of rectangular yokes depending from said tuning fingers, a rotatable shaft extending through said yokes, and a plurality of cam elements projecting radially from said shaft, said cam elements being enclosed by said yokes and being in operative engagement therewith for actuating said fingers in response to rotation of

said shaft, at least one of said cam elements being engageable in locked over-center relation with its corresponding yoke when said shaft is in a predetermined rotary position whereby to prevent undesired rotation of said shaft by the pressure of the strings on said fingers.

9. In a stringed musical instrument having a plurality of strings tensioned thereon, means for selectively varying the pitch of said strings comprising a plurality of slidably mounted tuning fingers each adapted to engage and deflect one of the strings intermediate the ends thereof for varying the string tension, certain of said fingers being engageable with the corresponding strings to deflect the same in one direction and the remainder of said fingers being engageable with their corresponding strings to deflect the latter in the opposite direction, a rotatable shaft extending across the strings, and a plurality of cam means coacting between said shaft and said fingers for deflecting predetermined combinations of strings in response to different predetermined rotary positions of said shaft whereby to vary the tuning of the instrument by rotation of said shaft.

10. In a stringed musical instrument having a plurality of strings tensioned thereon, means for selectively varying the pitch of said strings comprising a plurality of upright tuning fingers slidably mounted for movement transversely of the strings intermediate the ends thereof, each of said fingers comprising a vertically adjustable stem having a pair of spaced upper and lower shoulder portions adapted to engage and deflect the corresponding string for varying the string tension, certain of said fingers having their stems adjusted so that the upper shoulder portions thereof are engageable with the corresponding strings to deflect the same in a downward direction and the remain of said fingers having their stems adjusted so that the lower shoulder portions thereof are engageable with their corresponding strings to deflect the latter in an upward direction, a rotatable shaft extending across the strings, and a plurality of independent cam means coacting between said shaft and said fingers whereby predetermined groups of fingers are actuated for deflecting corresponding groups of strings in predetermined directions in response to different predetermined rotary positions of said shaft, the tuning of the instrument thereby being varied by rotation of said shaft.

11. In a stringed musical instrument having a plurality of strings tensioned thereon, means for selectively varying the pitch of said strings comprising a plurality of slidably mounted tuning fingers adapted to engage and deflect the strings intermediate the ends thereof for varying the string tension, each of said fingers having a stem portion provided with a string-engaging shoulder and a slotted collar on said stem portion and adapted to fit over said shoulder for retaining a string in engagement therewith, a rotatable shaft extending across the strings, and cam means operably connecting said shaft with said fingers for actuating the latter in response to rotation of said shaft.

12. In a stringed musical instrument having a plurality of strings tensioned thereon, means for selectively varying the pitch of said strings comprising a plurality of slidably mounted tuning fingers adapted to engage and deflect the strings intermediate the ends thereof for varying the string tension, each of said fingers having a stem portion and a replaceable thrust washer loosely mounted thereon for engaging the corresponding string, a rotatable shaft extending across the strings, and cam means operably connecting said shaft with said fingers for actuating the latter in response to rotation of said shaft.

13. In a stringed musical instrument having a plurality of strings tensioned thereon, means for selectively varying the pitch of said strings comprising a plurality of tuning fingers slidably mounted adjacent the strings and adapted to deflect the strings intermediate the ends thereof for varying the string tension, a rotatable shaft extending across the strings, cam means operably connecting said shaft with said fingers for actuating the latter in response to rotation of the shaft, an operating handle readily accessible from the normal playing area of the instrument, and operating connections between said handle and said shaft for rotating the latter.

14. In a stringed musical instrument having a plurality of strings tensioned thereon, means for selectively varying the pitch of said strings comprising a plurality of tuning fingers slidably mounted adjacent the strings and adapted to deflect the strings intermediate the ends thereof for varying the string tension, a rotatable shaft extending across the strings, cam means operably connecting said shaft with said fingers for actuating the latter in response to rotation of the shaft, an operating handle extending from the body of the instrument adjacent the normal playing area thereof, and operating connections comprising a rack and pinion mechanism extending between said handle and said shaft for rotating the latter.

15. In a stringed musical instrument having a plurality of strings tensioned thereon, means for selectively varying the pitch of said strings comprising a plurality of tuning fingers slidably mounted adjacent the strings and adapted to deflect the strings intermediate the ends thereof for varying the string tension, a rotatable shaft extending across the strings, cam means operably connecting said shaft with said fingers for actuating the latter in response to rotation of the shaft, an operating handle extending from the body of the instrument adjacent the normal playing area thereof, and operating connections between said handle and said shaft for rotating the latter, said connections comprising a pair of pinions mounted respectively on said shaft and said handle, and a rack operatively engaged with said pinions, the pinion on said handle being larger than the pinion on said shaft whereby rotary movement of said handle of relatively smaller extent produces a predetermined rotary movement of relatively greater extent in said shaft thereby insuring that said handle extends from the body of the instrument in readily accessible position at all times.

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