Nov. 14, 1967 C. L. FENDER 3,352,188

STRING MOUNTING FOR STEEL PEDAL GUITARS

Filed July 17, 1963

4 Sheets-Sheet 1

FIG. 1

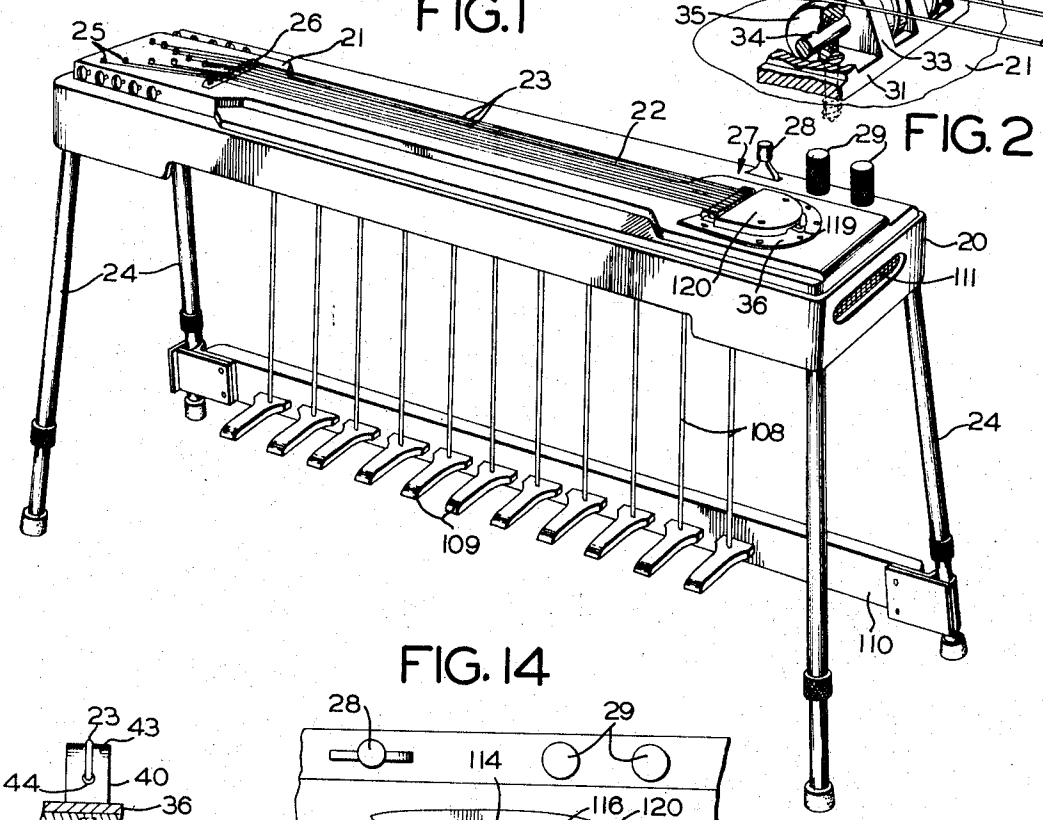


FIG. 2

FIG. 14

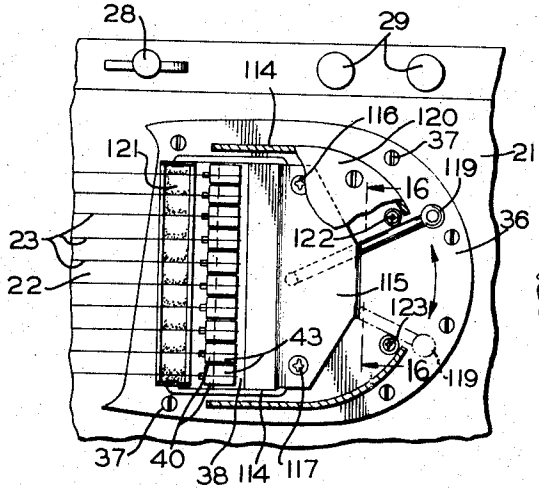


FIG. 16

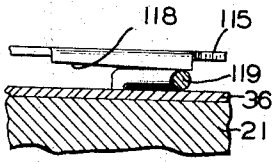
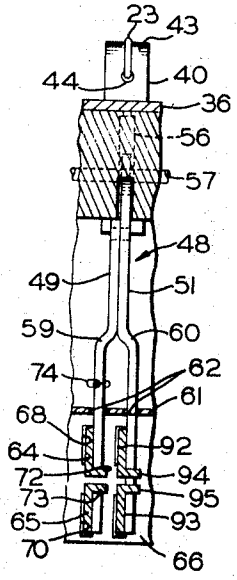


FIG. 7



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STRING MOUNTING FOR STEEL PEDAL GUITARS

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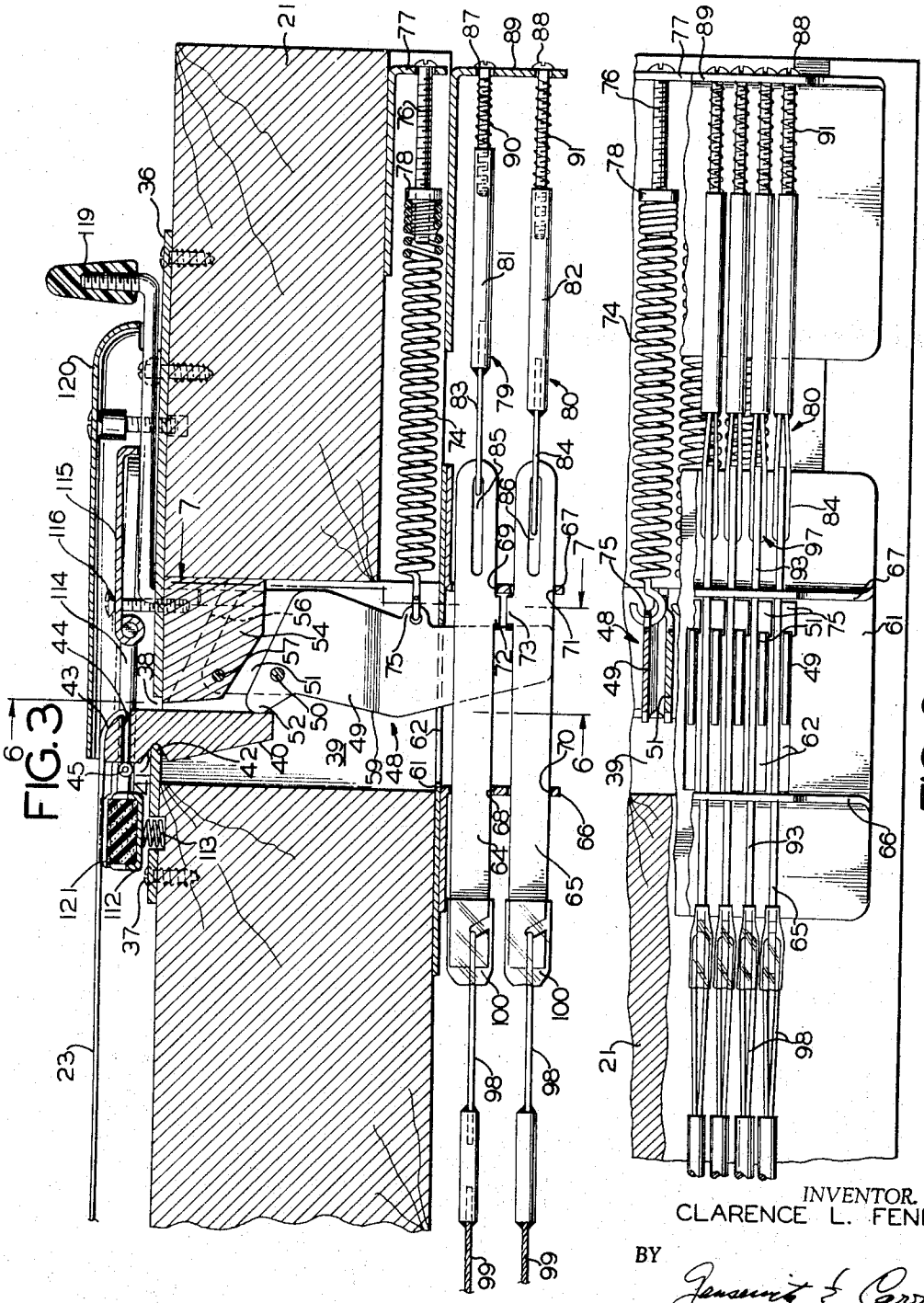


FIG. 3

FIG. 8

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STRING MOUNTING FOR STEEL PEDAL GUITARS

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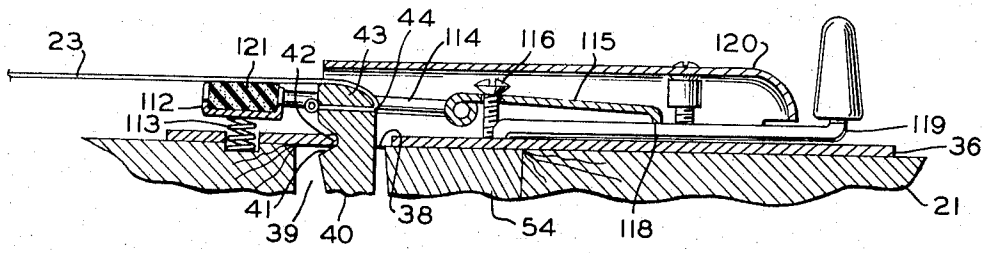


FIG. 4

FIG. 15

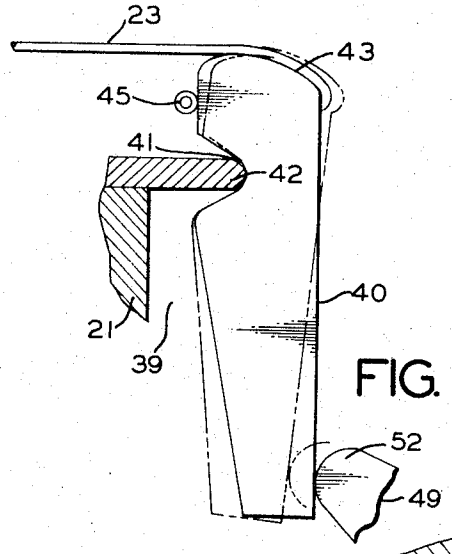


FIG. 5

FIG. 13

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Nov. 14, 1967 C. L. FENDER 3,352,188

STRING MOUNTING FOR STEEL PEDAL GUITARS

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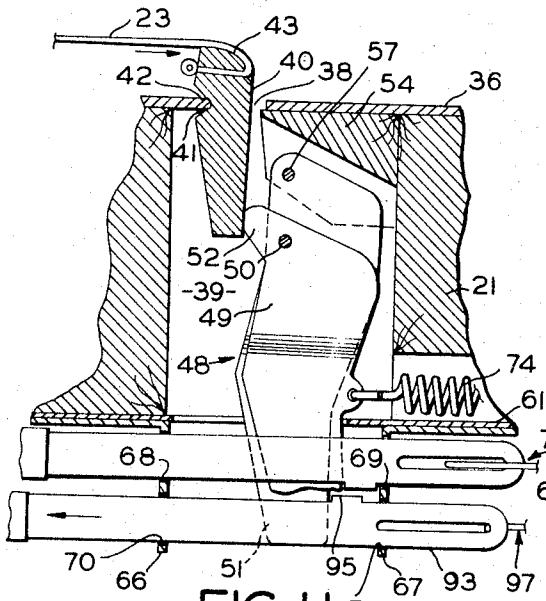


FIG. 11

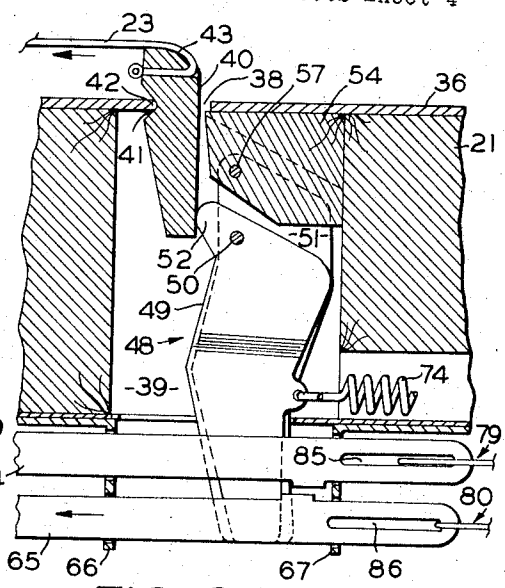


FIG. 9

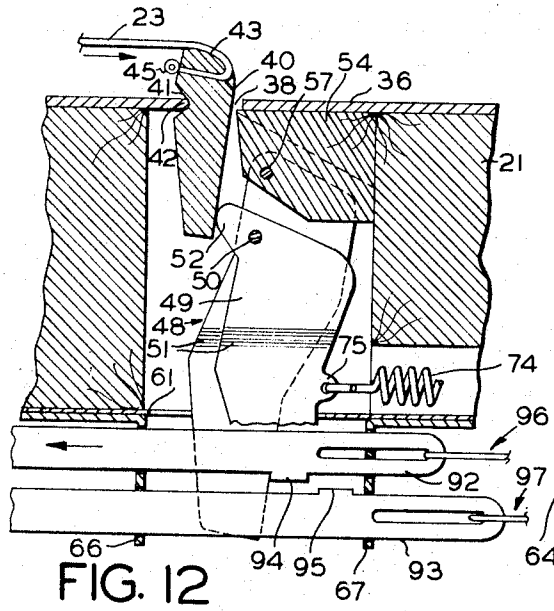


FIG. 12

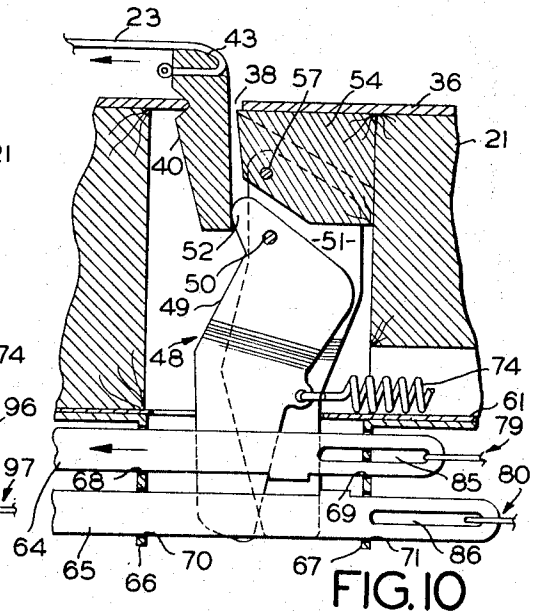


FIG. 10

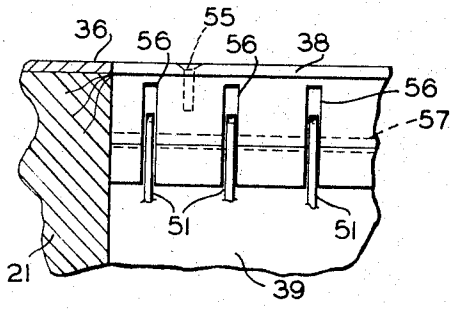


FIG. 6

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3,352,188

STRING MOUNTING FOR STEEL PEDAL GUITARS

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Filed July 17, 1963, Ser. No. 295,641
15 Claims. (Cl. 84—312)

ABSTRACT OF THE DISCLOSURE

The disclosure relates to an electric steel pedal guitar in which a fulcrum is provided transversely of each string and a lever is pivotally associated with the fulcrum, one end of the lever being secured to the string. Actuating means are provided for pivoting such lever and comprise first and second actuating levers which are pivotally connected to each other. One of the actuating levers engages the first-mentioned (string-connected) lever, whereas the other actuating lever is pivotally connected to a fixed support. The string extends over an arcuate surface at the upper end of the first-mentioned lever, such surface being arcuate about the indicated fulcrum.

This invention pertains to a stringed musical instrument and, more particularly, to the mounting of the strings of an electric steel pedal guitar.

One problem in the design of certain lute-type stringed instruments, such as electric steel pedal guitars, is found in the means for varying the tension of the strings. Linkages normally are provided for altering string tension in order to cause the note struck to become sharp or flat in various degrees. However, these arrangements have not always been readily adjustable and frequently have resulted in undue wear of the strings. Moreover, and of even greater consequence, there has been a loss of rigidity of the instrument insofar as the mounting of the strings is concerned. When this occurs, the dwell time of the musical note is reduced materially. If the ends of a vibrations are undesirably damped, and the time during phase vibrations may be set up which tend to cancel and counteract the vibrations of the strings. Hence, the string vibrations are undesirably damped, and the time during which the note sounds becomes reduced.

The present invention provides a steel pedal guitar of great rigidity, having improved string tensioning and muting provisions. In accomplishing this, the strings are mounted on individual levers, which replace the bridge at one end. Each lever pivots about a fixed fulcrum, eliminating the necessity for an axle with attendant clearances and loss of stiffness. The tops of the levers engaged by the strings are arcuate, having a radius of generation with its center point at the fulcrum, so that, regardless of the rotational position of the lever, the effective length of the string is constant. The levers that mount the strings are engaged by a dual lever system, which may be actuated by pedals. The dual lever units may be connected in various ways to suit the requirements of the musician to obtain desired effects upon the playing of the instrument. The levers are operable selectively so that the string tension is either increased or decreased.

Therefore, it is an object of this invention to provide an improved lute-type stringed instrument, such as an electric steel pedal guitar.

Another object of this invention is to provide a lute-type instrument with an improved arrangement for varying the string tension.

A further object of this invention is to provide a lute-type instrument of great rigidity.

An additional object of this invention is to provide a lute-type instrument having a string tensioning means which may be altered readily to selectively vary the tension in different combinations of strings.

These and other objects will become apparent from the following detailed description taken in connection with the accompanying drawings in which:

FIGURE 1 is a perspective view of the invention as incorporated in an electric steel guitar;

FIGURE 2 is an enlarged fragmentary perspective view, partially broken away, of the bridge at one end of the instrument;

FIGURE 3 is an enlarged longitudinal sectional view of the string mounting and tension adjusting arrangement, as well as the construction of the mute;

FIGURE 4 is a fragmentary longitudinal sectional view, similar to the upper portion of FIGURE 3, with the mute illustrated in its operative position;

FIGURE 5 is an enlarged side elevational view, partially in section, illustrating the bell crank and its pivotal mounting;

FIGURE 6 is a transverse sectional view taken along line 6—6 of FIGURE 3;

FIGURE 7 is a transverse sectional view taken along line 7—7 of FIGURE 3;

FIGURE 8 is a fragmentary bottom plan view, partially broken away, of the arrangement of FIGURE 3;

FIGURE 9 is a fragmentary longitudinal sectional view showing the rotation of the shorter one of the dual actuating levers in response to movement by one of the actuating slides;

FIGURE 10 is a view, similar to FIGURE 9, showing the movement of the lever by the other actuating slide;

FIGURE 11 is a view, similar to FIGURE 9, showing the movement of the longer actuating lever by one of its actuating slides;

FIGURE 12 is a view, similar to FIGURE 11, in which the second actuating slide for the longer actuating lever is operated;

FIGURE 13 is a fragmentary perspective view of the cable and pedal arrangement for operating the tension adjusting means;

FIGURE 14 is a fragmentary top plan view, partially broken away, of the mute arrangement;

FIGURE 15 is a fragmentary view of the mute showing the operating lever in its alternate position; and

FIGURE 16 is a fragmentary sectional view taken along line 16—16 of FIGURE 14 showing the cam for operating the mute.

With reference to the drawing and, in particular, to FIGURE 1, the invention is illustrated in connection with an electric steel pedal guitar. This musical instrument includes an elongated rectangular metal frame **20**, inside of which is carried a block **21** of hardwood. The latter unit includes a finger board **22** over which is a plurality of parallel strings **23**. The frame and the body block **21** are supported in the horizontal plane by four legs **24**.

The strings **23** extend from adjustable tuning pegs **25** across the nut **26** and over the finger board **22** to the string supporting and adjusting assembly **27**, which will be described in detail below. The device as illustrated is an electric guitar and, hence, includes an appropriate pick-up as well as switching and adjustment controls **28** and **29**.

The nut **26** includes a base **31** secured to block **21** transversely of the frame, having upstanding brackets **33** which mount an axle **34**. Grooved discs or pulleys **35** are carried by the shaft **34** and engaged by the strings **23**.

The string mounting assembly **27** includes a flat steel plate **36**, as may be seen in FIGURES 3, 4 and 14, fixed to the wood body block **21** by a plurality of screws **37**.

This plate is provided with a transverse rectangular slot 38 that partially covers a wider opening 39 through the block 21. Within this slot, in a side-by-side relationship, are bell cranks 40. There is one member 40 for each of the strings 23. Each member 40 includes a transverse recess 41 intermediate its ends which receives and engages the generally V-shaped forward edge 42 of the slot 38. The string 23 extends over the arcuate upper surface 43 of the bell crank 40, being doubled back through an opening 44 toward the opposite end of the instrument. A cylindrical enlargement 45 on the distal end of the string prevents the string from pulling through the opening 44.

From the foregoing it may be seen that the end of each string 23 is held by a member 40 mounted in the slot 38. Each member 40 is pivotal about the transverse edge 42 of the plate 36 which acts as a fulcrum. Such movement of the bell crank 40 will vary the tension on the string 23 by altering the pull on the string imposed by the top edge of the crank. The surface 43 is defined by a cylindrical segment having its axis at the fulcrum 42. Therefore, regardless of the rotational position of the member 40, the effective length of the string 23 remains unchanged. The operative portion of the string 23 always terminates immediately above the fulcrum 42, extending tangentially from the arcuate surface 43. This may be seen by reference to FIGURE 5, in which the extreme rotational positions of the crank 40 are shown by the solid line and phantom line illustrations.

In this manner, the members 40 replace the bridge normally found at the end of the instrument. Each of the members 40 acts as an individual bridge for the string which it carries. This gives certain important advantages. In the first place, it eliminates any rollers or other elements over which the strings extend and must be moved across in varying the tension as in conventional designs. This does away with a source of wear for the strings. Perhaps most important is the fact that the string tension can be varied by pivoting each bell crank about the fulcrum 42, entirely eliminating all axles or similar elements. There is no lost motion in the string tensioning arrangement, and the direct engagement of the members 40 to the plate 36 permits the device to assume great rigidity. There is always a firm contact between the recessed portion 41 of each bell crank and the fulcrum 42, and the force from the string is transmitted directly across the plate 36 to the block 21. The plate 36 is loaded primarily in compression by the members 40, resulting in a minimum tendency to deflect from the forces imposed upon it. As a result of these factors, the string will vibrate for a maximum period of time at the proper frequency and will not be damped by extraneous vibration induced in the instrument.

Rotational motion is imparted to the members 40 for tensioning the strings 23 by means of dual lever assemblies 48. Each of these includes a relatively short lever 49 connected by a pivot pin 50 to a longer lever 51. Adjacent the pin 50, the shorter lever 49 includes a rounded nose 52 that engages the lower end of the lever 40. The longer levers 51 of the assemblies 48 are carried within a slotted bar 54 mounted beneath the plate 36 adjacent the members 40. The bar 54 is held to the plate 36 by means of screws 55. It includes a plurality of parallel slots 56 which are aligned with the strings 23. The upper end of each of the levers 51 extends into one of the slots 56. A transverse shaft 57 extends through the bar 54 across the slots 56, pivotally mounting the levers 51.

The levers 49 and 51 of the assemblies 48 include offset intermediate portions 59 and 60 so that the bottom ends of these levers are parallel and slightly spaced apart. These bottom sections pass through a guide plate 61 mounted on the body block 21 at the lower end of opening 39. The plate 61 includes elongated parallel slots 62 which receive the lever ends.

Adjacent the end of each lever member 49 is a pair of actuating slides 64 and 65 located one above the other. These members are slidable longitudinally of the body block 21, being held on either side of levers 49 and 51 in support brackets 66 and 67. The latter elements include depending flanges having aligned slots 68 and 69 for the members 64 and similar slots 70 and 71 for the actuators 65. The actuators 64 and 65 include laterally projecting tabs 72 and 73 which hook around the rear edge of the lever member 49.

It can be seen, therefore, that if either member 64 or 65 is moved to the left, as the invention is illustrated, it will result in similar leftward movement of the lower end of the lever 49. This will cause the lever 49 to pivot about pin 50 in a clockwise direction. Consequently, the end 52 that contacts bell crank 40 will move to the right, causing the bell crank 40 to rotate in a counterclockwise direction (see FIGURES 9 and 10). The result is a reduction in the tension in the string as the member 40 relaxes its pulling force. Of course, as pointed out above, the effective length of the string stays the same by virtue of the arcuate upper surface 43 of the crank 40. Therefore, the rotation of lever 49 has the sole effect of reducing string tension, meaning that the note is made flat by movement of actuator 64 or 65.

Return movement of lever 49 is accomplished by a tension spring 74 which hooks through a tab 75 on lever 49 beneath the pivot pin 50. The force of the spring 74 on the lever 49 can be adjusted by means of screw 76 which extends through fixed depending flange 77 to engage a nut 78 fastened to the spring end. Levers 49 and 51 bear against the rearward ends of slots 62 when in the retracted position.

The translational movement of the actuating slides 64 and 65 is limited by adjustable stops 79 and 80. These include cylindrical portions 81 and 82, from one of which project loops 83 and 84. These loops extend through slotted apertures 85 and 86 in the ends of the actuating slides 64 and 65. The opposite ends of the cylindrical portions 81 and 82 receive adjusting screws 87 and 88. These screws extend through a flange 89 depending from the block 21 so that upon rotation of the screws 87 and 88 the positions of the stops can be set. Springs 90 and 91 around the shanks of screws 87 and 88 assure that they will hold their adjusted positions.

As a result of this construction, the lever 49 can be moved a controllable distance. By pulling upon the actuating slide 64, the tab 72 will cause the lever 49 to move until the end of aperture 85 is engaged by the loop 83. The amount of movement permitted in this manner is governed by the position of the stop 79 as set by its screw 87. Similarly, the slide 65 through its tab 73 can move the lever 49 a distance permitted by the position of the loop 84 with respect to the slot 86. Hence, for each lever 49 there are two adjustable actuators.

Therefore, actuation of lever 49 causes the note to go flat as the tension on the string 23 is relaxed. The amount of reduction in pitch depends upon which slide is operated to move the lever 49. As shown in FIGURES 9 and 10, there is considerably more rotation imparted to lever 49 from movement of slide 64 than for the other actuator 65 which has a shorter stroke. The amount of movement allowed the actuators, and hence the effect on the string 23, can be set with great precision through the adjustment of stops 79 and 80. Of course, either actuator may be set for the greater stroke, or they may be adjusted to equal strokes.

The levers 51 are movable in a manner similar to that of levers 49, as may be seen in FIGURES 11 and 12. Actuating slides 92 and 93, having hooked tabs 94 and 95, engage the lower end of each lever 51. Additional stops 96 and 97 are included to adjustably limit the travel of the slides 92 and 93 and, hence, the amount of movement imparted to the lower end of the lever 51.

Of course the movement of the lever **51** to the left also will cause clockwise rotation of it around the transverse shaft **57**.

The effect of this rotation of lever **51** on the bell crank is opposite from that of the similar rotation of lever **49**. As the lever **51** is turned clockwise it causes bell crank **40** to move in the same direction. This results because member **51** shifts the pivot pin to the left and, with it, the shorter lever **49**. This means that the end **52** of lever **49** will impose a clockwise movement on the bell crank **40**. This is made possible by the force of the tension spring **74** on the lever **49**. This spring biases lever **49** in a counterclockwise direction and opposes the clockwise torque that arises from the resistance to rotation of the lower end of crank **40**. Therefore, the spring **74** prevents the resisting force from turning lever **49** clockwise and permits the end **52** of the lever **49** to move the end of crank **40** to the left.

This result is facilitated by the location of the end **52** of lever **49** with respect to the pivot pin **50**. End **52** is almost in horizontal alignment with the pivot pin so that there is practically no moment arm between these two points. Hence, the resisting force of the bell crank **40** is virtually on center with the pivot pin, and the rotational force is minor. In contrast, the spring **74** contacts the lever **49** some distance from the pivot pin **50** and so has a sizable mechanical advantage.

It can be seen, therefore, that movement of lever **51** increases the tension on the string **23**, rather than decreasing it as for movement of lever **49**. Lever **51** consequently causes the string to go sharp when it is actuated. As the instrument is illustrated, actuator **92** is set to move lever **51** a greater distance than does the actuator **93**. Hence, the pitch of the note will rise more if the actuator **92** rotates lever **51** than if the lever **51** is operated by actuator **93**. As for the lever **49**, either of its actuators may impart the greater movement to lever **51**, or their effects may be the same, depending upon the settings of stops **96** and **97**.

Thus, through the actuating assemblies, each bell crank **40** can be given four predetermined arcs of rotational movement, two in one direction and two in the other. These arcs are individually adjustable.

Movement is imparted to the slides **64**, **65**, **92** and **93** through the looped ends **98** of the cables **99**. The slides include notches that receive the ends **98** which are held in place by flexible sleeves **100**. The cables **99** pass through pulleys **101**, each of which is engaged by an additional cable **102** (see FIGURE 13). The cables **99** will be formed as a loop so that various of the slide assemblies may be connected together at will. Each cable **102**, by pulling on a single cable **99**, will actuate a pair of the slide elements, depending upon the hookup of the ends of the cable **99**.

The cables **102** extend around individually rotatable pulleys **103** mounted on a common vertical shaft **104** secured, in turn, to the frame **20**. From the pulleys **103**, the cables **102** extend to bell cranks **105** pivotally mounted about pins **106** on brackets **107**. The latter members are carried by the frame **20**. Rods **108** also engage the bell cranks **105** on the opposite sides of the pivot pin **106**, depending downwardly for contact with foot pedals **109**. The pedals are pivotally secured to a beam **110** extending longitudinally between the two rear legs **24**. Therefore, when a pedal is pressed downwardly it causes a bell crank **105** to pivot, thereby pulling upon one of the cables **102**. This, in turn, through a pulley **101**, pulls upon a looped cable **99**, which moves two actuating slides. Therefore, depression of a pedal will cause two of the string mounting bell cranks **40** to be rotated, increasing or decreasing the tension in their strings **23**.

From the foregoing it may be seen that the control of the tension of the strings **23** is readily accomplished by manipulation of the pedals **109** as the musician plays the

instrument. Also, each pedal may be hooked up so that precisely the desired strings are moved, and predetermined musical effects may be obtained. The bell cranks may be moved in virtually any combination, and the amount of resulting string tension change may be governed with precision. The stops are readily accessible through opening **111** in the frame at the tail of the instrument. Hence, by control of the movement of the bell cranks **40**, the strings can be made to go sharp or flat, and to accomplish this in differing adjustable amounts. At the same time, the instrument may be constructed to possess great rigidity through the inclusion of the individual bell cranks for the strings, each bell crank being pivoted about a fixed fulcrum carried by the body of the instrument. The tension adjusting levers are not in direct connection with the strings, but only bear against the bell cranks. Hence, the tension adjusting linkage does not detract from the rigidity of the string mounting structure.

Another aspect of the instrument relates to the provision of muting means for the strings. This is accomplished by means of a rotatable lever that works through a cam to move the mute. The mute includes a channel **112** biased upwardly by a pair of small compression springs **113** towards the strings **23** forwardly of the bell cranks **40**, as shown in FIGURES 3 and 4. The channel is pivotally carried by a pair of arms **114** which rigidly connect to a plate **115**. Apertures through the plate **115** slidably receive screws **116** and **117**.

At the rearward end of the plate **115**, best seen in FIGURE 16, is an inclined cam surface **118**. This surface is engaged by a rotatable lever **119** which extends outwardly from beneath the cover **120**. Lever **119** includes an inner end which passes through plate **36** and into an aperture in the bar **54** which forms a bearing for it. By this construction, the screws **116** and **117** act as a pivot point for the plate **115** and, hence, for the channel **112** and the sponge rubber strip **121** received in the channel. By rotation of the lever **119** through its arc in a plane parallel to the surface of block **21**, its engagement point with the inclined cam surface **118** is varied. This causes a greater or lesser amount of pivotal movement of the plate **115**. Therefore, to operate the mute, the lever **119** is rotated to a position where it is adjacent the thinner portion of the cam surface (the position of FIGURE 15), allowing the springs **113** to force the channel **112** and the sponge rubber strip **121** toward the strings **23**. In this manner, the strip **121** is brought against the strings and a muting effect is obtained. The mute is disengaged by rotation of the lever **119** to the opposite position. When that occurs, the plate **115** is forced to pivot about the fulcrum of the screws **116** and **117** and bring the mute downwardly. Screws **122** and **123** are provided with small resilient bumpers and act as stops to limit the travel of lever **118**. An important feature of this mute is that the screws **116** and **117** not only act as a pivot axis but also provide an adjustment feature. The screws can be raised or lowered with respect to the body of the instrument, thereby controlling the amount of movement of the mute strip **121**. Also, they may be adjusted so that contact is equal transversely of the instrument. In other words, by appropriate adjustment of the screws **116** and **117**, the mute can be caused to exert constant pressure against the strings throughout the length of the strip **121**. Hence, the muting effect will be the same on all of the strings **23**. Moreover, with the force of the mute being controlled with accuracy, there is no danger of increasing the tension too much and causing the strings to go sharp.

The foregoing detailed description is to be clearly understood as given by way of illustration and example only, the spirit and scope of this invention being limited solely by the appended claims.

I claim:

1. In combination with a lute-type instrument having a plurality of strings, a device for mounting and controlling the tension of said strings comprising

a rotatable member for each of said strings,
a fixed fulcrum on said instrument having an edge transversely of said strings,
each rotatable member being pivotal about said edge,
each rotatable member having an arcuate surface defined by a cylindrical segment having its axis at said edge,
each string being wrapped around the arcuate surface of the rotatable member therefor,
and connected to said rotatable member inwardly of said arcuate surface,
and means for selectively rotationally positioning said rotatable members about said edge.

2. A device as recited in claim **1** in which said means for rotationally positioning said rotatable members includes
actuating members movable in one direction for selectively pivoting said rotatable members in two directions.

3. A device as recited in claim **1** in which said means for rotationally positioning said rotatable members includes
a dual lever means for each of said rotatable members,
and actuating means for each of said dual lever means,
said actuating means being movable in one direction for selectively causing said dual lever means to rotate said rotatable member in two directions.

4. A string mounting and tensioning arrangement for a lute-type stringed instrument comprising
a rotatable member;
a fixed fulcrum pivotally engaged by said rotatable member;
a musical instrument string connected to said rotatable member on one side of said fulcrum;
and means for causing such pivotal movement of said rotatable member,
said means including lever means,
said lever means including a duality of levers,
pivot pin means interconnecting said levers,
one of said levers engaging said rotatable member on the opposite side of said fulcrum,
fixed pivot means pivotally mounting the other of said levers,
and means for selectively rotating either of said duality of levers.

5. In combination with a musical instrument having a string, a means for mounting and controlling the tension of said string comprising
a fulcrum on said musical instrument transversely of said string;
a bell crank rotatably engaging said fulcrum,
one end portion of said bell crank being secured to said string,
and means for rotating said bell crank,
said means for rotating said bell crank including a duality of levers,
means pivotally connecting one of said levers to said instrument at one end of said one lever,
pivot pin means interconnecting said levers inwardly of said one end of said one lever,
the second of said levers on one side of said pivot pin means engaging the opposite end of said bell crang,
and means on the opposite side of said pivot pin means for selectively moving said levers.

6. A device as recited in claim **5** in which
said one end portion of said bell crank includes an arcuate surface,
said arcuate surface being a cylindrical segment the axis of which falls along said fulcrum,
said string extending over said arcuate surface.

7. A device as recited in claim **5** in which

said fulcrum includes a beam having a relatively narrow edge,
said bell crank having a notch in one side thereof receiving said edge for engagement with said edge inwardly of said notch.

8. A device as recited in claim **5** in which said means for selectively moving said levers includes for each of said levers
at least one slide movable through a stroke in a direction longitudinally with respect to said string,
and adjustable means for controlling the length of said stroke.

9. In combination with a lute-type instrument having at least one string, a device for mounting one end of said string and imparting tension thereto comprising
a bell crank,
said bell crank having a transverse notch intermediate the ends thereof,
a rigid beam having a relatively narrow edge extending transversely of said instrument,
said edge being received in said notch for providing a fulcrum for said bell crank,
said bell crank having an arcuate outer surface on one side of said fulcrum,
said surface being defined by a circular segment having its center point at said edge,
said string being wrapped around said arcuate surface and connected to said bell crank beyond said arcuate surface,
and a lever assembly for rotating said bell crank,
said lever assembly including a first lever, means rotatably mounting said first lever on said musical instrument about a transverse axis,
a second lever,
a pivot pin interconnecting said first and second levers, said second lever having a surface on one side of said pivot pin engaging said bell crank on the opposite side of said fulcrum,
resilient means biasing said surface of said second lever against said bell crank,
and actuating means for selectively and individually moving said levers in opposition to said resilient means.

10. In combination with a lute-type musical instrument having a plurality of strings arranged substantially in spaced parallelism, an arrangement for mounting said strings at one end thereof and controlling the tension thereof comprising
a plate attached to said instrument and extending transversely of said strings,
said plate having a relatively narrow edge,
a bell crank for each of said strings,
each bell crank having a notch receiving said edge whereby said edge acts as a fulcrum about which said bell crank is pivotal,
each bell crank having an arcuate outer surface generated by a radius extending from said fulcrum, each string being wrapped around said arcuate surface and attached to its bell crank inwardly of said arcuate surface,
a dual lever means for rotating each of said bell cranks,
a bar extending transversely of said musical instrument on one side of said bell cranks,
each of said dual lever means including a first lever, said bar including a plurality of slots each receiving one end of one of said first levers,
and a shaft extending through said bar for pivotally mounting said ends of said first levers,
each of said dual lever means including a second lever,
a pivot pin interconnecting said first and second levers in adjacency with the opposite end of said bell crank,
said second lever having a projection pro-

vided with an arcuate surface engaging said bell crank at said opposite end,

an adjustable tension spring connected to said second lever intermediate said pivot pin and the opposite end thereof,

and means for selectively moving said first and second levers in opposition to the force of said tension spring for thereby rotating said bell crank.

11. A device as recited in claim **10** including in addition

a mute for said strings,

said mute including an elastomeric strip engageable with said strings,

a support for said strip,

means pivotally mounting said support on said instrument,

and cam means for pivoting said support and urging said elastomeric strip against said strings,

said cam means including a rotatable lever, said lever having an end extending through said plate for rotation about said end relative to said plate.

12. A device as recited in claim **11** in which said means for selectively rotating said levers includes for each lever

a duality of slides,

means mounting said slides on said musical instrument for translational movement in a direction substantially parallel to said strings,

each of said slides being individually operable and engaging said opposite end portion of said lever,

and adjustable stop means for each of said slides for controlling the amount of movement thereof.

13. A device as recited in claim **12** in which for said adjustable stop means

each of said slides includes an elongated longitudinally disposed opening therethrough,

and including a loop extending through said opening whereby upon movement of said slide said loop engages one end of said opening for limiting the travel of said slide,

and mounting means for said loop,

said mounting means including threaded means engaging said instrument for variation of the position of said loop relative to said instrument.

14. A device as recited in claim **12** in which for operating said slides there are included

a plurality of movable cables,

each of said cables having a duality of ends,

each of which is selectively connectable to a preselected slide.

15. A device as recited in claim **12** including

two parallel plates located one on either side of said opposite ends of said levers,

said plates having aligned slots therein,

said slides being movable through said slots and guided thereby.

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