# United States Patent

**Jackson**

[15] **3,688,631**

[45] **Sept. 5, 1972**


[54] **PITCH-CHANGING TUNING DEVICE FOR STRING INSTRUMENTS**


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[52] **U.S. Cl.** ..... **84/312**
[51] **Int. Cl.** ..... **G10d 3/14**
[58] **Field of Search** ..... 84/312, 313, 267



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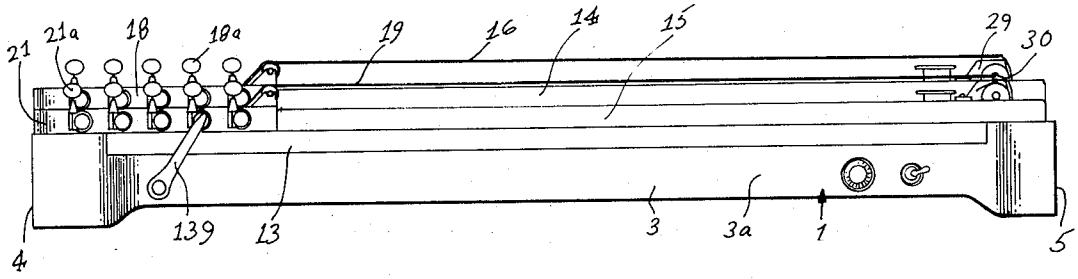
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[57] **ABSTRACT**

Pedal-actuated means for increasing or decreasing the pitch of individual strings, from their predetermined, tuned pitch, in a guitar or the like of the type having one or more necks. Each string of each neck is attached at its head end to an ordinary tuning machine and at its tail end to a tuning member pivotable from a normal position to a pitch increasing position or a pitch decreasing position. Each tuning member may have operatively connected thereto a first pull rod for moving the tuning member to its pitch increasing position and a second pull rod for moving the tuning member to its pitch decreasing position. The guitar or like instrument has a plurality of pedals, each capable of alternatively actuating a rocking assembly for each neck of the instrument. Each pull rod associated with each string of a neck may be attached to any one or ones of the rocking assemblies for that neck, so that each pedal may raise the pitch of certain desired strings and lower the pitch of other desired strings in any combination for each neck.


**11 Claims, 14 Drawing Figures**



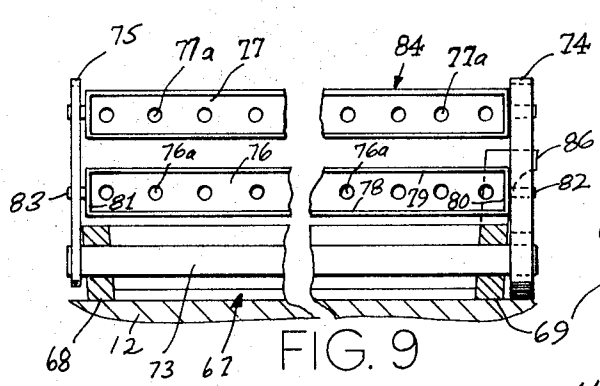



FIG. 9

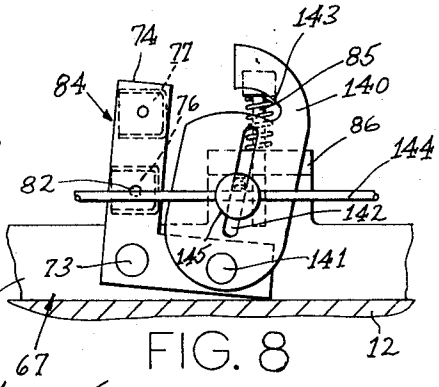



FIG. 8

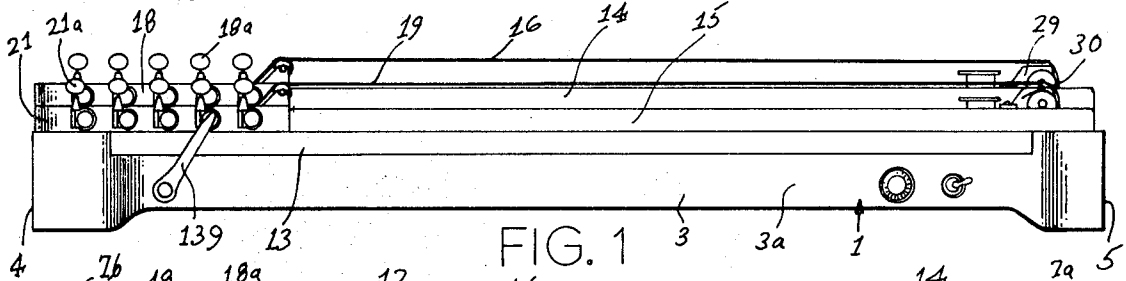



FIG. 1

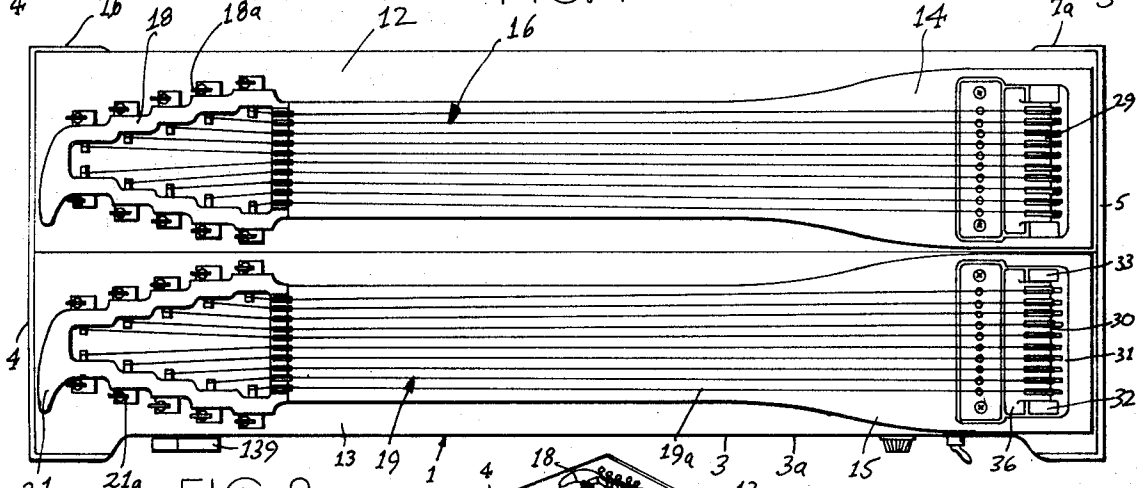



FIG. 2

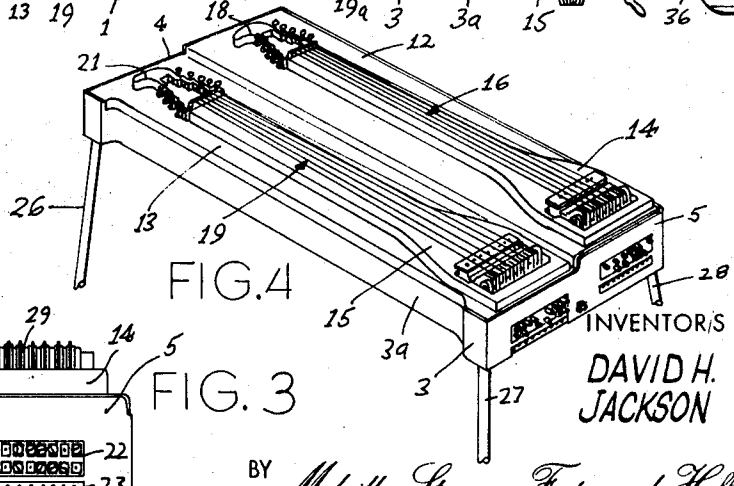



FIG. 4

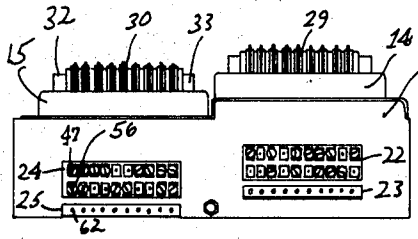



FIG. 3

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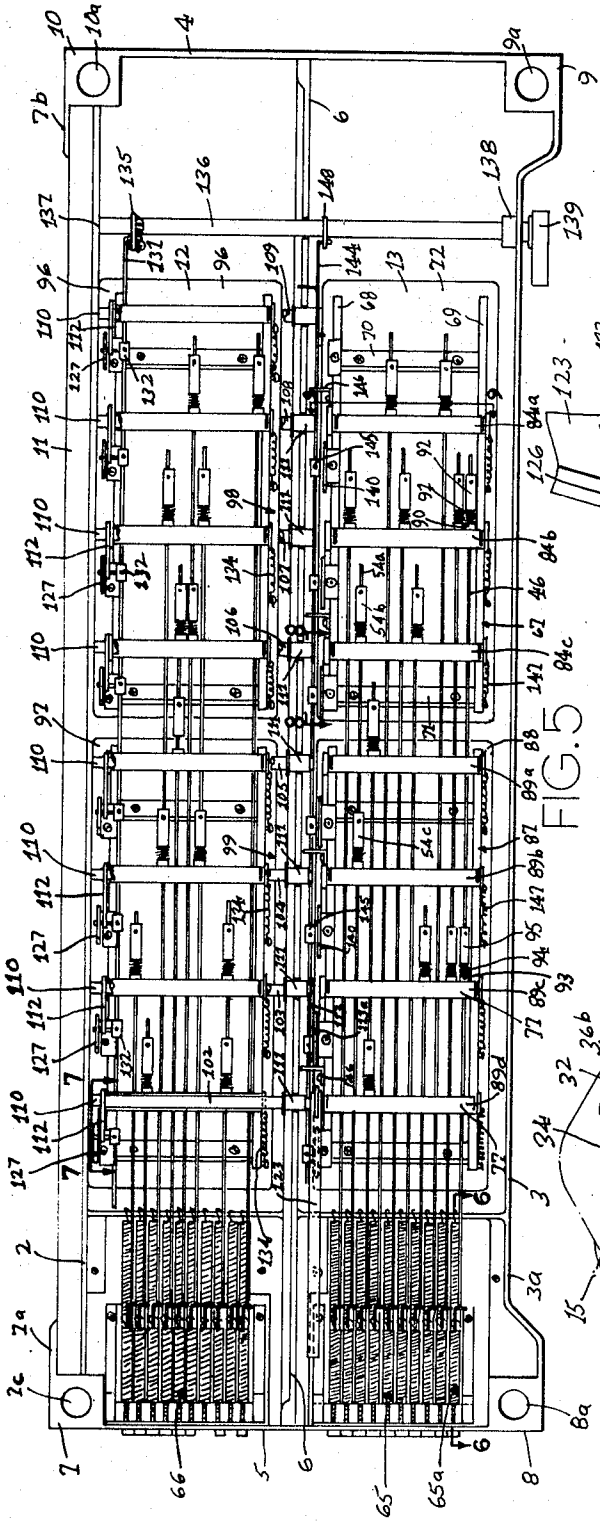


FIG. 5

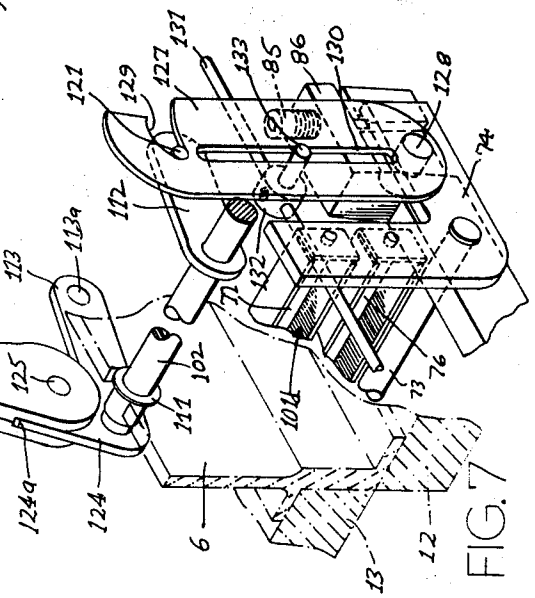


FIG. 7

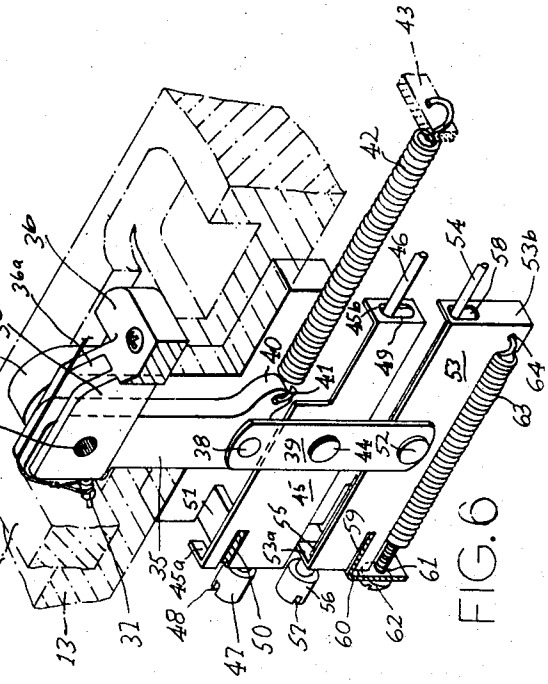


FIG. 6

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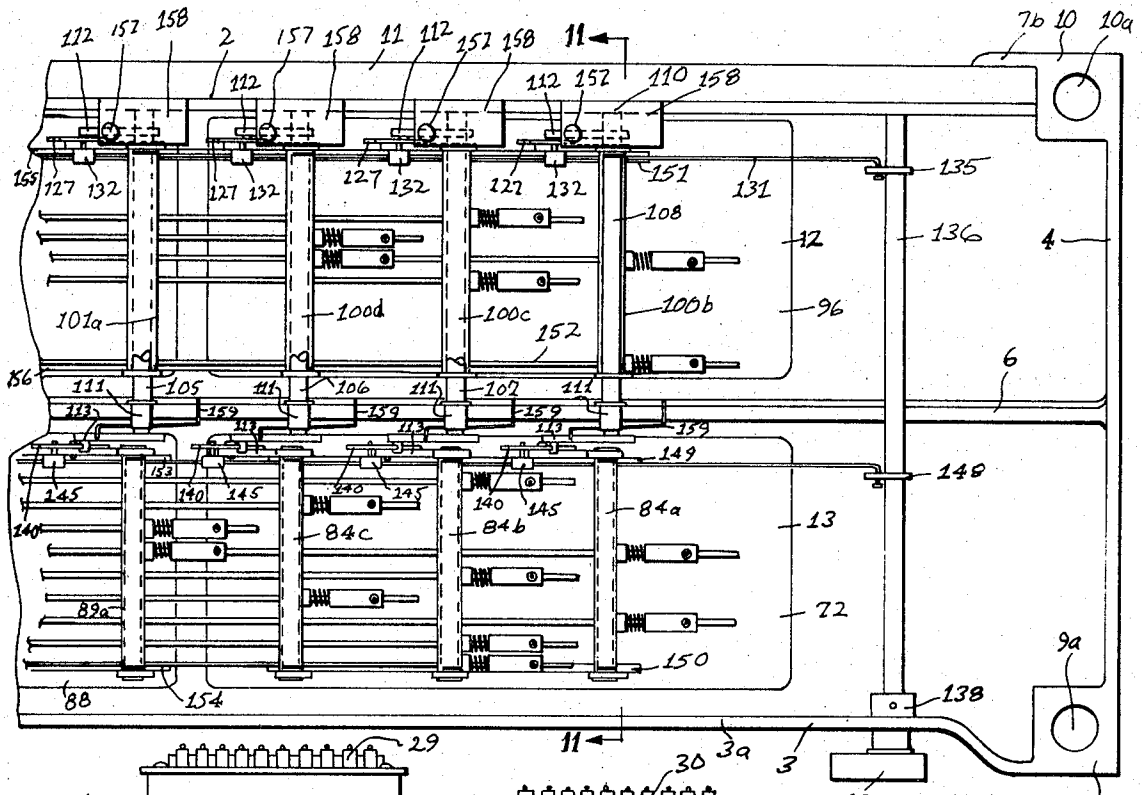


FIG. 10

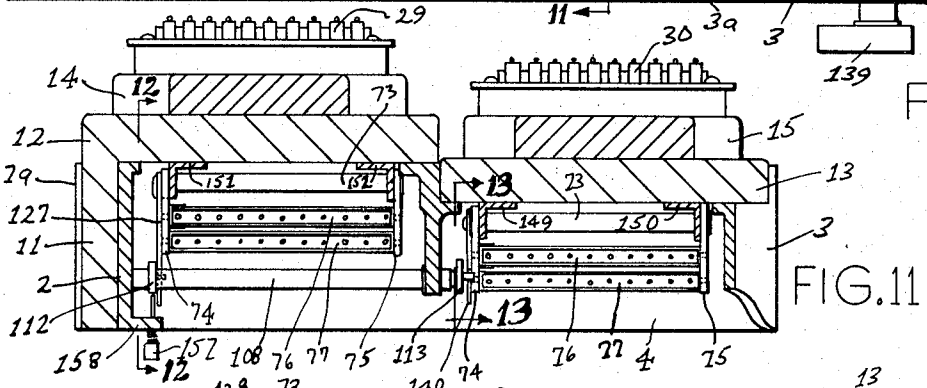


FIG. 11

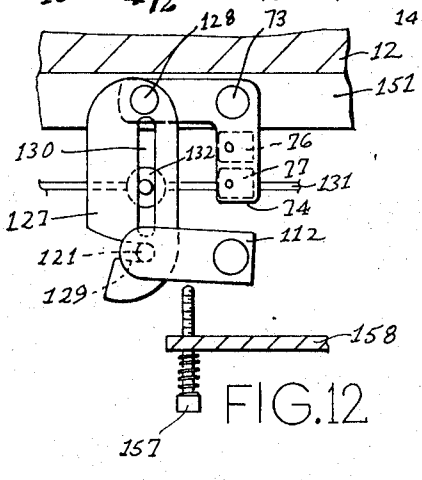


FIG. 12

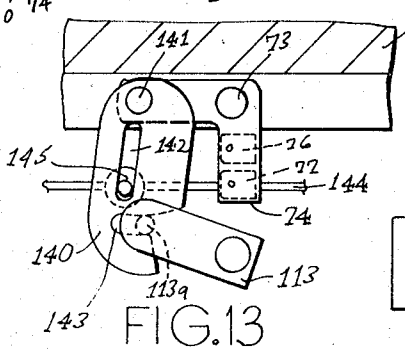


FIG. 13

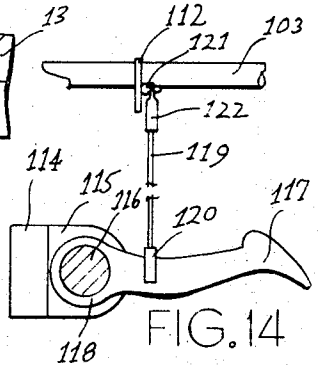


FIG. 14

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# PITCH-CHANGING TUNING DEVICE FOR STRING INSTRUMENTS

## BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

The invention relates to improved tuning means for stringed instruments, and more particularly to tuning means for stringed instruments of the type having pedal controlled means for raising and lowering the pitch of individual strings from their normal or tuned pitch.

2. DESCRIPTION OF THE PRIOR ART

In recent years, stringed instruments of the general type described, having string tension or pitch adjusting means, have come into increasing popularity. Prior art workers have devised a number of pedal actuated mechanisms for changing the tension or pitch of individual strings. Typical examples of such prior art U.S. Pat. No. 3,390,600.

While prior art mechanisms have performed well, they are generally characterized by certain deficiencies. For example, the tuning of such stringed instruments has frequently involved the adjustment of various means, at various locations on the instrument. In addition, the pitch-changing mechanisms are often complex in nature. When it is desired to change the "set-up" of the instrument, so that the pitch of any given string or group of strings may be raised or lowered by any desired pedal, it has been necessary to shift and/or add a number of parts, if such change-over could be made at all. When the stringed instrument was provided with more than one neck, each pedal operated the pitch-changing mechanism of both necks simultaneously, increasing the risk of torsional or mechanical distortion of the parts, thereby decreasing the tuning accuracy.

The tuning means of the present invention is characterized by a greater simplicity and a greater versatility than hitherto known. Tuning has been greatly simplified and distortion of the mechanical parts significantly decreased. Means are provided whereby the pedals actuate the tuning mechanism of only that neck being played. Finally, the player may readily change the "set-up" of the instrument by the simple addition or removal of pull rods, as will be described hereinafter.

## SUMMARY OF THE INVENTION

The present invention relates to pedal actuated pitch-changing means for stringed instruments having one or more necks, whereby the tension or pitch of each individual string may be raised or lowered, by a predetermined amount, from its normal or tuned pitch. While, for purposes of an exemplary showing, the invention will be described as applied to a steel string guitar having two necks, it will be understood by one skilled in the art that its application is not so limited. In addition, it will be understood that the various conventional features of the stringed instrument, including amplification means and the like, do not constitute a part of the present invention and will not be described herein.

In accordance with the present invention, each string of the instrument is affixed at its head end to a conventional tuning machine. The tail end of the string is affixed to a tuning member pivotable about a shaft from a normal position to a pitch raising position and a pitch lowering position. Each tuning member is pivotally



connected by link means to a pair of pull rod plates which, in turn, are shiftable by pull rods. One pull rod plate and pull rod combination is capable of moving the tuning member to its pitch raising position, while the other pull rod plate and pull rod combination is capable of pivoting the tuning member to its pitch lowering position.

Each pedal of the instrument is capable of being operatively connected to a rocking assembly for each neck of the instrument. Means are provided whereby all of the pedals may alternatively be connected to rocking assemblies for one neck of the instrument or the rocking assemblies for the other neck of the instrument. Each of the strings of a given neck may have its associated pull rods attached to any one or ones of the rocking assemblies for that neck, so long as both pull rods for a given string are not attached to the same rocking assembly. Thus, when a pedal is operatively connected to its rocking assembly for a given neck, it can raise or lower the pitch of any number of different strings of that neck, in any desired combination.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of the rear side of an exemplary instrument equipped with the tuning means of the present invention.

FIG. 2 is a plan view of the instrument of FIG. 1.

FIG. 3 is an end elevation as seen from the right in FIGS. 1 and 2.

FIG. 4 is a perspective view of the instrument of FIG. 1.

FIG. 5 is a bottom view of the instrument of FIG. 1.

FIG. 6 is a cross sectional perspective view, taken along the section line 6—6 of FIG. 5.

FIG. 7 is a cross sectional perspective view, taken along the section line 7—7 of FIG. 5.

FIG. 8 is a cross sectional view taken along the section line 8—8 of FIG. 5.

FIG. 9 is a cross sectional view taken along the section line 9—9 of FIG. 5.

FIG. 10 is a fragmentary bottom view of another embodiment of the instrument of the present invention.

FIG. 11 is a cross sectional view taken along the section line 11—11 of FIG. 10.

FIGS. 12 and 13 are cross sectional views taken along the section lines 12—12 and 13—13 of FIG. 11, respectively.

FIG. 14 is a fragmentary side elevational view of a pedal assembly, with parts in cross section.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

As indicated above, for purposes of an exemplary showing the tuning means of the present invention will be described as applied to an electric steel guitar of the type having two necks. Reference is made to FIGS. 1 through 5 and 11. The instrument is substantially rectangular in configuration and has a metal frame generally indicated at 1.

As is most clearly shown in FIGS. 5 and 11, the frame comprises a front side 2, a rear side 3, a head end 4 and a tail end 5. The frame also has a web 6 extending longitudinally thereof between the head and tail ends. The corners of the frame may be of increased thickness, as at 7 through 10. The corners 7 and 10 may extend

beyond the front side 2 of the frame and may include extensions 7*a* and 7*b*, adapted to receive and support a decorative wood panel 11. The rear side of the frame may be depressed inwardly as at 3*a*, so that operating instrumentalities extending though the rear side will not extend beyond the overall dimensions of the instrument.

Referring again to FIGS. 1 through 4 and 11, the upper surface of the frame supports a pair of longitudinally extending wooden panels 12 and 13. It will be noted that the frame is so configured as to support the panel 12 at a higher elevation than the panel 13. The panel 12, in turn, supports a first or front neck 14. The panel 13 supports a second or rear neck 15.

For purposes of an exemplary illustration, the front neck 14 is shown as having 10 strings, generally indicated at 16. The head end of this neck terminates in a roller nut 17 and a tuning machine 18, having a plurality of tuning keys 18*a*. At the tail end of the front neck 14, the strings are affixed to parts of the roller bridge 29 of the present invention, as will be described hereinafter.

The rear neck 15 is also illustrated (for purposes of an exemplary showing) as having ten strings, generally indicated at 19. The head end of the rear neck 15 terminates in a roller nut 20 and a tuning machine 21, having a plurality of tuning keys 21*a*. At the tail end of the rear neck, the strings are affixed to elements of the roller bridge 30 of the present invention, again as will be described hereinafter.

As is shown in FIGS. 3 and 4, the tail end 5 of the frame has openings 22 and 23, through which access may be had to parts of the tuning mechanism of the present invention controlling the strings of the front neck 14. Similarly, the tail end 5 of the frame has an opening 24 and an elongated notch 25 through which access may be had to portions of the tuning mechanism controlling the strings of the rear neck 15.

As shown in FIG. 4, the instrument may be provided with legs, three of which are illustrated at 26 through 28. The legs may be adjustable in length, and are preferably removable so that the instrument may be readily packed in a carrying case. The upper ends of the legs are affixed to the frame at the corners 7 through 10. The corner portions of the frame will have sockets 7*c*, 8*a*, 9*a* and 10*a*, respectively, into which the upper ends of the legs may extend. The manner in which the legs are affixed to the frame does not constitute a limitation on the present invention. For example, the sockets and the upper ends of the legs may be appropriately threaded.

The roller bridge of the present invention, to which the tail end of the strings are attached, is most clearly illustrated in FIGS. 2 and 6. At the tail end of the rear neck 15 there is an opening 31 which extends downwardly both through the neck and through the wood panel 13. A pair of side plates 32 and 33 are affixed to the wood panel 13 and have portions extending above the neck 15 at either side of the opening 31. These upwardly extending portions of the side plates mount a shaft 34, extending therebetween. There is a tuning member for each of the strings 19 pivotally affixed to the shaft 34. All of the tuning members are substantially indentical. FIG. 6 is a perspective view illustrating the side plate 32, the shaft 34 and the tuning member 35 for the string 19*a*.

As shown in FIG. 2, there is an elongated member 36 affixed to the neck 15. The member 36 has a plurality of spaced extensions. The spaced extensions have coaxial perforations through which the shaft passes. In FIG. 6, the member 36 is fragmentarily shown, together with two of its extensions 36*a* and 36*b*. The member 36 and its extensions serve both as an additional support for the shaft 34 and as a means to properly space the tuning members for each string along the shaft.

The tail end of the string 19*a* rides over the arcuate top edge of the tuning member 35 and is affixed to the tail edge thereof, as at 37. The bottom end of the tuning member is pivoted at 38 to a connecting link 39. An integral lug 40 extends forwardly of the bottom front edge of the tuning member and is perforated as at 41 to receive the hooked end of a tension spring 42. The other hooked end of the tension spring engages an integral rib 43 of the instrument frame, extending between the frame web 6 and the rear frame side 3.

The connecting link 39 is pivoted at 44 to a pull rod plate 45. The pull rod plate comprises a longitudinally extending member having inturned ends 45*a* and 45*b*. The end 45*a* has a perforation (not shown) through which a pull rod 46 extends. Means are provided at the end of the pull rod 46 to prevent its withdrawal from the above mentioned hole. The last mentioned means should be adjustable and may take any suitable form. For purposes of an exemplary showing, the end of the pull rod 46, extending beyond the inturned end 45*a* of the pull rod plate may be considered as being threaded and provided with a nut 47 having an end slot 48. The pull rod 46 extends through an enlarged perforation 49 in the inturned end 45*b* of the pull rod plate.

The pull rod plate 45, inclusive of its inturned end 45*a*, has a horizontal notch 50, adapted to receive a stop bar 51. The stop bar is affixed to and extends between the side plates 32 and 33. The stop bar 51 cooperates with the notch 50 to serve both as a guide for the pull rod plate when it moves longitudinally and as a stop for the pull rod plate, determining its maximum movement to the left in FIG. 6.

The bottom end of the connecting link 39 is pivoted at 52 to a second pull rod plate 53. The pull rod plate 53, like the pull rod plate 45, is an elongated member having inturned ends 53*a* and 53*b*. A second pull rod 54 passes through a perforation 55 in the inturned end 53*a* of the pull rod plate and again is adjustably held in place by a nut 56 having a slot 57. The pull rod 54 also passes through an elongated perforation 58 in the inturned end 53b of the second pull rod plate.

As in the case of the first pull rod plate, the second pull rod plate has a horizontal slot 59 therein, inclusive of the inturned end 53*a*. The slot is adapted to receive a second stop bar 60. The stop bar 60 is affixed to and extends between the side plates 32 and 33. Again, the stop plate 60 serves as a guide for longitudinal movement of the pull rod plate 53 and as a stop for its maximum longitudinal movement to the left in FIG. 6. The stop bar 60 is of angle iron cross section. The downwardly depending leg of the stop bar has a perforation 61 through which a screw 62 extends. The end of the screw 62 is threadedly engaged in a nut (not shown) affixed to the end of a tension spring 63. The other end of the tension spring is engaged in a perforation 64 in a downwardly depending portion of the pull rod plate 53.

The entire structure just described (and illustrated in FIG. 6) will hereinafter be referred to as a roller bridge assembly. The operation of the tuning member assembly may be described as follows. It will be understood that the string **19***a* will be tuned to its desired pitch by means of the tuning machine **21**. It will further be understood that if the tuning member **35** were to pivot about shaft **34** in a clockwise direction (as seen in FIG. 6) the tension on string **19***a* would be lessened and its pitch would be lowered. Alternatively, if the tuning member were to pivot in a counter clockwise direction about the shaft **34**, the tension on string **19***a* would be increased and its pitch would be raised.

FIG. 6 illustrates the roller bridge assembly in its normal, at rest position. The normal tension on string **19***a* results in a tendency of the tuning member to pivot in a clockwise direction. This, in turn, assures that the first pull rod plate **45** is seated against its stop bar **51**. Similarly, tension spring **63** assures that the second pull rod plate **53** is seated against its stop bar **60**.

Should the pull rod **46** have a pulling force applied thereto, the interaction of the nut **47** and the inturned end **45***a* will cause the pull rod plate **45** to move to the right in FIG. 6, away from the stop bar **51**. The second pull rod plate **53** will remain unaffected, and the pivot point **52** will serve as a fulcrum for the connecting link. The pivot point **38** will move to the right in FIG. 6, causing the tuning member to pivot about the shaft **34** in a counter clockwise direction, applying increased tension to the string **19***a*. When the pulling force on pull rod **46** is removed, the entire roller bridge assembly will move to its at rest position by virtue of the normal tension of string **19***a*.

Should a pulling force be applied to pull rod **54**, the nut **56** will engage the inturned end **53***a*, causing the pull rod plate **53** to move to the right in FIG. 6, away from the stop bar **60**. The pull rod plate **45** will remain unaffected, and the pivot point **44** will act as a fulcrum for the connecting link **39**. As a result, the pivot point **38** will move to the left in FIG. 6 and the tuning member will pivot about the shaft **34** in a clockwise direction, reducing the tension on string **19***a*, resulting in a lowered pitch. When the pulling force no longer acts upon the pull rod **54**, the tuning member assembly will return to its at rest position through the agency of the natural tension of the string **19***a* and the action of tension springs **42** and **63**. The amount by which a pulling force on pull rod **46** will raise the pitch of string **19***a* and a pulling force on pull rod **54** will lower the pitch can be adjusted by simply adjusting the rotative positions of slotted nuts **47** and **56**, by hand or with a screw driver. It will be noted in FIG. 3 that nuts **47** and **56** are readily accessible through the opening **24** in the tail end **5** of the instrument frame. Adjustment of tension spring **63** can also be made by turning the screw **62**. Again it will be noted in FIG. 3 that the screw **62** is readily accessible in the elongated notch **25** of the main frame tail end **5**.

In the roller bridge **30** of the rear neck **15**, there will be a roller bridge assembly for each of the strings. All of the roller bridge assemblies can be identical to that just described.

In like manner, the roller bridge **29** of the front neck will be of substantially identical construction, having similar roller bridge assemblies for each of the strings **16**.

In FIG. 5, the roller bridge assemblies for the strings of the rear neck are generally indicated at **65**. The roller bridge assemblies for the strings of the front neck are generally indicated at **66**.

FIG. 6 illustrates an instance where the string **19***a* is intended to be adjustable both to a higher and a lower pitch than that determined by the tuning machine **21**. In some instances, however, it may be desired that a given string have no such adjustable feature. When this is the case, the roller bridge assembly for that string will not be provided with pull rods. In other instances, when it is desired that a given string be adjustable only to a higher pitch or a lower pitch than that determined by its tuning machine, its roller bridge assembly need be provided only with an appropriate one of the pull rods.

FIGS. 5, 8 and 9 illustrate pedal-actuated rocking assemblies to which the pull rods of the various roller bridge assemblies are attached. As shown in FIGS. 5 and 9, a supporting frame (generally indicated at **67**)is provided having longitudinally extending side portions **68** and **69**, together with connecting transverse portions **70** and **71**. When desired, the frame **67** may comprise a unitary, one-piece casting. The frame **67** is located in an opening **72** in the instrument frame and is affixed to the underside of the panel **13** by screws passing through the transverse portions **70** and **71**. It will be understood by one skilled in the art that the frame is shown in inverted position in FIGS. 8 and 9, for purposes of clarity, since FIG. 5 is a bottom view.

The frame **67** may carry four rocking assemblies (see FIG. 5) one of which is shown in FIGS. 8 and 9. A shaft **73** extends transversely of the frame **67** and the ends of the shaft pass through frame side portions **68** and **69**. To the ends of the shaft **73** there are non-rotatively affixed a pair of supports **74** and **75**. As seen in FIG. 8, the support **74** is L-shaped. The support **75** is rectangular in configuration and equivalent to the downwardly depending leg portion of the L-shaped support **74**. The support **75** and the downwardly depending leg of the support **74** carry an upper pull rod actuator **76** and a lower pull rod actuator **77**. The upper pull rod actuator comprises an elongated member having a plurality of perforations **76***a*. The actuator **76** has an inturned upper flange **78**, lower flange **79** and end flanges **80** and **81**. The end flanges **80** and **81** bear pivot pins **82** and **83** passing through perforations in the supports **74** and **75**. Thus, the actuator **76** is freely rotatable about its pivot pins **82** and **83**. The lower actuator **77** is in every way identical to the upper actuator **76**.

The shaft **73**, supports **74–75** and actuators **76–77** comprise what has herein been termed a rocking assembly and is generally indicated by the index numeral **84**. Since the shaft **73** is rotatively mounted in the side portions **68** and **69** of the frame **67**, it will be understood that the entire rocking assembly is pivoted. The normal position of the rocking assembly is that shown in FIG. 8, and is determined by contact between the substantially horizontal leg of the L-shaped support **74** and the bottom surface of the panel **13**. It is within the scope of the invention to provide a pad of sound-deadening material (not shown) on the bottom surface of the panel **13** at this point of contact.

The pivoting of the rocking assembly **84** in a counter clockwise direction (as seen in FIG. 8) is limited by a stop screw **85** passing through a downwardly and outwardly extending integral flange **86** on the side portion **69** of the frame **67**.

As shown in FIG. 5, the frame 67 is adapted to support four such rocking assemblies. When not needed, any of the rocking assemblies may be eliminated. For purposes of an exemplary showing, FIG. 5 illustrates the frame 67 mounting three rocking assemblies 84*a*, 84*b* and 84*c*.

In FIG. 5, a second frame 87 is shown, mounted to the underside of the panel 13 in an opening 88 in the instrument frame. The frame 87 is identical to the frame 67 and carries four rocking assemblies 89*a*, 89*b*, 89*c* and 89*d*. The rocking assemblies 89*a*–89*d* are identical to the rocking assembly 84 described with respect to FIGS. 8 and 9. Thus, for the rear neck, there is a total of seven rocking assemblies.

The pull rods for the roller bridge assembly of each string of the rear neck will be affixed to one of the rocking member assemblies. The pitch increasing pull rod 46 (see FIG. 6) for each string will be affixed to an upper actuator 76 of one of the rocking assemblies. The pitch decreasing pull rod 54 (see FIG. 6) for each string of the rear neck will be affixed to a lower actuator 77 of one of the rocking assemblies.

For purposes of an exemplary showing, the roller bridge assembly for string 19*a* of the rear neck is indicated at 65*a* in FIG. 5. The pitch increasing pull rod 46, for string 19*a* is shown as passing through one of the perforations 76*a* in the upper actuator of each of the rocking assemblies 89*d*, 89*c*, 89*b*, 89*a*, 84*c* and 84*b*. That portion of the pull rod 46 which extends beyond the actuator 76 of the rocking assembly 84*b* is provided with a stop nut 90 abutting the actuator 76. The stop nut 90 is held in place by a compression spring 91 and a set screw sleeve 92 affixed to the pull rod 46. Thus, the rocking assemblies 84*c* and 89*a*–89*d* will lend support to the pull rod 46 and will aid in keeping it in proper alignment. However, movement of these rocking assemblies will not affect pull rod 46. On the other hand, when rocking assembly 84*b* is moved from its normal position (as shown in FIG. 8) to its pulling position (determined by adjustable stop screw 85) a pulling force will be exerted on pull rod 46 and the pitch of string 19*a* will be raised.

The pitch lowering pull rod 54 of string 19*a* will be raised.

The pitch lowering pull rod 54 of string 19*a* is shown in FIG. 5 as passing through perforations 77*a* in the lower actuator 77 of rocking assemblies 89*d* and 89*c*. That portion of pull rod 54 extending beyond the lower actuator of rocking assembly 89*c* is provided with a stop nut 93 abutting the actuator 77 of rocking assembly 89*c* and held in place by compression spring 94 and set screw sleeve 95. Thus, while the lower actuator 77 of rocking assembly 89*d* will help support and guide the pull rod 54, only movement of rocking assembly 89*c* to its pulling position will cause the pitch of string 19*a* to be lowered.

In similar manner, each of the rocking assemblies 84*a*–84 and 89*a*–89*d* may be caused to actuate either the pitch increasing or pitch decreasing pull rod of any of the strings of the rear neck. Thus, any of the rocking assemblies may raise or lower the pitch of any number of strings in any desired combination. The set up of the instrument may be changed by simply changing the pull rods 46 and 54, using pull rods of appropriate length to be actuated by the desired rocking assembly.

It is also possible to have a given pull rod actuable by more than one rocking assembly. For example, pull rod 54*a* in FIG. 5 is shown as having one stop nut — compression spring — set screw sleeve assembly 54*b* abutting rocking assembly 84*c* and another such assembly 54*c* abutting rocking assembly 89*b*. Thus, while the pull rod 54*a* is supported by rocking assemblies 89*a*–89 and 84*c*, it will be actuated only by rocking assemblies 84*c* and 89*b*.

The tuning mechanism of the present invention, thus far described with respect to the rear neck, is substantially identical for the front neck as well. As shown in FIG. 5, the instrument frame has openings 96 and 97 therein, in which frame members 98 and 99 are mounted to the underside of woden panel 12. The frame 98 is identical to the frame 67 (FIGS. 8 and 9) and bears four rocking assemblies 100*a*–100*d*, identical to the rocking assembly 84 of FIGS. 8 and 9. In like manner, the frame 99 and its four rocking assemblies 101*a*–101*d* are identical to the frame 67 and rocking assembly 84 of FIGS. 8 and 9. Pull rods extending from the roller bridge assemblies 66 of the front neck are attached to desired ones of the rocking assemblies 100*a*–100*d* and 101*a*–101*d*, in the same manner described with respect to the pull rods of the rear neck. It will be noted that, in the particular embodiment illustrated in FIG. 5, the rocking assembly 100*a* is not used.

The rocking assemblies of the rear neck and the rocking assemblies of the front neck are substantially aligned with each other, as will be noted from FIG. 5. Each aligned pair is adapted to be alternatively operable by a pedal assembly. To this end, there is a shaft extending transversely of the instrument for each aligned pair of rocking assemblies. In FIG. 5, a first shaft is shown at 102. Additional shafts are fragmentarily shown at 103–109. One end of the shaft 102 is rotatively mounted in a suitable bearing means in the front side 2 of the instrument frame, as indicated at 110. The other end of the shaft 102 is mounted in a bearing means 111, supported by the longitudinally extending web 6 of the instrument frame. The remaining shafts 103–109 are similarly mounted, and like parts have been given like index numerals. Adjacent the ends of each of the shafts supported by the front side wall 2 of the instrument frame, there is a crank 112 non-rotatively affixed to the shaft. In similar manner, each shaft has a crank 113 non-rotatively affixed to that portion thereof which extends slightly beyond the bearing means 111 in the main frame web 6. For purposes of clarity, only one such crank 113 has been illustrated in FIG. 5, affixed to the shaft 103.

Each of the shaft cranks 112 (with the exception of crank 112 on shaft 102) is adapted to be operatively connected to a pedal assembly. All of these pedal assemblies may be substantially identical. An exemplary assembly is illustrated in FIG. 14. The pedal assembly comprises a bar 114, the ends of which may be removably affixed to the front legs of the machine. That surface of the bar 114 which faces the rear side of the machine has a pair of spaced brackets, one of which is shown at 115. The brackets non-rotatively support a bar 116. The pedals are rotatively mounted on this bar.

As shown in FIG. 14 the pedal 117 has at its pivoted end a sleeve 118 mounted on the bar 116. A connecting rod 119 has at one end means 120 for pivotally at-

taching it to the shank of the pedal **117**. The attachment means **120** may be of any suitable type and is preferably removable either from the end of the connecting rod or from the pedal shank.

For purposes of an exemplary showing, shaft **103** is fragmentarily illustrated in FIG. **14**, including its crank **112**. The crank **112** bears a transversely extending pin **121**. For reasons which will be apparent hereinafter, it is preferable that the pin **121** pass through the crank so that its ends extend from both sides thereof.

The upper end of the connecting rod **119** is provided with a fitting **122** adapted to removably engage one end of the pin **121**. The precise configuration of the fitting **122** and the pin **121** does not constitute a limitation on the present invention. It is desirable to have the connection of these elements a removable one so that the entire pedal assembly may be readily disengaged from the instrument and disassembled for packing in a carrying case or the like. As indicated in FIG. **14**, the fitting **122** may have a perforation therein adapted to receive the end of the pin **121** and to ride in an annular groove in the pin end.

It will be evident from FIG. **14** that a downward pressure when applied to pedal **117**, will cause the crank **112** to move downwardly, by virtue of the connecting rod **119**. Downward movement of the crank **112** will, in turn, cause rotation of the shaft **103**. Rotation of the shaft **103**, in turn, will cause a similar downward movement of crank **113** at its other end. The movements just described will be true of shafts **104–109** and their respective cranks **112** and **113**, when the pedal assemblies operating these shafts are actuated. It will be noted that since there is no fourth rocking assembly mounted to frame **67**, and since the rocking assembly **100***a* on frame **98** is not used on the particular set up illustrated in FIG. **5**, no pedal assembly need be provided for shaft **109**.

The movement of shaft **102** and its cranks **112** and **113** will be the same as that described with respect to the other shafts, with the exception that shaft **102** is actuated by a folding knee pedal **123**. In FIG. **5**, the knee pedal **123** is shown in its folded position. FIG. **7** illustrates the knee pedal **123** in its downwardly depending position. Again it will be understood that FIG. **7**, a perspective cross sectional view along the section line **7—7** of FIG. **5**, illustrates the parts in inverted position, since FIG. **5** is a bottom view of the instrument. As shown, the shaft **102** bears, in addition to crank **112**, a slightly modified crank **113**, having an additional leg **124**. One end of the knee pedal **123** is bifurcated, the bifurcations receiving the leg **124** therebetween and being pivoted to it, as at **125**. When in its downwardly depending position, the pedal surface **126**, between the bifurcations, abuts the end **124***a* of the leg **124**, making the assembly rigid. As seen in FIG. **7**, counter clockwise movement of the knee pedal **123** will cause counter clockwise rotation of shaft **102** and the downward movement of the ends of cranks **112** and **113***b*.

FIG. **7** also illustrates a latch means **127**. The latch means is pivoted at its upper end to the horizontal leg of the support **74** of the rocking assembly **101***d*. This pivotal attachment is accomplished by a rivet **128**, or like means. The lowermost end of the latch **127** has a hooked-shaped configuration, formed by the notch **129**. Finally, the latch has a longitudinally extending slot **130**. A rod **131**, extending longitudinally of the instrument, carries a lug **132** having a transverse pin **133**. The pin **133** is engaged in the latch slot **130**. It will be understood that longitudinal movement of the rod **131** will, through the agency of pin **133** in slot **130**, cause the latch **127** to pivot about the rivet **128**. When the rod **131** moves longitudinally to the right in FIG. **7**, the latch **127** will pivot in a clockwise direction to a position where the notch **129** will engage that end of pin **121** in crank **112** opposite the end engaged by the connecting rod of the pedal assembly (see FIG. **14**). When so engaged, downward movement of the crank **112** (by actuation of a pedal assembly connected to the other end of pin **121**) will cause a downward movement of the latch **127**. Such a downward movement of the latch **127** will, in turn, cause the entire rocking assembly **101***d* to pivot about its shaft **73**, applying a pulling force to any pull rods actuable by it. When pressure on the pedal assembly is released, the rocking assembly **101***d* will return to its normal position and the pedal will be pulled upwardly to its normal position by means of spring **134** (see FIG. **5**). The spring **134** is attached at one end to the side portion of frame **99** and at the other end to the support **83** of the rocking assembly **101***b*.

All of the shafts **103–109** and their related rocking assemblies have identical latch means, and like parts have been given like index numerals. The operation of the latch **127** for each shaft-rocking assembly combination is identical to that described with respect to FIG. **7**.

As shown in FIGS. **5** and **7**, the rod **131** is of such length that it passes through an opening **77***a* in the lower actuator **77** of each rocking assembly and is supported thereby. The rod **131** bears an adjustable, pin-carrying lug **132** for each latch **127**. Thus, when the rod **131** is shifted to the left in FIG. **5**, all of the latches **127** will engage all of the pins **121** on all of the cranks **112** so that the various pedal means will be operatively connected to the rocking assemblies for the front neck and will control the pitch of its strings.

Again as will be noted from FIGS. **5** and **7**, a shift of the rod **131** to the right in FIG. **5** (equivalent to a shift to the left in FIG. **7**) will cause the latches **127** to pivot to a position where their notches **129** will no longer engage the crank pins **121**. Thus, the pedal assemblies will no longer control the pitch of the strings of the front neck. Such shifting of the rod **131** is brought about by virtue of its connection to a crank **135** non-rotatively affixed to a shaft **136**. The shaft **136** extends transversely of the entire instrument and has one end supported in suitable bearing means in the front side to the instrument frame, as at **137**. The other end of the shaft extends through the rear side **3** of the instrument frame and is supported in suitable bearing means **138**. That end of the shaft **136**, extending through the rear frame side **3** is provided with a lever **139** (see also FIGS. **1** and **2**). The lever **139** enables manual rotation of the shaft **136** by the player of the instrument.

Reference is now made to FIGS. **5** and **8**. As indicated above, each of the shafts **102–109** carries a crank **113**. Each crank **113** carries a pin **113***a*. Each of the rocking assemblies **84***a–84c* and **89***a–89d* carries a latch **140**. The assembly shown in FIG. **8** may be considered as typical of all the rocking assemblies for the rear neck. The latch **140** is pivoted as at **141** to the sub-

stantially horizontal leg of the support **74**. The latch has a longitudinal slot **142** and a hooked-shaped configuration, defined by the notch **143**.

A rod **144**, similar to the rod **131**, extends longitudinally of the instrument and bears a pin-carrying adjustable lug **145**. The pin of the lug engages the latch slot **142** so that shifting of the rod **144** will cause pivoting of the latch about its pivot point **141**. The latch is pivotable between a position where its notch **143** engages the pin **113***a* of the adjacent crank **113**, and a position wherein the notch **143** does not engage the crank pin **113***a*. The primary difference between the latch **140** and the latches **127** for the rocking assemblies of the front neck, lies in the fact that the notches **129** in the latches **127** open toward the tail end of the instrument, while the notch **143** in the latch **140** opens toward the head end of the instrument.

As indicated above, each rocking assembly for the rear neck has a latch **140**. As shown in FIG. **5**, the rod **144** supported by brackets **146** affixed to the side portions of the frames **67** and **87** is of sufficient length to carry a pin bearing lug **145** for each latch **140**. Longitudinal movement of the rod **144** to the right in FIG. **5** (equivalent to movement to the left in FIG. **8**) will cause all of the latches **140** to engage the pins **113**a of all of the cranks **113** so that all of the rocking assemblies of the rear neck will be operatively connected to the shafts **102–109** and will be actuable by the pedal assemblies so that the pedal assemblies will control the pitch of the strings of the rear neck. Each of the rocking assemblies of the rear neck are provided with springs **147**, equivalent to the springs **134** on the rocking assemblies of the front neck, and serving the identical purposes.

When the rod **144** is moved to the left in FIG. **5** (equivalent to the movement to the right in FIG. **8**), all of the latches **140** will be disengaged from the crank pins **113***a* and all of the pedal assemblies will no longer control the pitch of the strings of the rear neck.

The end of the rod **144** is attached to a crank **148** non-rotatively affixed to the shaft **136**. It will be evident from FIG. **5** that when the lever **139** is in the position shown, the rods **131** and **144** will be shifted to their left hand most positions. Thus, the foot pedals will be operatively connected to the rocking assemblies of the front neck and will control the pitch of the strings thereof. When the lever is shifted to the right in FIG. **5**, the rods **131** and **144** will be in their right hand most positions and the pedals will now be operatively connected to the rocking assemblies of the rear neck, controlling the pitch of the strings thereof. Thus, by the simple operation of shifting lever **139**, the player can instantly determine whether the pedals will control the pitch of the strings of the front neck or the rear neck.

The tuning means of the present invention having been described in an exemplary embodiment, a method of "setting up" the instrument may be described as follows. The player will tune the strings of the front and rear necks by means of the conventional tuning machines **18** and **21**. He will decide which strings will have their pitch controlled by each pedal means. He will also determine whether a given pedal will raise or lower the pitch of a given string. This may be accomplished by connecting the pitch-raising pull rod of each string to a desired one or ones of the rocking assemblies and the pitch-lowering pull rod of each string to another desired one or ones of the rocking assemblies. The amount by which the pitch of each string will be raised or lowered from its normal or tuned pitch can be determined by proper adjustment of the nuts **47** and **57** (see FIGS. **3** and **6**).

Once the machine has been set up as described, each string may be readily and quickly tuned at any time by adjustment of the tuning keys of the tuning machines and by adjustment of the nuts **47** and **57**.

FIGS. **10** through **13** illustrate a modification in the structure of the rocking assemblies and rocking assembly latches. The embodiment of FIGS. **10** through **13** is, for the most part, similar to the embodiment just described, and like parts have been given like index numerals.

The primary difference between the structure of FIGS. **10** through **13** lies in the fact that the rocking member assemblies are not mounted on frame members such as those shown at **67**, **87**, **98** and **99** in FIG. **5**. In this instance, the rocking assemblies are supported by pairs of spaced angle irons. Such angle iron pairs are shown at **149–150**, **151–152**, **153–154** and **155–160**. The pair of angle irons **149–150** are located in the opening **72** in the instrument frame and are affixed by screws or the like to the underside of panel **13**. Similarly, angle iron pairs **151–152** are affixed to the panel **12** in the instrument frame opening **96**. Angle irons **153–154** are affixed to panel **13** in frame opening **88** and angle irons **155–156** are affixed to panel **12** in frame opening **97**.

The individual rocking assemblies are identical to those described above, and like parts have been given like index numerals. It will be noted that the shafts **73** of each rocking assembly is rotatively mounted in perforations through their respective pairs of angle irons.

All of the rocking assemblies of the front neck are provided with latch means **127** adapted to engage the pins **121** on the cranks **112** of the pedal-actuated shafts. In this instance, however, the cranks **112** are located on the opposite sides of the latches **127**, which engage the opposite ends of the pins **121**. In this embodiment, the ends of the pins **121** which face the front side **2** of the instrument frame constitute those ends engaged by the upper ends of the pedal connecting rods. As in the case of the embodiment of FIG. **5**, the latches **127** are shiftable between a pin engaging and a pin releasing position, by virtue of rod **131** and its pin carrying lugs **132**.

In this embodiment, the amounts by which the pedal actuated shafts rotate, and thus the amounts by which the rocking assemblies pivot in a pulling or counter clockwise direction (as seen in FIGS. **12** and **13**) is determined by stop screws **157**. As is most clearly shown in FIG. **11**, the stop screws **157** are mounted in horizontal inwardly extending lugs **158**, constituting a part of the front side **2** of the instrument frame. The ends of the stop screws **157** are adapted to have an adjustable abutting relationship with the bottom edge of the shaft cranks **112**.

The rocking assemblies for the rear neck are provided with latches **140**, as described above with respect to FIG. **8**. The latches are swingable between a position wherein they engage the pins **113**a of the shaft cranks **113** and a position wherein they do not engage these

pins. Movement of the latches is again caused by the rod **144** carrying adjustable pin-bearing lugs **145**. In the embodiment of FIGS. **10** through **13**, however, the rod **144** passes through one of the openings **77***a* in each of the lower rocking assembly actuators **77**, in the same manner as the rod **131** in FIGS. **5** and **10**. Thus, the lugs **145** lie on the opposite side of the latches **140** from that shown in FIG. **8**, but otherwise function in identical manner.

When pressure is released from a given pedal assembly, means are provided for returning the pedal and the particular rocking assembly to which it was operatively connected to their normal positions. This means comprises a spring **159**. The spring **159** passes over that end of a pedal actuated shaft extending beyond the bearing means **111**. One end of the spring engages the bottom edge of frame web **6** and the other end of the spring engages the bottom edge of crank **113**. There will be a spring **159** for each pedal actuated shaft.

The embodiment of FIGS. **10** through **13** is, in all other ways, substantially identical to that described with respect to FIGS. **1** through **9**. The "set-up" procedure may be substantially identical and the various parts function in the manner described above.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

**1**. A tuning means for increasing and decreasing by a determined amount the normal tension of one or more of the strings of a stringed instrument of the type having a head end and a tail end, the head end of each string being attached to a conventional tension adjusting means at the head end of the instrument, said tuning means comprising a pivoted tuning member at the tail end of the instrument for each string, said tuning member extending downwardly through an opening at the tail end of said instrument, the tail end of each string being attached to its tuning member adjacent the upper end thereof, each tuning member being pivotable from a normal position to a first position in which the tension of its string is increased and between said normal position and a second position in which the tension of its string is reduced, linkage means at the underside of said instrument for attaching the tail ends of a first and a second pull rod to each of said tuning members in such a way that a pulling force applied to said first pull rod will pivot its tuning member to said first position and a pulling force applied to said second pull rod will pivot its tuning member to said second position, a plurality of rocking assemblies affixed to the underside of said instrument and extending transversely thereof in parallel spaced relationship, each of said rocking assemblies having a first actuator to which the head end of any of said first pull rods may be operatively attached and a second actuator to which the head end of any of said second pull rods may be operatively attached, said rocking assemblies being pivotable between a normal position and a pulling position in which said first and second actuators apply a pulling force respectively to any of said first and second pull rods operatively attached thereto, each of said first pull rods being guided and supported by said first actuator of any of said rocking assemblies located between said linkage means and that rocking assembly having the first actuator to which the head end of said first pull rod is operatively attached, each of said second pull rods being guided and supported by said second actuator of any of said rocking assemblies located between said linkage means and that rocking assembly having the second actuator to which the head end of said second pull rod is operatively attached, means for rocking each of said rocking assemblies from said normal position to said pulling position and means for returning each of said rocking assemblies from said pulling position to said normal position.

**2**. The structure claimed in claim **1** wherein said linkage means comprises a link member and first and second pull rod plates for each of said tuning members, the upper end of said link member being pivoted to the lower end of said tuning member, said first pull rod plate extending transversely of said link member and being pivoted thereto at a first pivot point intermediate the ends of said link member, said second pull rod plate being substantially parallel to said first pull rod plate and being pivoted to said link member at a second pivot point at the lower end of said link member, a first stop means limiting the longitudinal movement of said first pull rod plate toward the tail end of said instrument, a second stop means limiting the longitudinal movement of said second pull rod plate toward the tail end of said instrument, means for urging said first and second pull rod plates against said first and second stops, respectively, said tail end of one of said fist pull rods being operatively attached to said first pull rod plate and said tail end of one of said second pull rods being operatively attached to said second pull rod plate.

**3**. The structure claimed in claim **1** wherein each of said rocking assemblies comprises a pair of downwardly depending supports pivotally attached to the underside of said instrument in spaced relationship, said first and second actuator comprising elongated members extending transversely of said instrument and between said supports, the ends of said first and second actuators being pivotally affixed to said supports with said first actuator above said second actuator, each of said first and second actuators having a plurality of perforations spaced along the length thereof through which first and second pull rods may extend, respectively, all of said first actuators of said rocking assemblies lying in substantially the same plane with their perforations being substantially coaxial, all of said second actuators lying in substantially the same plane with their perforations being substantially coaxial.

**4**. The structure claimed in claim **1** wherein said means for rocking each of said rocking assemblies from said normal position to said pulling position comprises a pedal for each of said rocking assemblies, linkage means for operatively connecting each of said pedals to its rocking assembly.

**5**. In a stringed instrument of the type having two necks, a head end, a tail end and a conventional tension adjusting means at the head end of each neck, each string of each neck being attached at its head end to the conventional tension adjusting means of that neck, tuning means for increasing and decreasing by a determined amount the normal tension of one or more of the strings of each neck, said tuning means comprising a pivoted tuning member at the tail end of each neck for each string of that neck, each tuning member extending downwardly through an opening at the tail end of its

respective neck, the tail end of each string being attached to its tuning member adjacent the upper end thereof, each tuning member being pivotable from a normal position to a first position in which the tension of the string is increased and between said normal position and a second position in which the tension of its string is reduced, linkage means for each neck at the underside of said instrument for attaching the tail ends of a first and a second pull rod to each of said tuning members for that neck in such a way that a pulling force applied to said first pull rod will pivot its tuning member to said first position and a pulling force applied to said second pull rod will pivot its tuning member to said second position, a plurality of rocking assemblies for each neck affixed to the underside of said instrument, the rocking assemblies for each neck extending transversely thereof and in parallel spaced relationship to each other, each of said rocking assemblies for a given neck having a first actuator to which the head end of any of said first pull rods for that neck may be operatively attached and a second actuator to which the head end of any of said second pull rods for that neck may be operatively attached, said rocking assemblies for both necks being pivotable between a normal position and a pulling position in which said first and second actuators apply a pulling force respectively to any of said first and second pull rods operatively attached thereto, each of said first pull rods of a given neck being guided and supported by said first actuator of any of said rocking assemblies for that neck located between said linkage means for that neck and that rocking assembly having the first actuator to which the head end of said first pull rod is operatively attached, each of said second pull rods for a given neck being guided and supported by said second actuator of any of said rocking assemblies for that neck located between said linkage means for that neck and that rocking assembly having the second actuator to which the head end of said second pull rod is operatively attached, each rocking assembly for one of said necks being in longitudinal alignment with a rocking assembly for the other of said necks, a rocking means for each of said aligned pairs of rocking assemblies, for alternatively rocking the rocking assemblies of each pair from said normal position to said pulling position, means for alternatively connecting all of said rocking means simultaneously to their respective rocking assemblies for one neck and simultaneously to their respective rocking assemblies for the other neck, and means for returning each rocking assembly of each neck from its pulling position to its normal position.

6. The structure claimed in claim 5 wherein said linkage means for each of said necks comprises a link member and first and second pull rod plates for each of said tuning members of said neck, the upper end of said link member being pivoted to the lower end of its respective tuning member, said first pull rod plate extending transversely of said link member and being pivoted thereto at a first pivot point intermediate the ends of said link member said second pull rod plate being substantially parallel to said first pull rod plate and being pivoted to said link member at a second pivot point at the lower end of said link member, a first stop means limiting the longitudinal movement of said first pull rod plate toward the tail end of said instrument, a second stop means limiting the longitudinal movement of said second pull rod plate toward the tail end of said instrument, means for urging said first and second pull rod plates against said first and second stops, respectively, said tail end of one of said pull rods being operatively attached to said first pull rod plate and said tail end of one of said second pull rods being operatively attached to said second pull rod plate.

7. The structure claimed in claim 5 wherein each of said rocking assemblies for each neck comprises a pair of downwardly depending supports pivotally attached to the underside of said instrument in spaced relationship, said first and second actuators comprising elongated members extending transversely of their respective neck and between said supports, the ends of said first and second actuators being pivotally affixed to said supports with said first actuator above said second actuator, each of said first and second actuators having a plurality of perforations spaced along the length thereof through which first and second pull rods may extend, respectively, all of said first actuators of said rocking assemblies for a given neck lying in substantially the same plane with their perforations being substantially coaxial, all of said second actuators of said rocking assemblies for a given neck lying in substantially the same plane with their perforations being substantially coaxial.

8. The structure claimed in claim 5 wherein said rocking means comprises a pedal assembly for each of said aligned pairs of rocking assemblies, a rotatable shaft for each of said aligned pairs of rocking assemblies extending transversely of said instrument, each of said shafts having a first and second pin-bearing crank non-rotatively affixed thereto, each of said pedal assemblies being operatively connected to one of said pin-bearing cranks on one of said shafts, each of said rocking assemblies for one neck having a first latch pivotally mounted thereto, said first latches being shiftable between a normal position and a position wherein each of said first latches engages said pin on the adjacent one of said first cranks, each of said rocking assemblies for the other neck having a second latch pivotally mounted thereto, said second latches being shiftable between a normal position and a position wherein each of said second latches engages said pin on the adjacent one of said second cranks, and means for simultaneously shifting all of said first latches into engagement with said pins of said first cranks and all of said second latches to their normal positions, and alternatively, simultaneously shifting all of said first latches to their normal positions and all of said second latches into engagement with said pins of said second cranks, whereby all of said pedal assemblies will be operatively connected to their respective rocking assemblies of the same one of said necks at any given time.

9. A musical instrument comprising a first set of strings, a second set of strings, a first tension-control means for varying the tension in strings of said first set of strings, a second tension-control means for varying the tension in strings of said second set of strings, a single operating means for operating said first and said second tension-control means, and shift means for selectively causing said operating means to be connected to either one of said tension-control means and

disconnected from the other of said tension-control means.

10. In combination with a musical instrument having two sets of strings, a string-tensioning arrangement comprising a first tension-control means for varying the tension in strings of one of said sets of strings, a second tension-control means for varying the tension in strings of the other of said sets of strings, and shift means for selectively causing either one of said tension-control means to be operative and the other of said tension-control means to be inoperative.

11. A musical instrument comprising a body, a first set of strings on said body, a second set of strings on said body, a first means for adjusting the tension in strings of said first set, a second means for adjusting the tension in strings of said second set, movable means for operating said first and second means, and shift means for causing said movable means to selectively disengage one of said first and second means for operating only the other of said first and second means.

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