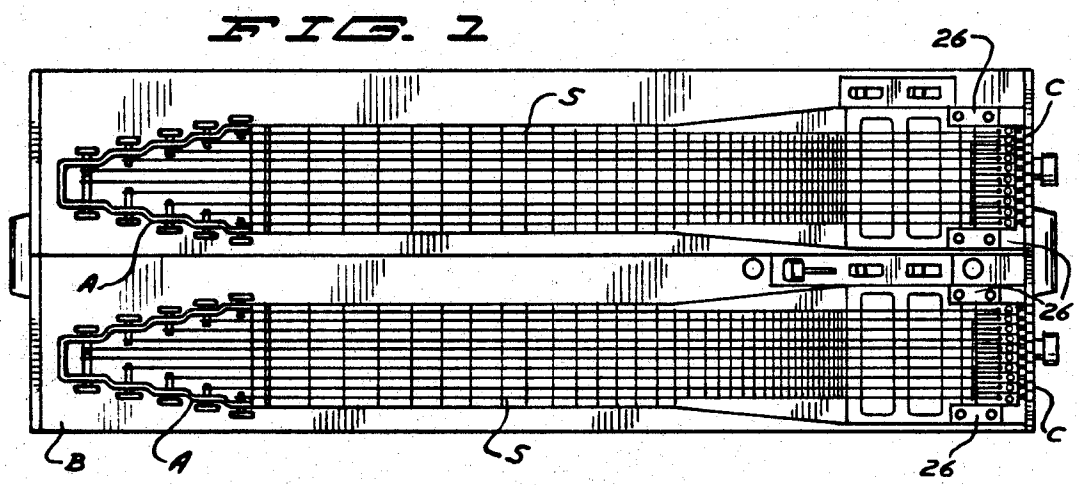
July 2, 1968 J. J. KELLEY, JR 3,390,600

STRING TENSION ADJUSTMENT FOR STEEL GUITARS

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FIG. 1



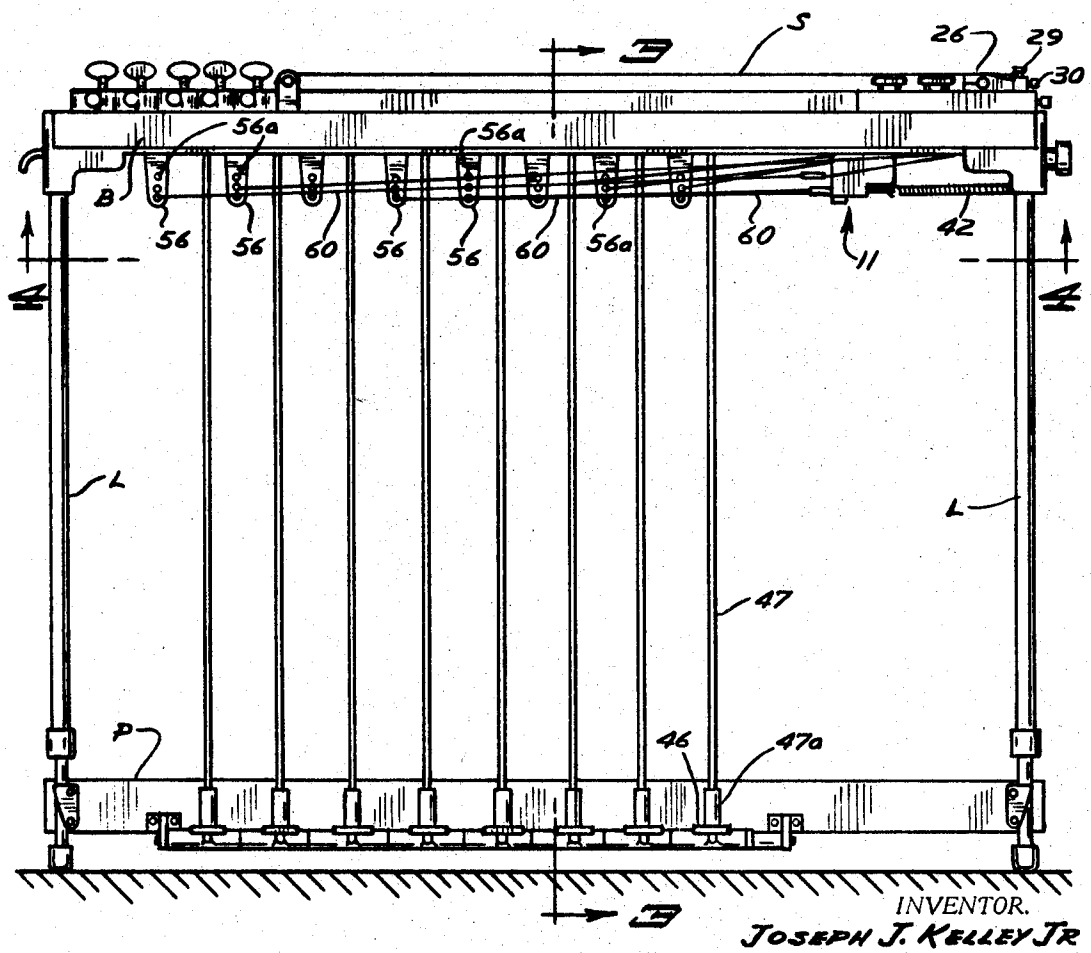


FIG. 2

INVENTOR.
JOSEPH J. KELLEY JR

BY
Adams & Cuaynor
ATTORNEYS

July 2, 1968 J. J. KELLEY, JR 3,390,600

STRING TENSION ADJUSTMENT FOR STEEL GUITARS

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FIG. 3

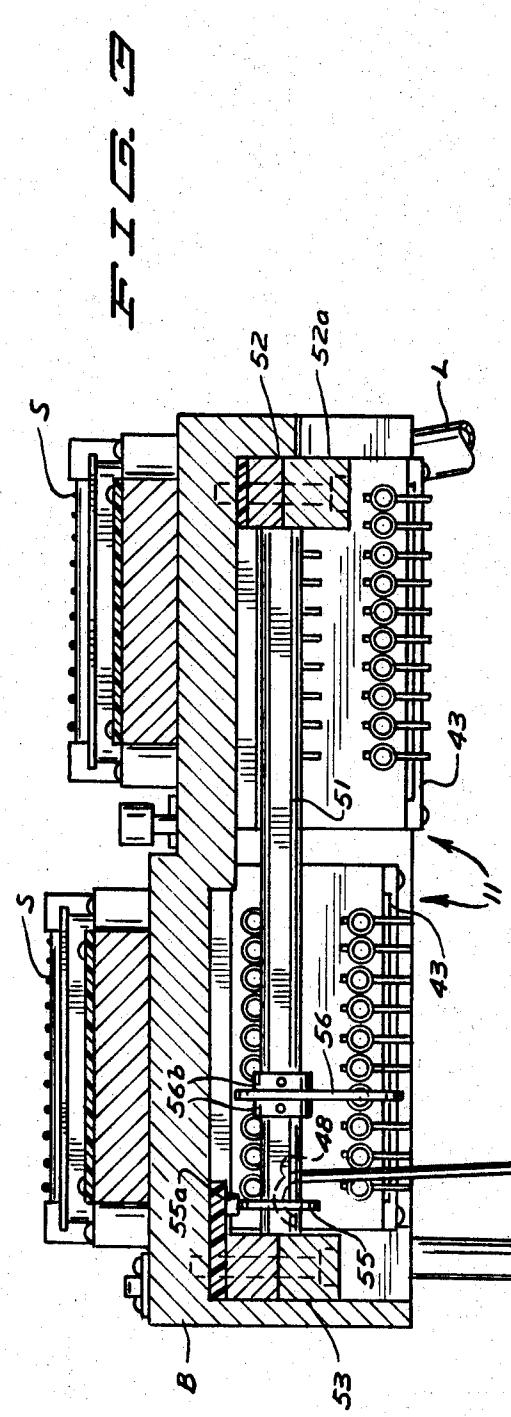
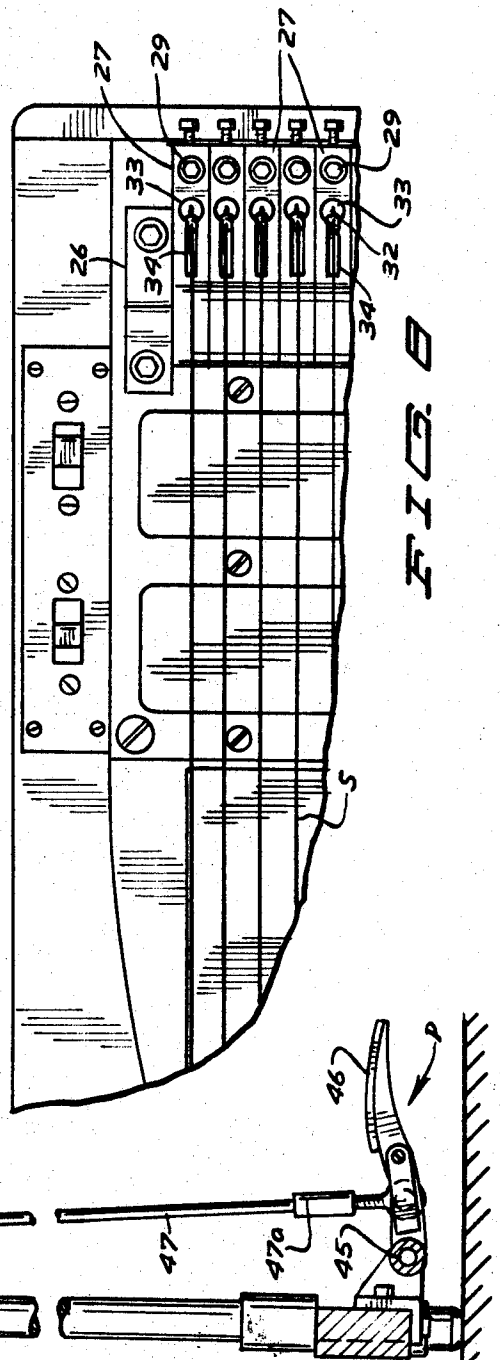


FIG. 8



INVENTOR.
JOSEPH J. KELLEY JR.
BY
Adams & Cuayna
ATTORNEYS

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STRING TENSION ADJUSTMENT FOR STEEL GUITARS

Filed Sept. 10, 1965 4 Sheets-Sheet 3

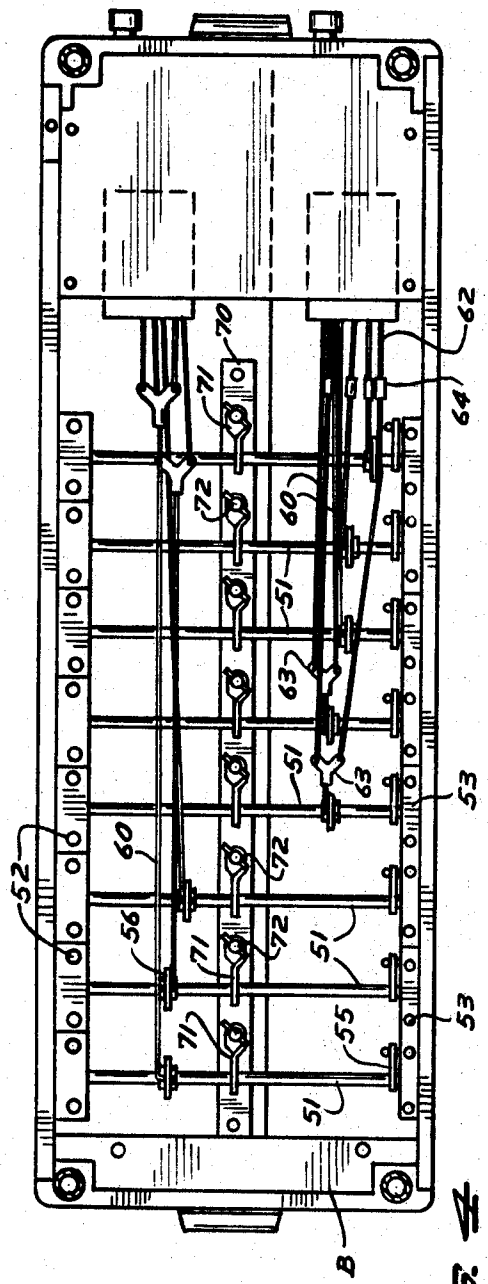


FIG. 4

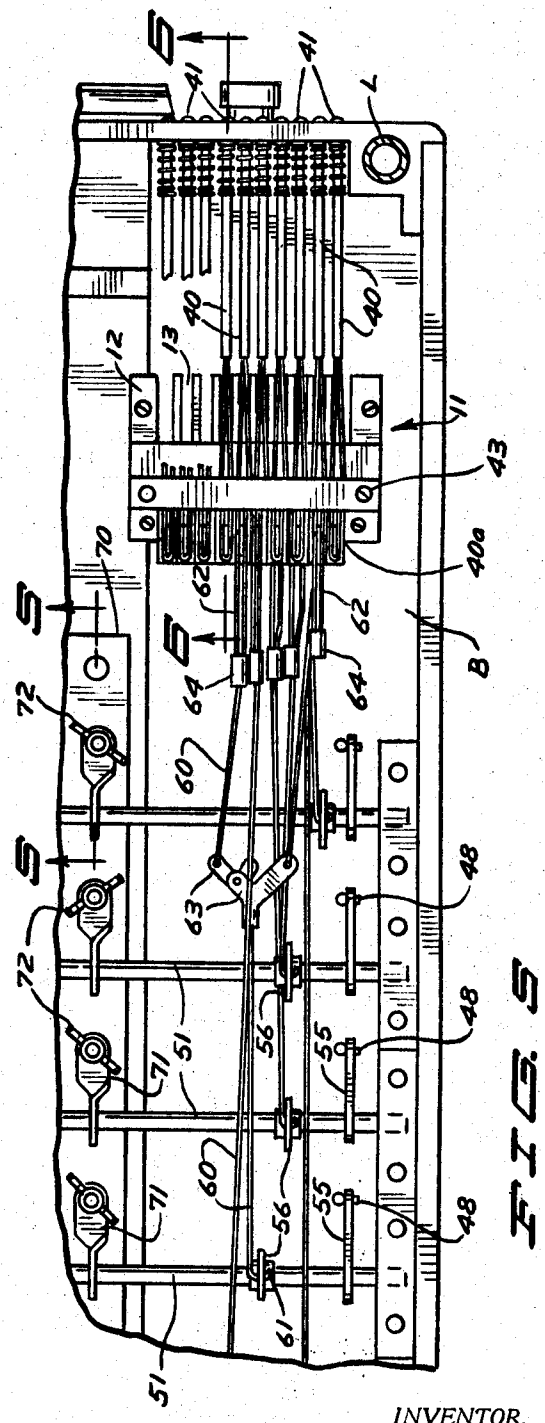


FIG. 5

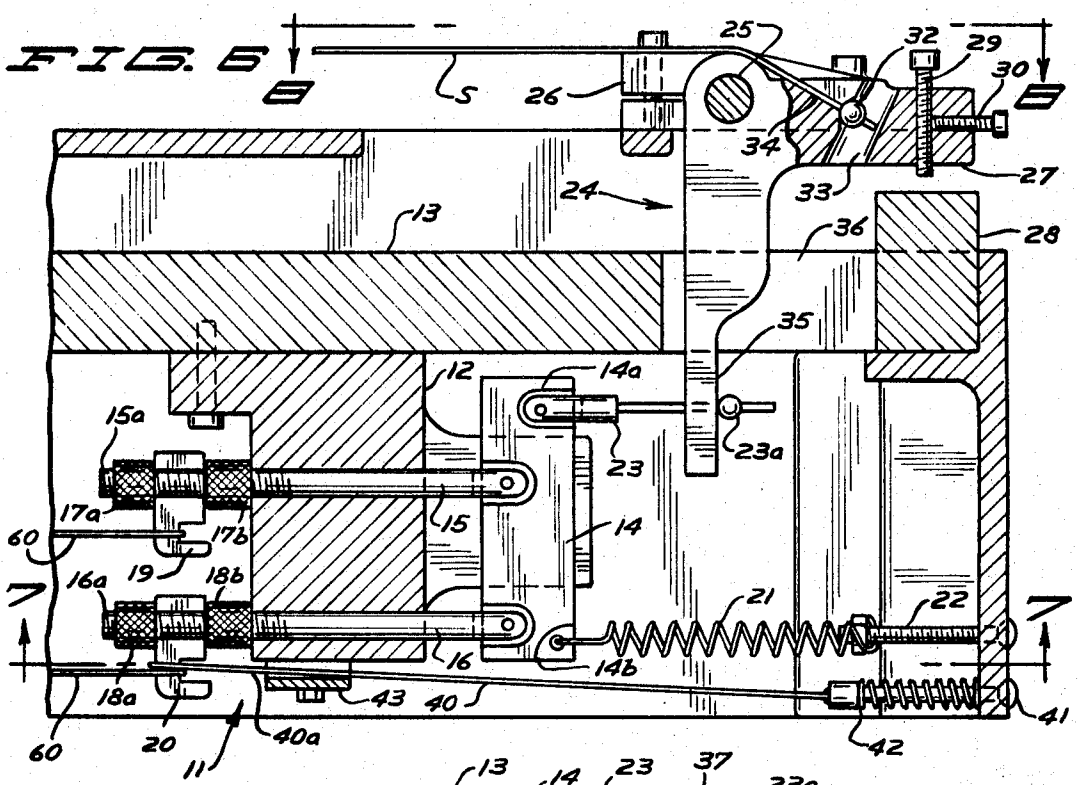
INVENTOR.
JOSEPH J. KELLEY JR.
BY
Adams & Cuayna
ATTORNEYS

July 2, 1968 J. J. KELLEY, JR 3,390,600

STRING TENSION ADJUSTMENT FOR STEEL GUITARS

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FIG. 6



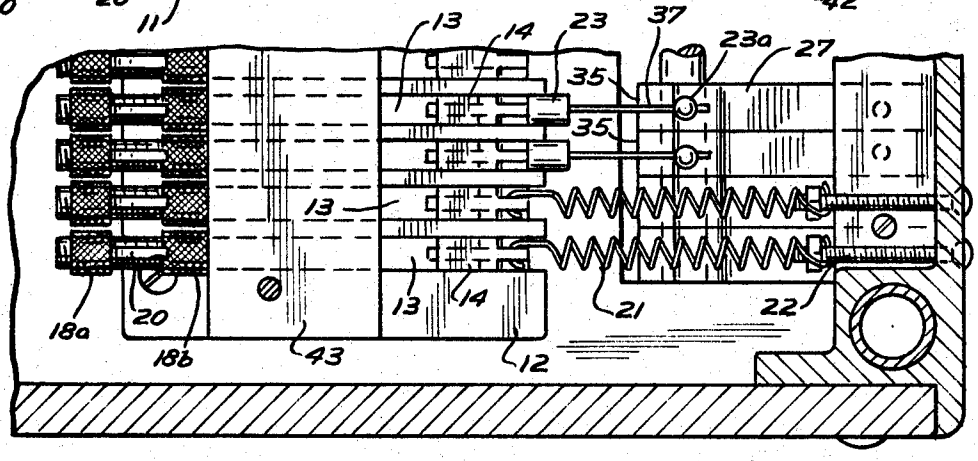


FIG. 7

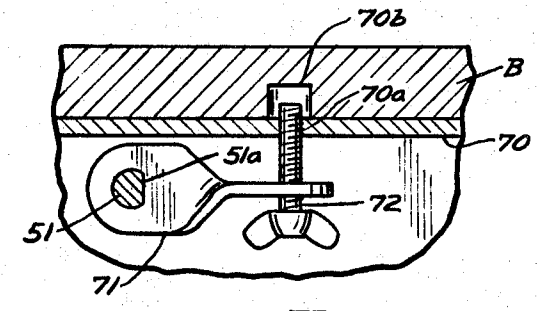


FIG. 9

INVENTOR.
JOSEPH J. KELLEY JR.

BY
Adams & Cuayna
ATTORNEYS

United States Patent Office 3,390,600 Patented July 2, 1968

3,390,600

STRING TENSION ADJUSTMENT FOR STEEL GUITARS

Joseph J. Kelley, Jr., 13400 Cedar Ave. S., Rosemount, Minn. 55068

Filed Sept. 10, 1965, Ser. No. 486,431
11 Claims. (Cl. 84—312)

ABSTRACT OF THE DISCLOSURE

This invention relates to a structure for adjusting the tension of the strings of guitars through the utilization of a pedal connection to the strings which includes a crank attached to the end of each of the strings with a crank pivoting device connected therewith which permits the crank to be moved from a normal position to either increase or decrease the tension on the particular controlled string when a pedal is depressed. The crank controlling mechanism includes a spring arrangement which permits the crank to be moved to an increasing or decreasing tension position. The arrangement of the pedals to control the cranks provides means for attaching a plurality of cranks to any one particular pedal.

A steel string guitar as known is a generally horizontally, stably mounted guitar unit which is provided with a moveable fret bar for manually selecting chords rather than "fingering" the strings and wherein the player plucks and strums the strings much as he would on a standard guitar. The amount of variation in the chordal selection of a steel guitar is of course limited to the skill of the player and the amount of tonal variation attainable by placing the fret bar at various positions along the strings. In the past few years, various devices have been provided for adjusting the tension and thus changing the pitch of any one of the strings of these guitars and it is an object of this invention to provide a new and unique tuning structure for steel guitars which will enable the user to adjust the tension of strings and thus alter the tone of the strings at his greatest ease and permit a great amount of flexibility in such tone control.

Generally the previously used tension adjustment structures for steel guitars considered consisted of pluralities of steel cables designed to either increase or decrease the tension of any one of the various strings of the guitar by pulling directly thereon such that the tone of the tightened or relaxed string would be varied. These cable systems required a complex mechanical hook-up in order to attain both the increase and decrease of tension which is required to change the tone of the string both upwardly and downwardly of the musical scale. One difficulty in such a tension adjusting device arises when the user or player wants to increase the tension on one particular string on one beat or stroke of the guitar while decreasing the tension on another string and obtaining this action through shifting only one control pedal or lever. Naturally this type of arrangement requires a dual hook-up to a plurality of strings and most of the mechanical actions to attain this hook-up presently available and used on guitars are indeed complicated and cumbersome.

Applicant however through the design of the device described herein provides means for changing the tuning of the strings of a guitar which is accomplished with particular ease through the arrangement of multiple controls on any one string of the guitar such that it is possible through manipulation of the control pedals provided to decrease or increase the tension on any one string through its longest possible tonal range. The system as further provided by the applicant provides a positive action as compared to the previously used cables which included a

certain amount of stretch inherent to a cable operated device and thus the tonal effect or tonal change achieved by applicant's device will be more accurate than such cable controlled devices.

The device provided herein by applicant provides a multiple hook-up or control on any or all of the strings such that any or all of the strings may be put through their greatest range of change simply by manipulation of the various control pedals. This is to say that the structure provided by applicant will permit the change of a pitch of any one particular string from its point of most tension or highest pitch to the point of most relaxed or lowest pitch attainable in accordance with the specific size of the string. This multiple hook-up arrangement then provides a certain degree of flexibility heretofore unattainable in such steel guitar tension adjustment devices while providing this adjustment in a very simplified arrangement which will enable a device to be used by the ordinary guitar player without requiring a high degree of mechanical skill.

Further as provided herein by applicant, a certain finger-tip maximum adjustment control is provided for each of the strings which will permit the various adjustments to be achieved on each string with a relatively simple movement. It is only necessary with applicant's device to set an initial maximum setting through a first adjustment mechanism and to tune the string either tonally upwardly or downwardly from the maximum setting by coordinating certain other stop features of the unit.

In order to obtain an extreme degree of tonal flexibility applicant has provided a unique lever arrangement which provides a double pivotal action for the attached string unit. This is to say that he provides essentially a free floating lever system wherein the application of force to one end of the lever will provide one distinct movement either upwardly or downwardly to increase or decrease the tension and thus tone of a string while a subsequent force applied to the opposite end of the lever will absolutely reverse this string action without requiring any complicated mechanical linkages to attain this mechanical shifting.

In order to utilize the complete adjustability of applicant's device a unique string resting feature has been provided which will permit the required adjustments to the string including the repeated stretching and relaxing of the string without substantially decreasing the strength of the string. Further incorporated into this unique string attachment device is a rapid attachment structure which permits insertion or removal of a string with a minimum of difficulty to the player. Further, this particular string holding mechanism also incorporates a setting device which controls the maximum tension placed on a string and therefore serves a dual purpose.

It is therefore an object of applicant's invention to provide a new and unique string tensioning device for use with steel guitars and other string instruments wherein the pitch of a single or various strings may be altered to the player's desire.

It is a further object of applicant's invention to provide a new and unique system for adjusting the tension on the strings of steel guitar which includes a unique lever system wherein the lever is substantially a free floating system wherein pressure on one end of the lever will produce a reaction in one direction and pressure on the other end of the lever will produce an opposite reaction while holding the lever from shifting in an undesired direction.

It is a further object of applicant's invention to provide a new and unique tension adjusting device for string guitars or the like which includes a means to positively limit the maximum increase or decrease in tension on a guitar and includes devices for limiting the extension of said string ntermedate the maximum tension positions.

It is a further object of applicant's invention to provide a new and unique string fastening device for use with a steel guitar wherein the string is easily fastened thereto and wherein a certain portion of the device includes a maximum tension setting unit to limit the amount of tension being placed on any one of the strings.

It is a further object of applicant's invention to provide a free floating lever device for increasing or decreasing the tension on a guitar string or the like which includes a free floating lever member with means to apply forces to either end of said lever whereby certain restraining forces are automatically applied to the opposite end of said lever such that the tension on the string may be either increased or decreased at the player's desire.

It is a further object of applicant's invention to provide a string tensioning device for steel guitars and the like which includes a positive linkage system which is easily shiftable and which permits a multiple tune or pitch change on any one of the strings of a steel guitar which change is achieved through a minimum of difficulty and wherein the change is made to positively locate the pedals of the unit with respect to one another such that the pedals of the unit will all be active at a certain level.

It is a further object of applicant's invention to provide a string tensioning unit and thus a pitch adjustment unit for steel guitars or the like wherein solid stopping situations are provided for each of the various control pedals of the unit such that upon attaining said solid stopping portion, the player will know that the string is at its proper tonal tension.

It is a further object of applicant's invention to provide a tonal adjustment for steel guitars and the like wherein a multiple of tonal change elements may be mounted on a single control member of a guitar string wherein actuating different of such elements will provide the desired tonal effect without incorporating and without affecting the other various changes available to the strings of the guitar.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawing, wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a plan view showing a double necked guitar unit incorporating the concepts of applicant's invention;

FIG. 2 is a front elevational view of the unit as shown in FIG. 1;

FIG. 3 is a vertical section taken substantially along line **3—3** of FIG. 2;

FIG. 4 is a bottom plan view of the unit embodying the concepts of applicant's invention and illustrating the control features on only certain of the strings;

FIG. 5 is a portion of FIG. 4 drawn on to an enlarged scale showing particular details of the actuator portion thereof;

FIG. 6 is a vertical section taken substantially along line **6—6** of FIG. 5 and drawn to an enlarged scale to illustrate the string control portion of the unit;

FIG. 7 is a partial section taken substantially along line **7—7** of FIG. 6;

FIG. 8 is a partial plan view taken along line **8—8** of FIG. 6;

FIG. 9 is a vertical section taken substantially along line **9—9** of FIG. 5.

In accordance with the accompanying drawings, the steel guitars presently available and as particularly illustrated in FIGS. 1 and 2 include at least one of the string sections S as illustrated with the adjustment portions A at one end thereof designed to capture and hold one end of the strings of the guitar with certain adjustment screws which are commonly known provided thereon to provide for an initial tuning arrangement of the unit. These basic structures are ordinarily arranged in pairs and are mounted on a basic mounting board B. The other end of the string structure includes a means for attaching the end of the strings thereto and in this case this attaching element is referred generally to as C.

Those skilled in the art will recognize that various features in order to accomplish the playing and amplification of the string unit are naturally provided on these guitars and these devices are not particularly described herein as these devices are thought to be commonplace and well known by anyone associated with such musical instruments.

Certain additional elements provided in tunable steel guitars are likewise provided in applicant's device and ordinarily the mounting board B is supported by a plurality of legs L on the ends thereof which legs are arranged to mount and position a pedal mounting board P.

In order to understand the function of this unit, the musical concepts of this unit are as follows. An initial tuning of the strings must be made which, for example, on a ten stringed instrument could be G sharp, E, B, G sharp, F sharp, E, D, B, G sharp and E. Various of these strings on a guitar are either what are commonly known as steel or wound strings and the possible adjustment attainable with the device provided herein is figured in coordination with the possible increasing or decreasing of tension permitted and recommended for steel or wound strings. As for example, it is possible with this unit to raise the initial G sharp string, which is a steel string to A or likewise possible to raise the first E to an F or an F sharp key. Continuing from the tuned strings as mentioned above the possible raises for the strings could be as follows: B to a C and to a C sharp and the next adjacent G sharp string to an A, a B flat or a B. In other words, it is possible to raise most of the wire wound strings three ½ tones and to raise at least most of the steel strings at least a minimum of two ½ tones. This is, of course, to say that two ½ tone raises will produce a total shift of one whole tone.

Likewise the object of this invention is to provide a means to lower these similarly arranged strings to at least an additional tone lower than that originally tuned on the unit. For example, in a move to lower tuning it would be possible to lower the G sharp to a G, the E to an E flat and thence to a D, or the B to a B flat and thence to an A, and thence to an A flat. The possible extremes of this tonal adjustment is controlled purely by the fact of the guitar string being either a plain steel string or a wire wound string but with the structure as provided herein it is possible to attain on each of the strings a maximum of three ½ tone changes which is to say that three half tones or a total of one and a half otnes shifting either upwardly or downwardly is possible on any of the strings.

The primary apparatus provided herein to obtain the string tension change includes a unique free floating lever unit designated in its entirety **11** which includes a mounting block **12** securely atached to the bottom of upper mounting board B and extends transversely across the width of one of the string units S. A plurality of mounting slots **13** are provided in spaced relation across the block **12**; the number of slots **13** corresponding to the number of strings on the guitar unit, said slots being of a width to mount a lever bar **14** therein.

In the form shown, as best illustrated in FIG. 6, the lever bar **14** is arranged normally to the mounting bar B and has an upper **14*a*** and lower end **14*b*** to which the various elements actuated thereby will be attached. A pair of actuating rod members **15–16** are arranged for sliding reciprocatory movement through apertures in block **12** which apertures are in communicating alignment with the mounting slots **13**. A linkage receiving end of the rods **15*a*–16*a*** extends outwardly from the block **12** and is provided with a pair of threaded capturing elements **17*a*–17*b***, **18*a*–18*b*** for mounting a hook element **19–20** therebetween which hook element **19–20** will receive certain actuating linkages from the pedal system to control the movement of lever **14**.

As illustrated in FIG. 6, rod **15** is pivotally attached to lever **14** intermediate the ends thereof while rod **16** is attached adjacent end **14***b* thereof. A holding spring member **21** is attached at one end to end **14***b* of lever **14** and is attached to a portion of the mounting board B through a threaded adjustment member **22**. Adjacent end **14***a* of lever **14** a primary connector member in the form of a pivotally mounted link **23** on lever **14** with means such as a stop enlargement **23***a* on the extending end thereof is provided for actuating attachment to the crank string shifting mechanism generally designated **24**.

In the form shown each of the string shifting mechanisms **24** are individually pivotally mounted for rotation upon an axle **25**, the ends of which are mounted onto the mounting board B through stationary capturing elements **26—26**. Crank structure **24** is of course commonly known and includes a pair of arms extending at an angularly relation. One arm **27** of said crank **24** extends generally parallel to board B and overlies an abutment plate **28** provided on the end of board B. This arm **27** includes a first adjustment member **29** with a locking member **30** arranged normally thereto. Adjustment member **29** extends generally vertically through arm **27** to be in approximate abutting relation to block **28** and as should be obvious, varying the exposure of adjustment member **29** through arm **27** will limit the movement of crank **24** about axles **25** in one rotative direction. This structure then is the adjustment to govern the maximum stretching of the strings and thus control the upper limit of their tune change.

String end S is held to arm **27** through a unique capturing device which includes an enlarged stop **32** secured on the end of the string S which stop will be received into an arcuate passage **33** formed angularly through arm **27** and wherein the string S will be received into a substantially smaller communicating slot **34** which slot **34** will not permit the enlarged portion **32** to pass therethrough. This string attachment system also provides a quick change string release in that it is only necessary to substantially release the tension on the string S such that the enlarged end of the string **32** may be removed upwardly from the angularly arranged passage **32**.

The other end **35** of the crank **24** extends downwardly through an opening **36** formed in the mounting board B and has a slot **37** formed therethrough to receive a portion of the linkage **23** therein to thus abut with the enlarged portion **23***a* thereof. From this construction it should be obvious that the shifting of the lever structure **14** will either permit the crank **24** to rotate in one direction which direction is due to the intal tautness of the strings or pull the crank **24** in a string tightening direction.

In order to provide a limit to the downward tonal change which is decreasing the string S tension a structure is provided to control and limit the movement of rod **16** and in the form shown this structure includes a stop member **40** including an eye **40***a* portion on one end thereof to be received about engagement hook **20** with means for adjusting the other end thereof with respect to the frame portion of board B including a screw element **41**, an internally threaded member **42** to receive the screw and a spring between the board B and member **42** to hold member **42** for adjustment.

When the downward tone change of the strings is desired rod **16** will be pulled in the direction of hook **20** through links to be described hereinafter and thus the lever **14** will revolve about the now stationary rod **15** to allow the crank **24** to be shifted upwardly due to the tendency of the tuned, stretched string to return to unstretched condition. The limit of this shifting is achieved by properly locating the eye **40***a* of a stop **40** with respect to the hook **20** by adjustment of screw **41**. When pressure is released from the rod **16** spring **21** will serve to return the lever **14** and crank **24** to its normally tuned position. A partial cover plate **43** is provided to properly hold the stop elements **40** on the hooks **20**.

The action of the unit **11** when the player wishes to increase the tension on the string is to apply a force upon rod **15** tending to draw the rod **15** in the direction of hook **19** thus now permitting lever **14** to rotate about the now stationary rod **16**. In this situation the arms of the crank **24** will be pulled downwardly limited only by stop **29** and upon release of this actuating force the normal tension of the string S will return the string to its normally tuned position.

To provide the actuating force to the lever block **12** and associated lever **14** applicant illustrates the ordinary pedal structure P which includes a pedal mounting rod **45** to which the various pedals **46** are attached. Vertically extending rods **47** are provided for actuation by the pedals **46** and in the form shown are provided with turn buckle adjusters **47***a* to permit adjustment to facilitate locating all of the pedals in one plane. Below the mounting board B the structure for attaching the pedals to the rods **15–16** is shown and in the form shown consists of a plurality of transversely extending rod members **51** having their ends mounted for rotation in housings **52–53** arranged longitudinally of the mounting board B. To permit removal and change of these rods **51**, applicant provides certain portions of the capturing housings **52** to be segmented such that the bottom half portion **52***a* as illustrated in FIG. 3 may be removed and the respective rods **51** slid from housing **53** and lifted from the mounting assembly.

In the form shown each of the rods **51** includes a first fixedly attached arm **55** to receive an upper hook element **48** of the pedal linkage member **47** and these first bars **55** are arranged generally horizontal for actuation by the pedals **55**. A stop member **55***a* may be provided on the mounting board B such that upon release of a pedal E no noise will be heard when the bar **55** is returned to its normal position.

The actual control linkages controlling rods **15–16** are illustrated in the various views but for simplicity all of the possible linkages for the tonal changes have not been illustrated and therefore in the following discussion it should be obvious that each of the structures disclosed could be placed on each of the available bars **51** to provide additional linkage elements.

In order to achieve the shifting of the rods **15–16** of adjustment block **12**, second generally vertically extending finger elements **56** are slidably secured to the rods **51** by providing a flat side **51***a* on the rods **51** and positioning collars **56***b* on either side thereof and are further provided with a plurality of apertures **56***a* passing therethrough to receive appropriate links for attachment to the rods **15–16**. The apertures **56***a* are provided for proper stretching of the strings S as various of the strings S are naturally larger in diameter than others and of necessity require a greater degree of stretch in order to properly shift the tone. In the form shown these attachment links generally designated **60** each include a hook **61** on one end to be received into the finger elements **56** and an eye element **62** on the other end thereof for engagement with either hook **19** or hook **20** depending upon the effect wanted from each pedal. In the case of dual control desired from any one pedal, a U-shaped intermediate attachment member may be provided for attachment to the initial control finger **56**; said U-shaped member **63** then providing at least two possible apertures for receiving the hook element **61** of the links **60**. A triple hook-up likewise is attainable with this unit and one of said triple links is shown in FIG. 5 wherein two of the U-shaped elements **63** are connected. Likewise additional multiple hook-ups are attainable but each additional string connected requires additional power to depress the pedals.

In order to provide the proper adjustment of the links **60** each of the links **60** is provided with a turn-buckle type portion **64** which will eliminate any longitudinal play in the links **60**. Likewise in order to provide the best

action the finger members **56** are slidable on rods **51** to attain a straight line relation for the links **60** connecting the levers **14**.

Control for the maximum 3-shift tonal effects as previously stated, lies in the adjustment screw **29** on crank **24** and the positioning of eye **40***a* on adjustment member **40** through screw **41**. The player in using this instrument may want to change any specific string either upwardly or downwardly three steps. To do this he will pick the maximum step desired and set this through the appropriate adjustment on screw **29** or screw **41**. Now if it is desired to play either or both of the two steps between this maximum adjustment an additional adjusting feature is provided herein. In the form shown a bar member **70** is provided longitudinally below the mounting board B intermediate the ends of rod **51** and a third arm **71** is provided on each of the rods **51**. This particular structure is shown more specifically in FIG. 9 wherein the shape of the bar **70** is shown provided with a plurality of threaded passages **70***a* therethrough corresponding to the location of arm **71** and a relief opening **70***b* is provided in mounting board B directly therebelow. A thumb screw **72** or the like is provided to be received through a clearance aperture in arm **71** and threaded aperture **70***a* whereby the maximum rotation of the rod **51** will be controlled through abutment of arm **71** with the head of the thumb screw **72**.

At this point it should be stated and should be obvious that it is possible to control either one of the bars **15** or **16** through a plurality of linkages **60** received about the respective hooks **19–20**. Thus for example, should the player wish to have a three step change in one tonal direction it is necessary to attach three of the linkages **60** to one of the hooks **19** or **20**. Then it should be obvious that having set the maximum control through adjustment members **29** and **41**, the intermediate control steps would be set by adjusting two of the stop devices **72** on the other two controlling links **60** on this single hook **19** or **20**.

The device as disclosed herein permits complete flexibility for the player as he may easily shift any of the controlling linkages **60** to control the proper string and the flexibility likewise includes the possibility of one pedal controlling any number of such strings and this control includes either loosening or tightening or a combination thereof for any of the strings.

It should be obvious that applicant has provided a new and unique tonal arrangement for steel guitars or other stringed instruments which will allow complete range of flexibility in adjusting the tension on the string while providing a mechanical arrangement to attain this effect which is extremely simple and unique in its operation.

It should, of course, be understood that various changes may be made in the form, details, arrangements and proportion of parts without departing from the scope of my invention, which generally stated consists in the matter set forth in the appended claims.

What I claim is:

1. A device for selectively increasing or decreasing the tension on the strings of a steel guitar to change the tones of the strings thereof, the guitar including a string section mounted on a mounting board, said device including:

(a) a plurality of individual shifting means arranged to engage one end of each of the guitar strings including a crank mounted for rotation about an axle, the string being attached to one of the arms of said crank;

(b) actuator means operatively connected to said shifting means to produce rotation of said crank to selectively increase or decrease the tension on said string including:

(1) a plurality of rotatable rod members mounted transversely along said board;

(2) a free floating lever system having a plurality of levers arranged to control the shifting of said crank members each of said lever members pivotally mounted on a pair of actuator connector members to permit rotation thereof about one actuator member when the other such actuator member is moved;

(3) linkage means connected to said rods and said actuator connector member for selective actuation of said levers to control the direction of movement thereof; and

(4) means for rotating said rods whereby said levers are shifted in accordance with the rotation thereof to produce the proper rotation of said string controlling crank.

2. The structure set forth in claim **1** wherein said lever system includes a mounting block member having said levers arranged therein each of said levers being pivotally provided with said pair of actuating connector members mounted for sliding movement through said block, said linkage means being connected at one end thereof to said rotatable rods and at the other end thereof to one of said sliding connector members whereby rotation of said rod in one direction will shift one end of the lever, the other end of said lever pivoting on said other connector member whereby the lever effect will be reversed in accordance with the actuation of one of the connector members to produce the proper rotation of said crank to thus increase or decrease the tension of the attached string.

3. The structure set forth in claim **2** wherein said mounting block includes a plurality of lever receiving guide slots to prevent transverse movement of the lever and said passages are provided through said blocks to communicate with said slots.

4. The structure set forth in claim **3** wherein said connector members are provided with hook elements on the ends opposite the lever engaging ends to receive and capture the linkage members thereon.

5. The structure set forth in claim **3** and return means including a spring member are provided on the ends of the respective levers opposite the crank attachment end to return the lever to a normal position.

6. The structure set forth in claim **3** and adjustable stop means engaging at least one of said connector members to limit the shifting of said free floating lever thereby.

7. A string guitar including:

(a) a mounting board;

(b) a string section having a plurality of musical strings mounted on said board with means to tune said strings on one end of said strings;

(c) a crank member removably secured to the other end of each of said strings, said cranks being mounted for rotation on said board with one arm of said crank extending below the surface of said board;

(d) an actuator operatively connected to said cranks to control the rotation thereof including:

(1) a plurality of lever members having one end thereof respectively controllably connected to each of said cranks;

(2) a pair of actuating rod members, one of said rods pivotally connected to said lever intermediate the ends thereof, the other of said rods pivotally connected to said lever adjacent the other end of said lever; and

(3) means for selectively actuating one of said rod members to produce rotation of said lever about the other of said rod members whereby the rotation of said crank will be controlled to increase or decrease the tension on one of the guitar strings.

8. The structure set forth in claim **7** and stop means are provided to limit the rotation of each of said cranks whereby the maximum tension change thereof may be limited.

9. The structure set forth in claim **8** wherein a plurality of actuating means may be operatively connected to one of said rod members and adjustable stop means provided for each of said actuating means to limit the movement thereof to thereby limit rotation of the con-

nected crank as it is rotated from a normal position to a position of maximum tension change whereby a plurality of tones may be sounded from any of said strings in accordance with the permitted movement of the selected actuating means.

10. The structure set forth in claim **7** and each of said strings provided with an enlarged stop member on the crank engaging end thereof said crank providing a quick release mechanism for retaining said enlargement stops.

11. The structure set forth in claim **10** said quick release including a passage angularly through one arm of said crank to receive the stop enlargement therein and a slot member communicating with said passage receiving the string therein but preventing the passage of said enlargement therethrough.

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RICHARD B. WILKINSON, *Primary Examiner.*

LAWRENCE R. FRANKLIN, *Assistant Examiner.*