Nov. 17, 1925. 1,561,789

W. F. LUDWIG ET AL

TUNING MEANS FOR DRUMS AND THE LIKE

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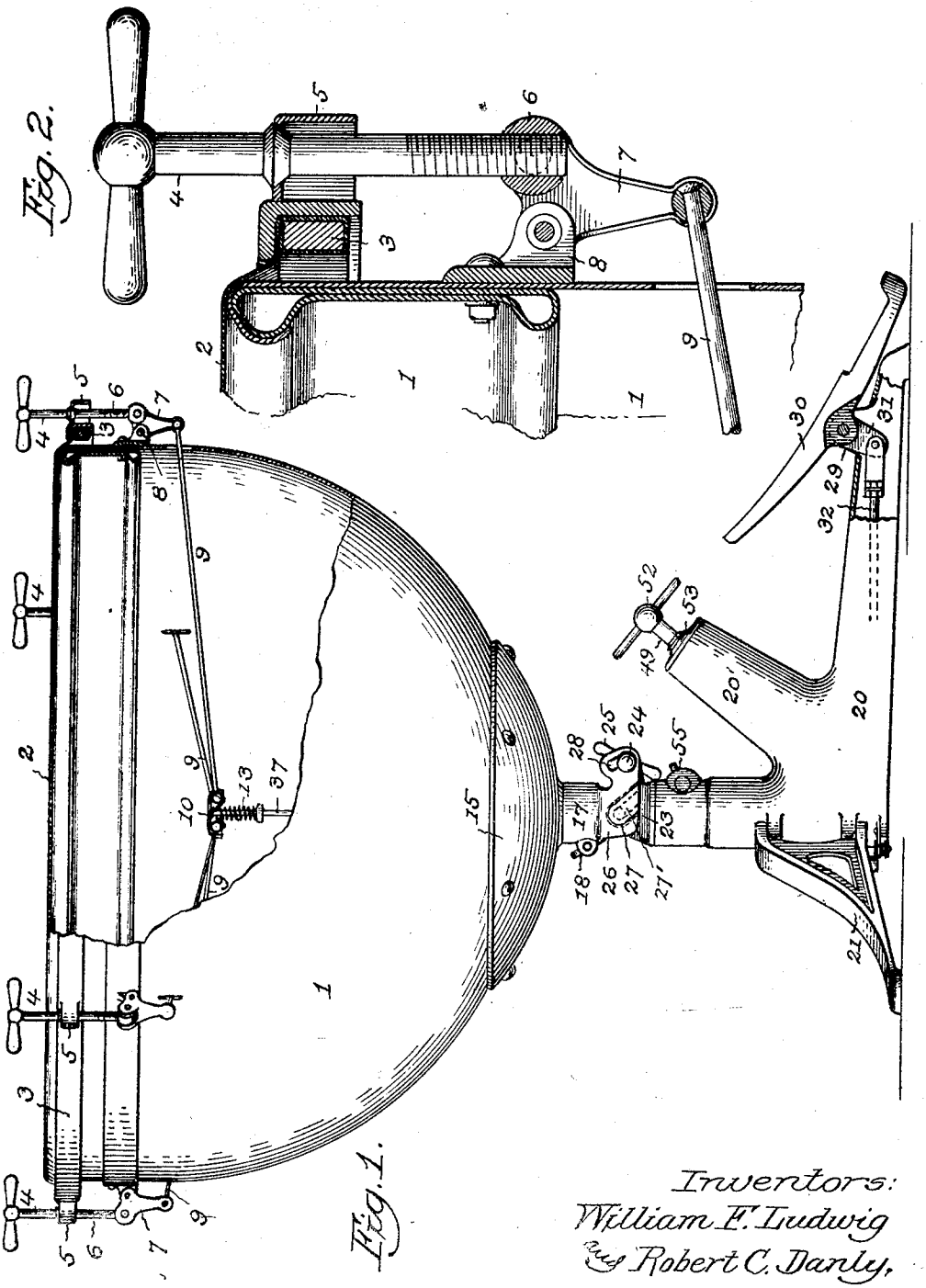


Fig. 2.

Fig. 1.

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Fig. 3.

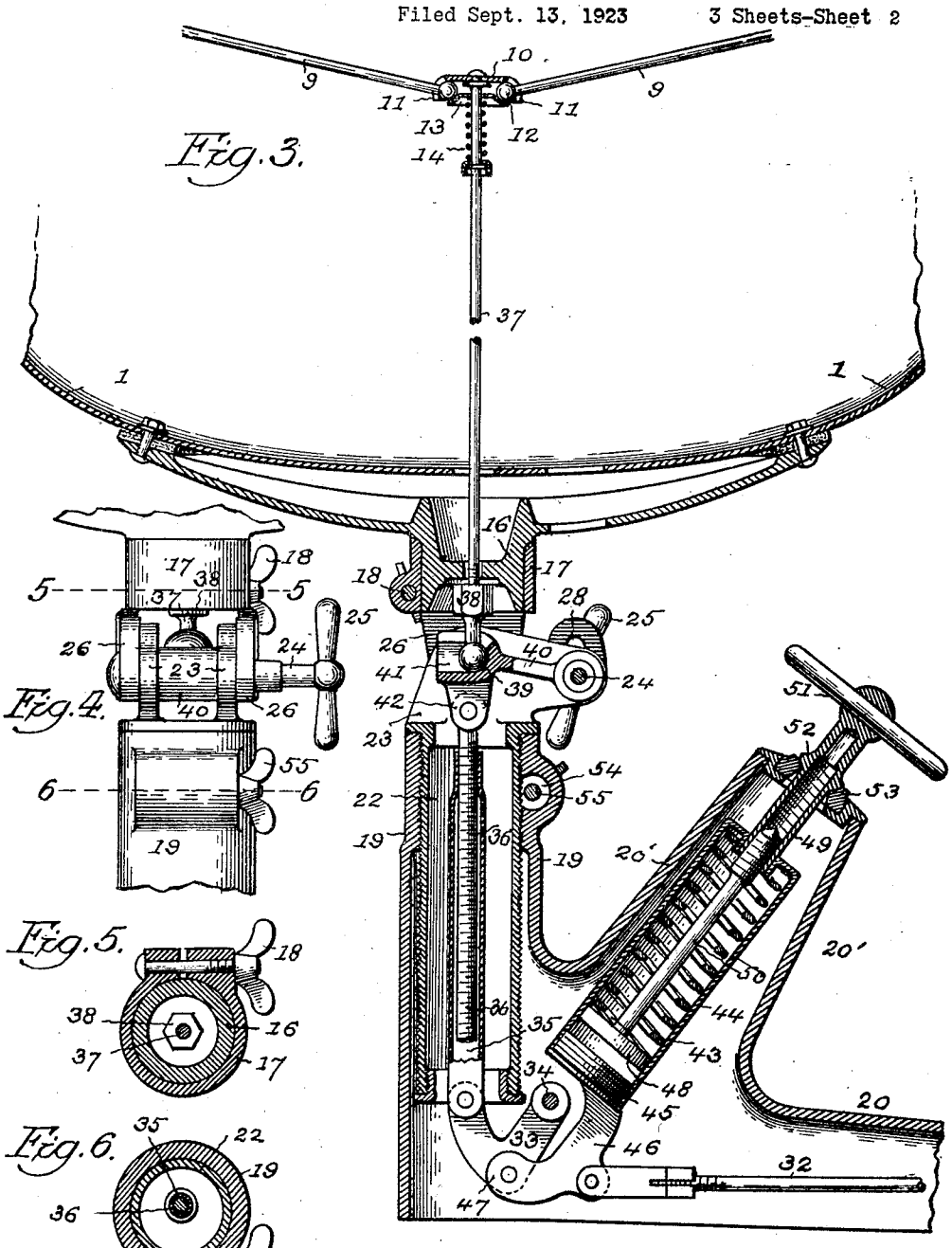


Fig. 4.

Fig. 5.

Fig. 6.

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Fig. 7.

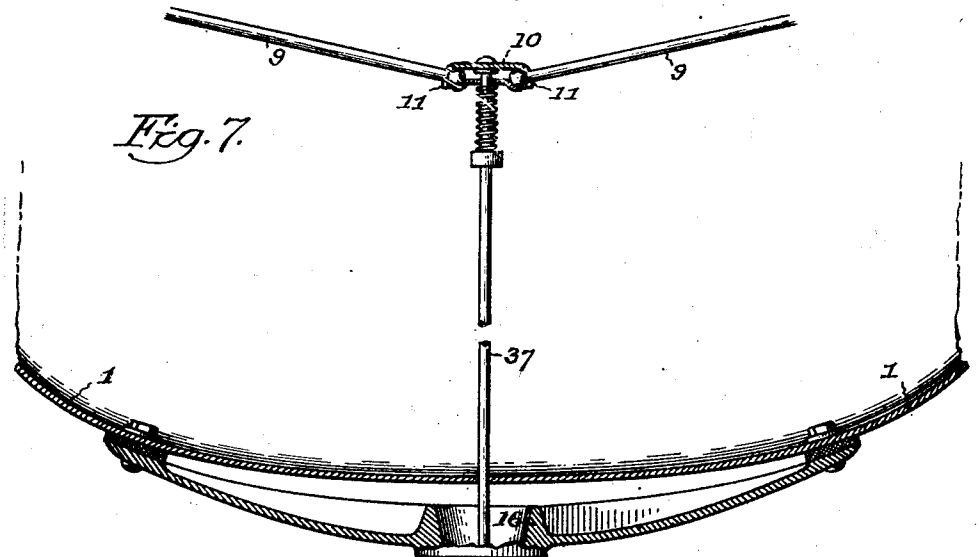
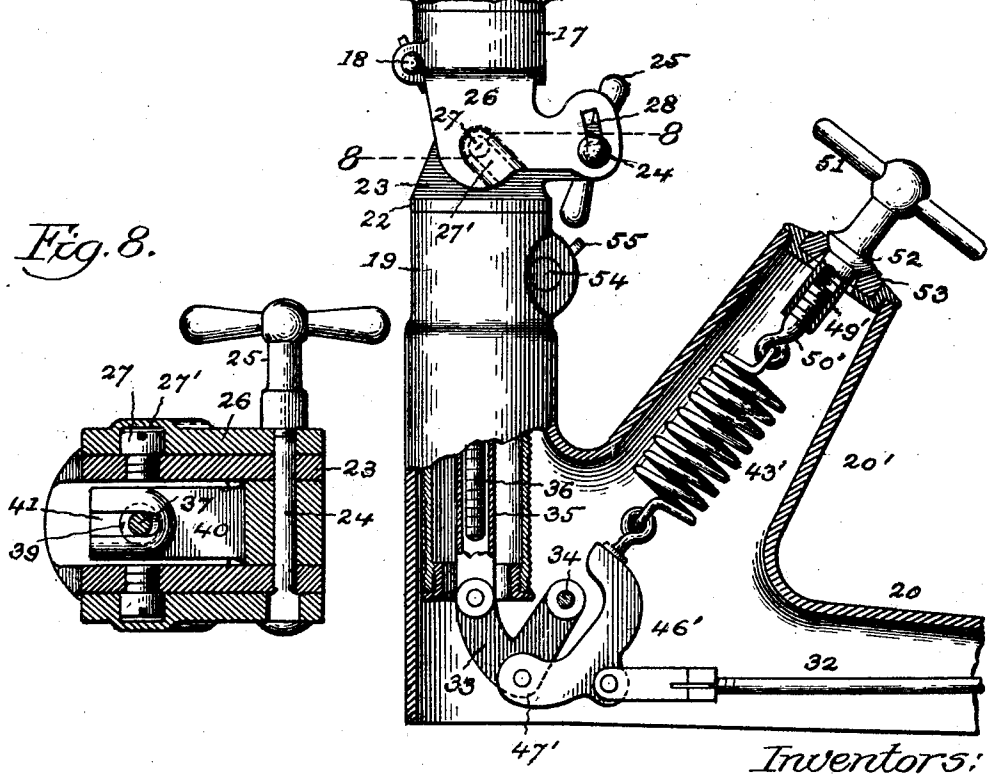


Fig. 8.



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Patented Nov. 17, 1925. 1,561,789

UNITED STATES PATENT OFFICE.

WILLIAM F. LUDWIG AND ROBERT C. DANLY, OF CHICAGO, ILLINOIS, ASSIGNORS TO LUDWIG & LUDWIG, INC., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TUNING MEANS FOR DRUMS AND THE LIKE.

Application filed September 13, 1923. Serial No. 662,400.

To all whom it may concern:

Be it known that we, WILLIAM F. LUDWIG and ROBERT C. DANLY, citizens of the United States of America, and residents of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Tuning Means for Drums and the like, of which the following is a specification.

This invention relates to tuning means for the resonant member of kettle drums and like musical instruments, and more especially to that type of the same in which the tuning means is actuated and controlled by the movement of a foot pedal, and the present improvement has for its object:—

To provide a combination of parts in a tuning mechanism usually of the pedal actuated type, whereby the progressively increasing stress or load at one end of the mechanism, due to a progressive tensioning of the resonating head of the instrument, in raising the tone of the same, is counterbalanced by a corresponding progressively increasing resistance or load to hold the parts to the position to which they have been manually adjusted, usually by the foot of the operator, and without the use of separate holding or fastening means which require separate manipulation by the player, and by means of which an easy, rapid and accurate adjustment of the parts by the operator is attained.

In the accompanying drawings:—

Fig. 1, is a side elevation, with parts in section, of a kettle drum and its support to which is applied the preferred form of the invention.

Fig. 2, is an enlarged detail section of the drum head and the immediate parts of the adjusting mechanism.

Fig. 3, is a detail central vertical section of the preferred form of the present drum head tuning or adjusting mechanism.

Fig. 4, is an elevation, transverse to Fig. 1, of the joint between the kettle drum carrying spider and its standard or support.

Fig. 5, is a detail horizontal section on line 5—5 Fig. 4.

Fig. 6 is a similar view on line 6—6 Fig. 4.

Fig. 7, is a detail elevation, partly in section, illustrating a modified arrangement of the counterbalancing spring shown in Fig. 3.

Fig. 8 is a detail section on line 8—8 Fig. 7.

Like reference numerals indicate like parts in the several views.

In the drawings, the present invention is shown applied to the kettle drum or tympani type of band instrument, in which the shell or body 1, is of a kettle form, the open top of which is closed by a resonating head or skin 2 attached to the usual skin hoop 3, which in turn is provided with a circularly arranged plurality of manually actuated adjusting means by which the drum head or skin 2 is stretched and tuned over the usual rounded rim of the drum shell or body 1 in an ordinary tuning operation on the instrument.

In the construction shown in Figs. 1, and 2, each manual adjusting means, above referred to, comprises a handled screw rod 4, journalled in a bearing ear or lug 5 on the hoop 3, with its screw threaded end having operative engagement in a nut 6 pivoted in one arm of a bell crank lever 7.

The lever 7 is pivoted in bearing ears or lugs 8 secured to the outer face of the drum shell 1, and its arm opposite to that carrying the nut 6 aforesaid, has pivotal and sliding connection to the outer end of one of the plurality of pull rods 9, which extend inwardly through the wall of the drum shell 1 for connection in common to a centrally arranged connecting head 10.

In the construction shown, the inner ends of the pull rods 9 have a spherical form and have engagement with a circular series of open bottom slots in a down turned marginal flange 11 of the connecting head 10 aforesaid, with the spherical rod ends 12, held in place by a follower disk 13 sliding on the vertical operating rod hereinafter described, and yieldingly held to place by a coiled spring 14 encircling said operating rod, as illustrated in Figs. 1 and 3.

On its underside the drum shell 1 has the usual fixed carrying cup or spider 15 formed with a central tubular hub 16 for turning adjustment in a horizontal plane in correspondingly formed split socket or sleeve 17 of the hereinafter described yoke member by which pivotal adjustment of the drum shell 1 in a vertical plane is effected on the standard or floor support, as hereinafter set forth in detail. The split sleeve 17 is provided with a clamping bolt 18 by which the same is clamped around the hub 16, after a horizontal adjustment of the drum shell.

The standard of floor support for the drum shell 1 above referred to, consists of an up-

right hollow standard 19 and a main horizontal foot 20 integrally formed with the standard, and extending horizontally from the side of the standard to provide in conjunction with a pair of folding auxiliary feet 21 a substantial support for the instrument and its adjusting mechanism in actual use.

The upper end of the tubular standard 19 is formed with an internal screw thread for engagement with the screw threaded periphery of a hollow post 22, with a view to effect a telescoping adjustment of the post and drum shell. At its respective upper and lower ends the hollow post 22 is provided with the usual outturned flanges or collars to confine adjustments in either direction, while at its upper end said post 22 carries a pair of cheek plates 23 arranged in spaced relation and formed with side extensions to afford bearings for a pivot pin 24 by which the intermediate yoke member heretofore referred to is pivotally mounted on the post 22. Said pivot pin 24 is formed with a screw threaded end for the reception of a wing nut 25, by which the parts are clamped together after adjustment. In addition said pivot pin 24 provides a bearing for the hereinafter described radius link of the pedal actuated pull connection of the turning mechanism.

The intermediate yoke member heretofore referred to, consists of the upper split sleeve 17 and clamping bolt 18 aforesaid, and a pair of cheek plates 26 depending from the sleeve 17 and having pivotal connection with the cheek plates 23 of the tubular post 22 aforesaid by pivot studs 27 and open sided pivot slots 27′ formed in the cheek plates 26 as shown in Figs. 1, 7 and 8. The cheek plates 26 are formed with segmental slots 28, embracing the pivot pin 24 aforesaid, to have limited movement thereon in an adjustment of the parts in a vertical plane. The construction above described constitutes a part of the subject matter of a divisional application Serial No. 76, filed January 2, 1925, and provides for a ready tilting of the drum body 1 to any angle required, and admits of a ready disconnection of the drum body and floor support for packing and transportation.

The horizontal foot 20 of the floor support heretofore referred to, is of a hollow open bottom form, and at a point remote from its attachment to the standard 19 is provided with a pair of pivot ears 29 in which an operating foot pedal 30 is mounted midway its length so as to be capable of positive operation from either end from its pivot point. In the construction shown, the pedal 30 carries a depending rock arm 31 operatively connected by a horizontal rod 32 with a reverse motion member 33 of a motion transmitting mechanism as follows:

The reverse motion member 33 above referred to is preferably of the angle lever type of the V form shown, and pivotally mounted by a pivot pin 34 in the interior of the foot 20, with its lower end pivotally connected with the horizontal rod 32 by the spring shell bracket 46 hereinafter described.

At an upper end opposite to the one having pivotal connection with the pivot pin 34 the angle lever 33 has pivotal connection with the lower member 35 of an extensible pull member having vertical arrangement in the bore of the hollow post 22 aforesaid. In the construction shown the aforesaid lower member 35 is of a tubular internally screw threaded form adapted for adjustable attachement to a companion externally screw threaded rod 36 having operative connections, now to be described with the connecting head 10 of the tuning mechanism heretofore described.

The pull rod 37 heretofore referred to as extending down from the connecting head 10 of the series of radial pull rods 9 of the upper portion of the tuning mechanism is provided near its lower end with an adjustable stop nut or collar 38 for abutment against a lower side of an orificed web of the hub 16 aforesaid to limit the upper travel of said rod 37. At its extreme lower end, the collar 38 is provided with a spherical head 39 adapted for operative engagement with a radius link 40 by which motion in an approximately vertical plane is imposed upon the upper end of the rod 36 above described.

The radius link 40 is pivotally mounted at one end on the pivot pin 24 aforesaid, and at the other end is formed with an open ended tubular socket head 41 for operative engagement with the aforesaid spherical head 39 of the pull rod 37, and with depending pivot ears 42 for pivotal connection with the upper end of the vertical rod 36 aforesaid.

The open end form of the recess in the socket head 41 permits of an easy lateral separation of said head from the spherical head 39, in a disengagement of the upper and lower drum parts for packing and transportation, heretofore referred to. In such disengaging operation the pivot pin or shaft 24 is first removed from its engagement with the cheek plates 23 and 26, before the socket head 41 is moved laterally out of engagement with the spherical end 39 of the pull rod 37, and also before a like movement of pivot slots 27′ of the cheek plates 26 out of engagement with the pivot studs 27 of the cheek plates 23.

In the construction above described, which constitutes a part of the subject matter of a divisional application, Serial No. 76, filed Jan. 2, 1925, the pitch of the screw threads on the tubular member 35 and associated rod 36 are alike to the screw threads on the standard 19 and post 22, so that in

the turning of the drum shell 1 to attain vertical adjustment of the same, the vertical members 35 and 36 of the pull connection just described will have a corresponding lengthening or shortening adjustment, to preserve the existing tensioning or tuning condition of the same, and due to the fact that while the upper screw threaded member 36 has a turning movement with the drum shell 1, the associated lower member 35 is held from rotation by attachment to the angle lever 33 aforesaid.

The material part of the present improvement involves the combination with a tuning mechanism of the type described, of a balancing means of the stored energy type arranged in opposed relation to the pulling stress exerted by the resonant or skin head of the instrument in its normal tendency to return to a less tensioned condition and the lowermost tone of the scale required, which prevailed previous to an active operation of said pedal mechanism, and so that such normal return tendency will be counterbalanced and the pedal mechanism will remain in the position at which it may be placed without the use of pawl and ratchet or like mechanism to hold said mechanism at its points of adjustment and which have been found necessary in pedal actuated tuning mechanisms heretofore on the market, and with the added advantage of greater ease in operation.

In the preferred mechanism for attaining the above described function, shown in Fig. 3, of the drawing, a coil spring 43, of a predetermined strength is arranged within a cylindrical casing 44 the upper end or head of which forms an upper abutment for said spring, while the lower end of the casing is provided with a closure head 45 carrying the depending bracket 46 of a C form having a pivot eye 47 at its lower end for operative engagement with the lower end of the angle lever 33, so as to move in unison therewith and with the other portions of the pedal actuated mechanism.

Moving in the lower end of the casing 44 is an abutment head 48 forming the lower abutment for the spring 43 aforesaid, and provided with a sectional rod or stem formed by an upper internally screw threaded sleeve 49 having adjustable screw threaded engagement with a lower screw threaded rod 50 fixedly attached to said abutment head 48. In such construction, a manual rotation of the sleeve 49 in one direction or the other will cause an extension or contraction in the length of the connection, with a like increase or decrease in the force of the spring 43. To such end the sleeve 49 is provided with a handle 51 for convenient manual operation.

The casing 44, and associated parts just described are arranged in an upstanding hollow extension 20′ of the horizontal foot 20, of the instrument support, and have pivotal support in said extension by means of a pivot collar 52 fixed on the sleeve 49 and having bearing in a concave seat formed in a closure bushing 53 of said extension. In the described construction the lower part of the casing 44 and its described accessories are adapted to have a vibratory movement in unison with the horizontal movement of the rod 32 of the pedal actuated mechanism with the parts operating as follows:—

In the normal and inactive position of parts, illustrated in Fig. 3, the stop nut or collar 38 is at holding rest against a web of the hub 16, to maintain the manual tuning mechanism to the position to which it had been adjusted by the hand mechanism and at which position of parts the drum head of the instrument had been tensioned by such mechanism to the lowermost tone of the scale required. It being the universal practice for the player to maintain such adjustment and meet changing conditions of temperature and humidity by means of said hand tuning mechanism. In the position of parts above set forth, the center line of the casing 44 and the pivot axis of the eye 47 of the pivot bracket 46 are in aligned relation with the pivot axis 34 of the angle lever 33, so that the stress of the spring 43 is on a dead line with the axis of the lever 33, and is incapable of exerting a working stress upon and movement of said lever in either direction.

With an operation of the foot pedal 30 to rock the angle lever 33 and in turn effect a downward pull on the described vertical connections of the drum head, the lower pivot connection 47 of the casing 44 moves to the right in Fig. 3, and away from the "dead" line above referred to, and introduces, as such movement progresses, a corresponding increase in the percentage of resilient power or resistance on the part of the spring 43 equal to and adapted to resist an effectively counterbalance the pulling stress on the other arm of the angle lever 33, by the tensioned drum head or membrane 2 through the intermediate connections heretofore described. The tendency of such pulling stress on the part of the head or membrane 2 is to return the said intermediate connections to a position in which the stop nut or collar 38 of the pull rod 37 is in abutment contact with the under face of a web portion of the hub 16 of the drum shell supporting spider 15 aforesaid, and is adapted to hold the drum head or membrane 2, tensioned through the primary manual adjusting means heretofore described, to the lowermost tone of the scale required. With such counterbalancing effect, the parts of the tuning mechanism are adapted to remain at the point to which

they were forced by the foot pedal 30, without any additional fastening means, such as holding pawls and ratchets, but requiring positive movement on the part of said pedal in one direction or the other to effect a change in the position to which said parts had been placed.

The modified arrangement of parts shown in Figs. 7, involves the substitution of a coiled spring 43′ of the tension type, for the coiled spring 43 of the compression type shown in Fig. 3, and the connection of said spring 43′ at one end with the bracket member 46′ and at the other end with the lower end of the screw threaded rod 50′ of the spring adjusting means heretofore described.

While a coiled spring arranged in either manner heretofore described, is found by practical test to afford a very effective and practical variable resistance element, it is within the scope of the invention to substitute for said spring any other usual means for providing progressively increasing resistance load or stress, such for instance as a compressible air cushion, or a weight or load carried by a suitably arranged crank arm.

The vertically adjustable post 22, of the present construction, is provided with any usual means for fastening the same in place after an adjustment, preferably by means of a tangentially arranged wedge block 54 and an operating screw bolt 55 associated with the said post and with the tubular standard 19, as illustrated in Figs. 3, 4 and 6.

Having thus fully described our invention what we claim and desire to secure by Letters Patent, is:—

1. In a musical instrument, the combination of a resonant member, tensioning means for said member, a balancing means of the stored energy type, and a reverse motion member, one side of which is connected to said tensioning means and the other side to said balancing means and operating to vary the force of the balancing means in a manner corresponding with the variation in the stress of said tensioning means on the resonant member.

2. In a musical instrument, the combination of a resonant member, tensioning means for said member, a balancing means of the stored energy type, and a reverse motion member of the rocker type arranged intermediate of the tensioning and the balancing means and operating to vary the force of the balancing means in a manner corresponding with the variation in the stress of said tensioning means on the resonant member.

3. In a musical instrument, the combination of a resonant member, tensioning means for said member, a balancing means of the stored elastic energy type, and a reverse motion member one side of which is connected to said tensioning means and the other side to the balancing means and operating to vary the force of the balancing means in a manner corresponding with the variation in the stress of said tensioning means on the resonant member.

4. In a musical instrument, the combination of a resonant member, tensioning means of the rocker type for said resonant member, a balancing means of the stored elastic energy type, and a reverse motion member of the rocker type arranged intermediate of the tensioning and the balancing means and operating to vary the force of the balancing means in a manner corresponding with the variation in the stress of said tensioning means on the resonant member.

5. In a musical instrument, the combination of a main shell, a support therefor, a resonant head and its carrying hoop fitting an end of said shell, a pedal actuated mechanism for adjusting said head to raise and lower its tone, a balancing means of the stored energy type, and a reverse motion member, one side of which is connected to said pedal actuated mechanism and the other side to said balancing means.

6. In a musical instrument, the combination of a main shell, a support therefor, a resonant head and its carrying hoop fitting an end of said shell, a pedal actuated mechanism of the rocker type for adjusting said head to raise and lower its tone, a balancing means of the stored energy type, and a reverse motion member one side of which is connected to said pedal actuated mechanism and the other side to said balancing means.

7. In a musical instrument, the combination of a main shell, a support therefor, a resonant head and its carrying hoop fitting an end of said shell, a pedal actuated mechanism for adjusting said head to raise and lower its tone, a balancing means of the stored elastic energy type, and a reverse motion member, one side of which is connected to said pedal actuated mechanism and the other side to said balancing means.

8. In a musical instrument, the combination of a main shell, a support therefor, a resonant head and its carrying hoop fitting an end of said shell, a pedal actuated mechanism of the rocker type for adjusting said head to raise and lower its tone, a balancing means of the stored elastic energy type, and a reverse motion member, one side of which is connected to said pedal actuated mechanism and the other side to said balancing means.

9. In a musical instrument, the combination of a main shell, a support therefor, a resonant head and its carrying hoop fitting an end of said shell, hand actuated means for effecting an adjustment of the resonant head to the lowermost tone of the required scale, a pedal actuated mechanism operatively connected to said hand operated means, a

balancing means of the stored energy type, and a reverse motion member, one side of which is connected to said pedal actuated mechanism and the other side to said balancing means.

10. In a musical instrument, the combination of a main shell, a support therefor, a resonant head and its carrying hoop fitting an end of said shell, hand actuated means for effecting an adjustment of the resonant head to the lowermost tone of the required scale, a pedal actuated mechanism of the rocker type operatively connected to said hand operated means, a balancing means of the stored energy type, and a reverse motion member, one side of which is connected to said pedal actuated mechanism and the other side to said balancing means.

11. In a musical instrument, the combination of a main shell, a support therefor, a resonant head and its carrying hoop fitting an end of said shell, hand actuated means for effecting an adjustment of the resonant head to the lowermost tone of the required scale, a pedal actuated mechanism operatively connected to said hand operated means, a balancing means of the stored elastic energy type, and a reverse motion member, one side of which is connected to said pedal actuated mechanism and the other side to said balancing means.

12. In a musical instrument, the combination of a main shell, a support therefor, a resonant head and its carrying hoop fitting an end of said shell, hand actuated means for effecting an adjustment of the resonant head to the lowermost tone of the required scale, a pedal actuated mechanism of the rocker type operatively connected to said hand operated means, a balancing means of the stored elastic energy type, and a reverse motion member, one side of which is connected to said pedal actuated mechanism and the other side to said balancing means.

13. In a musical instrument, the combination of a main shell, a support therefor, a resonant head and its carrying hoop fitting an end of said shell, hand actuated means for effecting an adjustment of the resonant head to the lowermost tone of the required scale, a pedal actuated mechanism operatively connected to said hand operated means, the same comprising a foot pedal pivoted at its midlength on the support aforesaid and having a lateral arm, an angle lever pivoted in said support, a connecting rod between one arm of the angle lever and the lateral arm of the foot pedal, a centrally disposed head having a rod connection with the other arm of the angle lever aforesaid, and a plurality of pull rods extending radially from said central head and having operative connections with the hand actuated means aforesaid, and a balancing means of the stored energy type, connected to the arm of the angle lever to which operative connection of the connecting rod from the foot pedal is made.

14. In a musical instrument, the combination of a main shell, a support therefor formed with an orificed web, a resonant head and its carrying hoop fitting an end of said shell, hand actuated means for effecting an adjustment of the resonant head to the lowermost tone of the required scale, radially arranged pull rods operatively connected at their outer ends to said hand actuated means, a central head forming a connection in common for the inner ends of said pull rods, a pedal actuated mechanism mounted on the aforesaid support, and a rod connecting said pedal mechanism with the central head aforesaid and having a stop collar for stop abutment beneath the orificed web of the shell support aforesaid.

15. In a musical instrument, the combination of a main shell, a support therefor, a resonant head and its carrying hoop fitting an end of said shell, a pedal actuated mechanism for adjusting said head to raise and lower its tone, the same comprising a foot lever pivoted on the shell support, an angle lever pivoted on said support, a rod connection between one arm of the angle lever and the foot pedal, and operative connections between the other arm of the angle lever and the resonant head, and a balancing means of the stored force type pivotally mounted at one end in the shell support and pivotally connected at the other end to the first mentioned arm of the angle lever.

16. In a musical instrument, the combination of a main shell, a support therefor, a resonant head and its carrying hoop fitting an end of said shell, a pedal actuated mechanism for adjusting said head to raise and lower its tone, the same comprising a foot lever pivoted on the shell support, an angle lever pivoted on said support, a rod connection between one arm of the angle lever and the foot pedal, and operative connections between the other arm of the angle lever and the resonant head, and a balancing means comprising a coiled spring, a casing providing an abutment for one end of said spring and having at a point adjacent to the other end of the spring a bracket having pivotal connection with the arm of the angle lever which has connection with the foot pedal, a head in said casing providing an abutment for the last mentioned end of the spring, and a supporting rod for said head attached to the main support of the instrument.

17. In a musical instrument, the combination of a main shell, a support therefor, a resonant head and its carrying hoop fitting an end of said shell, a pedal actuated mechanism for adjusting said head to raise and

lower its tone, the same comprising a foot lever pivoted on the shell support, an angle lever pivoted on said support, a rod connection between one arm of the angle lever and the foot pedal, and operative connections between the other arm of the angle lever and the resonant head, and a balancing means comprising a coiled spring, a casing providing an abutment for one end of the spring and having at a point adjacent to the other end of the spring a bracket having pivotal connection with the arm of the angle lever which has connection with the foot pedal, a head in said casing providing an abutment for the last mentioned end of the spring, and a supporting rod for said head pivotally attached to the main support of the instrument and formed by a pair of aligned sections connected together by screw threads, one of said sections having individual rotation with relation to the other.

18. In a musical instrument, the combination of a main shell, a resonant head and its carrying hoop fitting an end of said shell, a support for said shell, a pivotal connection between said support and shell comprising cheek plates on the parts pivotally connected together by pivot studs and open sided recesses, a pedal actuated mechanism mounted on said support and operatively connected to the resonant head through a connecting member formed in sections, a radius link arranged adjacent said cheek plates and pivotally connected to one section of the aforesaid connecting member and detachably connected by an open ended socket with the other section of said member.

19. In a musical instrument, the combination of a main shell having on one end a cup member provided with cheek plates, a resonant head and its carrying hoop fitting the other end of the shell, hand actuated means for effecting an adjustment of the resonant head to the lowermost tone of the scale required, the same comprising radially arranged pull rods operatively connected at their outer ends to the resonant head, a central head forming a connection in common for the inner ends of said pull rods, a pull rod attached to said head and having a stop lug for abutment against a web portion of the aforesaid cup member, a support having an upstanding post formed with cheek plates for pivotal connection with the cheek plates of the aforesaid cup member, a pedal actuated mechanism mounted on said support and operatively connected to the pull rod of the aforesaid central head by a connecting member moving in the aforesaid hollow post, a radius link pivotally connecting the upper end of the hollow post and the upper portion of said connecting member to maintain the same in position.

20. In a musical instrument, the combination of a main shell having on one end a cup member provided with cheek plates a resonant head and its carrying hoop fitting the other end of the shell, hand actuated means for effecting an adjustment of the resonant head to the lowermost tone of the scale required, the same comprising radially arranged pull rods operatively connected at their outer ends to the resonant head, a central head forming a connection in common for the inner ends of said pull rods, a pull rod attached to said head and having a stop lug for abutment against a web portion of the aforesaid cup member, a support having an upstanding post formed with cheek plates for pivotal connection with the cheek plates of the aforesaid cup member, a pedal actuated mechanism mounted on said support and operatively connected to the pull rod of the aforesaid central head by a connecting member moving in the aforesaid hollow post, a radius link pivotally connecting the upper end of the hollow post and the upper portion of said connecting member to maintain the same in position.

21. In a musical instrument, the combination of a main shell, a support therefor formed with an orificed web, a resonant head and its carrying hoop fitting an end of said shell, hand actuated means for effecting an adjustment of the resonant head to the lowermost tone of the required scale, radially arranged pull rods operatively connected at their outer ends to said hand actuated means, a central head forming a connection in common for the inner ends of the pull rods, said central head having a radially slotted marginal flange for detachable engagement with heads formed on the inner ends of said pull rods and a pedal actuated mechanism operatively connected to said central head.

22. In a musical instrument, the combination of a main shell, a support therefor, formed with an orificed web, a resonant head and its carrying hoop fitting an end of said shell, hand actuated means for effecting an adjustment of the resonant head to the lowermost tone of the required scale, radially arranged pull rods operatively connected at their outer ends to said hand actuated means, a central head forming a connection in common for the inner ends of the pull rods, said central head having a central rod and a radially slotted marginal flange for detachable engagement with heads formed on the inner ends of said pull rods, a spring impelled follower disk mounted on the central rod of said central head to hold the inner ends of said pull rods in place in said head.

Signed at Chicago, Illinois, this 16th day of August, 1923.

WILLIAM F. LUDWIG.
ROBERT C. DANLY.