Feb. 8, 1927.

1,616,662

A. LOOMIS

OCTAVE KEY MECHANISM

Filed Oct. 29. 1925 2 Sheets-Sheet 1

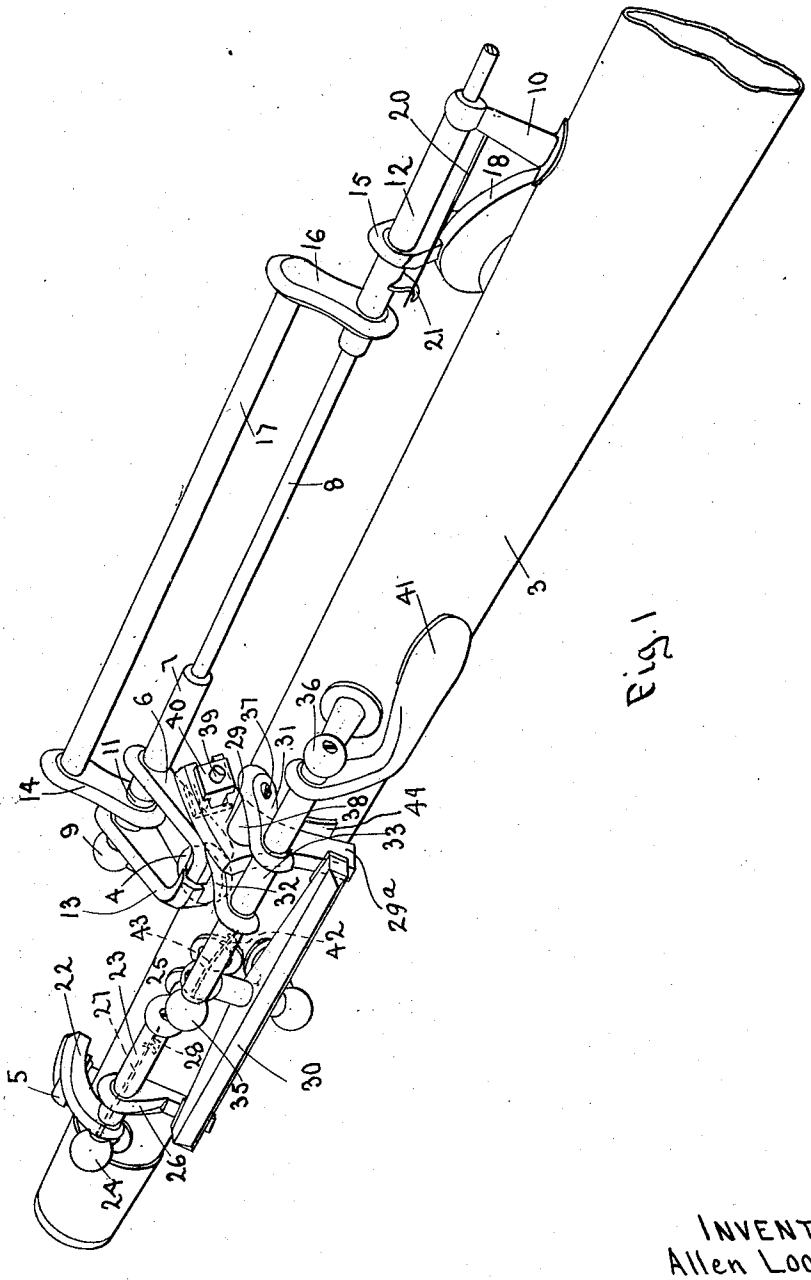


Fig. 1

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Att'ys

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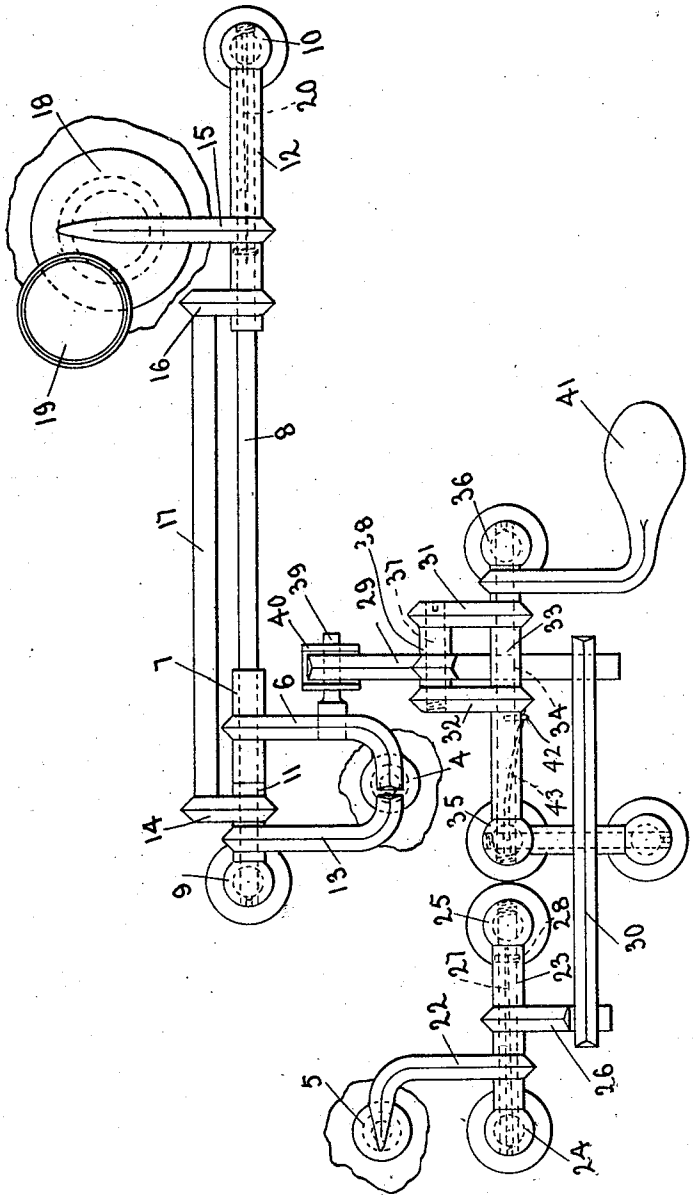


Fig. 2

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# UNITED STATES PATENT OFFICE.

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## OCTAVE-KEY MECHANISM.

Application filed October 29, 1925. Serial No. 65,671.

The present invention relates to the octave keys of musical instruments of the wood wind type. More particularly, it is concerned with an octave key or mechanism of the general type disclosed in my prior Letters Patent of the United States, No. 1 585,295, dated May 18, 1926, and embodies the same principles of the mechanism described in said prior application, with modifications in construction and arrangement adapting said principles to use with instruments of specifically different form. For instance, whereas the mechanism illustrated in said prior application was designed with particular reference to saxophones having curved mouth tubes, and similar instruments, the present mechanism has been designed for straight instruments; at least those which are substantially or nearly straight as to the parts of the body tube where the octave holes are located. Such instruments include saxophones of the smallest sizes and highest pitches, and the various sizes of oboes, etc. The mechanism herein shown and described to illustrate the present invention has been designed for the E-flat soprano saxophone, but in principle, and in substantially complete detail also, it is applicable to other instruments of the wood wind type, wherefore such illustration is not to be construed as a limitation of the protection which I claim. Such protection extends to all equivalent forms of the mechanism herein described, and the combination of such mechanism, or its equivalents, with all instruments of the wood wind type to which it may be usefully applied. Within the meaning of the term "wood wind type" as here used, I include all musical instruments of which the distinguishing characteristic is a tubular body containing a vibrating column of air and having lateral holes adapted to be opened and closed for determining the length of the vibrating air column, and hence the pitch of the emitted note, whether actually made of wood or of metal or other material.

The objects of this invention are the same as those set forth in my prior application aforesaid, together with the further object of adapting the same principles to an instrument having a substantially straight tube. In the preferred form it is made with both octave holes on the upper side, in order to prevent them from filling with water.

In the drawings which accompany and form a part of this specification,—

Fig. 1 is a perspective view showing the upper part of a straight saxophone having the present octave key mechanism applied thereto;

Fig. 2 is a diagrammatic or development view showing the octave key mechanism resolved into a single plane.

Like reference characters designate the same parts in both figures.

The numeral 3 designates the body tube of a straight saxophone, and typifies other instruments of the wood wind type also. The mouth piece or reed, commonly used with saxophones and other instruments of this type, is not shown here, but all those skilled in the art will understand that it is to be applied to the upper (smaller) end of the body tube. The numerals 4 and 5 represent the stoppers or keys which cover the lower and upper octave holes respectively. Such octave holes, in the embodiment shown in Figs. 1 and 2, are both on the upper side of the body, by which I mean that neither one is so near the lower side, when in the position for playing, that water can collect and fill them or stand in contact with the pads of the cover keys. The stopper or key 4 is connected to an arm 6 secured to a sleeve 7 having a rotative bearing on a rod 8, which rod is mounted in posts or pillars 9 and 10 secured to the instrument body, and is substantially parallel to such body. Sleeve 7 is prevented from moving endwise on the rod 8 by sleeves mounted at either side of it on the same rod, one, at the left of the sleeve 7, being shown in these drawings, and that or those at the right of it being omitted for the sake of clearness. The rod 8 provides a fixed axis for the key or stopper 4 approximately or nearly in the plane of the rim of the octave hole, enabling the stopper to open and close without in any circumstances sliding or scuffing across such rim.

Also mounted on the pivot rod 8 are sleeves 11 and 12, the former of which carries an arm 13 overlying the stopper 4 and a second arm 14, and the second of which carries arms 15 and 16. The arms 14 and 16 are connected rigidly by a bridge rod 17. The arm 15 carries a stopper or cover 18 for one of the tone holes of the instrument, and to this cover is secured a finger key 19. Thus the key 19 serves as means for moving

the arm 13, raising the latter when depressed, owing to the rigid connection which exists between the key and arm through the parts above described, and causing the arm to be raised when the key is depressed. In this specification, the term "raised," or terms of similar import, when applied to designate the movement of, or pressure applied to or by, a key or stopper, or parts associated therewith, signifies movement or pressure away from the body of the instrument, whatever may be the direction of such movement or pressure with respect to the horizontal, and the term "depressed," or terms of equivalent import, used in the same connection, means movement or pressure toward the body of the instrument. A spring 20 is mounted in the post or pillar 10 and acts on a hook 21 fastened to the sleeve 12, with tendency to raise the key 19 and to depress the arm 13 and the octave key 4. The particular key 19 here shown typifies any key which might be connected with the arm 13, or an equivalent member, for controlling the octave key 4. It will be appreciated that the spring 20 tends to close the octave key and that depression of key 19 overcomes this tendency and leaves the octave key free to be opened by other agency.

The stopper or key 5 for the upper octave hole is carried by an arm 22 secured to the sleeve 23, mounted rotatively on a pin supported by posts or pillars 24 and 25. A second arm 26 is secured to the sleeve 23 and projects to the opposite side of the pivotal axis of the arm 22. A spring 27 is mounted in the post 24 and is engaged with a hook 28 on the sleeve 23, exerting tendency to close the stopper 5.

Connection is made between the two octave keys through a lever 29 and a rocker or rock lever 30. The lever 29 is mounted in a floating manner on a carrier consisting of two arms 31 and 32, secured to a sleeve 33, mounted on a pivot rod 34 held in posts or pillars 35 and 36. The arms 31 and 32 carry and are connected by a pivot pin 37, on which the floating lever 29, and a hub or sleeve 38 secured thereto, have their bearing.

One arm of lever 29 is connected to the arm 6 of the lower octave key by means of a pin 39 projecting from the side of the arm 6 and having a slide block or cross head 40, which occupies in a sliding manner a notch in the adjacent arm of the lever 29. The opposite arm $29^a$ of said floating lever 29 underlies one arm of the rock lever 30, and the other arm of the rock lever overlies the arm 26 which is rigidly connected to the upper octave key, as previously mentioned. Said rock lever is mounted on a transverse pivot rod, supported by pillars from the body, as clearly shown in the drawings and well understood in the art. The pivotal axes of both octave keys, the floating lever and the floating lever carrier, are all generally parallel to the body of the instrument, and therefore to each other. The two arms of the floating lever are in the same plane, or substantially so, transverse to their axis and to said body.

To the sleeve 33 of the floating lever carrier is connected a key 41, adapted to be depressed by the performer's thumb; and a spring 43 is mounted in the pillar 35 and engaged with a hook 42 on the sleeve 33, tending to raise key 41 and depress the pivot pin 37.

The tendency of the springs 20, 27 and 43 is to close both octave keys, all cooperating to the same end. No spring is applied directly to the lower octave key, but this key is freely rotatable about its pivot rod, and is moved only as it is acted upon in one manner or another by the springs above named and the mechanisms affected thereby. Spring 43 acts to move it into the closed position when the key 41 is released after having been pressed on, and holds it in closed position unless the thumb key is depressed, by acting through the floating lever, the arm $29^a$ of which then bears and reacts on the body. Such reaction of the floating lever is an important feature and has an essential coaction with the spring 43 in closing the lower octave key and holding it tightly closed. This closing means is effective even though the pressure of the arm 13 be released. Preferably, a cork buffer or pad is cemented to the body underneath the arm $29^a$. Changes in the positions of the octave keys from the normal positions shown in these drawings are effected by manipulation of the keys 19 and 41, or equivalent keys.

Depression of the key 19 alone has no effect on the octave keys, but the opening movement of the latter is effected by depression of the key 41, and one or the other of the octave keys is opened according as the key 19 is depressed or not. If key 41 alone is depressel, the octave key 5 is opened because the pivot pin 37 on the carrier is raised and the pin 39 on the arm 6 remains stationary. The floating lever then turns about the pin 39 as a fulcrum, raising its other arm, rocking the lever 30 and depresing the arm 26. Such depression of arm 26 and raising of the upper octave key 5 takes place against the resistance of spring 27, and occurs because the resistance opposed by spring 20 to the forces exerted upon and through the floating lever is greater than the resistance of spring 27, being sufficiently stiff to have that effect. The rock lever 30 has no spring of its own, and therefore opposes no resistance or assistance to any of the movements in which it takes part, except the slight and negligible resistance of friction on its pivot.

But if key 19 is depressed before and during the time that the key 41 is pressed upon, the lower octave key 4 is opened and the upper octave key remains closed. This effect occurs because, as spring 20 now opposes no resistance to the movement of the floating lever, the resistance of spring 27 is sufficient to hold the rock lever 30 stationary as an abutment, causing the floating lever to turn about its point of engagement with the rock lever and thereby to raise the octave key 4. Finally, if the key 19 is shifted after key 41 has been depressed, either by pressure of the performer's finger or by spring 20 when such pressure is released, the conditions of both octave keys are reversed, the one which was previously opened being closed and the previously closed one being opened.

It follows from the actions just described that the octave holes are properly opened to control the playing of notes in the middle and upper registers of the instrument, by the performer pressing upon the key 41, and that where a transition from one register to another requires the position of the octave keys to be reversed, such reversal is automatically effected by pressing upon or releasing the tone key 19. But the octave keys are both tightly closed when notes in the lower register are played.

The mechanism herein described lends itself very readily to manufacture by economical factory methods of quantity production, and the longitudinal members are made principally of standard tubing which can be cut in any lengths. Thus in order to adapt the essential mechanism to instruments in which the holes are differently spaced apart, the only members of the structure which need to be different from one another, among a wide range of instruments, are the longitudinal members. Floating levers and arms of the same sizes and dimensions may be used in many different instruments, and identical sliding blocks and pins may be used with instruments of all sizes and models, and in all situations, in which this particular machine element is used. The last statement is also true with respect to the arm 6 which carries the lower octave hole stopper and the arm 13, which overlies such stopper. These two arms are economically made from a single piece machined and bent into U form, and then sawed apart at or near the middle of the bend. The contiguous extremities of the two arms thus resulting are cut away so as to receive the hole cover, and the operation of thus cutting them may be performed before they are sawed apart. Afterwards, the recess in the arm 13 may be cut a little deeper to receive the cork or other buffer pad which is preferably applied to it to deaden the noise of striking the cover.

What I claim and desire to secure by Letters Patent is:

1. In combination with an instrument of the wood wind type having a substantially straight body tube, and two octave holes, keys for the said octave holes supported from the body of the instrument and having pivotal motion, and their only motion, about fixed axes generally parallel to said body, a floating lever carrier, a floating lever pivoted to said carrier, both said carrier and floating lever having their only motion about axes generally parallel to said body, means connecting one arm of said floating lever to one of said octave keys, and transmission mechanism for converting rising movement of the other arm of said floating lever into rising movement of the other octave key.

2. In a musical instrument of the wood wind type having two octave holes and being substantially straight in that portion where said octave holes are located, octave keys respectively covering said holes and pivoted on axes substantially parallel to said body and having their only motion about said axes, a floating lever pivotally connected to one of said octave keys, a floating lever carrier pivotally supported from the instrument body and to which said floating lever is pivoted, the axes of both said carrier and said lever being substantially parallel to the instrument body, and motion transmitting means between said floating lever and the other octave key.

3. In a musical instrument of the wood wind type having a substantially straight body and two octave holes, a floating lever pivotally supported from the axis of said body to turn about an axis substantially parallel thereto, a floating lever pivoted to said carrier on an axis substantially parallel to the axis of the latter, and motion transmitting connection between the two arms of said floating lever and the respective octave keys.

4. In a musical instrument of the wood wind type having a substantially straight body and two octave holes, a floating lever carrier pivotally supported from said body to turn about an axis substantially parallel thereto, a floating lever pivoted to said carrier on an axis substantially parallel to the axis of the latter, and motion transmitting connections between the two arms of said floating lever and the respective octave keys, said connections causing the movement of either octave key and of that arm of the floating lever which is respectively connected thereto to occur in the same sense with respect to the body of the instrument.

5. In a musical instrument of the wood wind type having a substantially straight body with two octave holes, a floating lever carrier pivotally supported from the body of the instrument, a floating lever pivoted

to said carrier, the axes of both the carrier and the floating lever being substantially parallel to the instrument body, a coupling between one arm of said floating lever and one of the octave keys, and a rock lever engaged with the other arm of said floating lever and with the other octave key.

6. In musical instrument of the character set forth having two octave holes, octave keys for said holes pivoted on fixed axes substantially parallel to the body of the instrument and having their only movement about said axes, an arm connected to one of said octave keys and extending to the opposite side of its axis from said key, a rock lever pivoted to the instrument body and engaged with said arm, a floating lever carrier pivotally supported from the body to turn about an axis substantially parallel thereto, and a floating lever pivoted to said carrier on an axis substantially parallel to the axis of the latter and having arms extending to opposite sides of its pivot, one of said arms being engaged with said rock lever and the other being engaged with the other octave key.

7. In a musical instrument of the character set forth having two octave holes, octave keys for said holes pivotally supported from the body of the instrument, a floating lever carrier pivotally supported from said body to turn about an axis substantially parallel thereto, a floating lever pivotally supported by said carrier, both arms of said floating lever being in the same plane transverse to its pivot, and one of said arms being coupled pivotally with one of said octave keys, and an arm arranged to bear on the other arm of said floating lever and being pivotally mounted from the instrument body and arranged to impart movement to the other octave hole key.

8. An octave key mechanism of the character set forth comprising a floating lever having a tubular hub pivotally supported from the body of the instrument on an axis substantially parallel to said body, a finger key secured to said tubular hub, parallel arms secured to said hub and projecting from one side thereof, a floating lever having a tubular hub interposed between said arms, and a pivot or fulcrum pin passing through the floating lever hub and mounted in said arms, a plurality of octave keys, and a pressure transmitting connection between the arms of said lever and the different octave keys.

In testimony whereof I have affixed my signature.

ALLEN LOOMIS.