Oct. 18, 1938. A. LOOMIS 2,133,624

WOOD-WIND INSTRUMENT

Filed Dec. 21, 1936 4 Sheets-Sheet 1

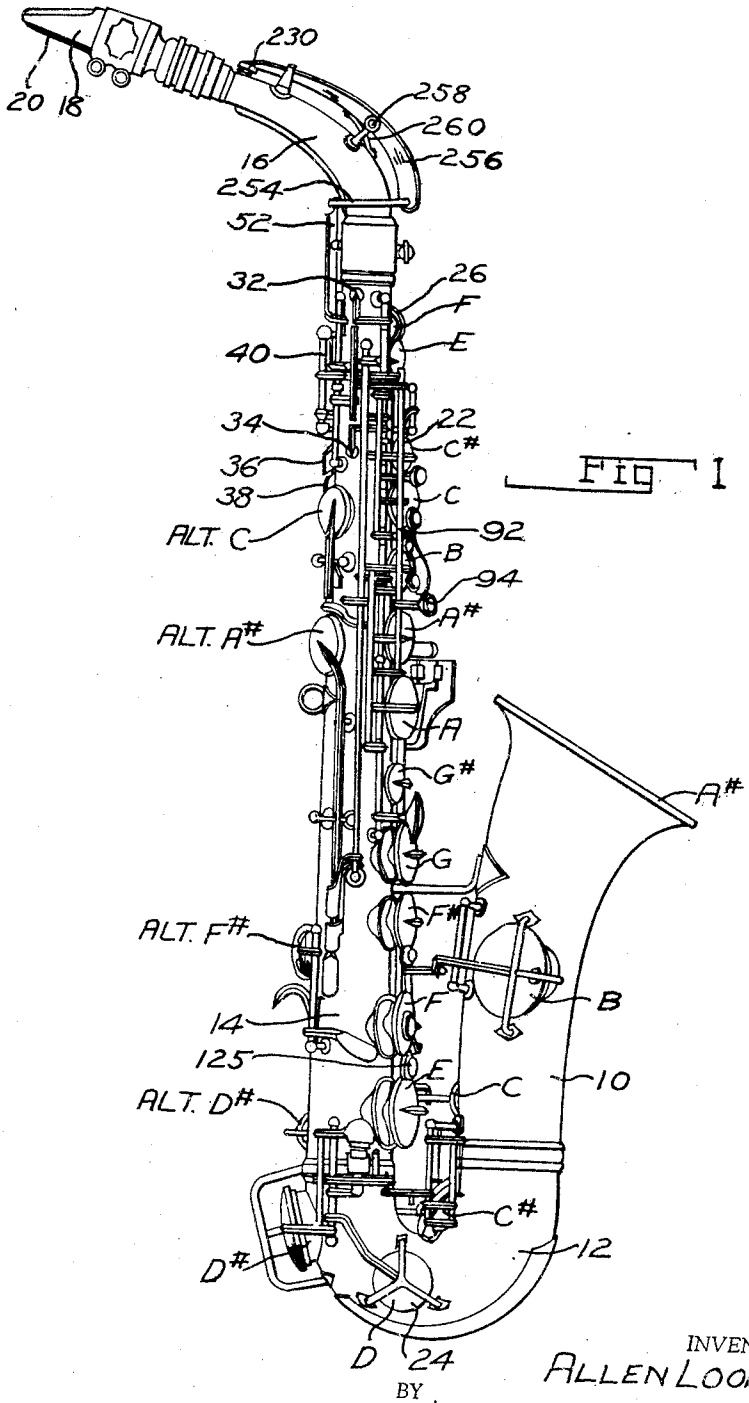


Fig. 1

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WOOD-WIND INSTRUMENT

Filed Dec. 21, 1936 4 Sheets-Sheet 2

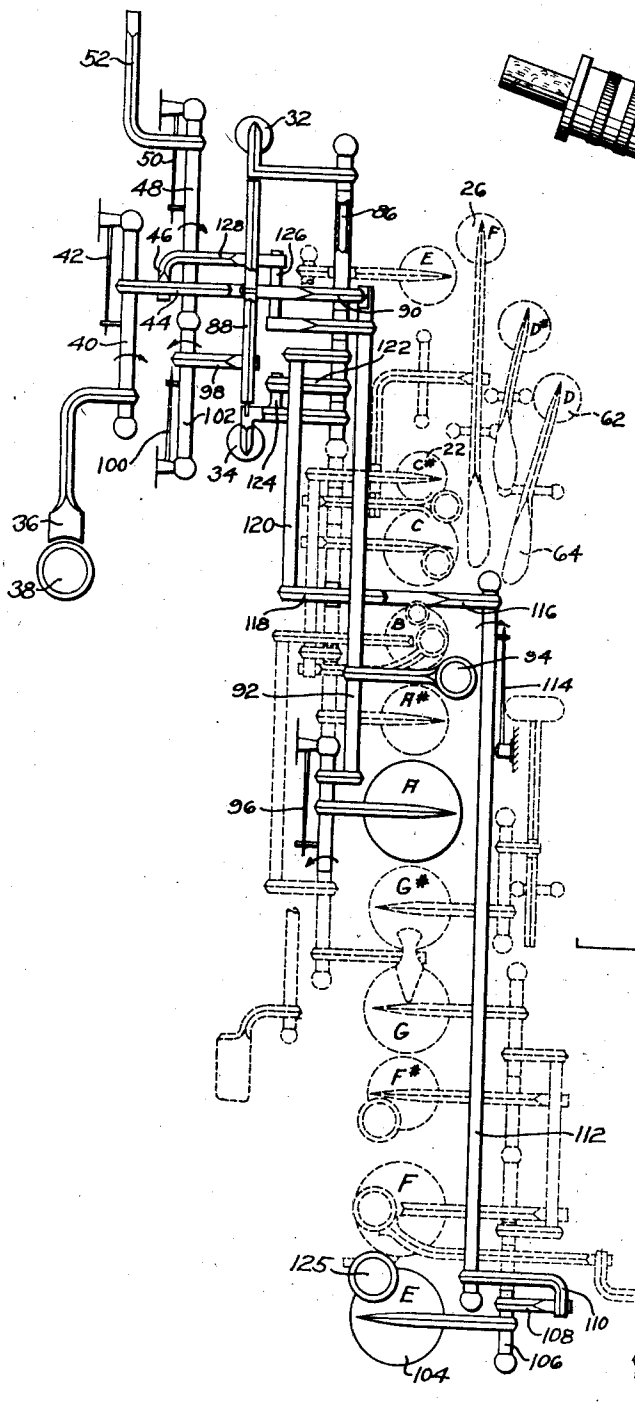


Fig. 3

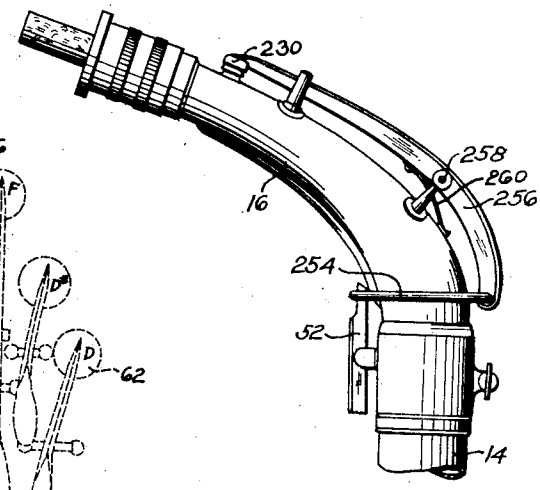


Fig. 2

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WOOD-WIND INSTRUMENT

Filed Dec. 21, 1936 4 Sheets-Sheet 3

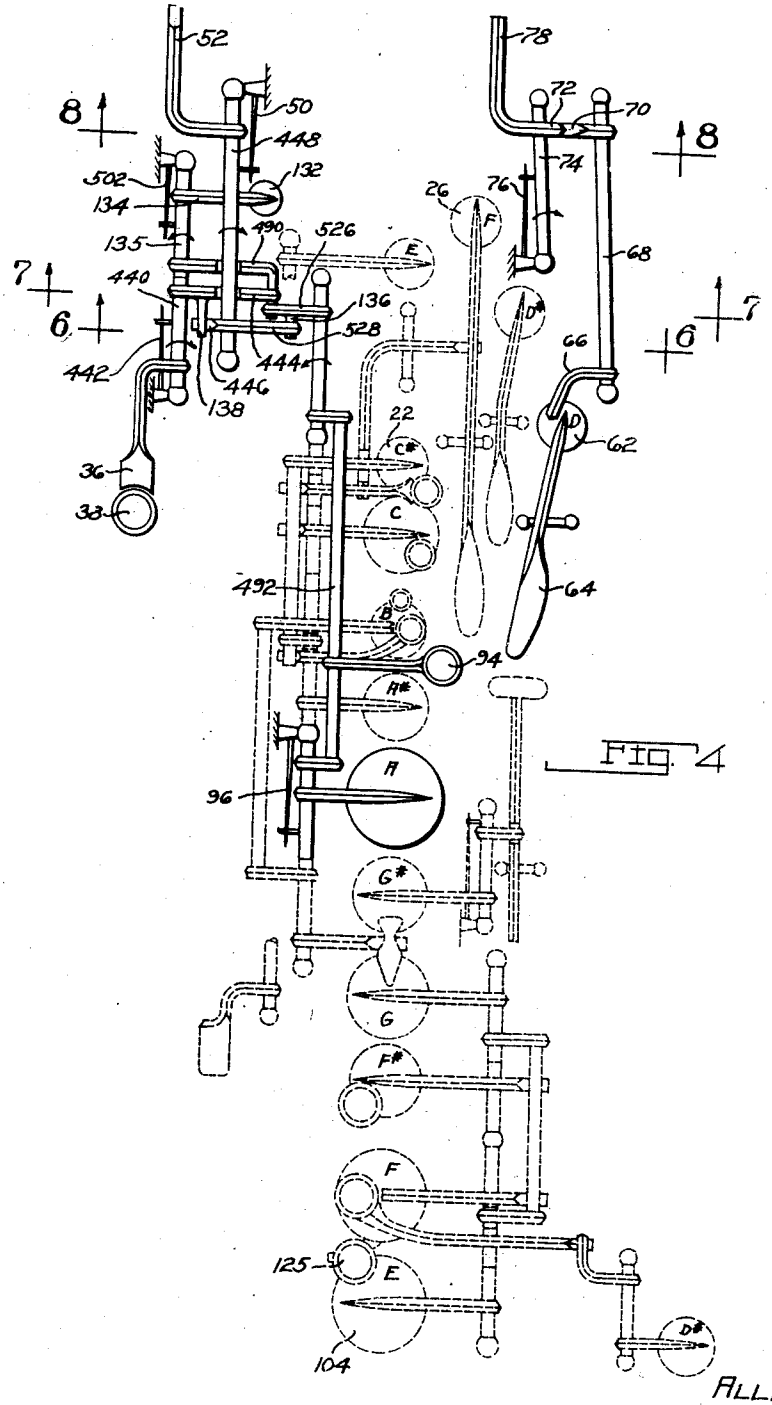


FIG. 4

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WOOD-WIND INSTRUMENT

Filed Dec. 21, 1936 4 Sheets-Sheet 4

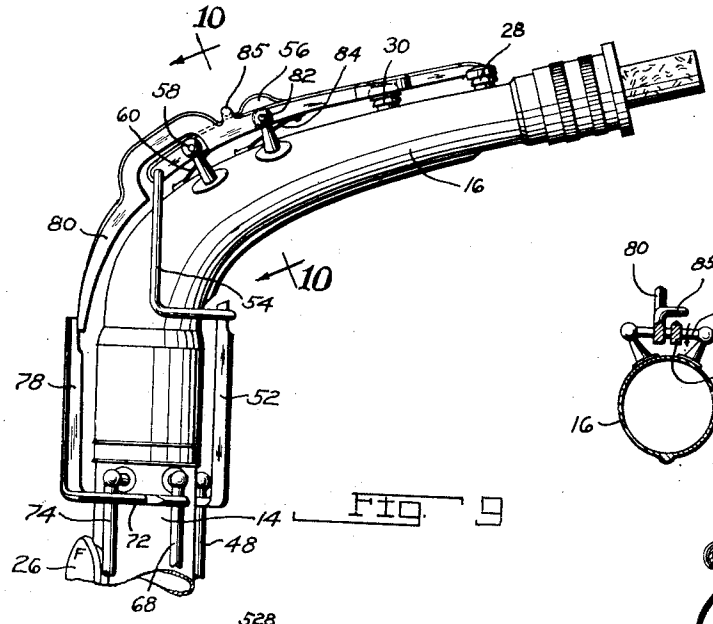


Fig. 9

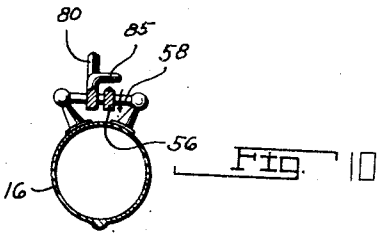


Fig. 10

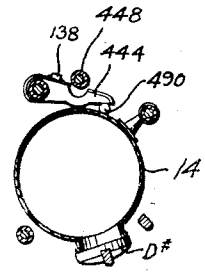


Fig. 7

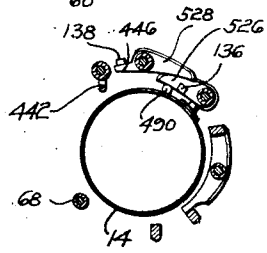


Fig. 6

Fig. 5

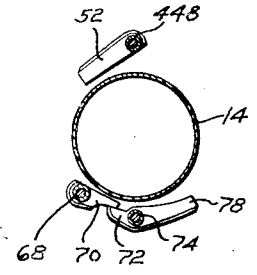


Fig. 8

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Patented Oct. 18, 1938 2,133,624

UNITED STATES PATENT OFFICE

2,133,624

WOOD-WIND INSTRUMENT

Allen Loomis, Elkhart, Ind., assignor to C. G. Conn, Ltd., Elkhart, Ind., a corporation of Indiana

Application December 21, 1936, Serial No. 116,948

15 Claims. (Cl. 84—385)

This invention relates to woodwind instruments (so-called whether or not they are made of wood) and more particularly to providing on woodwind instruments a series of spaced octave holes and means for automatically opening these holes when the instrument is played.

While the invention is applicable to woodwind instruments of any type, whether made of wood or metal, e. g. clarinet, oboe, bassoon, and the like, it is described in this application as applied to a saxophone. However, it is to be understood that the scope of the invention is not to be limited to saxophones only.

It is well understood by those skilled in the art that to enable a musician to play a woodwind instrument in the upper register, a small hole called an octave hole must be provided: and it has been found that to obtain a full tone the hole should be approximately midway of the vibrating column of air which sounds the particular note being played. However, to accomplish this would necessitate the provision of a separate hole for each note in the upper register octave, and these, with their separate keys, would unduly complicate the instrument and make it extremely difficult to play.

For many years manufacturers of these instruments compromised by using only two octave holes. These were usually so placed as to be satisfactory for the middle notes of the upper register but caused difficulty in sounding the higher and lower notes and also tended to cause lack of tone clarity in those notes.

The primary object of this invention, therefore, is to improve the octave mechanism to secure greater ease in sounding the higher and lower notes of the upper register of a woodwind instrument.

Another object is to improve the tone and pitch of the higher and lower notes of the upper register of a woodwind instrument.

I prefer to accomplish the above objects by providing at least three octave holes, normally closed by pads; and by providing a single octave key adjacent the left hand thumb rest which, whenever it is depressed, results in opening one or the other of these octave holes and closing the others and by providing means interconnecting the various octave hole pads and the keys of the instrument whereby with the octave key depressed the appropriate octave hole is opened by the operation of the keys required to play a particular note.

There are also features of mechanical novelty in the connections associated with particular ones of the above-described octave holes.

The above and other objects and desirable particular constructions will be apparent upon reference to the following detailed description of several illustrative embodiments of the invention shown in the accompanying drawings, in which:

Figure 1 is an elevational view of the right side of an alto saxophone employing an octave mechanism having three octave holes;

Figure 2 is an elevational view of the right side of the mouth-pipe portion of the alto saxophone shown in Figure 1;

Figure 3 is a developed view of the key mechanism of the instrument shown in Figure 1;

Figure 4 is a developed view similar to Figure 3 of the key mechanism of a second embodiment, having the two upper octave holes on the mouthpipe and having only a single octave hole in the branch or body of the instrument:

Figure 5 is a perspective view of a portion of the octave key mechanism of the instrument of Figure 4;

Figures 6, 7, and 8 are transverse sections on an enlarged scale through the branch or body of the instrument of Figure 4 taken in planes corresponding to lines 6—6, 7—7 and 8—8 respectively of Figure 4;

Figure 9 is an elevation of the mouthpipe of the instrument of Figure 4; and

Figure 10 is a section on the line 10—10 of Figure 9.

Referring to the drawings, both of the instruments shown are of the type known as alto saxophones comprising a bell 10, a U-shaped tubular member 12 known as the bow, and a tapered tube or main body 14 called the branch, together with a curved mouth-pipe 16 detachably connected to the branch and detachably carrying a mouthpiece 18 provided with a reed 20; all of these members being connected in the order named to form the body of the instrument.

Tone holes are provided at spaced intervals along the body of the instrument, each having the usual key-operated pad whereby it may be closed or opened at the will of the player. Each of the tone holes is designated by a note of the musical scale which is the note sounded by the instrument when that hole is open and the holes above it (i. e. toward the mouthpiece) are closed. The arrangement of the tone holes illustrated is identical with standard instruments, as are also the mechanisms for opening and closing the holes, and therefore, will not be set forth in detail as they are well known to those skilled in the art.

The range of the instrument is from A♯ on the second line below the staff (B flat in the second space) to F in the fourth space above the staff and comprises 32 notes in all or approximately three octaves. As every note except A, G♯, G and F♯ occurs three times, they will be designated lower, middle, or upper according to their positions in the scale of the instrument.

The first sixteen notes from lower A♯ to middle C♯, generally called the lower register, are played in ascending scale by first closing all the tone holes to sound lower A♯ and then successively opening the tone holes, beginning at the bell, until that numbered 22 is opened (disregarding those marked "Alt.", to indicate alternates), and in playing all of these notes the air colum in the body of the instrument vibrates in its fundamental frequency.

The remaining 16 notes, generally called the upper register, beginning at middle D, are played by closing all the tone holes down to 24 and successively opening the tone holes until that designated by the numeral 26 is opened, at the same time increasing the blowing pressure to cause the air column to vibrate in its first harmonic.

In order to produce these first harmonic tones easily and to prevent them from being toneless and unstable, it is necessary to create a leak somewhere near the center of the vibrating column of air. This is done by providing small holes called octave holes which are opened when these notes are played. At present, standard instruments are provided with two octave holes, one of which is opened while approximately half of the upper register notes are being played and the other of which is open while the remaining upper register notes are played.

In the embodiment of Figures 1 and 2, there are three octave holes normally closed by pads 230, 32, and 34. The holes covered by pads 32 and 34 are in the branch 14, and are respectively open when the group of notes middle G♯, G, F♯, F, and E, and the group D♯ and D, are played and are closed at other times. The hole closed by the pad 230 is in the mouthpipe 16, in a compromise position such that it is open when any of the notes upper F to A is played, and is closed at all other times. All three of the octave holes are brought into play by depressing the usual octave key or spatula 36 located adjacent the left hand thumb rest 38 and employing the usual fingering required to play the respective notes.

An important minor feature of the invention relates to an additional fingering permitted by the location of the octave hole 34 whereby middle C♯ may be played in the same manner as lower C♯ but with the spatula 36 depressed.

The spatula 36 is mounted on a hinge 40 urged by a spring 42 in the direction of the arrow. An arm 44 on the hinge 40 engages a wiper 46 on a hinge 48 urged in the direction of the arrow by a spring 50, weaker than spring 42. A crank arm 52, mounted on the hinge 48 engages a ring 254 surrounding the mouthpipe 16 and secured to a lever 256 hinged at 258. The lever 256 carries the pad 230 for the upper octave hole and is urged by a leaf spring 260 in the direction to close the octave hole. Spring 260 is weaker than spring 50.

Octave hole pads 32 and 34 are each hinged on an axle 86 and are interconnected by a floating lever 88 pivoted at its center on an arm 90 hinged on the axle 86 and one end of which is engaged by the arm 44. The other end of the arm 90 is engaged by a bridge rod 92 hinged on the axle 86 and carrying a fingertip 94 which is depressed whenever middle or high G, is played. The bridge rod 92 is urged by a spring 96 in a direction to depress the floating lever 82 and hold both octave holes 32 and 34 closed.

A wiper arm 98 mounted on a hinge 102 and urged in the direction of the arrow by a spring 100 engages the floating lever 88 below its pivot. The spring 100 is insufficient in strength to overcome the spring 96 and lift the octave hole pads.

The lower and middle E tone hole pad 104 is mounted on a hinge 106 having a wiper arm 108 engaging another wiper arm 110 on a long axle 112 which is urged by a spring 114 in the direction of the arrow. On the long axle 112 is an arm 116 engaging an arm 118 secured to a bridge rod 120 hinged on the axle 86. An arm 122 secured to the upper end of the bridge rod 120 engages a projection 124 on the arm of the octave hole pad 34. Through these interconnections, it will be noted that the spring 114 serves to hold the octave hole 34 closed.

The tone hole pad 104 is provided with a finger tip 125 which is always depressed to sound either lower or middle D♯ and all notes below.

A crank arm 126, connected to the bridge rod 92, passes underneath the arm 90 and under an arm 128 on the hinge 48 at a distance therefrom (see Figure 6) which permits the hinge 48 to rotate in the direction of the arrow sufficiently to open the octave hole 30 before engaging it.

When the instrument is played in the lower register, the thumb of the player's left hand rests on the thumb rest 38 and spring 42 acting through arm 44 overcomes the tendency of spring 50 to open the octave hole 230, and the engagement of arm 44 with arm 90 prevents spring 102 from lifting the floating lever 88 and thereby opening either of the octave holes 32 or 34. Therefore, the depression of either of the fingertips 94 or 125 in playing any of the lower register notes, although the pressure of springs 96 and 114 is thereby relieved, has no effect on the octave holes.

When playing in the upper register, spatula 36 is depressed as in the standard instrument. This raises the arm 44 from the wiper 46 permitting the spring 50 to rotate the crank arm 52 and open the octave hole 230. It will be noted that when this occurs, arm 128 moves into engagement with crank 126. Depression of spatula 36 also raises arm 44 from arm 90. In this condition the notes upper C♯, C, B and A♯ may be played, but if any note below A♯ is played, fingertip 94 must be depressed and, when this occurs, the force of the spring 96 is relieved from the arm 90 permitting the spring 100, through lever 90, to raise the floating lever 88. Since spring 114 is still acting on the octave hole pad 34 through the lever 122 and the projection 124 the floating lever 88 will pivot about the pad 34 and raise the octave hole pad 32. At the same time the crank 126 is raised bringing the arm 128 back to its original position and permitting the octave hole 30 to close. In this position the notes middle G♯, G, F♯, F and E may be played.

In order to go below these notes pad 104 must be depressed by fingertip 125. This relieves the force of spring 114 on the octave hole pad 34, and since arm 98 acts below the pivot of the floating lever 88, the floating lever will be swung about its pivot closing the octave hole 32 and opening the octave hole 34. In this position middle D♯ and D may be played. As previously stated middle C♯ may also be played by closing

the D tone hole instead of by releasing spatula **36** and opening all of the tone holes as described above, and as is now the usual fingering.

It is theoretically possible that, if fingertip **94** or **125** were depressed while spatula **64** is depressed, octave hole **32** or **34** would open, but this could only happen by accident and would never occur if the instrument is played in the usual manner with the standard fingering.

In the modification of Figures 4 to 10 inclusive identical elements are designated by the same reference numerals while corresponding elements are designated by the same reference numerals plus 400. This modification differs from the preceding one just described in having only one octave hole **132** on the branch **14** of the instrument. The mouthpipe **16** and the mechanism thereon is shown in Figures 9 and 10, and is further described below, the principal difference from the first modification being that there are two octave holes **28** and **30** on the mouthpipe.

The octave hole **132** is positioned somewhere between the holes **32** and **34** of the preceding modification and is employed in playing the group of notes from middle G♯ to middle D inclusive. The octave hole pad is mounted on an arm **134** having a hinge **135** urged in the direction to open the octave hole by a spring **502**. An arm **490** on this hinge is engaged by an arm **444** on a hinge **440** carrying the spatula **36** and urged in the direction of the arrow by a spring **442** stronger than the spring **502**.

The fingertip **94** is mounted on a bridge rod **492** urged in the direction of the arrow by the spring **96** and having secured thereto an arm **526** engaging the arm **490**. Spring **96** is also stronger than spring **502**.

The hinge **448** carrying the arm **52** is urged by the spring **50** in the direction to open the octave hole **30** and has a wiper **446** engaged by a projection **138** on the arm **444**. Spring **50** is of such strength that its action combined with that of the spring **502** is insufficient to overcome the spring **442**. An arm **528** on the hinge **448** is adapted to be moved into engagement with a projection **136** on the arm **526** when the hinge **448** is rotated sufficiently to operate the crank arm **52** to open an octave hole **30** on the mouthpipe. The crank arm **52** engages a distorted ring **54** surrounding the mouthpipe **16** and rigidly secured to a lever **56** hinged at **58**. This lever **56** carries a pad **30** for one of the upper octave holes, and is urged by a leaf spring **60** in the direction to close that hole. Spring **60** is weaker than spring **50**.

A tone hole pad **62**, adapted to be lifted by spatula **64** to play high D, is engaged by an arm **66** on a hinge **68** having a second arm **70** engaging a wiper **72** on a hinge **74**. The hinge **74** is urged in the direction of the arrow by a spring **76**, and carries a crank arm **78** which engages a lever **80** pivoted on the mouthpipe at **82** (see Figure 9). The lever **80** carries a pad **28** which closes the second of the octave holes on the mouthpipe, and is urged by a spring **84** in a direction to close the octave hole.

A wiper **85** integral with the arm **80** between the two hinges **58** and **82** of the arms **56** and **80** engages the arm **56**, when it is in the position it occupies when octave hole **30** is open, in such a manner that if arm **80** is moved in the direction to open the octave hole **28**, the octave hole **30** will be positively closed.

In operation, the depression of the spatula **36** raises the arm **444** and the projection **138**, permitting the spring **50** to open the octave hole **30**. At the same time the arm **528** moves down into engagement with the projection **136** on the arm **526**.

When the fingertip **94** is depressed, the arm **526** is raised and projection **136** rotates the arm **528** in a direction to close the octave hole **30** while at the same time arm **490** being relieved of the force of both springs **442** and **96** is lifted by the spring **502**, thereby lifting the octave hole pad **130**.

The operation of octave hole **28** by means of the high D key mechanism **62**—**64** is as just described.

While two illustrative embodiments have been described in detail, it is not my intention to limit the scope of the invention to those particular embodiments, or otherwise than by the terms of the appended claims.

I claim:

1. A wood-wind instrument having a generally tubular body including a branch and a mouthpipe detachably connected with each other, said branch being formed with tone holes and provided with pads therefor and with key-actuated operating mechanism, said mouthpipe having two octave holes formed therein and provided with yieldingly-closed pads, means actuated by one manner of operating said mechanism for yieldingly lifting one of said pads and thereby opening one of said octave holes, and means actuated by another manner of operating said mechanism for forcibly closing the octave hole so opened and at the same time opening the other octave hole.

2. A wood-wind instrument having a generally tubular body formed with tone holes and provided with pads therefor and with key-actuated operating mechanism, said instrument having two octave holes formed therein and provided with pads, means actuated by one manner of operating said mechanism for yieldingly lifting one of said pads and thereby opening one of said octave holes, and means actuated by another manner of operating said mechanism for closing the octave hole so opened against its yielding resistance and at the same time opening the other octave hole.

3. A wood-wind instrument having a generally tubular body including a branch and a mouthpipe detachably connected with each other, said branch being formed with tone holes and provided with pads therefor and with key-actuated operating mechanism, said mouthpipe having two octave holes formed therein and provided with yieldingly-closed pads, means actuated by one manner of operating said mechanism for yieldingly lifting one of said pads and thereby opening one of said octave holes, and means actuated by another manner of operating said mechanism for forcibly closing the octave hole so opened and at the same time opening the other octave hole, said branch having a third octave hole, and means actuated by a third manner of operating said mechanism for closing both of the first two octave holes and opening said third octave hole.

4. A wood-wind instrument having a generally tubular body formed with tone holes and provided with pads therefor and with key-actuated operating mechanism, said instrument having two octave holes formed therein and provided with pads, means actuated by one manner of operating said mechanism for yieldingly lifting one of said pads and thereby opening one of said octave holes, and means actuated by another

manner of operating said mechanism for closing the octave hole so opened against its yielding resistance and at the same time opening the other octave hole, said instrument having also a third octave hole, and means actuated by a third manner of operating said mechanism for closing both of the first two octave holes and opening said third octave hole.

5. A wood-wind instrument comprising a generally-tubular body including detachably connected mouthpipe and branch sections, said branch section having tone holes provided with pads and having an octave hole provided with a pad and with key-actuated mechanism for operating said pads, and said mouthpipe section having two octave holes provided with pads, in combination with levers carrying said pads for the octave holes on the mouthpipe section and which are arranged on opposite sides of the mouthpipe section and which interengage with the key-actuated mechanism substantially at the joint between the two sections.

6. A wood-wind instrument comprising a generally-tubular body including detachably connected mouthpipe and branch sections, said branch section having tone holes provided with actuated mechanism for operating said pads, and said mouthpipe section having two octave holes provided with pads, in combination with levers carrying said pads for the octave holes on the mouthpipe section and which are arranged on opposite sides of the mouthpipe section and which interengage with the key-actuated mechanism substantially at the joint between the two sections, and spring means rendered effective by one manner of operating said mechanism for yieldingly rocking one of said levers to open one of the octave holes in the mouthpipe, the operation of the other of said levers to open its octave hole being a different manner of operating said mechanism and said other lever being arranged when operated to overcome the spring means to return said one lever to closed position.

7. A wood-wind instrument comprising a generally-tubular body formed with tone holes provided with pads and with octave holes provided with pads, and mechanism for operating the pads including a floating lever having the pads for the octave holes at its ends and an octave key connected to rock said lever to lift one or the other of said octave-hole pads, said mechanism also including tone keys for operating the tone-hole pads and certain of which cooperate with the floating lever to predetermine which one of the octave-hole pads will be lifted thereby when the octave key is operated.

8. A wood-wind instrument comprising a generally-tubular body including a mouthpipe having connected thereto a branch formed with tone holes provided with pads and with octave holes provided with pads, said mouthpipe having an octave hole provided with a pad, and mechanism on said branch for operating the pads including a floating lever having the pads for the octave holes at its ends and an octave key connected to rock said lever to lift one or the other of said octave hole pads, said mechanism also including tone keys for operating the tone-hole pads and certain of which cooperate with the floating lever to predetermine which one of the octave-hole pads will be lifted thereby when the octave key is operated, in combination with auxiliary mechanism partly on said mouthpipe and partly on said branch and operated by certain of said tone keys for preventing the rocking of the floating lever and at the same time raising the pad of the octave hole in the mouthpipe.

9. A wood-wind instrument comprising a generally tubular body including detachably connected mouthpipe and branch sections, the latter being formed with tone holes and with at least one octave hole and the former being formed with two octave holes, pads for said tone holes and octave holes, mechanism on said branch section for operating the pads of the tone holes and the pad of the octave hole in the branch section and a pair of levers pivoted on the mouthpipe section and each carrying at its upper end one of the pads of the octave holes in the mouthpipe section, said levers both interengaging directly at their lower ends with said mechanism approximately at the joint between said sections.

10. A wood-wind instrument comprising a generally tubular body including detachably connected mouthpipe and branch sections, the latter being formed with tone holes and the former being formed with two octave holes, pads for said tone holes and octave holes, mechanism on said branch section for operating the pads of the tone holes and a pair of levers pivoted on the mouthpipe section and each carrying at its upper end one of the pads of the octave holes, said levers both interengaging directly at their lower ends with said mechanism approximately at the joint between said sections.

11. In a wood-wind instrument, a pad mounted on a hinged lever, a second pad on a second hinged lever, a third hinged lever between said first two, floating lever pivotally mounted on said third lever and pivotally engaging said first two levers, a first spring means acting on said third lever to hold both pads down, a second spring means acting on said first lever to hold it down, a third spring means acting on said floating lever intermediate said first and third levers to raise it, said third spring means being weaker than either of said first two and means for relieving either one or both of said first and second spring means.

12. A wood-wind instrument formed with two octave holes, a first pad for closing one of said holes, a second pad for closing the other hole, a rocking lever interconnecting the pads, a pivot for the rocking lever, a first spring means urging the pivot down to close both octave holes, a second spring means acting between the pivot and the first pad urging the lever up, a third spring means urging the first pad down, the first and third spring means each being stronger than the second spring means, means for relieving the first spring means whereby the second spring means swings the rocking lever about the first pad as an axis raising the second pad and the pivot, and means for thereafter relieving the third spring means whereby the second spring means rocks the rocking lever about its pivot lowering the second pad and raising the first.

13. A wood-wind instrument formed with two octave holes, a first pad for closing one of said holes, a second pad for closing the other hole, a rocking lever interconnecting the pads, a pivot for the rocking lever, a first spring means urging the pivot down to close both octave holes, a second spring means acting between the pivot and the first pad urging the lever up, a third spring means urging the first pad down the first and third spring means each being stronger than the second spring means, means for relieving the first spring means whereby the second spring means swings the rocking lever about the first pad as an axis raising the second pad and the

pivot, means for therefter relieving the third spring means whereby the second spring means rocks the rocking lever about its pivot lowering the second pad and raising the first, a fourth spring means acting on the pivot independently of said other spring means to hold it down, and means to relieve the pressure of said fourth spring means.

14. In a wood-wind instrument a mouthpipe formed wth a pair of octave holes, pads for closing the octave holes, a pair of levers arranged side by side carrying the pads, spaced parallel pivots for said levers, a wiper on one of said levers between the pivots so constructed and arranged as to be engaged by the other lever when its pad is raised whereby when said one lever is moved to raise its pad the other lever is moved to depress its pad.

15. In a wood-wind instrument a mouthpipe formed with a pair of octave holes, pads for closing the octave holes, a pair of levers arranged side by side carrying the pads, spaced parallel pivots for said levers, a wiper located between the pivots on the lever whose pivot is nearest the pads engaged by the other lever when its pad is raised.

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