

May 23, 1950

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2,508,550

CYLINDRICAL PIPE WOOD-WIND INSTRUMENT

Filed Aug. 5, 1948

2 Sheets-Sheet 1

FIG. 4

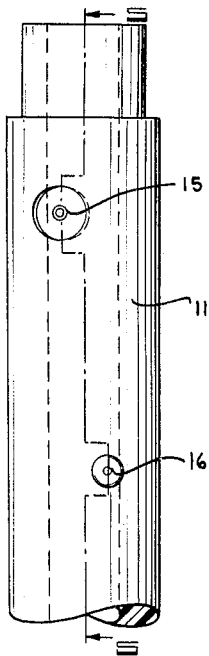


FIG. 5

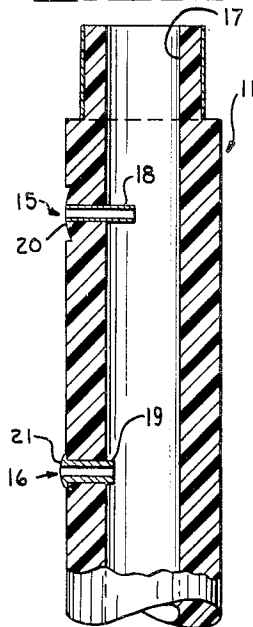


FIG. 2

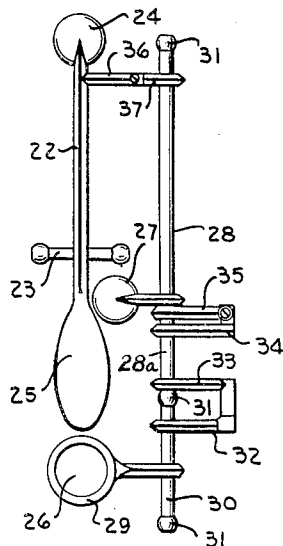
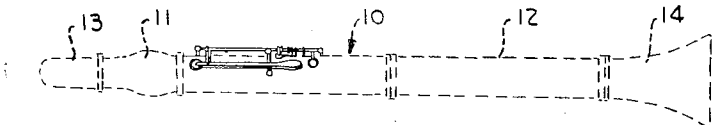


FIG. 1



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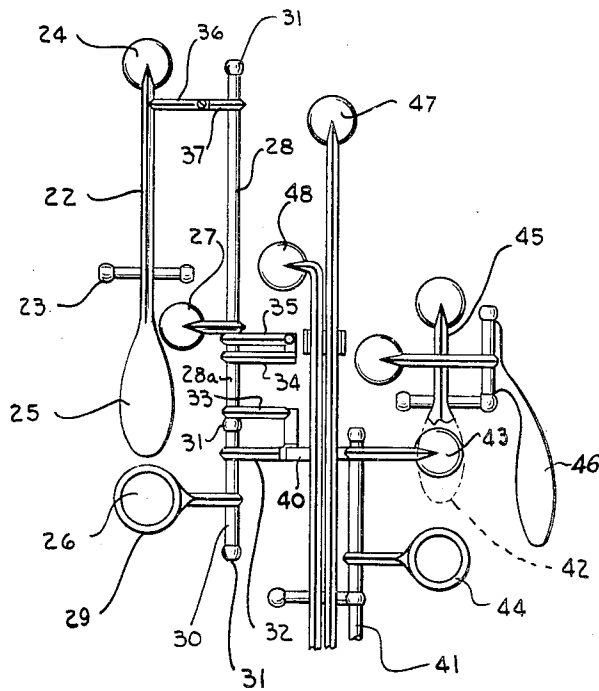
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FIG. 3



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CYLINDRICAL PIPE WOOD-WIND INSTRUMENT

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6 Claims. (Cl. 84-382)

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The present invention relates to improvements in cylindrical pipe wood wind instruments, and more particularly to improvements in the placement and construction of certain tone holes for the purpose of producing a resonant properly tuned B flat and for providing a separate register or speaker tone hole correctly sized and placed to produce in the upper register of the instrument the properly tuned duodecims of the fundamental register.

The B flat above referred to and to be herein-after referred to in this specification is the B flat located on the third line of the treble clef.

The invention herein disclosed will be described as applied to a Boehm system clarinet, although it is understood that the same invention may be applied to any cylindrical pipe wood wind instrument in which a register or speaker tone hole is provided to produce, when open, the duodecims of a fundamental register and in which such register or speaker tone hole is used also in the production of the tone B flat.

Prior to the present invention the tone B flat has been produced in such instruments by the combined use of the register or speaker key and the A natural key. Upon opening these keys, tone holes are opened which result in the production of a tone corresponding to B flat. The production of such a tone is not satisfactory in a critical musical work for the tone B flat so produced is not a resonant tone having a true pitch. The production of a resonant properly tuned B flat requires the use of a tone hole which is larger than that required to produce the true duodecims of the fundamental register by the use of the register or speaker tone hole.

In order to effect a compromise between these conditions, it heretofore has been the standard practice to employ a speaker or register hole which is larger than that required to produce properly tuned duodecims of the fundamental register but smaller than that required to produce a resonant properly tuned B flat. Because of such compromise, the tone B flat cannot be produced on such an instrument with the desired full resonance and true pitch. Also, the tones of the upper register may not be true since the speaker or register tone hole in order to produce a compromise B flat is larger than the proper size of tone hole to produce the true duodecims in the upper or overblown register of the instrument.

This fundamental defect in wood wind instruments of the cylindrical pipe type has heretofore been recognized and remedies for it have been

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suggested in several prior United States Letters Patent. Those believed to most closely approach the present invention are United States Letters Patent No. 706,557 issued August 12, 1902, No. 1,529,567 issued March 10, 1925, No. 1,585,296 issued May 18, 1926, and No. 1,926,489 issued September 12, 1933.

The last three patents above listed disclose the use of a speaker or register tone hole which is separate from the tone hole used to produce the tone B flat. The key systems proposed in these patents are such as to open one hole and close the other selectively as required to produce the desired tone. As distinguished from the disclosures of these three prior patents, my invention utilizes a properly sized speaker or register tone hole located at the proper point to produce a node in the air column which will cause it to vibrate in the proper segments to produce in the overblown register the duodecims of the fundamental tones of the lower register of the instrument. This tone hole when used alone will act as the register or speaker tone hole. A separate resonance tone hole is located downstream of the speaker or register tone hole and is spaced relative thereto. The resonance tone hole is of such size and location that when it is opened in cooperation with the speaker or register tone hole, it produces a properly tuned resonant B flat. Thus, in my invention, the speaker or register tone hole and the resonance tone hole are both opened to produce B flat. When the resonance tone hole is closed, the speaker or register tone hole is open for producing the tones of true pitch in the upper or overblown register.

In the first named of the above patents, i. e. No. 706,557, the disclosure teaches the use of two tone holes to produce a divided air column. Both tone holes are employed to produce the tone B flat and also for playing in the upper or overblown register. The effect of the construction shown in this patent is that if the combined tone holes will produce a resonant B flat of true tone, the upper or overblown register will not be properly tuned. If the combined tone holes are such as to produce properly tuned tones in the upper or overblown register, the B flat will not have the proper resonance and tone. The present invention is, therefore, distinguished from this prior patent in that the speaker or register tone hole is a single opening of the proper size and placement at the correct node position to produce the true tones desired in the upper or overblown register. This single tone hole acting as the speaker or register tone hole is adequate to function only

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as the register or speaker tone hole and is inadequate to produce a resonant properly tuned B flat. In the present invention, this defect is corrected by the provision of the separate resonance tone hole which, when opened in conjunction with the speaker or register tone hole and the open A tone hole produces a resonant, properly tuned B flat.

It is, therefore, an object of the present invention to provide a cylindrical pipe wood wind instrument in which a properly tuned resonant B flat can be produced and in which the tones in the upper or overblown register are true duodecims of the tones produced in the fundamental register.

It is a further object of the present invention to provide a cylindrical pipe wood wind instrument in which a simplified key mechanism is provided either as a part of the original construction of the instrument or as an accessory to be attached to existing instruments which permits the selective opening and closing of the resonance tone hole used to produce the tone B flat without affecting the open speaker or register tone hole used to facilitate the production of the true tones in the upper or overblown register of the instrument.

It is another object of the present invention to provide a cylindrical pipe wood wind instrument in which a system of tone holes and a simplified key system is provided which may be readily applied either to new or existing instruments and which will improve the tones of the overblown register as well as the B flat tone without requiring any changes in the fingering of the instrument.

It is a further object of the present invention to provide a cylindrical pipe wood wind instrument in which a novel form of tone hole and pad seat is provided which contribute to the production of accurately pitched clear resonance tones.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

Fig. 1 is a side elevation on a reduced scale showing in dotted outline the general configuration of a clarinet and showing the present invention as applied to the upper joint thereof.

Fig. 2 is an enlarged plan view of the key mechanism forming a part of the present invention.

Fig. 3 is a plan view of a portion of the key mechanism on the upper joint of a Boehm system clarinet and showing the key mechanism of the present invention associated therewith.

Fig. 4 is a fragmentary elevation of a portion of the top joint of a clarinet with all keys removed to show the speaker or register tone hole and the resonance tone hole associated therewith.

Fig. 5 is a section taken substantially on the line 5-5 in the direction of the arrows, Fig. 4.

The production of a resonant B flat of true pitch is particularly difficult in a cylindrical pipe wood wind instrument. In a clarinet, for example, the tone is produced by opening tone holes located at the top portion of the fundamental or Chalumeau register. At this point, the tone is produced by the shortest possible basic air column which can be used for tone

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production. The compression and force in the air column at this point is the highest of any point in the air column. As is well known, the quality of tone produced by a short air column is accordingly impaired and makes it very difficult to control the pitch of the produced tones. By dividing the air column with a speaker hole located at the proper node to produce the desired upper or overblown register tones and supplementing the speaker hole with a resonance tone hole located downstream from the speaker tone hole, the effect is to produce the desired resonant B flat tone of proper pitch. The effect is to provide a corresponding lengthening of the air column necessary to produce the true B flat tone and this in turn permits its production at a reduced pressure in the air column and the resultant better control of the tone production.

It is understood that the sizes and placement of both the speaker hole and the resonance hole are governed by the characteristics of the particular instrument to which they are to be applied as both are proportional to the bore of the instrument. Variations in the bore will affect the specific sizes and placement of these tone holes but will not affect the general application of the invention nor the particular key mechanism to be employed in carrying out the invention.

As will be more fully explained hereinafter, the actuation of the pad for opening and closing the B flat resonance hole is by a key mechanism which does not change the basic fingering of the instrument and which includes an actuating arm attached to the speaker key and the use of the conventional thumb ring surrounding the thumb hole. Thus, very little change is required in the construction of the instrument and no change is required in its fingering.

By way of example, the present invention will be described as applied to the upper joint of a Boehm system clarinet. As shown in Fig. 1, the upper joint 10 connects with the lower end of the tuning barrel 11 and extends between the tuning barrel 11 and the lower joint 12. The mouthpiece 13 connects to the opposite end of the tuning barrel 11 and carries the reed (not shown) which vibrates to excite the air column in the bore of the clarinet to produce sound. The bell 14 connects with the lower end of the lower joint 12.

It is to be understood that a series of conventionally placed tone holes are provided in both the upper joint 10 and the lower joint 12 for providing other tones of the scale. These tone holes are controlled by conventional key mechanisms for opening and closing the pads which control the opening and closing of the tone holes. These arrangements are conventional arrangements and are not disturbed by the present invention, so they have been omitted from the present disclosure.

In carrying out the present invention, a speaker hole 15 (Fig. 4) is provided near the top of the upper joint 10 and is of the proper size, when placed at the node of the vibrating air column within the bore, to produce as the tones of the upper or overblown register the true duodecims of the fundamental register. By way of example, I have found that in a clarinet whose bore in the upper joint is approximately 0.59 inch, the speaker hole is preferably approximately 0.103 inch in diameter and is placed downstream approximately 0.7092 from the top of the upper joint of the instrument. A resonance hole 16

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is spaced circumferentially downstream from the speaker hole 15 and is of the proper size and is so placed that when opened in conjunction with the speaker hole 15, the A key 45, the vibrating air column in the upper joint 11 will be divided and lengthened to produce a resonant B flat of true tone.

The resonance hole 16 is preferably approximately 0.116 inch in diameter in a clarinet whose bore is approximately 0.59 inch and it is located preferably $2\frac{1}{8}$ inches downstream from the top of the upper joint of the instrument. It is to be understood, however, that these dimensions will be readily changed or varied by one skilled in the art as may be necessary to compensate for changes or variations in the bore dimensions of the upper joint of the clarinet. I do not desire therefore, to be limited to the precise dimensions here set forth as one preferred embodiment of the invention.

As shown in Fig. 5, the upper joint 11 comprises a pipe having a cylindrical bore 17 extending lengthwise thereof. The speaker hole 15 and resonance hole 16 are formed by hollow cylindrical tubes 18 and 19 respectively, which extend through the sidewall of the upper joint 11 and open into the cylindrical bore 17. The length and the size of the opening in each of the tubes 18 and 19 is selected to produce, when the hole is opened, the desired division of the vibrating air column in the bore 17. As here shown, the tubes 18 and 19 terminate in pad seats 20 and 21 respectively on which conventional pads (not shown) are seated. The pad seats 20 and 21 are curved radially downward and away from a centrally located high point. The tubes 18 and 19 are centrally located respectively on a line which extends axially through the high points of the pad seats 20 and 21. Thus, the air stream escaping through the tubes 18 and 19 is deflected by the pads and distributed uniformly over the arcuate surfaces of the pad seats 20 and 21. It has been found that such pad seats have properties which assure not only a better closure of the tone hole by its associated pad but also a better opening characteristic, particularly as regards the ability to produce thereby a full resonant tone. It is to be understood that the use of such pad seats is not limited to the tone holes here shown but that they may be used with other tone holes of the instrument as well.

The pads controlling the opening and closing of the speaker hole 15 and the resonance hole 16 are conventional types of pads and hence are not shown. The pads are actuated by the key mechanism which is shown in Fig. 2. As here shown, a speaker key 22 is pivotally mounted as at 23 and has a pad cup 24 on one end which contains the pad for controlling the opening and closing of the speaker hole 15. The other end terminates in a spatulate thumb portion 25 located immediately above the conventional thumb hole 26. A suitable spring (not shown) maintains the speaker key 22 normally in the proper position to close the speaker hole 15 at all times except when an opening force is applied by the thumb of the player to the spatulate thumb portion 25.

The opening and closing of the resonance hole 16 is controlled by a pad carried in the pad cup 27 which is mounted on a rotatable sleeve 28 which is normally held by a conventional spring (not shown) in the position to close the resonance hole 16. A thumb ring 29 is placed concentric to the thumb hole 26 and is connected with a

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rotatable sleeve 30. The rotatable sleeve 28 and the rotatable sleeve 30 are mounted on a common shaft (not shown) which also carries a rotatable sleeve portion 28A. The shaft is mounted in a plurality of posts 31 which are secured to the body of the instrument. An L-shaped arm 32 is secured to the sleeve 30 and underlies an arm 33 which is secured to the rotating sleeve 28A. Another L-shaped arm 34 is secured to the rotating sleeve 28A and underlies an arm 35 also secured to the sleeve 28. An arm 36 is secured to the speaker key 22 and overlies an arm 37 secured to the upper portion of the rotatable sleeve 28.

The key mechanism above described is associated with other key mechanisms of the clarinet as shown in Fig. 3. As here shown, the L-shaped arm 32 has an end which underlies an arm 40 carried by the rotatable sleeve 41 to which is attached the first finger ring auxiliary key 43 which underlies the spatulate end 42 (shown in dotted line) of the pivotally mounted A key 45. The first finger ring auxiliary key 43 is closed by the action of the first finger ring 44. The first finger ring auxiliary key 43 is normally held open by a spring (not shown).

Other keys shown in this figure include the pivotally mounted side G sharp key 46, the side B—C trill key 47, and the side B—B flat trill key 48. These keys are here included merely as being representative of the conventional keys on such an instrument and to show how the key system of the present invention may be readily associated therewith without changing the fingering of the instrument.

The operation of the above described key mechanism is as follows: When thumb pressure is applied to the spatulate end 25 of the speaker key 22, it is caused to pivot about the pivot point 23 and the speaker hole 15 is opened. At the same time, the arm 36 is raised and the arm 37 is allowed thereby to raise and permit rotation of the rotatable sleeve 28 by the action of the spring (not shown). This rotation causes the resonance key 27 to be raised and the resonance hole 16 to be opened. Thus, with both the speaker hole 15 and the resonance hole 16 open and with the A key 45 opened, the tone B flat is produced with a full resonance and its true pitch.

When it is desired to close the resonance hole 16 and open the speaker hole 15 for the production of the tones in the upper or overblown register, the A key 45 is closed, the thumb ring 29 is depressed and the thumb hole 26 is closed by the action of the player's thumb while the speaker key 22 is held open. This raises the arm 32 which in turn raises the arm 33 and rotates the sleeve 28A to raise the arm 34 which in turn raises the arm 35 and moves the resonance cup 27 to its position for closing the resonance hole 16.

If the thumb ring 29 is depressed while the speaker key 22 is closed the spring action of the speaker key 22 transmitted through the arms 36 and 37 to the rotating sleeve 28 is sufficient to hold the resonance cup 27 on the resonance hole 16 and to nullify action of the thumb ring 29 as concerns the opening or closing of the resonance cup 27 on the scale 16. In this instance, the thumb ring 29 acts in a conventional manner through the arms 32 and 40 to control the closing of the first finger ring actuated key 43.

From the foregoing, it will be seen that the key mechanism and the tone holes provided by the present invention are additions to the key mechanism and tone holes of a conventional

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Boehm system instrument and that they may be employed without changing the normal fingering thereof. Thus, the tone holes and key mechanism of the present invention may be employed advantageously either in the production of new instruments or as additions to existing instruments. In either instance, the present invention permits the production of a resonant B flat of true tone and the production of true tones in the overblown or upper register of the instrument when the speaker hole is open.

Having thus described my invention, what I desire to secure by United States Letters Patent is:

I claim:

1. A wood wind instrument having a spaced register hole and a B flat tone hole adapted to produce when opened with said register hole and with the A hole of the instrument, a divided air column for producing a rational fundamental resonant B flat of true tonal properties, a key mechanism for operating pads to selectively open and close said register hole and said B flat tone hole, said key mechanism including a pivotally mounted thumb operated key for controlling the opening and closing of the said register hole and said B flat tone hole and a thumb ring for controlling the separate closing of the said B flat tone hole when said thumb operated key is in its raised position to open said register hole.

2. A wood wind instrument as claimed in claim 1 and further characterized in that the said B flat tone hole is spaced circumferentially downstream from said register hole.

3. A wood wind instrument as claimed in claim 1 and further characterized in that an operating arm is interposed between said thumb ring and said B flat key to control the closing thereof by actuation of said thumb ring.

4. A cylindrical pipe wood wind instrument having a speaker tone hole located at a node in the air column in the upper joint of the instrument and adjacent the tuning barrel and sized when opened to produce in the upper register the true duodecims of the tones of the lower register of the instrument, and a separate resonance

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hole spaced from said speaker tone hole and sized to produce when opened with said speaker tone hole and the A tone hole a true toned resonant B flat, and a key mechanism for selectively operating pads to open and close said tone holes a pivoted thumb key for opening and closing said speaker tone hole and a thumb ring surrounding the thumb hole for selectively operating a pad to close said resonance tone hole when said speaker tone hole is open.

5. In a Boehm system clarinet, a register aperture in the upper joint thereof adapted to produce, when opened, an upper register having true toned duodecims of the fundamental register, a resonance aperture in the upper joint thereof and spaced circumferentially downstream from said register aperture and adapted to produce when opened with said register aperture and the opened A key, a true toned resonant B flat, and a key mechanism for selectively opening and closing said apertures.

6. A Boehm system clarinet as claimed in claim 5 further characterized in that said key mechanism comprises a pivoted thumb key for opening and closing said register aperture and a separate thumb ring for selectively operating a pad for closing said resonance aperture while said register aperture is open.

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367,347	France	June 22, 1906
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