

March 20, 1956

S. RITTERBACH

2,738,696

TONE ADJUSTING MEANS FOR BRASS WIND INSTRUMENTS

Filed Nov. 5, 1952

Fig. 1

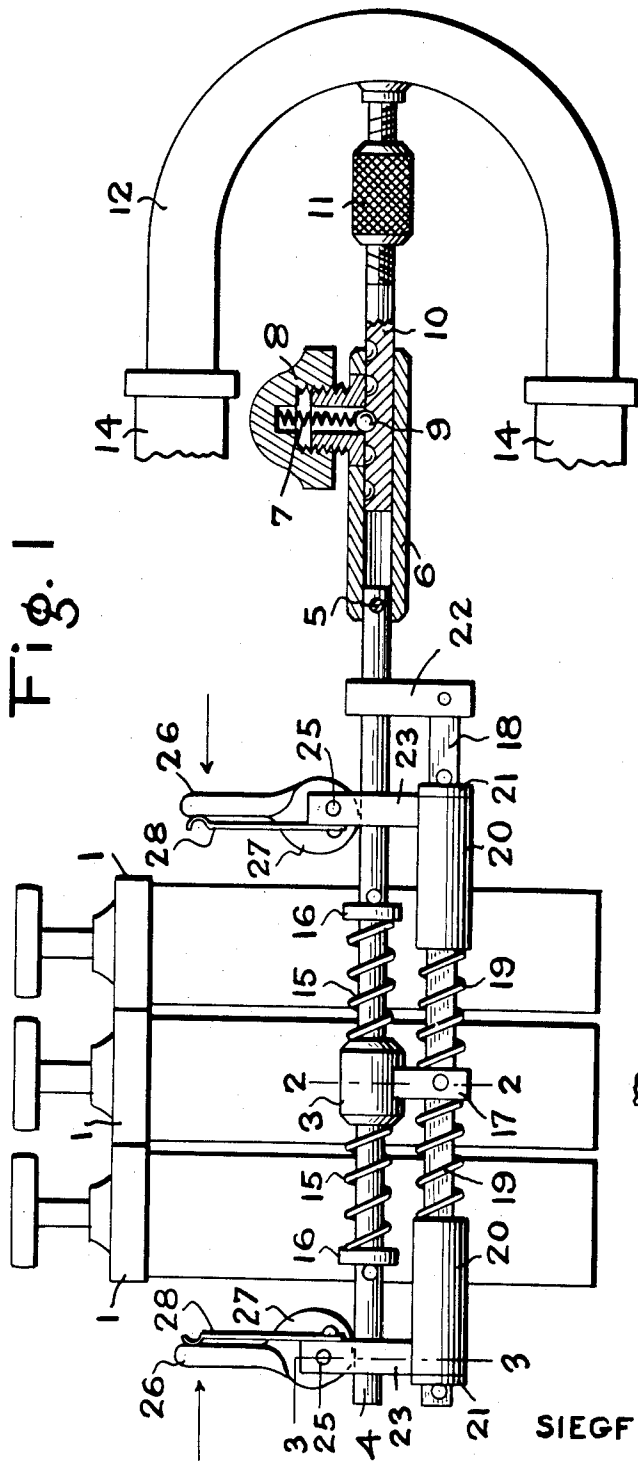


Fig. 2

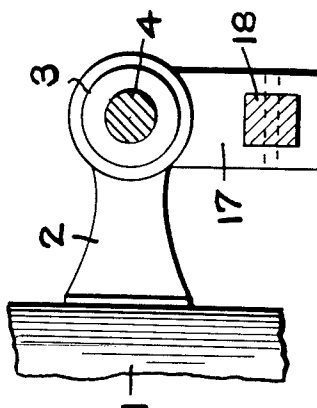
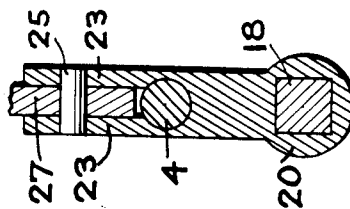


Fig. 3



INVENTOR.
SIEGFRIED RITTERBACH

BY

Connolly and Hulse
HIS ATTORNEYS

1

2,738,696

1 TONE ADJUSTING MEANS FOR BRASS WIND INSTRUMENTS

Siegfried Ritterbach, Munich, Germany

Application November 5, 1952, Serial No. 318,841

3 Claims. (Cl. 84—394)

This invention relates to tone or pitch adjustment in brass wind instruments. More particularly this invention relates to an improved brass wind instrument construction which includes integral structure for obtaining true faultless tuning under widely diverse performance conditions.

In practically all present valved brass wind instruments only a few tones are precisely in tune, most of the tones being regularly too high or too low, due to the construction of the instrument. Accordingly, the performer must "drive" them with the mouthpiece, which, however, is not always possible to the required degree. This method of operation endangers the setting up and holding of the tones, is detrimental to the tone color (timbre), weakens the endurance of the lips and renders vibration difficult. Furthermore, due to the poor tuning, the 6, 10, 12 and 14 aliquot tones are useless and a higher aliquot tone must be used necessitating a longer air column.

Among the known causes for the tuning defects are: changes in air temperature which change the number of air molecules in the instrument (cold air makes the instrument lower while warm air makes it higher in tone); the difference between "pure aliquot tones" and the "tempered" tuning of present day practical music; the difference between the actual length of the individual graduated valve tube channels and the required lengths of the same upon combined employment of the valves; the varied length of the cylindrical middle tube due to use of the valve which changes the total course of the air column and thereby the degree of the "konik" (cone formation); the change in pitch when obtaining extremely strong sounds due to increased introduction of air into the instrument and a greater densifying of the air whereby the breadth and number of vibrations in the air molecules experience a change; and pitch changes due to diverse methods of blowing to which the performers are frequently forced by over exertion of the lips in order still to bring forth strong tones of long duration.

The above named factors tend in practice to compensate each other; however, they may have an additive effect and operate in the same direction so strongly upon the height of the tone that only a performer of the very highest qualifications can correct the great defects. Further, with conventional valved brass wind instruments the performer can experimentally compensate for changes in air temperature by adjustment of the main tune passage and the valve tune passages, but this only during a pause in the playing. All other prior attempts to reduce the above enumerated drawbacks have proved unsatisfactory in practice; the known devices for adjusting the length of the air passageways at the first and third valve attain only a partial solution in the most favorable case because only such tones whose air stream passes through the first and third valve passageways are influenced.

Accordingly, it is the main object of the instant invention to eliminate the above enumerated difficulties and produce a valve wind instrument which is inherently capable of precise adjustment to produce pure tonal qualities under diverse ambient conditions of operation. It is a

2

further object to produce a tone adjustment means for valved brass wind instruments which is readily and easily manipulated during the operation of the instrument. It is a still further object of the invention to provide a tone adjusting structure which may compensate to the high and the low side of the medial basic tonal pitch. Other distinct objects will become apparent from the description that follows.

The instant invention proposes to avoid the above enumerated difficulties by combining the excellent characteristics of the single brass wind instrument which is capable of automatically correcting tone faults due to ambient circumstances, i. e., a trombone, within the structural arrangement of valved brass wind instruments. The rectification permitted by adjustment of the main slide of conventional trombones readily eliminates tonal faults due to the previously enumerated circumstances, but such structure up to the present time has not been satisfactorily incorporated into other valved brass wind instruments. This failure in all probability stems from the fact that the performer of a valved brass wind instrument is normally fully occupied with the maneuvers of operating the various valves with one hand while supporting the instrument with the other. Up to the present invention no one has even devised a satisfactory solution whereby the simple tone adjusting characteristics of the trombone could be incorporated into similar brass wind instruments without requiring difficult and tiring manipulative acts on the part of the performer.

Broadly, the invention may be described as consisting of a valved brass wind instrument wherein the main tune passage is made readily slidable, in like manner to the slide of a trombone, and connected through resilient biasing means to an operating mechanism mounted adjacent the usual digital operated valves. With this construction the performer may move the main tune passage against the resilient biasing to either of two limit positions to produce a higher or lower pitch for a desired duration after which the main tune passage will be automatically restored to its preset medial position by virtue of the resilient biasing means. This construction is readily applicable to structurally simple instruments such as the trumpet, French horn, and tuba, since in each case the adjustable main tune passage is positioned relatively close to the digital operated valve members so that a simple structural arrangement will suffice. In the case of large instruments, such as parlour-organs, the adjustment must be attained through intermediate control mechanism such as rods-levers, etc. In the latter case a suitable control element such as a hand knob or a foot treadle may be positioned for easy access and may function through mechanical, hydraulic or electromagnetic devices to adjust the main tune passage.

Some instruments such as tenor horns in B flat require twice the passage length of a trumpet in B flat, while in others such as base tubas in B flat the tune passage must be quadruple that of the trumpet in B flat. It is therefore necessary that for similar pitch corrections in different instruments the movement of the main tune passages must vary widely. This, however, is easily compensated for in fact that such instruments usually employ two movable channels or passageways so that, as in the case of doubled tune passageways in tenor horns, movement of the passageways changes the length of the air columns by quadruple the length of movement of the actuator due to the fact that four passage tubes are displaced relative to each other. In such case it is advisable to provide a plurality of actuating members or levers so that one may maintain one set of tune passageways at rest while the other actuates a second set and vice versa.

Preferably the main tube passageway is arranged in a

manner similar to the main slide of trombones so that movement thereof may correspond with the previously conceived mental concept of direction of movements which the performer has inherently derived from making tone corrections on conventional type instruments.

If the main tune passage is actuated to its limit positions by two levers, then the tone raising lever should have a direction of movement towards the mouth and the tone lowering lever a direction away from the mouth. In the case of pedals it should be arranged so that when the pedals are depressed the tone becomes lower and when the pedals are raised the tone becomes higher.

One of the advantages of the instant invention is apparent in cases where the performer is to play an entire portion of a composition in an extremely strong sound, for example "pianissimo," or in case he has to employ a damper which raises all tones of his instrument uniformly, then all tones would sound too high. Nevertheless the performer must correct individual tones and if he has in addition to correct all tones downwardly this would be difficult for him and tire him. Also he would have to leave the safe basis of the basic tune fixed, i. e. the main tune passage or slide would remain in the initial position. By lengthening the basic position of the main tune passage into the required new position one may overcome this difficulty. The new basic position provides the basic tune in combination with quiet blowing (or with the higher making damper) with the old or basic sound pitch. Upon blowing loudly (and with a lower making damper) it is correspondingly the reverse.

The necessary supplemental basic register positions, as for blowing extremely loudly, and for use of badly tuning dampers, may be predeterminedly fixed by conventional detent devices. These devices could, like in the organ and parlour organ, be named as "piano" and "forte" registers. With them the performer can also approach with the greatest ease the extreme limits of sound strengths.

Having generally disclosed the invention an exemplary embodiment as applied to a trumpet will now be specifically described with reference to the attached drawings, and in which:

Fig. 1 illustrates a partial schematic, partial fragmentary view of the invention applied to a trumpet.

Figs. 2 and 3 are sectional views of particular elemental parts of the invention.

In the drawing, 12 illustrates the slidable main air tube or passageway of a conventional trumpet and which is adapted to reciprocate without resistance in the usual fixed support tubes or passageways 14, the remainder of the trumpet structure being omitted for the sake of clarity with the exception of the conventional digital operated valve members (three in number) indicated generally by the numeral 1. Mounted upon the cylinder of the second or middle valve 1 is a guide member 3 having a central cylindrical bore. This guide member includes a socket element 2 which may be fixedly connected to the middle valve cylinder by any conventional means such as screws, soldering, etc.

A reciprocable or slidable rod section 4 is mounted in the cylindrical bore of the guide 3 and carries at its right-hand extremity a cylindrical or tubular sleeve support member 6, the latter being connected to the rod as by means of a rivet or cotter pin 5. The cylindrical extension or supporting sleeve 6 in turn supports a threaded socket 7 upon which an adjustable closure cap 8 is mounted, the cap 8 being adapted to be threaded to and fro on the socket 7.

A second rod section 10 extends within the bore of the support sleeve 6 and has at its left-hand end a plurality of semi-spherical depressions and, at its right-hand end, is threaded for cooperation with a turnbuckle sleeve 11. The turnbuckle sleeve 11 in turn is threaded upon a rodlike extension 13 which is integrally connected to the reciprocable tube passageway or slide 12. It will thus be

apparent that the rodlike extension 13, sleeve 11 and rod section 10 cooperate to form an adjustable linkage connection between the slide 12 and the rod section 4. In this respect the threaded socket 7 houses a conventional locking detent structure including a spiral spring and a ball 9, the ball 9 being spring urged to cooperate with the depressions in the left end of the rod section 10 and locks such rod section to the sleeve 6 and therewith the rod section 4.

Adjustment of the relative spacing between the ends of the rod sections 10 and 4 are accommodated by virtue of the threaded lock nut 8 which may be loosened to permit movement of the ball 9 into any of the depressions carried by the rod section 10. With the above construction the right-hand end of the rod section 4 can be brought into five different predetermined distances (corresponding to different registers) from the left-hand end of the rod section 10 by virtue of the five depressions formed in the rod section 10 and the cooperation therewith of the locking detent 7, 8 and 9.

The turnbuckle 11 permits finer differential adjustments between the rod section 4 and the slide 12. In one direction of rotation the turnbuckle sleeve 11 separates the rodlike extension 13 from the rod section 10 and thereby the slide 12 from the rod section 4; while in the other direction of rotation the turnbuckle 11 brings the rodlike extension 13 and the rod section 10 closer together and thereby the slide 12 and rod section 4 in like manner. The several rod sections 4, 10 and 13 cooperate together to provide a simple unitary control device for correcting tonal faults while permitting precise and fine adjustment for different ambient conditions.

On each side of the guide 3 there are provided opposed seating flanges 16 which are affixed to the rod section 4 and which cooperate with respective spiral springs 15 disposed between such flanges and the adjacent side face of the guide member 3. The springs 15 are of equal weight or tension and function to resiliently urge the rod section 4 to a medial or central position. Displacement of the rod section to either side of the centered position compresses either of the respective springs 15 to store energy therein for subsequently returning the rod section to the centered position upon release of the displacement force.

A depending noselike extension 17 integrally projects from the guide 3 and includes a central rectangular opening which functions as a seat for a second guide bar 18 fixedly mounted therein as by riveting or by cotter pins, etc. The right-hand end of the guide bar mounts a crosshead member 22 having a guide bore (not illustrated) for accommodating and guiding the rod section 4 in its to and fro movement.

A pair of opposed slidable shoe members 20 are mounted to reciprocate along the bar 18 on either side of the nose 17 and include upwardly projecting arms 23 for a purpose hereinafter explained. A second pair of helical springs 19 are disposed about the bar 18 between the inner opposed end faces of the respective shoes 20 and the coaxial faces of the nose 17 to thereby resiliently urge the shoe members 20 away from the nose 17. Flange members 21 are fixedly mounted on the bar 18 and serve to limit the movement of the shoes 20 under the action of the springs 19.

The upwardly projecting arms 23 of the shoe members 20 may be made of any suitable spring type metal or like substance whereby they may be snapped over the rod section 4 and retain the same with a relatively loose grip. These arms support a pivot pin or arbor 25 upon which is rotatably fixed a key operated cam element 26, 27. The cam 27 has an active surface along an eccentric radius to the pivotal axis 25 and functions to lock the rod section 4 to the key member 26 when the key is depressed in a direction of the arrow. This action also serves to lock the rod section 4 via cam 27 and the pivotal axis 25 to the slidable shoe member 20 and prevents any

looseness or lateral play in the structural arrangement. Suitable springs 28 are positioned to hold the key levers 26 in a normal upright and inoperative position wherein the rod section 4 is free from contact with the cams 27 or the shoes 20.

When blowing, the instrument is held with the left hand in such a manner that the thumb and ring finger may freely and movably rest upon the respective lever keys 26 without pressure. If now a tone is blown which would, for example, sound too high, then the performer presses with the thumb against the back lever key 26. Through this pressure, the corresponding sliding shoe 20 becomes connected firmly with the pull rod section 4, and through further pressure the pull rod section 4 is displaced in the direction of the pressure against resistance of the centering springs 15 and 19. The air tune passage or slide 12 connected with the pull rod section 4 is thus brought into the position required for the correction.

Should the performer have to discontinue the correction in the next moment, such is immediately obtained by a release of pressure, and a small movement of the thumb contrary to the previous direction of pressure for releasing the lever key 26 and cam 27 from connection with the pull rod section 4. The spring pressure of the spring 19 is so calculated that the spring 28 exerts a stronger pressure than the spring 19, so that the pull rod section 4 returns with high speed into its original position without being hindered by the slowness of the finger movement. In case of necessity however it is also possible to effect a slow return of the pull rod section 4 by feel as by maintaining a light retarding thumb pressure since the pressure difference between the springs is small. In this manner it is possible to make both rapid and also slow corrections.

When the thumb has pressed the air tune passage on slide 12 into the above-mentioned position of correction, it is possible to retain the ring finger in place because the second sliding shoe with the corresponding lever key is not influenced by the movement of the pull rod section 4. This is of particular advantage when it is intended to go immediately from the above mentioned correcting position, attained by the pressure of the thumb, into a new correcting position which lies at the other side of the basic tonal position, whereby upon return of the thumb, and shortly before reattainment of the basic position, the ring finger may be pulled upon or pressed against its lever key to provide the new change without delay.

Should the performer want to insert or remove a register for the sound strengths during a performance, he may block the movement of pull rod section 4 by simultaneously pressing both lever keys 26 with one hand and directly grasp the slide or air tune passage 12 with the other hand to move it against the resistance of the detent spring in the cap 8. This latter adjustment may be easily accomplished during a few rest bars without requiring removal of the instrument from playing position.

By turning the double threaded turnbuckle 11 the performer can make fine adjustments in the position of slide 12 to compensate for any change in the temperature of the air.

In the case of instruments which have the adjustable main tune passageway or slide tube oriented to reciprocate along an axis which is at angle to the valve alignment and mouthpiece it is necessary to either reorient the slide to coincide with the directional axis of the mouthpiece and valves or to incorporate a supplemental linkage as a connection between the end of the rod terminal section 13 and the angularly related slide piece. In the former case, the entire instrument configuration must be rearranged, while in the latter, it is possible to adopt existing instrument structures to operate according to the instant invention.

To accomplish this latter innovation it is only necessary that the terminal rod section 13 be connected, as by a pivot pin, to one end of a bell crank or pivoted lever

which in turn has its other end fixedly connected to the adjustable main tune slide tube. Due to the firm support provided for the pull rod section 4 by the particular arrangement previously described, it is unnecessary to support extended terminal end section 13 by any additional means. However, if such is desired, it is easily provided by permitting the extended end of section 13 to reciprocate to and fro in a suitable boss or bearing supported on a fixed portion of the instrument. The translating bell crank or lever may also be pivoted about an arbor or pin supported on a fixed portion of the instrument. No further change in structure is required.

With the above construction, the instrument may be operated in an identical manner to that previously described for the trumpet, the only difference being that the changes in length of main air tune passageway will be provided indirectly by the translating linkage (i. e., bell crank or lever) in lieu of directly by the rod section 13.

Adjustments, either up or down, of the register from its basic position (i. e. with ball 9 in the central one of the five depressions on rod section 10) may also be attained in identical manner to that previously described, the only difference being that the performer will actuate the air tune slide tube in a direction which is at an angle to the directional movement of rod sections 10 and 13, the movement being translated to section 10 via the translating linkage (i. e. bell crank or lever).

In the case of large instruments, such as parlour organs, the control device of the present invention may be located adjacent the keyboard in easy reach of the performer and the movements of the rod section 13 may be translated to the adjustable main air tune passageway by any suitable servo mechanism such as a hydraulic system, or an electro-magnet, or an electric motor in the usual manner of follow-up mechanisms.

It further will be obvious to those skilled in the art that the resilient biasing springs 15 and 19 may be replaced by other like biasing means such as hydraulic or pneumatic dashpot constructions, electro magnets, and permanent magnets. In the latter case, the guide post 3 may be formed as a permanent magnet while the central portion of rod section 4 may be magnetized so that it will always tend to center itself within the bore of the guide post.

One important advantage of the instant invention resides in the fact that the tonal corrections may be accomplished by simple manipulative movements in a manner which is natural and instinctive to the performer and which also closely corresponds to movements inately acquired in previous experience on conventional like instruments. This advantage dispenses with the need for additional training and requires only a few practice sessions for the performer to fully familiarize himself with the new movements.

What is claimed is:

1. A brass wind instrument having at least one tubular main air tune passage including a section which is readily slidably adjustable to change the length of the passage, a control device connected to said slidable section and being readily displaceable in two directions, said control device including resilient means biasing said device and said section to a basic position, and actuator structure connected to said control device for displacing same to either side of said section basic position.

2. A brass wind instrument according to claim 1 in which said control device includes adjustable sections which are displaceable one from another, and means to adjust the spacing of said sections from each other.

3. In a brass wind instrument having at least one tubular main air tune passageway including a section which is slidably adjustable to change the length of the passageway, said instrument further including at least one valve element for controlling the flow of air in said passageway, the improvement which comprises means for selectively

adjusting pitch and tone and including a reciprocable control device positioned adjacent said valve element and including separate displaceable and spacially adjustable sections, translation structure connecting one of said adjustable control sections to said slidable air tune passageway section, manipulative control structure connected to a second one of said control sections adjacent said valve element and adapted to reciprocate said second section in either direction, and adjustment means connecting all said control sections in predetermined spacial relation-

5

10

ship to each other and said slidable air tune passageway section and said valve element and wherein there are biasing means connected to said second control section yieldingly biasing it to a central position.

References Cited in the file of this patent

UNITED STATES PATENTS

828,273	Conn	Aug. 7, 1906
	FOREIGN PATENTS	
305,385	Great Britain	Feb. 7, 1929