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Sandner

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[54] **CYLINDRICAL FLUTE**

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[30] **Foreign Application Priority Data**

Apr. 22, 1971 Germany ..... P 21 19 616.7

[52] **U.S. Cl.** **84/384**, 84/386

[51] **Int. Cl.** **G10d 7/02**, G10d 9/00

[58] **Field of Search** 84/384, 386, 380, 84/383

[56] **References Cited**

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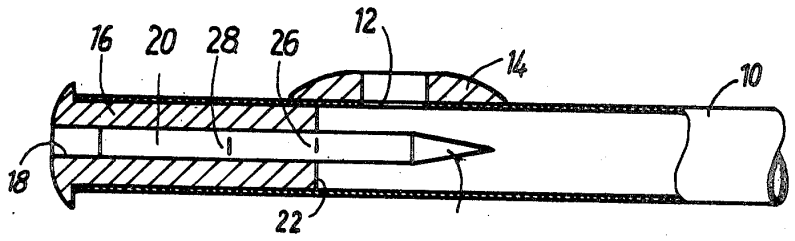
[57] **ABSTRACT**

The specification describes a flute with a cylindrical bore whose blowing end is closed by a transverse wall at or behind the embouchure (the labial in the case of a recorder-type flute or the blowing hole in the case of a transversely blown flute). The flute is provided with means for correcting the sound of the flute so as to obtain the pure tonality which would otherwise not be obtained owing to the cylindrical bore of the flute.

3 Claims, 6 Drawing Figures



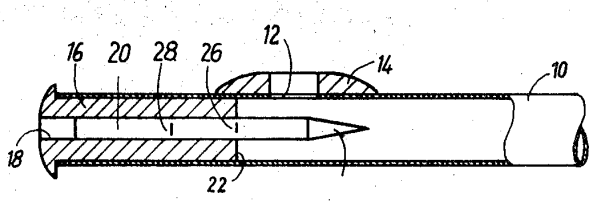


Fig. 1a

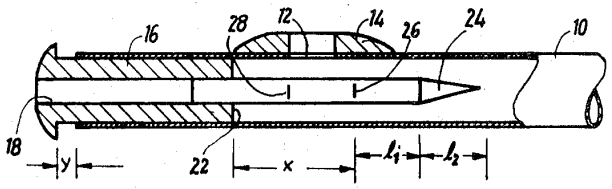


Fig. 1b

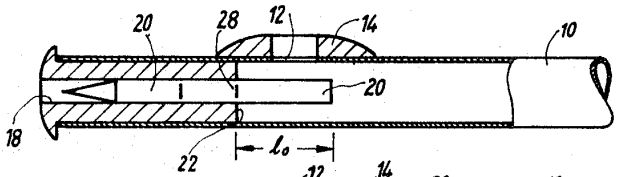


Fig. 2a

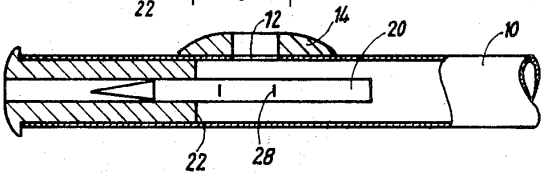


Fig. 2b

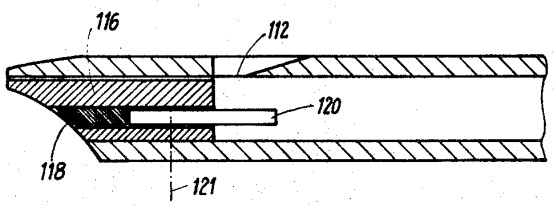


Fig. 3a

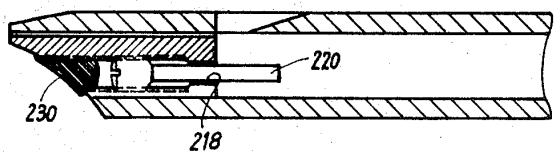


Fig. 3b

CYLINDRICAL FLUTE

The present invention relates to cross blown and end blown flutes with a cylindrical bore and more particularly to such flutes whose blowing end is provided with a transverse wall at or behind the blowing opening (the labial in the case of recorder-type or end blown flutes and the blowing hole in the case of cross blown flutes) means being provided for correcting tuning of the instrument to obtain the pure tonality which would otherwise not be obtained owing to the cylindrical bore.

Additionally flutes have mainly been made with a completely or partially conical bore or measure. Thus, in the case of Meyer's flute the bore runs along the whole length of the flute and tapers towards the free end, while in accordance with Schwedler's flute the bore is cylindrical for the first quarter of the flute length and for the remaining three quarters of the length of the flute the bore is conical and at the free end it tapers. In the case of Bohm's flute there is a widening conical bore for the first quarter of the length of the flute, which is followed by a cylindrical bore for the remaining three quarters of the flute length. Many attempts have been made to replace a conical form of bore, which is difficult to make by a cylindrical bore which can be produced readily. These attempts were made more especially in the case of flutes made of metal tubes.

A strictly cylindrical bore, however, leads to the disadvantage that the tuning of the instrument is lost. Thus, although the basic notes are correct in pitch for 3/2 octaves, beyond this range the octave notes are flat, and must therefore be made more sharp using suitable means.

For this purpose the German Pat. Specification No. 1,111,914 proposes a recorder-type flute with a cylindrically bored body tube and a pipe tube connected with it, a cylindrical widening of the cross-section being provided below the vicinity of the embouchure, this being achieved by the pipe tube being held at a distance from the body tube by an inserted sleeve. This widened cross-section extends over a length of approximately 12 mm.

Furthermore, the German Gebrauchsmuster No. 1,994,229 proposes the recovery of the pure instrument tuning, which would otherwise be lost owing to the completely cylindrical bore, by adopting the feature that the bore has a portion which is narrower and is cylindrical adjacent to the embouchure. This narrowed portion can be obtained more especially by reducing the diameter of the tube.

All these known proposals, whether they relate to the use of a conical bore, a cylindrical restricted part of the tube or a broadened part of the tube for obtaining true tuning of the instrument have the disadvantage that it is only possible to produce flutes of consistent quality with these features if all tools are very precisely checked which are used for the production of the bore in question. Furthermore, there are difficulties on the part of companies supplying flute components to provide accurate cylindrical tubes with small tolerances, or in the case of wood and plastics material wear of the tubes used for making the bore cannot be avoided so that effects consistently occur which prevent there being a true tuning of the instrument. These effects cannot be avoided.

This constant and onerous checking of the tools and the raw materials used for flute production can be avoided in accordance with the invention in the case of the production of flutes of the type mentioned above by using a correcting means in the form of a plug extending from the transverse wall adjacent to the embouchure.

It has been found that by suitable adjustment of the length of the plug the octave notes can be both made sharper and flatter to an above average extent without the flute tube or the setting of the transverse wall, which is constituted mostly by a stopper provided on the embouchure side, being changed.

If in the particular case in hand it is a question of a cross blown flute, the plug can be used to overcome a problem which had not previously been dealt with in an extremely simple manner: As is known the precise pitch of the octave notes of a cross blown flute depends upon the lip thickness of the player. If he or she has thick lips, the note is pressed, that is to say sharp and vice versa. These variations in pitch found in prior art flutes can be compensated for with the adjustable plug in accordance with the invention without any difficulty.

Furthermore, in the case of flutes in general there are also certain variations in pitch of the basic notes themselves, which are partly due to manufacturing tolerances and partly to temperature differences etc. For the compensation of these pitch variations recourse was previously had, for example in the case of a recorder made up of a pipe tube and a body tube fitted together, making a slight change in the relative position of these two parts. In the case of a cross blown flute various types of longitudinally sliding stoppers have been used for the same purpose. However, the change, produced by these measures taken to harmonize with other instruments, in the length of the bore led to the tuning of the octave notes become somewhat impure again. For in the case of all flutes there is a close relationship between the position of the transverse wall and the particular chosen correcting means for recovering the pure or true instrument tuning (that is to say completely or partly conical bore, cylindrical widening of the tube or narrowing of the tube), so that every change in the length of the the bore has a disadvantageous effect on the pureness of the octave. In this case as well the plug in accordance with the invention provides a remedy in the simplest manner using a corresponding setting of the plug. Thus, for example when the stopper of a cross blown flute is drawn out somewhat for tuning to agree with other instruments, the plug only extends somewhat further into the tube in order to obtain a true tuning of all notes. In this respect the correcting device in accordance with the invention in the form of a plug is suitable for all forms of flute with means to harmonize with other instruments, whether they are com-pletely or partly conical or cylindrical.

Owing to the simplified production of flutes in accordance with the invention it is preferred for the plug to be tubular and more particularly to have a circular cross-section. It has also been found possible to use a plug which for at least part of its length is conical. In this case the cone can taper towards the free plug end and may run to a point. It is also possible to provide spherical thickened portions on the free end of the plug. As regards the particular form of the plug there is substantial latitude. The plug, however, does cer-

tainly not need to be parallel to or coaxial with the axis of the bore of the flute, even although the latter form is preferred owing to reasons of simplicity in production.

It has been found convenient to use an average plug diameter of 30 to 70 percent, preferably 40 to 50 percent of the bore diameter, while the plug length in the normal position amounts to 3 to 16 percent, preferably 7 to 11 percent of the bore length, the larger plug diameters corresponding to the shorter plug lengths and vice versa. The term "normal position" means in this respect the plug length in the case of a flute produced with the manufacturing tolerance of zero with respect to an average lip thickness of the player. The adjustability of the plug is generally between +1/6 and −1/17 of the flute length.

It should also be remarked in this connection that in the case of cross blown flutes the transverse wall defined by the stopper is generally spaced from the upper edge of the embouchure by a distance equal to 20 and 70 percent of the bore diameter. If the plug used has a thickness below the above-mentioned limit, the mechanical stability of the plug is insufficient and the possibility of adjustment is too small. Plugs which are thicker than the above-mentioned range cause the tone to become blunt.

Finally, in the interest of facilitating tuning of the instrument it is to be recommended to provide the longitudinally sliding plug with suitable calibration marks. These calibration marks should give the most often metwith lip thicknesses in the case of a cross blown flute.

In what follows the invention is described with reference to embodiments shown in the accompanying drawings.

FIGS. 1*a* and 1*b* show in longitudinal section the embouchure end of a transversely blown flute in accordance with the invention.

FIGS. 2*a* and 2*b* are views corresponding to FIG. 1 of a modified embodiment.

FIGS. 3*a* and 3*b* are sectional views through the embouchure end of a recorder or recorder-type flute in accordance with the invention.

The cross blown flute shown in FIGS. 1*a* and 1*b* has a cylindrical bore defined by the flute tube **10.** The flute tube **10** is provided with the required note holes which are not shown. The embouchure **12** is in the form of a cross blowing hole and has a rest **14.** The left end of the tube **10** as shown in FIG. 1 has a stopper **16** which can be moved in the length direction and is provided with a hole **18** for receiving a cylindrical plug **20.** The plug projects beyond the transverse wall **22,** formed by the stopper, adjacent to the embouchure **12.** At its free end it is provided with a conical part **24** running to a point. Reference numeral **26** denotes a calibration mark for the projecting length of the plug **20,** which when the stopper **16** is completely inserted gives true tuning for average lip thickness.

Two examples now follow which relate to a C-cross blown flute tuned to A=880 Hz.

EXAMPLE 1

Bore diameter	12 mm
Distance between transverse wall **22** and start of upper edge of embouchure: 20 to 70 percent of bore diameter,	
Overall plug length $l_0 = l_1 + l_2 =$	25 mm
Length of cylindrical plug part **11**	13 mm
Diameter of cylindrical plug part	6 mm
Length of conical plug part **12**	12 mm.

EXAMPLE 2

Bore diameter	12 mm
Distance between transverse wall **22** and start of upper edge of embouchure: 20 to 70 percent of bore diameter,	
Overall plug length $l_0 = l_1 + l_2$	30.4 mm
Length of cylindrical plug part l_1	18.4 mm
Diameter of cylindrical plug part	5 mm
Length of conical plug part l_2	12 mm.

FIG. 1*b* also shows the case in which the stopper **16** is drawn out a distance *y* for adapting the flute tuning to other instruments. For obtaining a pure or true tuning of the octave notes, which would otherwise be lost, the plug **20** must be displaced by a distance *x*. For a stopper displacement in the outward direction of $y =$ 2.5 mm in the case of a cross blown flute in accordance with example 1 the displacement $x = 8$ mm, the plug being further pushed in by this amount, while on drawing out the stopper by an *y* distance of 5 mm *x* lies at 24 mm (the latter case is shown generally in FIG. 1*b*.

As mentioned above the most varied types of plug can be used. Owing to particularly easy production a truly cylindrical plug shape is preferred. FIGS. 2*a* and 2*b* therefore indicate the case in which the plug **20** is simply inserted in a reversed direction. For this case the calibration mark **28** applies, which thus has the same meaning as the above-mentioned calibration mark **26.** For a truly cylindrical form of plug two examples are given also.

EXAMPLE 3

Plug length l_0	19 mm
Plug diameter	6 mm

Remaining dimensions as in example 1.

In the case of a plug adjustment of up to ±14 mm in the flute in accordance with examples 1 and 3 the octave notes can be changed by up to approximately ±14 Hz.

Large adjustments in the plug are possible but require correspondingly longer plugs.

EXAMPLE 4

Plug length l_0	26 mm
Plug diameter	6 mm

Remaining dimensions as in example 2.

FIG. 2*b* shows the case in which the plug **20** has been inserted somewhat in order to take into account the lip shape of the player concerned.

FIGS. 3*a* and 3*b* show the plug in accordance with the invention in conjunction with a completely cylindrical recorder or recorder-type flute. As shown in FIG. 3*a* the plug **120** is inserted into the transverse wall **122** formed by the core **116** of the flute mouth piece and extends in the vicinity of the labial **112.** In the example shown the plug **120** is offset in relation to the flute axis and accommodated in a corresponding hole or bore **113.**

After tuning the flute initially the plug **120** can be pinned in position for example. The plug **120** can then be pinned generally at **121,** following which the rear part of the bore **118** is conveniently closed.

FIG. 3*b* shows a recorder in the case of which the plug is mounted in an adjustable manner in the core. The bore **280** is bored out in its rear part to a larger di-

ameter and provided with a thread and the plug **220** has its rear end continued in the form of a grub screw screwed into the threaded hole. The plug setting can thus be varied after removing the stopper **230**, closing the threaded hole, with a screwdriver.

Numerous other modifications for an adjustable plug holding arrangement are possible. For example, for this purpose a rack drive could be used in conjunction with a knurled wheel accessible from the outside. It is also possible in principle, in the case of a flute with a tuning device, to arrange for movement for the tuning device to be accompanied by movement of the plug for adjustment using cam drives so that on changing the tuning device setting in order to bring about basic tuning to agree with other instruments the plug is also correspondingly adjusted so that true tuning in the overtones is always ensured.

What I claim is:

1. A flute having a cylindrical bore, a stopper mounted in one end of the bore and having a transverse wall adjacent the embouchure, a plug carried by the stopper and extending from the transverse wall into the bore of the flute a distance of between 3 to 16 percent of the bore length and having a diameter of 30 to 70 percent of the bore diameter.

2. A flute as defined in claim **1** wherein the plug is movably mounted in the stopper to permit adjustment of the extension of the plug from said transverse wall into the bore of the flute.

3. A flute as defined in claim **1**, wherein the stopper is adjustably mounted in said one end of the bore.

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