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[54] **ADJUSTABLE TUNING BARREL**

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[51] **Int. Cl.⁵** **G10D 9/00**
[52] **U.S. Cl.** **84/386**
[58] **Field of Search** .... 84/382, 380 R, 386, 84/383 R, 383 A

[56] **References Cited**

U.S. PATENT DOCUMENTS

1,171,647	2/1916	Reynolds	84/386
2,485,021	5/1946	Strupe	84/386
2,802,387	8/1957	Bushnell	84/386
3,438,298	11/1967	Thompson	84/380 R
3,800,651	4/1974	Small	84/386
4,754,682	7/1988	Getzen	84/382
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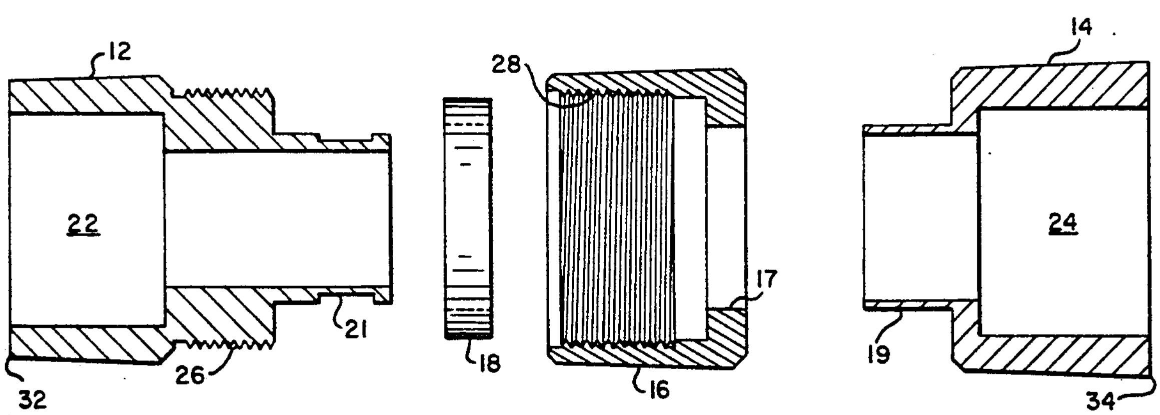
[57] **ABSTRACT**

An adjustable tuning barrel is disclosed for use with a woodwind instrument that allows the instrument to be easily tuned during play. The tuning barrel includes a fixed element, an adjusting ring coaxial with the fixed element and held in rotatable contacting relationship therewith, and an extending element in rotatable and threaded relationship with the adjusting ring, and in rotatable and motionally resisting relationship with the fixed element. The adjusting ring is wide enough to be comfortably located and manipulated during play. The fixed and extending elements are adapted to facilitate thermal exchange with the ambient environment.

16 Claims, 2 Drawing Sheets



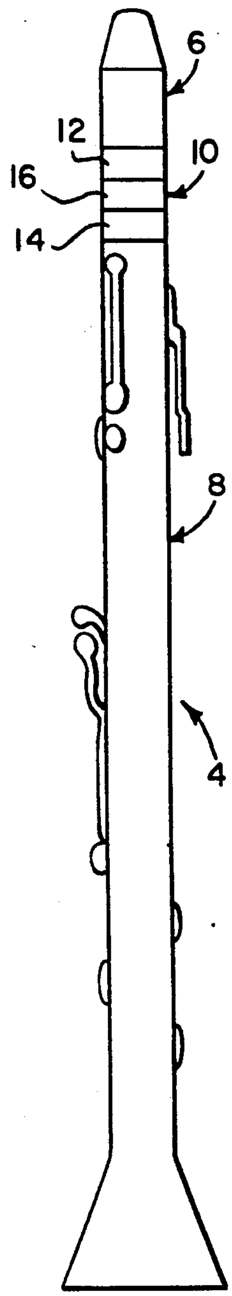


Fig. 1

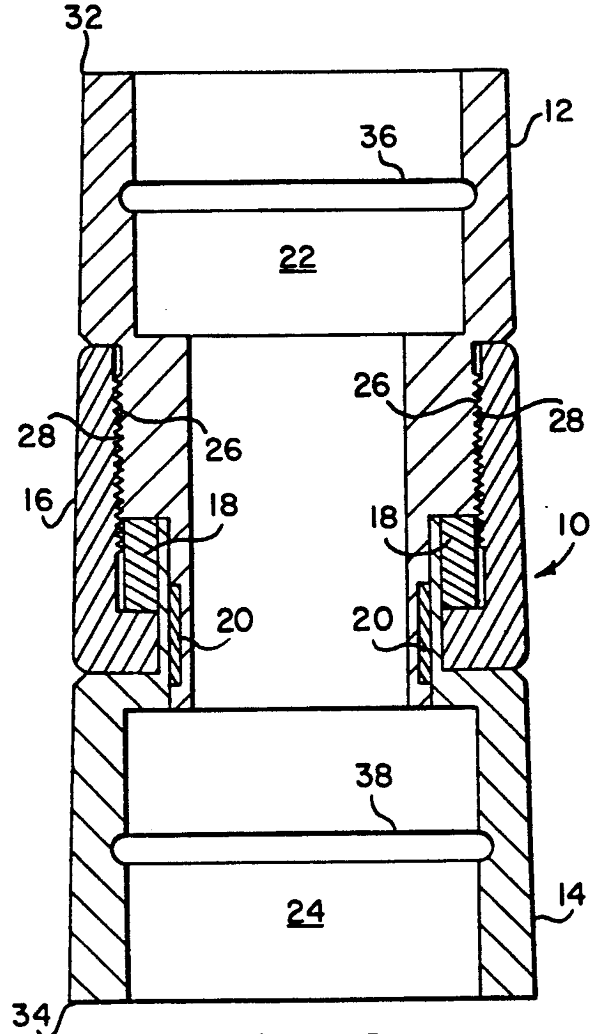


Fig. 2

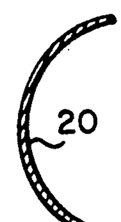


Fig. 4

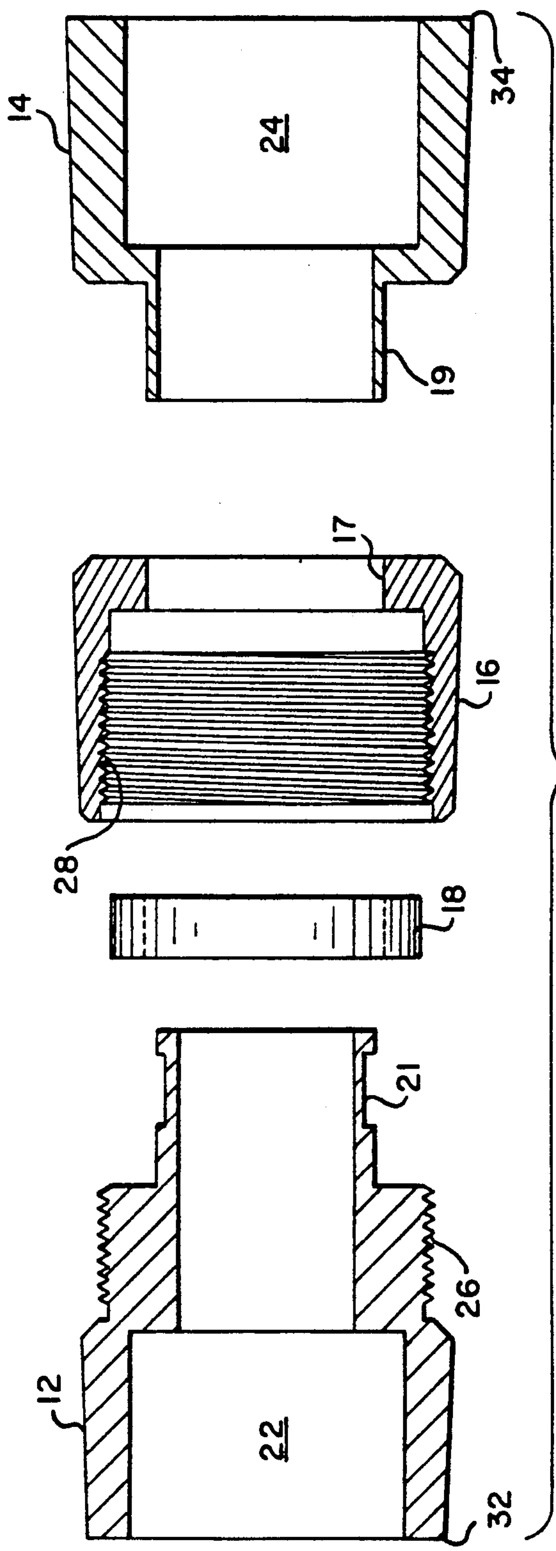


Fig. 3

ADJUSTABLE TUNING BARREL

FIELD OF THE INVENTION

This invention relates to to woodwind instruments, and particularly to tuning barrels for use therewith.

BACKGROUND OF THE INVENTION

A woodwind instrument, such as a clarinet, includes a mouthpiece section, a barrel section and a bell section. The pitch of the instrument can be lowered by moving the mouthpiece section away from the barrel section, thereby lengthening an air column within the instrument. The pitch of the instrument changes in response to ambient temperature and humidity, and to heat and moisture introduced by a player's breath. Although thermally induced changes in pitch can sometimes be compensated for by manually shifting the position that the mouthpiece is seated within the barrel, this maneuver is cumbersome, and therefore cannot be accomplished while playing the instrument. It is very inconvenient and disruptive to interrupt a musical piece to affect this adjustment. Furthermore, since thermally induced pitch changes are slight, but nevertheless perceptible, the adjustment of the mouthpiece with respect to the barrel must also be made precisely. This can be difficult, because the same properties that allow the mouthpiece to remain lodged within the barrel prevent smooth, precise adjustments.

A tuning barrel can facilitate this adjustment. The tuning barrel is included between the mouthpiece and the main body of the woodwind instrument. Tuning barrels and the like are well known in the art. However, known devices cannot be adjusted easily during play, and do not lend themselves to precise pitch adjustments. Furthermore, some tuning barrels do not allow the mouthpiece to be rotated with respect to the main barrel section, and some barrels themselves have poor thermal expansion properties and less than satisfactory vibratory responses. Moreover, early models are difficult to manufacture.

In particular, Bushnell U.S. Pat. No. 2,802,387 teaches a tuning device for musical instruments that includes a set screw for locking a tuning section in a selected position with respect to a barrel section, and for providing a desired telescopic adjustment. Bushnell lacks any threading between the tuning section and the barrel section, and therefore is not capable of the degree of precision adjustment that such threading facilitates. Additionally, adjustment of the set screw is difficult to accomplish during play.

Also, Reynolds U.S. Pat. No. 1,171,647 discloses a tuning slide for clarinets that includes an off-axis guide pin that serves to prevent turning of the mouthpiece of the clarinet with respect to its body upon adjusting the slide tube when tuning the clarinet. Furthermore, Reynolds depicts an adjusting ring of such thinness that the extent of overlap between the threads on a slide tube is consistently insufficient to provide lateral stability with respect to the central axis of symmetry unless the guide pin is also present to provide such stability. However, it is known in the art that it would be desirable if it were possible to both rotate the mouthpiece with respect to the body of a clarinet, or other woodwind instrument, and precisely adjust the length of a tuning barrel incorporated therein. Also, a thin adjusting ring is awkward to locate and uncomfortable to adjust. Furthermore, because most of the metal parts are not exposed, being covered in ebonite, the thermal dissipation properties of Reynolds's device are inadequate to provide satisfactory thermal properties.

SUMMARY OF THE INVENTION

An adjustable tuning barrel is disclosed for use with a woodwind instrument that allows the instrument to be easily tuned during play. The tuning barrel includes a fixed element, an adjusting ring coaxial with the fixed element and held in rotatable contacting relationship therewith, and an extending element in rotatable and threaded relationship with the adjusting ring, and in rotatable and motionally resisting relationship with the fixed element. The adjusting ring is wide enough to be comfortably located and manipulated during play. The fixed and extending elements are adapted to facilitate thermal exchange with the ambient environment. Controlled thermal exchange can reduce the need to adjust the tuning barrel during play.

Nevertheless, as ambient temperature and humidity change the tuning of the instrument, the tuning barrel is infinitely and precisely adjustable to compensate for such changes. Moreover, both ends can be rotated coaxially as necessary for positioning the instrument body relative to the mouthpiece, and this action is easily performed while the instrument is being played. Furthermore, the adjusting ring is wide, thereby making tactile location while playing easy. In a preferred embodiment, the tuning barrel is made of aluminum. Aluminum is not effected by humidity and it has excellent heat conduction and dissipation properties, as well as resonance enhancing qualities. Other materials which offer the above characteristics and benefits are ceramics, brass, and plastics. Additionally, since the extending element can be displaced over a distance that encompasses the displacements represented by all currently available fixed length tuning barrels, the tuning barrel of the invention can replace a variety of lengths of fixed length tuning barrels. Moreover, the adjustable tuning barrel provides ease of manufacture and assembly, and disassembles for easy cleaning.

DESCRIPTION OF THE DRAWING

The invention will be more fully understood from the following detailed description, in conjunction with the accompanying figures, in which:

FIG. **1** is a pictorial view of an exemplary woodwind instrument;

FIG. **2** is a cross-sectional view of an embodiment of the tuning barrel of the invention in its fully retracted position;

FIG. **3** is an exploded cross-sectional view of the embodiment of FIG. **2**; and

FIG. **4** is a cross-sectional view of a breaking spring.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. **1**, an exemplary woodwind instrument, such as a clarinet **4**, includes a mouthpiece **6**, an instrument body **8** and an adjustable tuning barrel of the invention **10**.

Referring to FIGS. **2** and **3**, the adjustable tuning barrel **10** includes an extending element **12**, a fixed element **14**, and an adjusting ring **16**. A neck **19** of the fixed element **14** extends through an opening **17** of the adjusting ring **16**, and is press fit within a retaining ring **18**. The retaining ring **18** serves to maintain the fixed element **14** in sliding contact with the adjusting ring **16** throughout any rotational motion of the ring **16** with respect to the element **14**. Accordingly, the retaining ring **18** is preferably press fit at a distance along the neck **19** such that rotational motion of the adjusting ring **16** with respect to the fixed element **14** is not restricted.

The extending element **12** includes a threaded portion **26** that is engaged with a complementary threaded portion **28** of the adjusting ring **16**. In a minimum extension position, shown in FIG. **2**, the threaded portions **26** and **28** exhibit a maximum extent of overlap. Rotating the adjusting ring **16** with respect to the extending element **12** will reduce the extent of overlap of the threaded portions **26** and **28**, and will consequently displace the extending element **12** axially and away from the adjusting ring **16** to an extent determined by a threads per inch parameter of the threaded portions **26** and **28**. In the preferred embodiment, the threaded portions **26** and **28** each have twenty-eight threads per inch. One skilled in the art will recognize that the function of the cooperative threaded portions **26** and **28** can also be performed, for example, by a cooperative pin and helical track mechanism.

The adjusting ring **16** is of a width along its axis of symmetry such that it presents a gripping surface sufficient to contact most of the bulb of a player's finger. In a preferred embodiment, the adjusting ring is of a width that extends more than 20% of the length of the tuning barrel along the axis of symmetry of the tuning barrel. (The bulb of a finger is the portion used to take finger prints.) Also, in the preferred embodiment, the outer surface of the adjusting ring **16** is finely knurled to provide an enhanced surface for manual manipulation. Furthermore, the knurled surface can be easily located without the need to remove the instrument **4** from playing position.

A breaking spring **20**, a side view of which is shown in FIG. **4**, is seated in a spring retaining channel **21** of the extending element **12**. The breaking spring **20** is of a curvature that is greater than the curvature of the channel **21**. Consequently, one or more portions of the spring **20** press against the inner wall of the neck **19**, thereby providing frictional deterrence against undesirable free rotational motion of the extending element **12** with respect to the fixed element **14**. Additionally, the pressing action of the spring **20** provides a frictional resistance to axial displacement of the extending element **12** that accompany any rotational motion of the adjusting ring **16** due to the cooperative threaded surfaces **26** and **28**, thereby attenuating rotational motion of the adjusting ring **16**. The breaking spring **20** is constructed of a material with spring-like qualities, such as standard spring steel, and is of a width to fit within the spring retaining channel **21**.

The mouthpiece mating section **22** of the extending element **12** is adapted to receive a mating section of any standard clarinet-type mouthpiece. In one preferred embodiment, shown in FIG. 2, at least one O-ring channel **36** is provided for seating an O-ring, not shown. The O-ring cooperates with an inner wall of the mating section **22** to provide an air-tight seal. In an alternate embodiment, shown in FIG. 3, a smooth inner surface of the mating section **22** cooperates with one or more O-rings or a cork seal of a clarinet-type mouthpiece. The circumference of the barrel end **32** most proximal to the mouthpiece is substantially the same as the circumference of the back end of a standard mouthpiece.

The mouthpiece mating section **24** of the fixed element **14** is adapted to receive a mating section of any standard clarinet-type instrument body. In one preferred embodiment, shown in FIG. **2**, at least one O-ring channel **38** is provided for seating an O-ring, not shown. The O-ring cooperates with an inner wall of the mating section **24** to provide an air-tight seal. In an alternate embodiment, shown in FIG. **3**, a smooth inner surface of the mating section **24** cooperates with a sealing section of a clarinet-type instrument body. The circumference of the barrel end **34** most proximal to the instrument body is substantially the same as the circumference of the portion of the instrument body that abuts the tuning barrel **10**.

The tuning barrel **10** is preferably made of a material that is lightweight, has good heat dissipation properties, and does not introduce acoustical damping effects. Preferred materials include aluminum, brass, ceramic, a graphite composite, or a polymer material. A preferred embodiment employs 7075 aluminum for all assembly constituents except the tension spring In an alternate preferred embodiment, the adjusting ring is made of a non-metallic material, such as plastic, to reduce the extent of metal-to-metal surface contact, and to provide a smoother turning action.

To tune the instrument or adjust its pitch, a player rotates the adjusting ring **16**. Clockwise rotation of the adjusting ring **16** effectively lengthens the barrel, thereby increasing the overall length of the instrument, and consequently lowering its pitch. Analogously, counter-clockwise rotation of the adjusting ring **16** raises the pitch of the instrument. Furthermore, when in playing position, the fixed element **14** and the extending element **12** may be rotated about the central longitudinal axis in relation to one another, thereby easing rotational adjustment of mouthpiece in to the instrument body. The extending and fixed elements are adapted to facilitate thermal exchange with the ambient environment. In particular, both the fixed element and the extending element expose at least 20% of their outer surface for thermal exchange with the ambient environment.

Other modifications and implementations will occur to those skilled in the art without departing from the spirit and the scope of the invention as claimed. Accordingly, the above description is not intended to limit the invention except as indicated in the following claims.

What is claimed is:

1. An adjustable tuning barrel for use with a woodwind instrument including a mouthpiece and an instrument body, said tuning barrel comprising:

an adjusting ring, freely rotatable about its axis of symmetry, said ring including:

first flange means; and

first thread means disposed on an inner surface of said adjusting ring;

a fixed element fixable with respect to the body of said woodwind instrument, said fixed element including:

second flange means, cooperative with said first flange means, for retaining said adjusting ring in rotatably contacting relationship with said fixed element; and

first mating means for attaching said tuning barrel to said body of said woodwind instrument; and

an extending element freely rotatable about its axis of symmetry, said extending element including:

second thread means disposed on an outer surface of said extending element for threadably engaging said first thread means of said adjusting ring so as to cause said extending element to move coaxially toward or away from said instrument body in response to rotation of said adjusting ring;

second mating means for attaching said tuning barrel to the mouthpiece of a woodwind instrument; and

a rotation impeder for resisting and permitting rotational and coaxial movement of said extending element with respect to said fixed element, being disposed between and in contact with an inner surface of said fixed element and an outer surface of said extending element.

2. The adjustable tuning barrel of claim **1** wherein said fixed element further includes a neck that extends coaxially through an opening of the adjusting ring, and wherein said first flange means consists of a retaining ring disposed within said adjusting ring and press fit about said neck.

3. The adjustable tuning barrel of claim **1** wherein said first and second thread means each includes a threaded portion having approximately twenty-eight threads per inch.

4. The adjustable tuning barrel of claim **1** wherein said gripping surface of said adjusting ring is finely knurled to provide an enhanced surface for manual manipulation.

5. The adjustable tuning barrel of claim **1** wherein said outer surface of said extending element also including a spring retaining channel, and said rotational impedance means is a breaking spring disposed in said spring retaining channel.

6. The adjustable tuning barrel of claim **5** wherein the channel having a curvature and the breaking spring is of a curvature that is greater than said curvature of the channel.

7. The adjustable tuning barrel of claim **1** wherein said mating means of said extending element further includes at least one O-ring channel for seating an O-ring, the O-ring for cooperating with an inner wall of the mating section and the mouthpiece to provide an air-tight seal.

8. The adjustable tuning barrel of claim **1** wherein said extending element, said adjusting ring, and said fixed element are each made of a material that is lightweight, has good heat dissipation properties, and does not introduce acoustical damping effects.

9. The adjustable tuning barrel of claim **8**, wherein the material is selected from the group consisting of aluminum, brass, ceramic, graphite composite, and polymer material.

10. The adjustable tuning barrel of claim **1** wherein the adjusting ring is made of a non-metallic material, such as plastic, to reduce the extent of metal-to-metal surface contact, and to provide a smoother turning action.

11. The adjustable tuning barrel of claim **1** wherein both said fixed element and said extending element expose at least 20% of their outer surface for thermal exchange with the ambient environment.

12. An adjustable tuning barrel for use with a woodwind instrument including a mouthpiece and an instrument body, said tuning barrel comprising:

a fixed element, connectable to said instrument body at a distal end, and with a flange at a proximal end;

an adjusting ring coaxial with said fixed element, and held in rotatable contacting relationship with said fixed element;

an extending element in rotatable and threaded relationship with said adjusting ring, and in rotatable relationship with said fixed element; and

a motion resistance element disposed between and in contact with an inner surface of said fixed element and an outer surface of said extending element, for providing frictional deterrence against rotational motion of the extending element with respect to the fixed element, while permitting such motion.

13. The adjustable tuning barrel of claim **12** wherein said adjusting ring is of a width that extends more than 20% of the length of said tuning barrel along the axis of symmetry of said tuning barrel.

14. The adjustable tuning barrel of claim **12** wherein said motion resistance element is a breaking spring.

15. The adjustable tuning barrel of claim **12** wherein said fixed element and said extending element each include mating means with at least one O-ring channel for seating an O-ring, the O-ring being for cooperation with an inner wall of the mating means and a mouthpiece to provide an air-tight seal.

16. An adjustable tuning barrel for use with a woodwind instrument including a mouthpiece and an instrument body, said tuning barrel comprising:

a fixed element, connectable to said instrument body at a distal end, and with a flange at a proximal end;

an adjusting ring coaxial with said fixed element and held in rotatable contacting relationship with said fixed element;

an extending element in rotatable and longitudinally advancing relationship with said adjusting ring and said fixed element along an axis of symmetry; and

a motion resistance element disposed between and in contact with an inner surface of said fixed element and an outer surface of said extending element, for providing frictional deterrence against rotational motion of the extending element with respect to the fixed element, while permitting such motion.

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