June 16, 1959 W. O. FEARN 2,890,614

WOODEN MOUTHPIECES FOR BRASS WIND MUSICAL INSTRUMENTS

Filed May 17, 1955

Fig. 1.

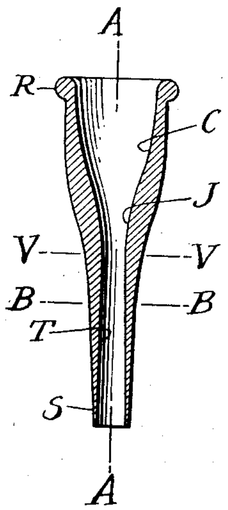


Fig. 2.

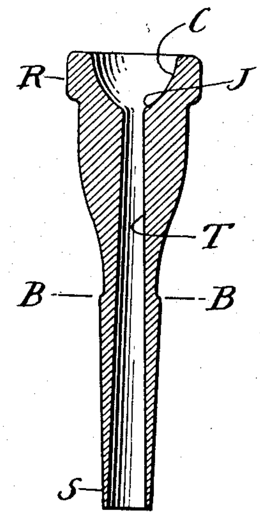


Fig. 3.

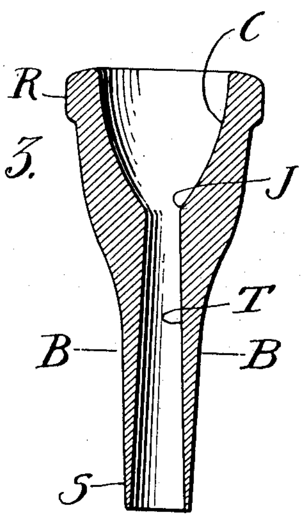
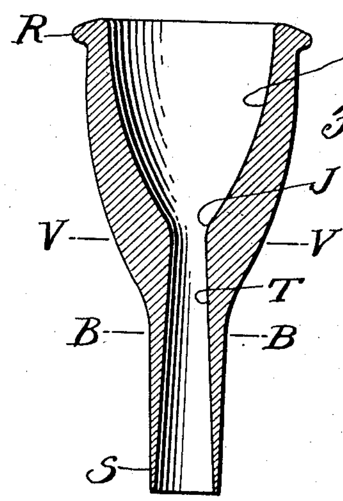


Fig. 4.



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United States Patent Office

2,890,614

Patented June 16, 1959

2,890,614

WOODEN MOUTHPIECES FOR BRASS WIND MUSICAL INSTRUMENTS

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Application May 17, 1955, Serial No. 508,933

10 Claims. (Cl. 84—398)

This invention relates to mouthpieces for musical instruments, and more particularly for use upon those classes of instruments generally designated as brass-winds; and the invention in general has in view the improvement of such mouthpieces in one or more of the following respects: configuration, material, durability, serviceability, playing qualities, and ease and uniformity of manufacture at moderate cost.

More specifically, the invention contemplates, as a new article of manufacture, a mouthpiece for brasswind instruments, formed of a single piece of hard, close-grained wood, or equivalent material readily made to any desired interior configuration (depending upon the requirements and preferences of the player), having (as compared with known types of mouthpieces, such as the usual brass or other metal mouthpieces) a novel exterior configuration which is adapted to take advantage of the desirable qualities of the material in such manner as to provide playing characteristics which are at least equal to and generally substantially superior to those of the known metal mouthpieces. In the latter regard, the invention contemplates the substantial improvement of the sound and performance of any high-grade brass-wind instrument and/or the improvement of the sound and performance of an instrument of relatively low quality so that it approaches or exceeds the sound and performance of an instrument of relatively higher quality. Among the improvements, in addition to tone quality, may be mentioned improved intonation, the facility with which the requisite vibration, for tone production, may be initiated by the lips of the player, and the ease with which various fundamental tones and overtones may be sustained without "breaking," even in pianissimo playing.

The invention further contemplates the obtaining of one or more of the above advantages, with a mouthpiece, for example, of hard, close-grained wood, which at the same time secures the advantage of the natural characteristics of the wood itself, notably its low rate of thermal conductivity (as compared with brass) which renders its playing much easier and more comfortable, even under conditions of extreme weather when played out of doors, as in the case of marching bands. Still other characteristics of the material, which are availed of in combination with the other advantages mentioned, are the hardness and durability of the wood, its low rate of vibration-damping (as compared with brass), its inertness with respect to the metal of the instrument, the facility with which it may be machined or otherwise formed, its resistance to scratching and other damage, and the freedom from sticking of the mouthpiece in the bore of the instrument which is such a prevalent difficulty with metal mouthpieces as generally heretofore used upon brass-winds.

A further feature of the invention resides in the impregnation and/or surface finishing of the mouthpiece with one or more materials which have the combined effects of resisting and repelling moisture, smoothing the surface of the mouthpiece, and rendering it even more resistant to

the scuffing or other damaging effects of abrasion or impacts, and further reducing its heat conductivity.

Still further, the invention contemplates the accomplishment of various of the foregoing objects and advantages, by means of a material and a construction which are especially adapted to ease of manufacture, within reasonable limits of cost, so that the mouthpiece, with its improved characteristics over those heretofore known, may still be produced and sold at a price as low as or lower than known mouthpieces for the same instruments.

Still another advantage of the invention is the adaptability of the same fundamentals of materials, configuration and finish, to mouthpieces for most if not all of the generally known and widely used brass-winds, throughout the range from high trumpet to low tuba.

Other objects and advantages of the invention are involved in the disclosure comprising the following description and the accompanying drawings, as will be apparent to those skilled in this art.

The presently preferred embodiment of the invention will now be described in detail, with reference to drawings illustrating four mouthpieces, adapted respectively for use on the French horn, the trumpet, the trombone, and the tuba.

Figure 1 is a sectional view, representing any longitudinal section containing the axis of the mouthpiece, of a wooden mouthpiece for French horn, configured and made according to the present invention (the original application drawing being made actual full-scale).

Figure 2 is a similar sectional view of a mouthpiece for trumpet, in accordance with the present invention.

Figure 3 is a similar sectional view of a mouthpiece for trombone, in accordance with the present invention.

Figure 4 is a similar sectional view of a mouthpiece for tuba, in accordance with the present invention.

In the preferred practice of the invention to date, the mouthpiece is formed from a single piece of hard, close-grained wood, such as grenadilla wood, and is preferably formed to the configuration shown, by turning the same on a lathe—the grain of the wood in general running parallel with the longitudinal axis A—A of the mouthpiece, about which axis the mouthpiece is symmetrical. Although grenadilla wood is the preferred material, the invention has also been successfully reduced to practice in ironwood, snake wood, mahogany, East Indian and Turkish boxwoods, Brazilian rosewood, satinwood, lemonwood, lignum vitae, African black ebony and other fairly equivalent materials.

It appears, from experiment, that the characteristics of such woods and other equivalent materials are not entirely naturally adapted for use as a mouthpiece for brass-winds, when they are made to the same overall configuration as a brass or other metal mouthpiece.

(Parenthetically, it is not entirely clear why a wood mouthpiece of identical configuration with a brass one should not operate similarly, but I find it inferior to the brass—whether it be due to difference in density, mass, hardness, elasticity, flexibility, excessive yieldability to vibration, or what-not.)

In short, the overall configuration of the hard wood or equivalent mouthpiece cannot be made identical with the brass one, and secure completely satisfactory results. At the same time, I find that it is generally important that the interior configuration of my improved mouthpiece be made to a profile similar to the brass, i.e. that the bore throughout (that is, including the cup, the throat and the transition between them) be to the usual profile desired by the player, especially in the case of experienced artists, who generally have their own marked preferences as to the internal shape of the mouthpiece. The two considerations just above stated would appear to render it almost impossible to utilize the types of materials herein contemplated (with what would otherwise be some very substantial advantages inherent in such materials) but after considerable experimentation I have found that such materials can indeed be used, and can be used in a way to secure the improved results referred to in the opening portion of this specification, by suitably configuring the external profile of the mouthpiece in relation to whatever internal profile has been selected as the standard or as the particular preference of the player.

Referring again to Figure 1, it will be observed that the French horn mouthpiece there shown has an interior longitudinal bore of circular cross-section throughout its length, which bore in longitudinal section comprises a cup C of smoothly-rounded longitudinal contour with its greatest diameter at the outer end of the mouthpiece and further comprises a gradually widening tapered throat T extending from the base of the cup to the inner end of the mouthpiece. The shape and depth of the cup, and to a lesser extent the taper of the throat and the diameter of its transitional juncture J with the cup, may be varied to suit requirements as aforesaid. However, with the materials utilized in the practice of the present invention the external profile follows a contour quite different from that of the ordinary metal mouthpieces heretofore generally used and I find it important that such external profile bear certain special relationships to the internal profile.

As shown, the external profile is of circular cross-section throughout its length and is concentric with the bore. In longitudinal section it is of a gradual taper (opposite to that of the internal taper of the throat) extending from the inner end of the mouthpiece for a distance of between one-fourth and one-half the length of the mouthpiece (in the case of Figure 1, about one-third), this portion being adapted to telescope within the cooperating tube of the instrument. For the most part, above the plane B—B the external profile is of a generally widening convex contour outwardly through a region comprising at least the zone adjacent the transitional juncture of cup and throat (said juncture being generally indicated at J), in such wise that the annular cross-section of maximum wall thickness is adjacent said juncture (in the instance of Fig. 1, the maximum thickness actually occurring slightly above the center of the transitional zone). The said widening contour is desirably so configured that the wall thickness at or near said zone (measured perpendicularly to the longitudinal axis A—A of the mouthpiece) is between about 60% and 300% of the dimension of the bore at the mid-portion of said zone.

In the case of the French horn mouthpiece of Figure 1, the transitional zone between cup and throat takes the form of a gradual bend (convex in longitudinal section) between the concavity of the cup C and the straight wall of the throat T, so that the narrowest point of the somewhat venturi-like bore is about at the level V—V. There also the wall thickness should be at least in the neighborhood of 60% or more of the bore diameter; a figure closer to 100% being found to produce even better results, for the French horn.

In the case of the tuba mouthpiece (Fig. 4) the zone of transitional junction J is marked by a convex curve of much sharper radius than in the case of the French horn mouthpiece, so that the level of minimum bore V—V is only slightly below the center of the zone J. In the case of the trombone mouthpiece (Fig. 3) and the trumpet mouthpiece (Fig. 2) the reverse curvature at zone J becomes almost a corner or edge, so that the minimum bore location may be said substantially to coincide with the point J. In these several mouthpieces, the wall thickness adjacent the zone of transition is desirably of the order of 150 to 300% of the general bore dimension at said zone and/or of the minimum bore dimension.

Thus, in all instances, the wall is substantially thickened in a region close to the zone J and/or to the minimum bore location V—V. Some excess wall thickness may be tolerated, either above the level V—V or above the center of zone J (as in the case of Fig. 1); or below the zone J (as in Fig. 2); or both above and below the point J (as in Figs. 3 and 4)—although it is desirable that the said thickness be tapered off somewhat, in each longitudinal direction.

I find that the vibrating characteristics and quality of tone of the instrument are substantially improved by the thickened configuration of the mouthpiece in accordance with the above description. In each case the extent and location of the thickening differs from the known brass mouthpieces; and my experiments show that reducing the wall thickness in the critical region referred to, either to the standard metal thicknesses or less, will cause an impairment of the quality of sound and the playing characteristics of the instrument.

In addition to the above-described substantial wall thickening in what I term the critical region, a slight general increase in thickness of other parts or of the whole of the mouthpiece is in some cases advantageous. Thus the rim R may desirably be made about 5 to 20% thicker than the usual metal rim, by increase of outside dimension; and a similar percentage increase in thickness may advantageously be employed at the shank S, but in the latter case it is preferable to do this by a slight decrease of bore dimension (not sufficient to interfere with the free-playing qualities of the mouthpiece), although an exterior thickening may here be resorted to, if, at the same time, the shank is correspondingly shortened so that when it is fitted into the cooperating tapered bore of the instrument the overall protrustion of the mouthpiece from the instrument is about normal.

In conjunction with the functional advantages of the thickenings herein disclosed, there is a manufacturing advantage by way of easier and less critical turning of the piece on the lathe; a structural advantage in that the mouthpiece is less apt to warp or get out of round; and a service advantage with respect to strength and durability of the mouthpiece.

While the substantially thickened wall region throughout the critical area lends itself to the application of ornamental carving or other configurations, such as the formation thereon of external ribs, grooves, and the like, when turning the piece on the lathe, I find that the best all-around results are obtained if the external profile is formed largely to a smoothly flowing contour as shown in the drawings.

In general, my mouthpiece as above described has the advantages mentioned in the beginning of this specification, notably an improved tone made with greater facility and reliability, and, for the player, a feeling of comfort and avoidance of damage to the skin or lips, especially when playing in cold weather.

To secure the advantages of the invention to the fullest extent, I have found it desirable to impregnate and/or to coat the mouthpiece with certain smoothing, toughening and water-resisting materials.

As an example, a mixture of white beeswax and benzene in the proportions of a teaspoon of benzene to six ounces of melted beeswax, is made up as follows. The white beeswax is brought to the boiling point, then taken from the fire and allowed to stand for about thirty seconds (but not long enough to commence to harden) and then the benzene is added and thoroughly mixed. The mixture is then kept hot enough to remain in liquid form, and the mouthpiece—while entirely dry—is submerged in the liquid mixture for about three seconds. The mouthpiece is then wiped off, both inside and outside, completely. The benzene evaporates off.

As an alternative to the foregoing, or as a succeeding finishing step, the mouthpiece may be dipped in a liquid form of clear penetrating primer having quick drying characteristics, which is commercially available, and then stood on a screen, or suspended in a vertical position from one or more wires or hooks, and any excess material dripping from the mouthpiece, when first suspended, is mopped off, as by a rag. It is preferable to suspend the mouthpieces with the cup end up, and to mop off the drip from the bottom of the shank.

As the first-mentioned treating mixture takes a little time to become thoroughly hardened in situ, it is best to allow the mouthpiece to stand for an hour or more before being used, or before being subjected to the penetrating primer.

Whether or not the penetrating primer is the sole treatment or is used as the second or finishing treatment, the mouthpiece may be handled and used within a minute or two after the excess material has dripped off, as this penetrating primer is a quick-drying material.

Referring again to the materials used in my improved mouthpiece, I would call attention to certain interesting comparisons between such materials as a group, on the one hand, and brass as heretofore used, on the other hand:

As to hardness and resistance to deformation, the close-grained heavy woods I find to have ample hardness for the purpose—and, in fact, mouthpieces made according to this invention have repeatedly been dropped on the floor and thrown across the room, with no apparent damage. With similar treatment, the customary brass mouthpiece has in some instances been dented, or bent out of round at the thin end of the shank.

At ordinary temperatures, the conductivity value (stated as calories transmitted per second through a plate one centimeter thick, over an area of one square centimeter, with a temperature gradient of 1° C.) is recognized, for ordinary yellow brass, to be about .26. On the same scale, the thermal conductivity value of beeswax is given by one authority as .0002, and the value for various hard and heavy woods as being in the neighborhood of four or five times that of beeswax, for example an average of not over .001. From this it is clear that the thermal conductivity of the materials here contemplated is less than one-half of 1% of that of brass, and the thermal conductivity of the beeswax is less than 1/1000 part of that of brass—so that the beeswax-impregnated or beeswax-coated mouthpiece is especially advantageous from this particular standpoint.

As to density, the various woods which have been successfully employed, range from about .54 gram per cubic centimeter for mahogany up to about 1.33 grams per cubic centimeter for ebony and the heaviest grade of lignum vitae. The brass, having a density of 8.4, is thus from six to fifteen times as heavy as the various materials which I have used to advantage in my improved mouthpiece.

As to transmission of sound, the velocity, in feet per second, is 11,480 in brass, and is about equally as great (or perhaps a little greater) in the hard woods. The vibrating characteristics of the heavy hard woods (such as freedom and amplitude), appear to be much greater than in brass, while on the other hand the brass has a much higher vibration-damping effect than do the heavy woods; and I believe it is for these reasons (possibly among others) that I have found it important to thicken the mouthpiece wall materially in what I have designated the critical region.

Since I have found a variety of wood materials suitable for the purpose, I believe that there are other materials which may be used, and I therefore intend the scope of the claims (where wood is referred to) to be inclusive of other materials having characteristics in common with those hereinabove discussed or with the materials herein specified as examples.

I claim as my invention:

1. A mouthpiece for a brass-wind instrument comprising a body portion of wood only, the physical properties of which are substantially the same as those of East Indian boxwood, and the surface of said body being smooth and moisture resistant.

2. For a brass-wind instrument, a mouthpiece comprising a unitary body the composition of which is substantially uniformly of wood material taken from the group consisting of: East Indian boxwood, Turkish boxwood, grenadilla wood, ironwood, snake wood, mahogany, Brazilian rosewood, satinwood, lemonwood, lignum vitae, African black ebony.

3. The mouthpiece of claim 2 having a density less than one-sixth that of brass and a thermal conductivity less than one-half of 1% of that of brass, said mouthpiece having an interior longitudinal bore of circular cross-section throughout its length, which bore in longitudinal section comprises a cup of smoothly-rounded longitudinal contour with its greatest diameter at the outer end of the mouthpiece and a gradually widening tapered throat extending from the base of the cup to the inner end of the mouthpiece, and having an external profile of circular cross-section throughout its length and concentric with said bore, which profile in longitudinal section is of a gradual continuous taper opposite to that of the throat and extending from the inner end of the mouthpiece through a distance of between one-quarter and one-half the length of the mouthpiece, adapted to telescope within the cooperating tube of the instrument, and which profile is of a generally widening exteriorly convex contour from adjacent its said taper outwardly through a region comprising at least the zone adjacent the juncture of cup and throat, so that the main portion of the cup itself is of tapering wall thickness and so that the annular cross-section of maximum wall thickness is adjacent said juncture and is substantially thicker than would be a corresponding section of concave outer contour.

4. The mouthpiece of claim 2, having a sound transmitting velocity characteristic substantially equivalent to that of brass.

5. The mouthpiece of claim 2 whereof the density is between .54 and 1.33.

6. The mouthpiece of claim 3 wherein the said widening exteriorly convex contour is so configured that said wall thickness at the zone of said juncture (measured perpendicularly to the longitudinal axis of the mouthpiece) is between 60% and 300% of the dimension of the bore at said juncture.

7. The mouthpiece of claim 2, having a thermal conductivity of not over .001.

8. The mouthpiece of claim 7 having an inhering coating of beeswax.

9. The mouthpiece of claim 7 the surface of which is treated with a quick-drying primer.

10. A mouthpiece for a brass-wind instrument comprising a body portion of wood only, the physical properties of which are substantially the same as those of East Indian boxwood, and the surface of said body being smooth and moisture resistant, the mouthpiece further having a density less than one-sixth that of brass and a thermal conductivity less than one-half of 1% of that of brass, said mouthpiece having an interior longitudinal bore of circular cross-section throughout its length, which bore in longitudinal section comprises a cup of smoothly-rounded longitudinal contour with its greatest diameter at the outer end of the mouthpiece and a gradually widening tapered throat extending from the base of the cup to the inner end of the mouthpiece, and having an external profile of circular cross-section throughout its length and concentric with said bore, which profile in longitudinal section is of a gradual continuous taper opposite to that of the throat and extending from the inner end of the mouthpiece through a distance of between one-quarter and one-half the length of the mouthpiece, adapted to telescope within the cooperating tube of the instrument, and which profile is of a generally

widening exteriorly convex contour from adjacent its said taper outwardly through a region comprising at least the zone adjacent the juncture of cup and throat, so that the main portion of the cup itself is of tapering wall thickness and so that the annular cross-section of maximum wall thickness is adjacent said juncture and is substantially thicker than would be a corresponding section of concave outer contour.

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