ABSTRACT

In a wood-wind instrument having a plurality of tone holes perforated at the prescribed points along the tubular portion of an elongated cylindrical hollow body and sealed airtight by pads disposed in key cups selectively depressed during performance, that part of each key cup facing the backside of the corresponding pad is provided with a means for adjusting the angle of inclination defined by the pad with the key cup so as to facilitate said adjustment without removing the pad from the key cup.

10 Claims, 12 Drawing Figures
TONE HOLE COVERING ASSEMBLY FOR A WOOD-WIND MUSICAL INSTRUMENT

BACKGROUND OF THE INVENTION

The present invention relates to a tone hole covering assembly for a wood-wind musical instrument and more particularly to a novel type of tone hole covering assembly capable of adjusting the degree with which the depressed pad contacts the edge of the corresponding tone hole without removing it from the key cup.

Generally, wood-wind musical instruments such as flutes, piccolos, oboes or clarinets are perforated, as shown in FIG. 1, with a plurality of tone holes 121, 122, 123, 124 and 125 at the prescribed parts along the tubular portion of an elongated cylindrical hollow body 11 made of wood or metal and provided with a tone hole covering assembly for selective airtight sealing of the tone holes during performance. There are vertically fitted a plurality of groups of key posts as 13a-13a and 13b-13b, at prescribed spaces from each other along the tubular length of the hollow body 11. Across the key posts of the respective groups are disposed tubular hinge rods 14a and 14b in a manner to rotate as described later. Into these hollow tubular rods 14a and 14b are inserted slender solid rods 15a and 15b which can rotate independently of the first mentioned rods 14a and 14b. The tone hole covering assemblies 171, 172, 173, 174 and 175 are fitted at the end of the later described laterally extending arms 181, 182, 183, 184 and 185 in a manner to be normally set apart from the edges 121a to 125a of the corresponding tone holes 121 to 125, as shown in solid lines in FIG. 2, so as to leave them open. However, when the tone hole covering assembly is selectively depressed by the right or left hand finger as desired in the direction indicated by the arrow 16 as shown in phantom in FIG. 2, then it seals the corresponding tone hole airtight through the rotation of the corresponding tubular or slender solid rod. The aforementioned arms 181 to 185 are integrally fitted with the tone hole covering assemblies 171 to 175 in such a manner that the other end of the arms 181 to 185 keeps the prescribed relationship with the tubular or slender solid rod. The tubular and slender solid rods are always subject to a rotating force due to the action of a needle or plate spring in order that when released from depression, the covering assembly may rotate backward to its original stable position as shown in solid lines in FIG. 2. As is well known, a wood-wind musical instrument may be so designed that some of the tone hole covering assemblies can be depressed alone, while the others can be operated together upon depression of a particular assembly associated therewith.

With a wood-wind musical instrument constructed as described above, it is important for maintenance of accurate tone pitches during performance that no air be unnecessarily released through the tone hole associated with the depressed tone hole covering assembly. In fact, however, there does occur such air leakage through the tone hole due to irregularities in the dimensions of parts involved in the covering assembly and the assembly precision or wear during long use, making it necessary to adjust the degree with which the depressed covering assembly contacts the edge of the corresponding tone hole.

FIG. 3 is a longitudinal sectional view of a typical example of the conventional tone hole covering assembly used in a wood-wind musical instrument. The assembly comprises a relatively shallow cylindrical key cup 22, on one side of which there is integrally formed an end plate 21 which is depressed by the finger substantially at the center during performance and the other side of which is left open. To the central part of the inner surface of the end plate 21 is fixed one end of a female screw 23. Around the peripheral surface of the female screw 23 is fitted an annular soft pad 25 made of, for example, felt, foamed polystyrol, rubber or cork so as to cause the peripheral edge of the pad 25 to be pressed to the inner surfaces of the side walls 24 of the cup 22. The pad 25 is fitted to the cup 22 by engagement of the male screw 27 with the female screw 23 using a flat washer 26.

With a wood-wind musical instrument constructed as mentioned above, the degree with which the depressed tone hole covering assembly contacts the edge of the corresponding tone hole is generally adjusted by disengaging the male screw 27 from the female screw 23 to remove the pad 25 from the cup 22 and then interpose, for example, a hard paper board 28 with a suitable thickness and inclined surface between the inside of the cup end plate 21 and the pad 25. However, the aforesaid wood-wind instrument which required the pad to be taken out of the cup at each time of adjustment has the drawbacks that manufacture consumed a great deal of time, not only resulting in low yield and high cost, but also necessitating an appreciable degree of skill in adjustment, thus making it difficult for a user to carry out such adjustment.

SUMMARY OF THE INVENTION

The present invention has been accomplished in view of the above-mentioned situation and is intended to provide a novel tone hole covering assembly for a wood-wind musical instrument wherein that part of the key cup facing the back-side of the pad received therein is provided with means for adjusting the angle of inclination defined by the pad with the associated key cup, thereby permitting easy adjustment of the degree with which the depressed tone hole covering assembly contacts the edge of the corresponding tone hole without removing the pad from the key cup.

BRIEF EXPLANATION OF THE DRAWINGS

FIG. 1 is a perspective view of the main part of a wood-wind musical instrument showing its general construction; FIG. 2 is a schematic enlarged sectional view on line A—A of FIG. 1 as viewed in the direction of the indicated arrow; FIG. 3 is a longitudinal sectional view of the conventional tone hole covering assembly for a wood-wind musical instrument; FIG. 4 is a longitudinal sectional view of a tone hole covering assembly for a wood-wind musical instrument according to an embodiment of the present invention; FIG. 5 is a top plan view of a key cup of the tone hole covering assembly; FIGS. 6 to 8 represent the modifications of the key cup cover; FIG. 9 is a longitudinal sectional view of a tone hole covering assembly for a wood-wind musical instrument according to another embodiment of the invention;
FIG. 10 is a top plan view of a key cup of a tone hole covering assembly for a wood-wind musical instrument according to still another embodiment of the invention; FIG. 11 is a top plan view of a key cup of a tone hole covering assembly for a wood-wind musical instrument according to a further embodiment of the invention; and FIG. 12 is an enlarged sectional view on line B—B of FIG. 11.

DESCRIPTION OF THE PREFERRED EMBODIMENT

There will now be described in reference to the appended drawings a tone hole covering assembly for a wood-wind musical instrument according to the preferred embodiments of the present invention. FIG. 4 is a longitudinal sectional view of one of said embodiments.

There is provided a key cup 32 made of, for example, silver, nickel silver or brass with a wall thickness of about 0.5 to 1.0 mm. The key cup assumes a relatively shallow cylindrical form and is integrally provided on one side with an end plate 31 which is depressed with the finger substantially at the central part of its outer surface during performance, and is left open on the other side. Substantially to the central part of the inner wall of the end plate 31 is fixed one end of the female screw 33. On the peripheral surface of the female screw 33 is mounted an annular pad 37 in such a manner that its peripheral edge is pressed to the inner side walls of the key cup 32. The pad 37 is prepared by enveloping with a very air-tight fish skin 36 the outer surface of a soft member 35 about 1 to 3 mm thick made of foamed styrol, rubber to cork to which there is integrally fitted on that side of the key cup 32 facing the end plate 31 a rigid base board 34 about 0.1 to 0.3 mm thick formed of hard paper board, metal or rigid plastics material.

The pad 37 is integrally fixed to the cup 32 by engagement of the male screw 41 with the female screw 33 using a washer 39. The inner surface of said washer contacting the pad 37 is worked smooth and substantially the central part of its outer surface is shaped into a spherical form. The inner surface of the head 40 of the male screw 41 which contacts the spherical surface of the washer 39 assumes a concave form so as to match said spherical surface.

With a tone hole covering assembly for a wood-wind musical instrument according to the present invention, the end plate 31 of the cup 32 facing the backside of the pad 37 to which there is fitted the rigid base board 34, is bored, as shown in FIG. 5, with a plurality of, for example, four threaded through holes 421, 422, 423, 424 equally spaced in the peripheral direction of said end plate. Into these holes 421 to 424 are movably inserted by screw engagement a plurality of, for example, four adjusting screws 431, 432, 433 and 434 respectively in such a manner that the end of the screws 431 to 434 touches the backside of the rigid base board 34.

An elongated cylindrical hollow body (not shown) of the musical instrument is fitted with a plurality of tone hole covering assemblies 30 of the aforesaid construction in the manner described by reference to FIGS. 1 and 2. With a wood-wind instrument involving such tone hole covering assemblies, the degree with which the pad, when depressed, contacts the annular edge of the corresponding tone hole is adjusted by introducing light into the hollow body at one end, and depressing the upper surface of the end plate 31 of each tone hole covering assembly 30 with the same force as is applied during ordinary performance to cause the assembly 30 to lightly touch the edge of the corresponding tone hole. If, under such condition, light leaks through the tone hole, it is only required to adjust the contact between the pad and the tone hole edge by screwing the corresponding adjusting screw 431, 432, 433 and 434 inward or outward. The outer surface of the pad 37 facing the tone hole is supported, as mentioned above, by means of the washer 39 contacted at its spherical part by the male screw 41, so that the inward or outward movement of the adjusting screw varies the angle of inclination which the pad 37 defines with the corresponding tone hole (the fitted height of the pad is adjusted by the male screw 41). That is, said inward or outward movement of the adjusting screw controls the degree with which the depressed pad attaches itself to the edge of the tone hole so as to prevent light, namely, air from leaking through the tone hole.

As mentioned above, the present invention permits easy adjustment of the contact between the pad of a tone hole covering assembly for a wood-wind musical instrument and the edge of the corresponding tone hole without removing the assembly, reducing time of adjustment to a far greater extent than has been possible in the past, and realizing the elevated yield and lower cost of a wood-wind musical instrument. What is better, said adjustment can be easily performed by a general user without any advanced skill. In this connection, it deserves particular attention that where the adjusting screws 431 to 434 are disposed at that part of the end plate 31 of the key cup 32 which is touched by the finger during performance, then there will result an unpleasant finger touch and moreover, if any of the adjusting screws projects from the finger-touched part, it will likely cause adjustment to be carried out at a wrong place. Accordingly, it is advisable that the undermentioned cover 44 be additionally fitted. To describe with reference to FIG. 4, the central part 45 of the end plate 31 of the key cup 32 including the parts provided with the adjusting screws 431 to 434 is made to project concentrically inward to a suitable depth from the peripheral edge of the remainder of the end plate 31. The center of the inwardly projecting part 45 is perforated with a through hole 47. It is preferred that the aforesaid cover 44 be made of a soft material, for example, polystyrol and constructed in such a manner that the cover has a leg member 50 formed substantially at the central part of its inner surface as to project therefrom, said leg member 50 being provided with a flanged section at the projecting end and further a slide slit 49 bored in its axial direction along the greater part of its length thereby enabling the cover 44 to be pushed into or drawn out of the through hole 47 and that the cover has such an outer diameter as allows its outer peripheral edge to engage the outer peripheral surface of the boundary defined by the inwardly projecting part 45 of the key cup 32 with its outer peripheral portion 46.

FIGS. 6 to 8 represent modifications of the cover. The cover of FIG. 4 is fitted to the key cup 32 by pressing the leg member 50 projecting substantially
from the central part of the inner surface of the cover into the through hole 47 perforated substantially at the central part of the end plate 31 of the key cup 32. With the cover 441 of FIG. 6, its circular stepped portion 51 on the boundary defined by the inward projection 451 of the key cup 321 assumes a tapered form which progressively increases in diameter toward the interior of the key cup 321. The cover is fitted to the cup 321 by engaging the similar circular stepped portion formed along the periphery of the cover with that of the cup end plate.

In FIG. 7, the key cup end plate is not provided with aforementioned stepped or taper portion. The cover is fitted into a depression at the back of the inward projection 452 of the cup end plate, using, if necessary, an adhesive agent.

In FIG. 8, the cover 443 envelopes all the outer surface of the key cup 322.

FIG. 9 is a longitudinal sectional view of a tone hole covering assembly for a wood-wind musical instrument according to another embodiment of the invention. In this embodiment, there is used in place of the female screw 33 of FIG. 4 a hollow female stop member 331 made of a rigid plastics material having a large diameter portion 62 formed substantially at the central part in the axial direction of its cylindrical inner wall surface. There is also used instead of the aforesaid male screw 41 of FIG. 4 a male stop member 411 made of a flexible, restorable material, for example, polystyrol. This male stop member 411 has a leg member 65 which in turn comprises a slide slit 63 bored at the end so as to enable said male stop member 411 to be easily pushed into or drawn out of the hollow area of the female stop member 331 and also a large diameter flanged portion 64 formed at that part of its outer peripheral surface corresponding to the large diameter portion of the female stop member 331. It will be apparent that a tone hole covering assembly constructed as described above may produce the same effect as the embodiment of FIG. 4. In FIG. 9, the contacting surfaces of the male stop member 411 and the washer 391 assume an opposite shape to that of FIG. 4, that is, the male stop member 411 has a convex surface and the washer 391 has a concave surface. It will be noted, however, that there is interchangeability between the shapes of these contacting surfaces.

FIG. 10 is a top plan view of a tone hole covering assembly according to still another embodiment of the present invention. In the preceding embodiments the adjusting screw for varying the angle of inclination which the pad defined with the key cup was disposed on the underside of the finger-touched central part of the cup end plate. In the embodiment of FIG. 10, however, the adjusting screws 431, 432 and 433 are positioned outside of the finger-touched central part of the cup end plate 314, that is, on the peripheral parts thereof. Such arrangement may possibly eliminate the necessity of fitting the aforementioned cover. Further, the embodiment of FIG. 10 involves three adjusting screws instead of four used in the foregoing embodiments. It will be apparent that, from the standpoint of properly adjusting the angle of inclination of the pad to the key cup, it is preferred to use an odd number of, for example, three or five adjusting screws rather than the previously used four.

FIGS. 11 and 12 jointly represent a tone hole covering assembly according to a further embodiment of the present invention. In this embodiment, a key cup 325 is preferably made of resilient material, for example, nickel silver, and the adjusting screws are substituted by a plurality of substantially U-shaped cut strips 711, 712 and 713 formed on the end plate 315. Each cut strip is bent downward toward the interior of the key cup, as illustrated in enlargement in FIG. 12, so as to contact the backside of the corresponding pad 37. With the tone hole covering assembly thus constructed, adjustment of the depth to which the cut strip is bent controls the angle of inclination of the pad substantially in the same manner as by the aforesaid adjusting screw. For easy adjustment to reduce the bent depth of the cut strips, it is advisable to perforate them with apertures 721 to 723 respectively through which to insert an adjusting rod (not shown).

What is claimed is:

1. A tone hole covering assembly for a wood-wind musical instrument with a tone hole therein to be sealed air tightly by the depression of the tone hole covering assembly, the assembly comprising a relatively shallow cylindrical key cup having an end plate, a pad of flexible material disposed therein and having at least that part thereof which covers the tone hole, said pad being tiltable with respect to said key cup, means for fixing the pad to the key cup, adjusting means disposed on said end plate to adjust the angle of inclination defined by the pad with the key cup, said pad being held in a desired inclined position with respect to the key cup by the movement of said adjusting means, said adjusting means projecting from said end plate to said pad and being movable towards and away from said pad so that the inclination of said pad with respect to said key cup can be adjusted.

2. The tone hole covering assembly according to claim 1 wherein the pad is provided with a rigid base board at its backside facing the end plate of the key cup.

3. The tone hole covering assembly according to claim 1 wherein the fixing means consists of a male screw and a female screw, the male screw contacting that side of the pad facing the tone hole through a washer and that surface of the washer which is contacted by the male screw assuming a spherical shape.

4. The tone hole covering assembly according to claim 1 wherein the fixing means consists of a male stop member and a female stop member engageable with and disengageable from each other, the male stop member contacting that side of the pad facing the tone hole through a washer and that surface of the washer which is contacted by the male stop member assuming a spherical shape.

5. The tone hole covering assembly according to claim 1 wherein said adjusting means includes a plurality of screw holes perforated in the end plate of the key cup and a plurality of screws threaded therein, each of said screws having an end projecting from the end plate of the cup toward the backside of the pad facing the end plate.

6. The tone hole covering assembly according to claim 5 wherein the adjusting means comprises at least three adjusting screws.
7. The tone hole covering assembly according to claim 1 wherein the adjusting means is protected with a cover mounted on the end plate.

8. The tone hole covering assembly according to claim 1 wherein the adjusting means is positioned in the peripheral parts of the key cup end plate.

9. The tone hole covering assembly according to claim 1 wherein the key cup is made of resilient material and the adjusting means consists of a plurality of cut portions cut out of the end plate of the key cup, the end of each cut portion being bent downward to an adjustable depth so as to allow the end to contact the backside of the pad facing the end plate.

10. The tone hole covering assembly according to claim 9 wherein the key cup is provided with at least three cut out portions.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION


Inventor(s)  Akira Nagao

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

[30] Foreign Application Priority Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Number</th>
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<tbody>
<tr>
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<td>52360/69</td>
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</tbody>
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Signed and sealed this 8th day of May 1973.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.  ROBERT GOTTSCALK
Attesting Officer  Commissioner of Patents
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Inventor(s)                                      Akira Nagao

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