United States Patent [19]

Kawakami

[11] **3,767,506**

[45] **Oct. 23, 1973**

[54] **METHOD FOR ASSEMBLING TONE HOLE COVERING IN WOOD-WIND MUSICAL INSTRUMENT**

[75] Inventor: **Genichi Kawakami,** Hamakita, Japan

[73] Assignee: **Nippon Gakki Seizo Kabushiki Kaisha,** Hamamatsu-shi, Shizuoka-ken, Japan

[22] Filed: **Jan. 6, 1972**

[21] Appl. No.: **215,892**

Related U.S. Application Data

[63] Continuation of Ser. No. 46,877, June 17, 1970, abandoned.

[52] **U.S. Cl.** **156/293,** 84/380, 84/382, 84/384, 156/313

[51] **Int. Cl.** **C09j 5/06**

[58] **Field of Search** 156/293, 313; 84/380, 382, 384

[56] **References Cited**

UNITED STATES PATENTS

3,421,399 1/1969 Greenleaf et al. 84/380

1,786,833 12/1930 Pytch 84/384

OTHER PUBLICATIONS

Armstead, B. H. & Begeman, M. L., Manufacturing Processes, N.Y., Wiley, 1965, pp. 264–271.

Van Vlack, L. H. Elements of Materials Science Reading, Mass., Addison-Wesley, 1964 p. 189.

Primary Examiner—Alfred L. Leavitt
Assistant Examiner—Caleb Weston
Attorney—Flynn & Frishauf

[57] **ABSTRACT**

A process for assembling a tone hole covering assembly comprises interposing an uncured thermosetting resin between the inner bottom surface of the cup and the pad, and heating and curing the resin while the pad is kept engaged with the tone hole socket of the instrument body in a predetermined airtight condition. The airtightness between the pad and the tone hole socket can be secured without the necessity for repeatedly adjusting the relative position of the pad and the cup.

14 Claims, 4 Drawing Figures

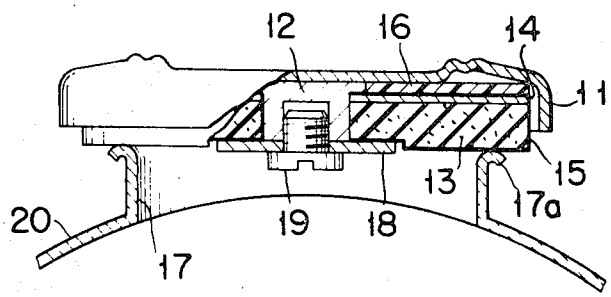


FIG. 1

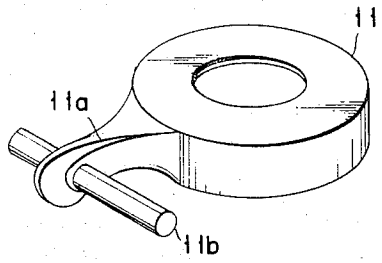


FIG. 2

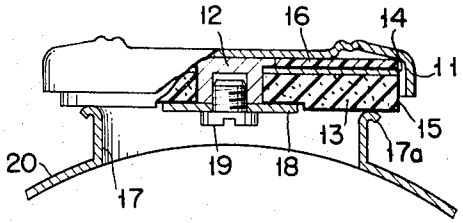


FIG. 3

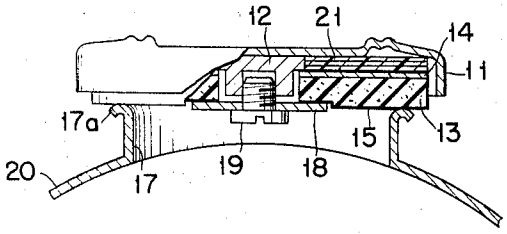
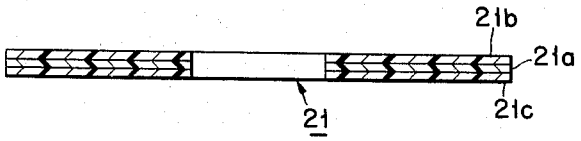


FIG. 4



METHOD FOR ASSEMBLING TONE HOLE COVERING IN WOOD-WIND MUSICAL INSTRUMENT

This is a continuation of U.S. Pat. application Ser. No. 46,877, filed Jun. 17, 1970 now abandoned.

This invention relates to a process for assembling a tone hole covering assembly for wood-wind musical instruments.

Usually, the tone hole covering assembly for a wood-wind instrument, such as a flute, engages a tone hole socket formed in the instrument in an open and closed relationship, by rotatably operating a key cup connected to a hinge through an arm extending from the cup, which hinge is pivoted to the body of the instrument. It is known that the airtightness of the pad with respect to the tone hole socket which is obtained when the pad engages the tone hole socket greatly influences the stability of the musical tone, especially at the bass tone region. Frequently, the pad does not engage the tone hole socket in a desired condition due to a lack of precision in positioning the key cup, the hinge and the tone hole socket and in the production of accessory parts. This calls for troublesome and inaccurate adjustments of removing the cup together with the hinge and placing a suitable number of spacer sheets between the bottom surface of the cup and the pad to control the inclination of the contact surface of the pad. Such adjusting operation requires high skill and is time-consuming, thus lowering the productivity.

The object of the invention is to eliminate the drawbacks described above and to provide a tone hole covering assembly and a process for assembling the same ensuring a positive and predetermined airtightness without the need of any later adjusting operation. The object is attained by securing the pad to the key cup, interposing an uncured thermosetting resin impregnated sheet therebetween, holding the pad in engagement with a tone hole socket of the instrument, and curing the thermosetting resin.

This invention can be more fully understood from the following detailed description when taken in connection with the accompanying drawing, in which:

FIG. 1 is a perspective view of a tone hole covering assembly embodying this invention;

FIG. 2 is a front view, partly in section, of the assembly;

FIG. 3 is a view similar to FIG. 2, illustrating a modification of the invention; and

FIG. 4 is a vertical cross section of an element of the assembly shown in FIG. 3.

The tone hole covering assembly for a wood-wind musical instrument as shown in FIGS. 1 and 2 comprises a key cup **11** having therein a central seat **12** with internal threads, a doughnut-shaped pad of felt or other suitable materials **13** received in the cup **11** about the threaded seat **12**, a base sheet **14** of a ring shape adhered on the surface of the pad which faces the inner bottom surface of the cup **11**, and a fish skin **15** covering the pad and the base sheet.

The cup **11** is provided with an outwardly extending arm **11***a* to which a key hinge **11***b* is secured. The key hinge **11***b* is pivotally connected to the tubular body **20** of a woodwind instrument by means of a journal not shown, and is rotatably operated. When the key hinge **11***b* is in its assembled state, the circular edge **17***a* of a tone hole socket **17** formed in the tubular body **20** engages the outer surface of the pad **13** including the fish skin **15**.

Between the inner bottom surface of the cup **11** and the corresponding surface of the pad **13** is interposed a cured thermosetting resin **16** such as cured polyester, epoxy or silicon resin. The thermosetting resin may, before it is cured, be mixed with a filler or loading agent such as calcium carbonate, and further with a reinforcement or strengthening material such as glass fiber, natural or synthetic fiber, yarn, or corky material, which may be either powder, grains or chips. One example of such mixture is as follows.

Polyester resin	100 parts
Calcium carbonate	230 parts
Glass fiber	42 parts
Benzoyl peroxide (as hardening agent)	4 parts

The process for assembling the tone hole covering assembly of this invention, as for example, employing the above-mentioned mixture will be explained hereinafter. Said mixture forming a kind of pre-mix is first placed into the cup **11** by a proper quantity. The pad **13** is then fixed in the cup **11**, backed by the mixture, as by threadedly engaging a screw **19** with the threaded seat **12** through a washer **18**, which serves to press the inner edge of the pad **13** against the inner bottom surface of the cup **11**. As a next step, the pad is pressed against the circular edge **17***a* of the tone hole socket **17** with proper pressure and kept in engaged relationship with the latter. The mixture is thereafter cured by heat treatment, for example, at 100° to 120° C for 30 to 60 minutes.

According to the process of this invention, the pad **13** is kept in forcedly engaged relationship with the circular edge **17***a* with the uncured thermosetting resin **16** being interposed between the inner bottom surface of the cup **11** and the pad **13**, and the resin **16** in a soft condition is so formed and then cured in the cup as to permit the contact surface of the pad **13** to tightly engage the tone hole socket **17** and as to allow the pad **13** to close the tone hole socket **17** to such an extent as to maintain required airtightness. The pad **13** is thus suitably positioned and fitted to the tone hole socket in its assembled state, and no further subsequent adjustment will be necessary.

In a modification shown in FIGS. 3 and 4, a doughnut-shaped flexible spacer **21** in which thermosetting resin is pre-impregnated is employed. The spacer **21** may be made of a strengthening material such as paper, felt, non-woven fabric or the like in which a thermosetting resin, such as polyester, phenol, epoxy, silicon or the like is preimpregnated. An example of the impregnates is as follows.

Polyester	100 parts
Magnesium oxide (as condensing agent)	2 parts
Zinc stearate (as parting agent)	3 parts
Benzoyl peroxide (as hardening agent)	1 part
Stylene monomer (as cross linking agent)	15 parts

The process for assembling the tone hole covering assembly using the aforesaid spacer **21** will be explained below.

A sheet of paper, for example, is soaked with a thermosetting resin, coated on both surfaces with separate sheets of polyethylene each having a thickness of say 0.03 mm so as to form a three-layer structure, and then dried at 60° C for 15 minutes. The sheet of paper thus treated becomes a kind of pre-preg. The sheet is cut

into a proper shape like a doughnut-shape as shown in FIG. 4, which constitutes the spacer **21** consisting of a pre-impregnated layer **21***a* and two separate layers **21***b* and **21***c* of polyethylene coated on both surfaces thereof. The spacer **21** whose shape conforms to the shape of the pad is placed into the cup **11** and the pad **13** is then laid on the spacer **21** and secured in the cup as by threadedly engaging the screw **19** with the seat **12** through the washer **18.**

The cup **11** carrying therein the spacer **21** and the pad **13** is assembled with the body of a musical instrument **20** with the outer surface of the pad **13** pressedly engaged with the edge **17***a* of the tone hole socket **17,** and kept in engaged relationship with each other, whereby the spacer **21** is deformed in such a manner that the pad **13** and the tone hole socket **17** are held in an airtight relationship with each other. While the spacer is held deformed, it is subjected to heat treatment at 100° to 120° C for 30 to 60 minutes, with the result that the spacer is cured in its deformed state without the necessity of any further adjustment of the pad **13.**

The sheet of paper above described is coated with the separate sheets of polyethylene so as to facilitate the releasing of the spacer **21** from the inner bottom surface of the cup **11** after the thermosetting resin impregnated in the spacer **21** is cured, but the polyethylene sheets may be omitted.

According to this invention, the pad can be fitted to the tone hole socket with positive and required airtightness without the need of repeatedly adjusting the position of the pad at the time of the assembling operation, so that the assembling operation can be greatly simplified and the efficiency of production can be greatly improved.

What is claimed is:

1. A process for assembling a tone hole covering assembly for a wood-wind musical instrument having a cup and a pad housed in the cup and for opening or closing a tone hole socket formed on the body of the instrument comprising steps of:

soaking a layer of sheet-like strengthening material in a thermosetting resinous solution so that said material is coated with a thermosetting resin;

drying said coated material so that it is brought into a pre-preg state;

then cutting said dried material into a shape conforming to the shape of the pad;

placing said shaped material into the cup;

laying the pad on said shaped material and placing the pad in the cup with said shaped material interposed between the pad and the cup;

pressing the pad to the edge of the tone hole socket so that the pad is engaged with the edge of the tone hole socket in a predetermined airtight relationship; and then

heating and then curing the thermosetting resin while pressing the pad in engaged relationship with the edge of the socket.

2. The process as claimed in claim **1,** wherein said thermosetting resin is heated during said heating and curing step at a temperature of 100° to 120° C for 30 to 60 minutes.

3. The process as claimed in claim **1,** further comprising a step of coating said strengthening material with polyethylene sheets after said material is soaked into the thermosetting resinous solution.

4. The process as claimed in claim **1,** wherein said strengthening material is a sheet of paper.

5. The process as claimed in claim **1** wherein said strengthening material is generally doughnut-shaped.

6. The process as claimed in claim **1** wherein said step of securing the pad in the cup comprises passing a screw member through said pad and threadably engaging said screw member with said cup.

7. The process as claimed in claim **1** wherein the steps prior to pressing the pad to the edge of the tone hole socket are performed prior to assembling said cup to the musical instrument, and comprising the step of assembling said cup carrying said pad and shaped material to said musical instrument prior to pressing the pad to the edge of the tone hole socket.

8. The process as claimed in claim **1,** wherein said strengthening material is a sheet of felt.

9. The process as claimed in claim **1** wherein said strengthening material is a sheet of non-woven fabric.

10. The process as claimed in claim **1,** wherein said strengthening material is dried at a temperature of about 60° C for about 15 minutes.

11. The process as claimed in claim **10,** wherein said thermosetting resin is heated at a temperature of 100° to 120° C for 30 to 60 minutes.

12. The process as claimed in claim **1** comprising covering at least one side of said coated layer of strengthening material with a thin sheet of polyethylene prior to said drying step to form a multi-layer structure.

13. The process as claimed in claim **12** comprising covering both sides of said coated layer of strengthening material with thin sheets of polyethylene before said drying step to form a three-layer structure.

14. The process as claimed in claim **13** wherein said covering step comprises covering said coated layer of strengthening material with separate respective thin sheets of polyethylene.

* * * * *