Dec. 30, 1930. H. DYTCH 1,786,833

MUSICAL WIND INSTRUMENT

Filed June 4, 1928

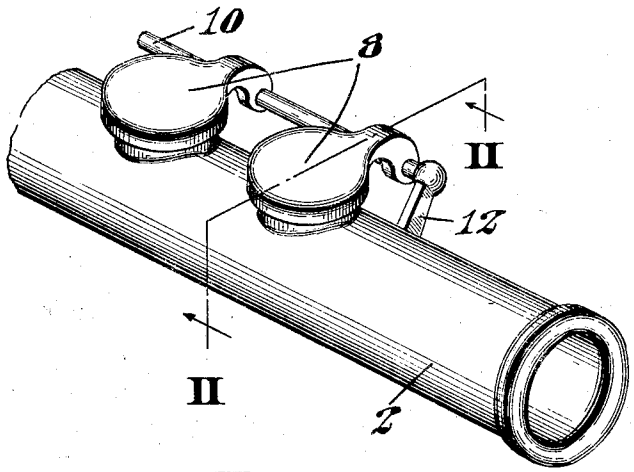


Fig.1.

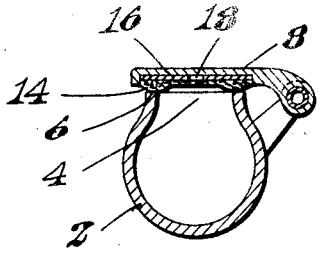


Fig.2.

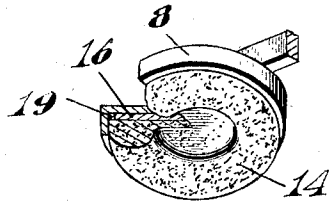


Fig.3.

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UNITED STATES PATENT OFFICE

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MUSICAL WIND INSTRUMENT

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This invention relates to musical wind instruments, and is herein exemplified in a key for such an instrument to which has been applied a novel pad in accordance with a novel method.

It has hitherto been customary to cushion the seating face of a wind instrument key with a skin-covered felt pad, which is held against the face of the key by means of a washer and a screw, bolt, or metal snap device passing through the center of the washer and also through the center of the pad. It is necessary, for proper tone production, that the pad be secured to the key in such position that when the key is closed the pad will seat evenly all around upon the edges of the tone hole of the instrument. The usual practice, in applying pads to keys, has been to employ crescent or segment shaped shims or spacing members of paper or of other thin sheet material between the pad and the key, arranging these spacing members and building them up to a sufficient thickness by a process of trial and error so as to compensate the unavoidable inaccuracy in the mounting of the key, and also to compensate the natural local inequalities of thickness and density of the pad itself. This method of fitting the pad to the instrument is tedious and requires skill.

Considerable pressure is required to force the ordinary felt pad to seat evenly all around the edge of the tone hole. It is therefore necessary to employ relatively heavy springs to maintain the pads of the normally closed keys properly seated, whereas the normally open keys are held open by relatively light springs. This difference in spring tension impedes the technique of the performer.

In the use of the ordinary felt pad, an annular groove is pressed into the pad by the edge of the hole. The felt, although a yielding material, is relatively non-resilient and retains this groove indefinitely. Until such a groove is formed by playing upon the instrument, the tone of the instrument is such as to render it unfit for public performances. Whenever a worn felt pad is replaced by a new one, the instrument is therefore rendered temporarily useless. Even after the groove is formed, moderate variations in temperature will affect the dimensions of the edge of the tone hole and thus prevent perfect registry of the groove therewith, greatly impairing the tone. The felt absorbs the moisture condensed from the breath, such absorption causing variations in the dimensions of the pad, so that the groove will not properly register, and again the tone quality is impaired.

The objects of this ivention are to devise a more accurate and expeditious method of applying a pad to a key, and to provide an improved pad and an improved means for attaching the pad to the key whereby the pad will seat accurately upon the edge of the tone hole under light pressure, eliminating the necessity of having heavy springs for the closed keys while employing light springs for the open keys, and rendering it possible to have the springs for all the keys of equal and relatively light tension. A further object of the invention is to provide a pad which will seat properly without the need of having a groove formed in it, and which therefore may be used immediately after attachment for public performance, and which will be unaffected by moisture or by variations of temperature.

In accordance with one feature of the invention, the pad has an annulus of a toroidal shape, the pad being composed of yielding material. Sponge rubber is employed, not only because it possesses the proper degree and quality of resilience, but also because it may readily be molded to the desired form.

In carrying out my novel method of applying and attaching a pad to a key, the pad is adhesively secured to the key by means of a thermo-plastic material, for example dental wax. The thermo-plastic material is of substantial thickness so as to form a matrix or bed for the pad. The matrix is softened by heat, and the key is closed while the matrix is soft to permit the pad to seat evenly upon the tone hole of the instrument, the key being held closed under a light pressure until the matrix cools to a permanent set.

The invention further consists in various features of construction and combinations

and arrangements of parts herein shown and claimed, the advantages of which will be apparent to those skilled in the art from the following description, reference being had to the accompanying drawings, in which:—

Fig. 1 is a perspective view of the end portion of a flute,

Fig. 2 is a transverse section taken through the plane II—II as indicated on Fig. 1, and

Fig. 3 is a perspective view partly in section showing the pad in the process of being applied to the key.

The tubular body 2 of the flute has tone holes 4 formed with raised circular edges 6. Keys 8 are mounted upon a shaft 10 which is supported by posts 12 secured to the body 2. The keys 8 are preferably cupped to receive a pad, and are otherwise like the keys hitherto employed, except that the usual central depending screws for holding the pads are omitted.

In place of the ordinary skin-covered felt pad, a pad 14 of resilient material, preferably sponge rubber of fine texture, is attached to the inner or cupped face of each of the keys 8. The attaching surface of the pad 14 is flat, while the side presented to the tone hole 4 has a central hollow or concave portion, all corners on this side being rounded off as shown. The pad 14 thus has a relatively thick annular portion or annulus which engages the edge 6 of the tone holes 4, and a relatively thin central portion. The relatively thick annular portion of the pad 14 has substantially the form of a segment of a torus formed by a plane normal to the axis of the torus, and the surface of the portion of the pad which is presented to the edge of the tone hole structure is therefore substantially toroidal. The edge 6 of the tone hole structure is coated with lacquer to protect the metal of the flute from direct contact with the rubber of the pad. As a further protection, the face of the pad which engages the edge 6 may also be coated with a protective material, preferably collodion. The pad 14 is seated in a bed or matrix 16 of thermoplastic material, such as dental wax, which adheres on one side to the inner face of the key 8 and on the opposite side to the flat surface of the pad 14, and which constitutes the means whereby the pad is attached to the key. The term "thermo-plastic" is used herein to denote substances which are solid at all normal atmospheric temperatures, but which assume a plastic and adhesive state at greater temperatures, approximately at 120° F. or somewhat higher. The bed 16 of thermoplastic material is in the form of a flat disk of slightly less diameter than the pad 14 to leave an annular space 19 (see Fig. 3), and having a central hole 18 (Fig. 2). The thickness of the bed 16 will, in general, depend upon the size of the key. For piccolos, it will be about one thirty-second of an inch; for flutes, clarinets or oboes, about one-sixteenth of an inch; for saxophones, it may be as much as one-eighth of an inch.

The beds 16 may be cut or stamped from dental wax which has been softened by heat and then rolled into sheets of the desired thickness. A bed 16 is applied to the flat side of a pad 14 by heating one face of the bed in the flame of a match or of a small alcohol lamp, or by any other convenient source of heat. High temperatures are unnecessary, as the dental wax will soften at 120° F. On slight pressure the heated face of the bed 16 will adhere permanently to the pad 14, and the pad with the bed attached may be set aside for future use or shipped to the user, or may at once be applied to the key 8.

To apply the pad 14 and the attached bed 16 to the key 8, the key is first heated. An alcohol flame may be used for this purpose. The exposed face of the bed 16 is then applied to the inner face or cup of the key 8, to which it immediately adheres. Fig. 3 shows the pad and the key at this stage of the process. The key 8 is then lightly pressed down to bring the pad 14 into contact with the edge 6 of the tone hole 4. The bed 16 is of less diameter than the cup of the key 8, as shown in Fig. 3, and the now plastic material of the bed will flow into the annular space 19 surrounding it and into the central hole 18 in such a manner as to insure an even seating of the pad 14 upon the edge 6. In a moment or two the key 8 may be released. The instrument is then ready for use.

It will be noted that the seating of the pad 14 in the plastic bed 16 is automatic, and that any inequalities in the key 8, the edge 6, or the pad 14 itself, will be exactly compensated by the flow of more or less material of the bed 16 from the locality corresponding to the inequality. In other words, any inequalities or irregularities in the key, the edge of the tone hole or the pad will be exactly compensated by complementary inequalities in the thickness of the bed 16, to the end that the pad 14 will seat evenly and uniformly on the edge 6. The dental wax, on cooling, maintains accurately the impression it received when plastic, and will retain that exact impression indefinitely.

It will be apparent from the foregoing description that the bed 16 serves a twofold purpose: it secures the pad 14 to the key 8, and it also positions the pad 14 upon the key 8 for proper seating upon the edge 6. The use of the bed 16 eliminates the need of screws, washers, etc., extending from the key 8 into the tone hole 4, and thus avoids the veiling of the tone caused by these members. It also permits the central portion of the pad 14 to be hollowed, as above described, thereby increasing the effective tone opening when the key is open, and during the opening

and closing movements of the key. The thickened annulus of the pad 14 gives desirable resilience for seating upon the edge 6. A centrally hollowed portion in the pad 14 is found preferable to a central perforation, inasmuch as the hollowed pad presents a greater surface for the adhesion of the bed 16. The physical properties of sponge rubber are such as to render it especially suitable to pads of the shape above described, this material having the further advantage of being easily molded to the desired shape, and of retaining this shape without the aid of external pressure. Because the rubber pad is thus normally unstressed, the full resilience of the rubber is available to insure an even seating of the pad when the key is closed.

While the invention has been described and illustrated with reference to a flute, it is not limited to flutes, but is applicable to all wood wind and reed instruments, including saxophones, and in general to all wind instruments having keys. It is equally applicable to the normally closed keys as well as to the normally open ones, the latter having been shown merely for convenience in illustration.

Having described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a keyed wind musical instrument, a key, a pad for said key composed of yieldable material having a face for attachment to said key and an opposite face for engaging the edge of a tone hole structure, said opposite face being formed to present a substantially toroidal surface to the edge of the tone hole structure and having a centrally hollow portion, and adhesive means for attaching said pad by the first-mentioned face to said key.

2. In a keyed wind musical instrument, a key, a pad for said key, and a bed of thermo-plastic material of substantial thickness for adhesively securing said pad to said key.

3. In a keyed wind musical instrument, a key, a pad for said key, and an adhesive matrix of substantial thickness between said pad and said key for holding said pad and said key in a fixed predetermined relation.

4. In a keyed wind musical instrument, a key, a pad, and a matrix of dental wax adhesively interposed between said pad and said key.

5. In a keyed wind musical instrument, a tubular body having a tone hole, a key for said tone hole, a rubber pad for said key, and means for protecting the edge of said tone hole from direct contact with the rubber of said pad.

6. In a wind musical instrument, a tubular body having a tone hole, a key for closing said tone hole, a rubber pad for said key, and a coating of lacquer on the portion of the instrument adjacent to the edge of the tone hole to protect said edge from the rubber of said pad.

7. A key pad for wind musical instruments composed of yielding normally unstressed material having a toroidal form for engaging the edge of a tone hole structure.

8. A key pad for wind musical instruments, having a relatively thick annular portion for engaging the edge of a tone hole structure and a relatively thin central portion which is integral with the annular portion.

9. A key pad for wind musical instruments, composed of yielding material and coated on one face with collodion.

10. In combination, a key pad for wind musical instruments, and a disk of thermo-plastic material adhesively attached to one face of said pad.

11. The method of attaching a pad to the key of a wind musical instrument, which consists in applying the pad to the key by means of a matrix of thermo-plastic material softened by heat, closing the key while the matrix is soft to enable the pad to seat evenly upon the edge of the tone hole of the instrument, and in holding the key closed under light pressure until the matrix cools to a permanent set.

12. The method of attaching a pad to the key of a wind musical instrument, which consists in interposing a matrix of thermo-plastic material between the key and the pad, applying heat to the matrix to soften the matrix, and holding the key closed under light pressure while the softened matrix flows to enable the pad to seat evenly upon the edge of the tone hole of the instrument and until the matrix cools to a permanent set.

13. The method of attaching a pad to the key of a wind musical instrument, which consists in softening one face of a disk of thermo-plastic material by heating, attaching the softened face of the disk to the pad, heating the key of the instrument, applying the free face of the disk to the heated key, and holding the disk under light pressure between the pad and the key until the material of the disk cools to a permanent set.

In testimony whereof I have signed my name to this specification.

HARRY DYTCH.