

March 18, 1969

B. A. PORTNOY
LIGATURES OR REED-HOLDERS FOR SINGLE-REED MUSICAL
WIND INSTRUMENTS

3,433,113

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FIG. 1

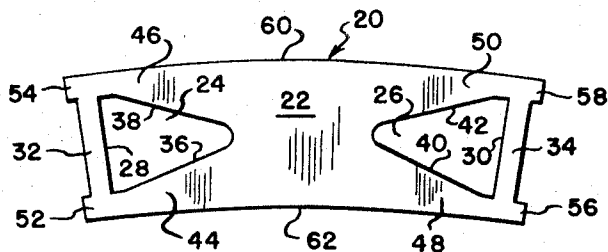


FIG. 2

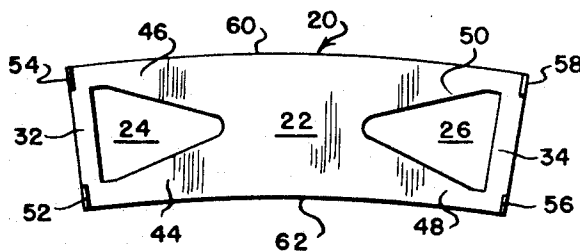


FIG. 3

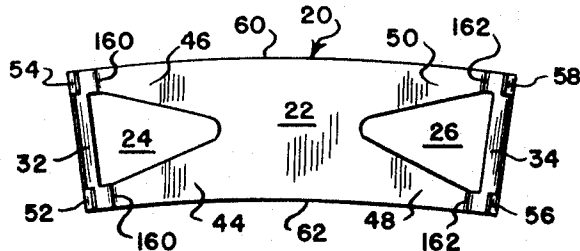


FIG. 4

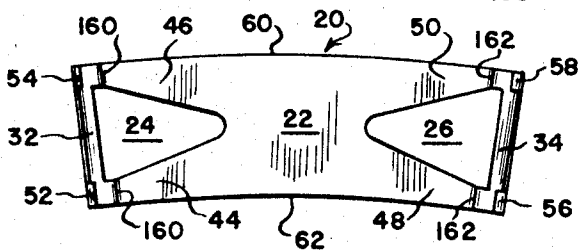


FIG. 5

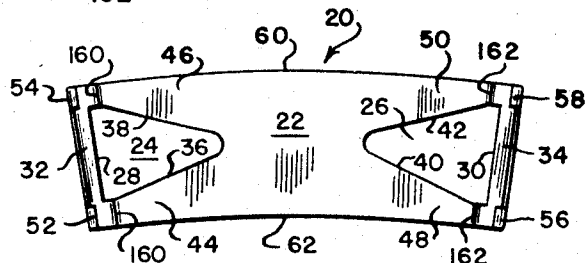
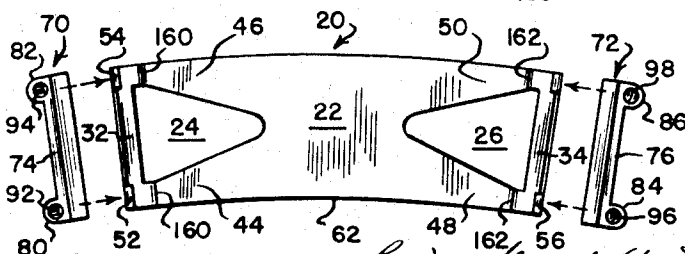


FIG. 6



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FIG. 7

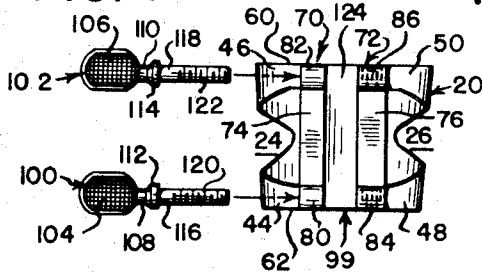


FIG. 8

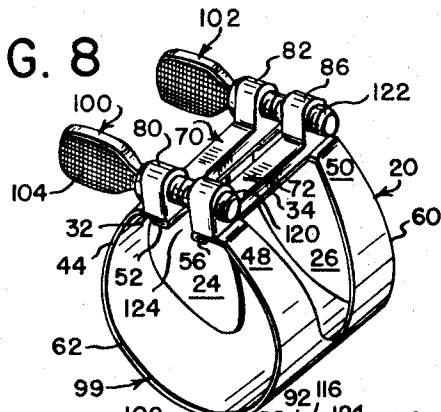


FIG. 9

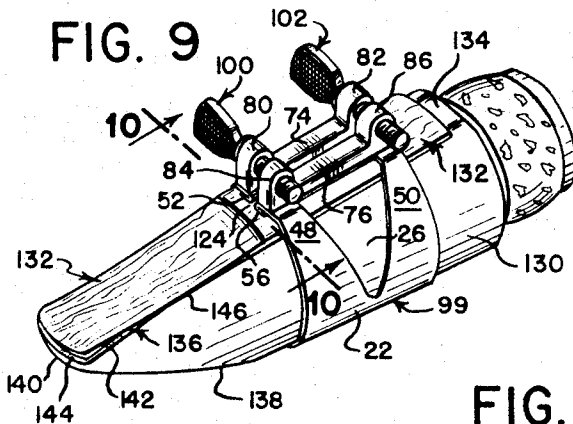


FIG. 10

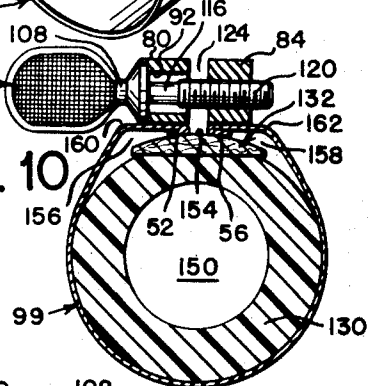


FIG. 11

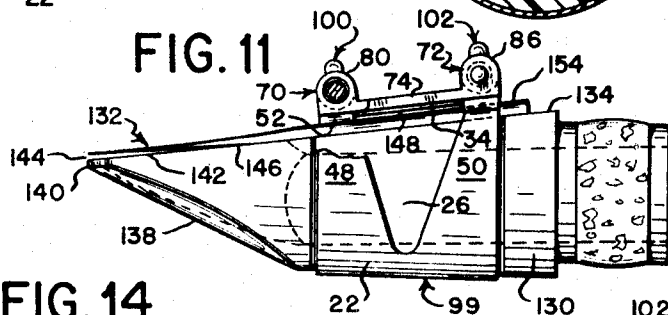


FIG. 13

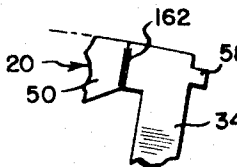


FIG. 14

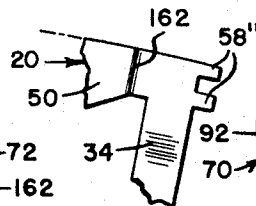


FIG. 15

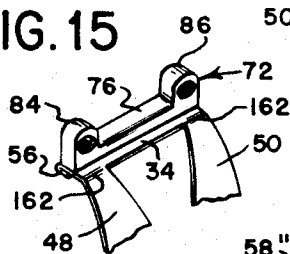


FIG. 16

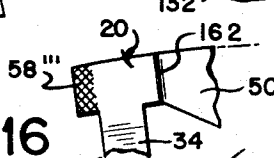
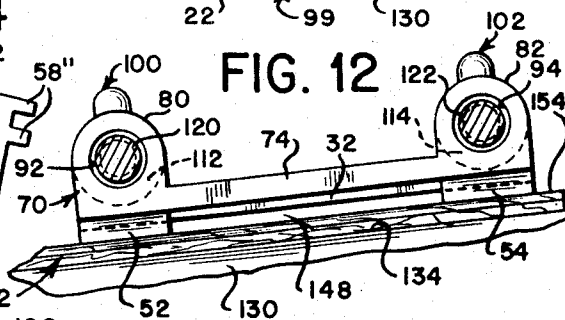


FIG. 12



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3,433,113

LIGATURES OR REED-HOLDERS FOR SINGLE-REED MUSICAL WIND INSTRUMENTS

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Int. Cl. G10d 9/02

9 Claims

ABSTRACT OF THE DISCLOSURE

A ligature or reed-holder for single-reed musical wind instruments is described in which the reed is held on the mouthpiece of the instrument by a lower and an upper pair of spaced and opposed bearing lugs positioned directly over and in contact with small areas of the thick outer mid-apex section of the heel of the reed so that the relatively thin longitudinal side portions as well as the thick mid-apex heel portion, between the lower and upper pairs of lugs, of the heel are free to vibrate.

This invention relates to ligatures or reed-holders for single-reed musical wind instruments. The invention relates more particularly to improvements in the blanks and parts from which they are made, the method of producing such ligatures or reed-holders, as well as the ligatures or reed-holders themselves as a product of manufacture.

There is a considerable variety of musical wind instruments that requires the use of a single-reed, including members within the same family of instruments. Thus, the clarinet family consists of at least five members, each in a number of keys, which differ from one another in size as well as tone:

The small soprano in D, E, F and A flat; the large soprano in C, B flat (often called simply "clarinet in B") and A; the alto or bariton in F (basset horn) and E flat; the bass in C, B flat and A; and the contrabass in E flat and B flat.

The saxophone, too, is a single-reed instrument. That family consists of at least six sizes with two keys to each. Like the clarinet, they differ from one another in size as well as tone: the small sopranino or piccolo or aigu in F and E flats; the large sopranino in C and B flat; the contralto in F and E flat; the tenor in C and B flats; the baritone in F and E flat; and the bass in C and B flat.

While the oboe and English horn (alto oboe) are considered to be double-reed musical wind instruments, manufacturers, teachers and others have designed oboe mouthpieces, for example, adapted to hold a single-reed, in close simulation tonewise of the oboe double-reed; the single-reed being a substitute for the usual double-reed. This arrangement is intended to make playing of the oboe easier and quicker for a beginner; who can later adopt the conventional oboe double-reed; or easier for a player who must double, for example, a clarinetist who also plays an oboe or English horn. The shift from one to another is made easier.

All of these musical wind instruments require the use of a ligature or reed-holder; and the present invention is intended to benefit all performers on such instruments. Among the many features desired of such instruments is the provision of easily operated mechanisms, ease of blowing, a fast staccato, and, above all, a pleasing tone. Unfortunately, these desirable features are not fully attained in or with a given instrument. They are features investigators aim or strive to achieve.

These wind instruments may be compared in many ways with a violin, or any other stringed instrument. The acoustics of stringed, as well as of wind, instruments are

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extremely complex. In general, predetermined lengths of the strings are made to vibrate (oscillate, pulsate) by the player. The elongated curved box-like structure, usually made of carefully seasoned wood, below or back of the strings, becomes a resonance chamber, or resonator, for those vibrations; as does the mouthpiece chamber of the single-reed wind instrument. The placement or release of a violin player's fingers on the violin strings determines the length of vibration of those strings. Those vibrations are conveyed through a bridge to the resonating box, which reinforces the notes initiated by the strings, and necessarily of those air vibrations escaping through the openings in the top of the box. In similar fashion, the placement or release of a player's finger on the holes or keys of his wind instrument (for example, a clarinet), determines the rate of pulsations within the mouthpiece resonance chamber, as well as the length and rate of the alternating columns of air within the bore of the instrument. The resonance box of the violin pulsates; so do the mouthpiece, reed, ligature and body of the wind instrument.

In order better to understand some over-all problems faced by performers on single-reed instruments, it may be advisable to discuss briefly some of the specific problems presented by the mouthpieces and the reeds, and then some of the particular benefits to be derived in the use of the present improved ligature or reed-holder.

All of the instruments mentioned require a mouthpiece, and a reed. They are closely related, since they must closely cooperate with each other; and here is where the ligature necessarily comes in. In the case of the mouthpieces, they are somewhat similar in shape to each other externally, but, of course, vary in size, depending upon the size of the instrument on which they are fitted. Each mouthpiece has a tapered, generally round, body, with an exposed open end upper section and an exposed closed end lower section flattened to form a *table*. The open end of the table is surrounded by a peripheral ledge or rail, on which the peripheral portion of the lower flat base side of the tapered upper portion of the reed may rest. The reed is fastened onto the table with a ligature or reed-holder, usually made from appropriate spring sheet metal having suitable flexibility. Plastics have also been proposed for the purpose.

The free or smaller end of the mouthpiece tapers down into a *beak*. This makes possible a minimum opening of the performer's mouth for playing the instrument. The interior of the mouthpiece forms a throat, tone or resonance chamber of various shapes to obtain a better, or at least a different, quality of tone. The forward end of the table is slightly curved horizontally and longitudinally upwardly, away from the rearward closed end of the table to form a *lay*. Since the back side of the reed is flat and in the same plane, when it is mounted on the table of the mouthpiece, the forward or tapered portion of the reed is spaced a very short distance from the forward lay portion of the table. This space allows room for the reed to vibrate back and forth and thus to produce the desired sound or tone. It is important that the mouthpiece "speak" instantly on the player's attack—blowing and tonguing. Why this does not always happen is not fully understood. Numerous variables are involved, some known and some unknown. The present invention at least offers a partial and important answer.

The straight and curved portions of the opposite rails on the sides of the table are, or should be, identically the same, so that both sides of the flat base of the wet reed may strike the curved rails at the same time, and be released from the rails simultaneously. The places at which the straight portions of the rails pass into the curved portions of the rails is called the *break-or bend-*

line. No matter how carefully mouthpieces are made, it is a common saying that no two of them are alike.

No matter how excellent is the single-reed instrument player, he is abjectly beholden to a reed. No matter how good is his instrument and his mouthpiece he is an unwilling victim of the vagaries of that reed. As in the case of mouthpieces, even of instruments, no two reeds blow alike or have the same tone. Indeed they are not physically duplicates of one another. For example, they often vary in cross-section, particularly in their rear or heel portions which contact the ligature.

Although plastic reeds have come into the market, most reeds are made of bamboo, commonly called cane. Is a given reed good or bad? There is only one test—trial and error. High quality tone is a principal desideratum; so is easy response and control; stability; intonation; etc.

The thinned, tapered, upper, forward, portion of a reed is primarily a spring, a very delicate one. It bends or vibrates, while wet from the player's mouth, over the break or bend-line mentioned above, under the pressure of the player's breath, back and forth many, many, times. It has been estimated that such round-trip vibrations occur at the rate of around 146 per second for low E on the B flat clarinet, and around 1900 per second on the same clarinet for the high C in the sixth space above the music staff. See Robert Williman: *The Clarinet and Clarinet Playing* (revised edition), page 42.

The wet reed, if functioning properly, seals the mouthpiece air-tight momentarily every time the reed vibrates (oscillates) and strikes the lay of the mouthpiece, to permit each single column of air under vibration to go undisturbed through the resonance chamber of the mouthpiece and then down the open bore or tube of the instrument, where the column of air continues to vibrate. On release of the tip of the player's tongue from the tip of the reed, the air-tight seal breaks and the reed returns to its former unbent condition; ready to repeat another vibration. When the tip of the tongue and the breath of the player bend the reed onto the upper or forward portion of the mouthpiece table, the tapered portion of the reed must not only bend over the break- or bend-line, but the upper or forward peripheral portions of the flat base side of the reed must contact and cling, at least for a moment, to the rails or ledges and tip or beak of the mouthpiece. In this way is the air-tight seal effected, and broken. The tip of the reed has been found to be tight against the beak for 50% of each vibration cycle; it stands wide open for about 25% of the cycle; and the other 25% of the time is taken up by the actual travel back and forth between these two positions (Williman, *supra*, page 55).

While it is important for the upper or forward portion of the reed to vibrate in the manner indicated, and that has been fully recognized for a long time, no one, so far as I am aware, has designed a metal ligature of the type herein contemplated that satisfactorily permits a maximum portion of the lower or heel portion of the reed also to vibrate to get maximum usefulness out of the reed. Ligature after ligature, reed-holder after reed-holder, has appeared on the market, and each one of them is so designed that a very substantial section of the lower or heel portion of the reed is held tightly against the mouthpiece, or is contrived otherwise, to interfere with or dampen its vibrations. The effect necessarily is to prevent that important portion of the reed freely to vibrate or pulsate and therefore to enhance the effectiveness of the reed as a whole.

As a result of my investigations I have discovered a ligature or reed-holder blank, a ligature or reed-holder itself, as well as its method of manufacture, or such improved design that a maximum amount of the heel portion of the reed is made to work for the player, by vibrating simultaneously with the upper or tapered end of the reed. Disadvantages of the kind mentioned for

mouthpieces and reeds are at least in large part overcome. I recognize full well that there are many variable factors to be considered, human as well as structural, which contribute to the problems of the instrument as well as the instrumentalist, and which a greatly improved ligature cannot entirely solve. It may be said of the present ligature, however, that it permits a player to obtain decidedly better all-around results.

Thus, his instrument will blow more easily; attack—the way it speaks—is prompt; speed and sharpness of staccato are enhanced; quality of tone is improved, with a reasonably good reed; its tone is not too harsh or too brilliant; its tone is enriched with added overtones; it is possible to obtain soft *pianissimo* to loud *fortissimo*; good intonation results; it is much easier to reach high notes; better results are obtainable with inferior instruments, mouthpieces and reeds; and certainly he gets better results with superior instruments, mouthpieces and reeds; etc.

These and other features of the invention will be better understood, it is believed, by referring to the attached diagrammatic drawings, taken in conjunction with the following description, in which

FIG. 1 is a plan view of a basic flat band blank, punched or stamped out of suitable flexible sheet metal, to be formed into a tapered ligature and showing a small reed-holding-lug protruding longitudinally of the band, at each of its four corners; the base of the two small reed-holding-lugs at each end being immediately adjacent to a transverse-band-end-panel of the blank;

FIG. 2 is a plan view of the blank of FIG. 1, showing the four small reed-holding-lugs bent uprightly, say vertically, from the transverse-band-end-panels;

FIG. 3 is a plan view of the blank of FIG. 2, showing the four small reed-holding-lugs in their same relative positions, but with the transverse-band-end-panels bent uprightly from the main body portion of the blank, at an appropriate angle, say about 45°, to conform generally to the curvature of the completed ligature;

FIG. 4 is a plan view of the blank of FIG. 3 showing the small reed-holding-lugs bent further downwardly, at an acute angle, toward their respective transverse-band-end-panels;

FIG. 5 is a plan view of the blank of FIG. 4, showing the small reed-holding-lugs bent down, or closely, to their respective transverse-band-end-panels;

FIG. 6 is a combination plan and exploded view of the blank of FIG. 5, showing a rigid cross-bar-support integrally attached (indicated by arrows) to the rear of each transverse-band-end-panel, as one views FIGS. 1-5;

FIG. 7 is a bottom view of FIG. 6 after the thus treated blank is bent or rounded rearwardly into its split tapered ligature form, with the rigid cross-bar-supports juxtaposed to each other on the outside, and showing a pair of thumb screws ready to be inserted into the screw holes of the juxtaposed cross-bars;

FIG. 8 is a perspective view of FIG. 7, showing the thumb screws mounted in outwardly extending standards at the ends of the juxtaposed rigid cross-bar-supports;

FIG. 9 is a perspective view, showing a mouthpiece with a reed held in playing position by the ligature of FIG. 8;

FIG. 10 is a cross-section on the line 10-10 of FIG. 9, with broken away sections showing a cross-section of the top pair of rigid cross-bar-support standards and the manner in which the thumb screws fit into them;

FIG. 11 is a side view of FIG. 9, with a section of the body portion of the ligature and the top cross-bar-support standard to the left of the viewer cut away to show the juxtaposed rear top cross-bar-support standard and the manner in which a very substantial intermediate portion of the heel of the reed between the upper and lower small reed-holding-lugs is free to vibrate;

FIG. 12 is a partial sectional view of the ligature down its split vertical center to show more plainly the rear

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rigid cross-bar-supports mounted on their transverse-band-end-panel, the small reed-holding-lugs resting on the curved top portion of the heel of the reed and the extended intermediate free air space between the spaced lugs and between the top of the heel of the reed and the straight bottom of the rigid cross-bar-support;

FIG. 13 is a plan view of one corner end of a modified form of ligature, showing small reed-holding-lugs inwardly located at the corners of the transverse-band-end-panels, and centrally disposed with respect to the above mentioned cross-bar-support standards;

FIG. 14 is a plan view of one corner end of another modified form of ligature, showing a plurality of serrated or "dental" (like teeth) reed-holding-lugs, also centrally disposed with respect to the above mentioned cross-bar-support standards;

FIG. 15 is a perspective view of a portion of a ligature, showing a rigid cross-bar-support integrally secured to a transverse-band-end-panel wider than the cross-bar-support to keep the flexible narrow mouthpiece side gripping extensions out of contact with a reed held in position on the mouthpiece by a ligature; and

FIG. 16 is a plan view of a portion of a ligature, showing the reed-holding lugs with their reed-facing sides scored to provide a firm grip on the reed.

Since the ligature is fitted onto the tapered body of a mouthpiece, the flat blank from which it is made must be carefully shaped to permit accommodation of the finally formed ligature on the mouthpiece. To a certain extent the ligature ends up generally in the form of an elliptical hollow frustum of a cone.

Referring to FIG. 1, a flat blank 20 is punched or stamped out of suitably flexible spring sheet metal, such as brass. Its body or band portion 22 is simultaneously provided with spaced elongated cut out portions or windows 24 and 26, although they may be cut out in a subsequent operation. The base or outer ends 28 and 30 of the windows define inner sides of transverse-band-end-panels 32 and 34. The window sides 36, 38 and 40, 42 define with the band flexible narrow side gripping extensions 44, 46 and 48, 50. The four corners of the blank band terminate in four relatively small reed-holding-lugs 52, 54 and 56, 58. To obtain the desired tapered effect, the band is symmetrically curved at its sides, as shown: A relatively long convex curve 60 (which becomes the lower edge of the ligature) and a relatively short concave 62 (which becomes the upper edge of the ligature). This causes transverse-band-end-panels 32 and 34, as well as small reed-holding-lugs 52, 54 and 56, 58 to be inclined in the same general direction.

The method of forming the ligature may now be followed: The first step is to produce a blank, as just described with respect to FIG. 1. The second step is illustrated in FIG. 2. Small reed-holding-lugs 52, 54, 56 and 58 are bent uprightly with respect to the flat blank; say at right angles thereto. The third step is illustrated in FIG. 3. Transverse-band-end-panels 32 and 34 are bent uprightly, say at an angle of about 45°, to the surface of the flat blank. This is about as much as is required to make their flat panel surfaces mesh in or simulate closely the curvature of the finished ligature adjacent its line of vertical split. The fourth step is illustrated in FIG. 4; that is to bend the small reed-holding-lugs 52, 54, 56 and 58 downwardly toward the flat surfaces of their respective transverse-band-end-panels 32 and 34; say about 60°. The fifth step is illustrated in FIG. 5; that is to bend the small reed-holding-lugs down, or at least very closely, to their respective transverse-band-end-panels. The sixth step is illustrated in FIG. 6.

The latter step should have some special attention. FIG. 6 shows a pair of solid rigid opposed cross-bar-supports 70 and 72; which may be likened to a straight span bridge supported at its ends by the reed-holding-lugs. They, too, are advantageously formed of brass, being cut to uniform size from a long solid strip of brass into a

desired functional shape and size. The cross-bar-supports shown are formed of rectangular cross-sectional elongated body portions 74 and 76, respectively; which terminate at their ends in outwardly extending standards 80, and 82, 84 and 86. Each cross-bar-support is placed in a jig, and their standards are in turn provided with transverse holes 92, 94, 96 and 98 adapted to receive thumb screws. The result is that the screw holes are just about perfect. They match with each other in juxtaposed standards. The result is that there is no swing in the reed when tightening the thumb screws. It will be noted that holes 92 and 94 in cross-bar-support 70 are smooth-surfaced; and that holes 96 and 98 in cross-bar-support 72 are threaded. This is customary practice, as will be explained below. The standard screw posts are attached with liquid solder. During the hardening of the solder, the screw holes tend to be thrown out of alignment; and the screw posts are so weak they tend to pull out of position. The rigid-cross-bar-supports provide much needed firmness in the seating of the ligature on a reed, perfect balance of the holding-lugs on the reed, and no swing of the reed on the mouthpiece.

FIG. 6 is an exploded view since it shows the rigid cross-bar-supports separated from the processed blank of FIG. 5. The arrows, however, are intended to indicate that the cross-bar-supports are in fact integrally attached at their under sides to the outer or reverse sides of transverse-band-end-panels 32 and 34. This is done in the present instance by placing a thin strip of silver solder between the cross-bar-supports and the reverse sides of the transverse-band-end-panels, and applying heat to effect a soldering together of the opposed parts. An extremely strong bond is effected in this manner.

The seventh step is illustrated in FIG. 7. The processed blank of FIG. 6 is bent or rounded backwardly into the shape of a ligature 99. Standards 80 and 84, as well as 82 and 86, are juxtaposed to each other so that their corresponding thumb screw holes are in alignment with each other. It is again to be noted that the holes in standard 70 are smooth surfaced while those in standard 72 are threaded. They are adapted to receive upper and lower thumbs screws 100 and 102. They have knurled grip handles 104 and 106. Integrally attached to the stem portions 108 and 110 of the screws are enlarged circular stops 112 and 114. They are immediately adjacent smooth surfaced stem sections 116 and 118. The free ends of the stems are provided with threaded sections 120 and 122. When assembling the ligature, thumb screws 100 and 102 are inserted into the near smooth surfaced holes and then the threaded end sections 120 and 122 of the thumb screws are inserted into the far threaded holes. On turning knurled handles 104 and 106 rigid cross-bar-supports 70 and 72 are drawn closer to each other.

FIG. 8 is a perspective view showing the finished ligature in its fully assembled state. Thumb screws 100 and 102 are in place, locking the ends of the blank in spaced opposition to each other by an air space 124, quite similar to the situation obtaining when the ligature is mounted on a mouthpiece and is holding a reed in playing position.

Just such a position is illustrated in FIG. 9. A mouthpiece 130 is shown with a reed 132 fitting on the top of flat table 134 and the lay 136 of the mouthpiece, the reed being held in position by ligature 99. The upper end 138 of the mouthpiece tapers to a beak 140. The beak and lay have a ledge or rail 142 extending peripherally around the lay against which the tapered upper portion of the reed may vibrate and even cling to momentarily. Although not very clearly shown in FIG. 9 (FIG. 11 is better for the purpose), an open gap 144 exists between the tapered portion of the reed and the beak and lay of the mouthpiece, down to its break or bend line 146. FIG. 9 also shows small reed-holding-lugs 52 and 56 in holding position on the curved top central portion of the heel of the reed. Since there is no binding of the sides of the heel of the reed, as well as no binding of its intermediate por-

tion across its entire width, fuller vibration of the entire reed is obtained. This, in brief, makes for better tone quality, evenness of scale throughout the range of the instrument, better reed life resulting in improved performance, etc.

Of particular importance is the extended open air space 148 between the top of the heel of reed 132 and the bottoms of the transverse-band-end-panels 32 and 34, integrally attached to rigid cross-bar-supports 70 and 72, and horizontally between the four small reed-holding-lugs 52, 54, 56 and 58. As already indicated, the cross-bar-supports may be likened to a bridge, beneath whose span is a free air space. This air space permits the extended intermediate top portion of the heel of the reed to vibrate freely, unencumbered with the remainder of the reed; and the resulting air currents may freely ebb and low in that open space. It is a very effective addition to the portions of the reed that are normally free to vibrate.

It may be helpful at this stage to point out that when reed 132 is placed on flat table 134 of the mouthpiece and ligature 99 is mounted around mouthpiece 130 and top and bottom screws 100 and 102 are screwed gradually to tighten the reed in its playing position, various interrelated pressure forces are brought into play. First, as the open gap 124 between cross-bar-supports 70 and 72 narrows, toward a closed position, the small reed-holding-lugs 52, 54 and 56, 58 tend to slide laterally over the curved top of the heel of the reed towards the apex or midpoint 154 of the reed's top curvature. In other words, the thrust of the juxtaposed cross-bar-supports is essentially side-ways, toward each other. As shown in FIGS. 3-6, 8-11, and 12, the ends of small reed-holding-lugs 52, 54 and 56, 58, facing the top crescent curved portion of reed 132, are rounded, so that they slide over, rather than dig into, the reed during this initial movement. This prevents damage to the reed. Second, when the sliding side movements just about cease, further tightening of the screws tends to exert a vertical thrust of the small reed-holding-lugs onto the apex portion of the reed's curvature. This is continued until the reed is held in a fixed playing position.

Being a cross section on the line 10-10 of FIG. 9, FIG. 10 gives a different view of the manner in which ligature 99 is mounted on mouthpiece 130 to hold reed 132 in place on flat table 134. It also shows the interior resonance chamber 150 of the mouthpiece. The flat bottom 152 of the heel of the reed rests on the flat surface 134 of the table, and the curved deeper crescent-shaped portion of the reed, especially its apex portion 154, comes in holding contact with the small reed-holding-lugs of the ligature. FIG. 10 shows the bottoms of small reed-holding-lugs 52 and 56 in contact with small spots or areas of the apex portion 154 of the upper part of the heel of the reed. In similar fashion small lugs 54 and 58 engage small spots or areas of the apex portion 154 of the lower part of the heel of the reed.

Transverse-band-end-panels 32 and 34 are of predetermined width, not only to help keep the bottom portions of cross-bar-supports 70 and 72 well above reed 132, but also to make sure that the upper portions of flexible-side-gripping-extensions 44, 46, 48 and 50 of ligature 99 remain separated from the reed by open air gaps 156 and 158. In other words, the extensions are not permitted to contact the sides of the reed, because if that should occur those and adjacent portions of the reed would not be free to vibrate. If the bottoms of cross-bar-supports 70 and 72 are not sufficiently wide to effect this result, panels 32 and 34 are made sufficiently wide to effect the same purpose; or the bottoms of the cross-bar-supports may be made sufficiently wide to effect the desired result; or, better still, the panel and the cross-bar-supports are of substantially the same width and capable of effecting the desired result. As a practical matter the upper ends of flexible-side-gripping-extensions 44, 46, 48 and 50 may be bent or creased at spaced away bend-

lines 160 and 162 to effect the same purposes in yet another way. Each extension is strengthened along the line of crease, and therefore resists and prevents contact of any portion thereof against the reed.

It will be noted that no part of band 22, no part of its flexible-side-gripping-extensions 44, 46 and 48, 50, in fact no part of ligature 99 ever comes in contact with the peripheral side and end portions of the heel of the reed. Those portions are always free to vibrate with the tapered end tip portion of the reed. The small reed-holding-lugs 52, 54, 56 and 58 obviously must exert some dampening effect on vibrations that occur at or immediately adjacent to those small lugs. However, the four spots or areas of the reed so affected are kept as small as practically possible. The lugs must, of course, be big enough to hold the reed in a fixed playing position. Furthermore, the lugs must not be so small as to damage the reed, say by splitting. A practical compromise is possible. That is the one that should be adopted.

Thumb screw 100 (FIG. 10) is detailed in such a manner as to show how it is placed in operating position. Its stem 108 extends through circular stop 112, which is against standard 80, and its smooth surfaced stem section 116 and threaded end section 120 extend through smooth surfaced hole 92 in standard 80. Then its threaded end section 120 passes across air gap 124 into and through threaded hole 96 in standard 84. In similar fashion thumb screw 102 has its stem 110 extending through circular stop 114, which is against standard 182, and its smooth surfaced stem section 118 and threaded end section 122 extend through smooth surfaced hole 94 in standard 82. Then its threaded end section 122 passes across air gap 124 into and through threaded hole 98 in standard 86.

FIG. 11 is a side view of the mouthpiece, reed and ligature of FIG. 10, except, as noted above, a portion of the band flexible-side-gripping-extension 48 of ligature 99 is cut away, as is standard 84 and a portion of cross-sectional elongated body portion 76 of cross-bar-support 72. In this way one gets a better view of extended open air space 148 (also see FIG. 12) between the top or apex portion 154 of the heel portion of reed 132 and transverse-band-end-panels 34 and 32 underlining cross-bar-supports 72 and 70. When the mouthpiece, as shown in FIG. 11, is held up to the light, one can easily look through open air space 148. It is a fairly long horizontal slot compared with the small spots or areas of reed-holding-lugs in actual contact with the reed. That portion of the entire width of the heel of the reed is free to vibrate or pulsate when a performer plays his instrument. As is indeed the entire width of the heel portions of the reed extending outwardly beyond (above and below) the ligature.

The only portions of the reed that are not capable of vibrating or pulsating freely are the four relatively small spots or areas where the four corner reed-holding-lugs contact the top of the heel portion of the reed to hold it in playing position. Even at these small spots or areas, there may be only a dampening effect on such vibrations or pulsations. I am inclined to believe that those portions of the reed, as well as the ligature itself, is subject to some vibration.

This is true also of the instrument as a whole. It is thus seen that I make every effort to free as much of the total reed surface (and hence volume) as possible from contact with or pressure from the ligature, so that as much as possible of the total reed is free to vibrate or pulsate, consistent with holding the reed in playing position and with doing no physical damage to the reed. In general, the more of the reed free to vibrate or pulsate, the better it plays, the better its intonation, the quicker it speaks on the attack, the easier it plays, the more its overtones, the better and more pleasing its tone, the easier it is to play the high notes, the easier it is for the player to handle the

dynamics (piano, forte, fortissimo and the like) of a composition being played, etc.

Another important advantage of the four small spots or areas of contact between the four lugs and the reed is that the lugs can be made to accommodate themselves to uneven surface contours often encountered in the heel portions of reeds. Because the cross-bar-supports are rigid, and the screws fit loosely in the smooth surfaced holes, thus permitting some up and down movement of the cross-bars and hence of the lugs, of one of the cross-bar-supports, the cross-bars may be screwed toward each other in non-parallel relationship; that is to say, the gap 124 between them may be so adjusted in size and shape as to permit one or more lugs, for example, to sink into a depressed area of the reed's surface, or indeed to rise to an elevated area of the reed's surface, thus holding or gripping the reed firmly in spite of its low and high spots. Stated another way the improved ligature permits perfect balance of the lugs on the reed in spite of its irregular top surface. The flat bottom of the reed may in this way be made to fit onto the flat table of the mouthpiece under substantially equalized pressure. This permits the reed as a whole to function more efficiently for the player.

To aid in a better understanding of the invention, reference may be made to FIG. 12. It may be regarded as a somewhat enlarged partial view of a portion of the far side of FIGS. 9 and 11, taken on a line extending through open air space 124 (FIG. 9) of the split portion of ligature 99. Cross-bar-support 70 is shown in position on reed 132, in turn mounted on flat table 134 of mouthpiece 132. Transverse-band-end-panel 32 and its small reed-holding-lugs 52 and 54 are shown in place under the cross-bar-support 70 and its elongated body portion 74. The small lugs separate the apex 154 of the heel portion of reed 132 from elongated body portion 74 of cross-bar-support 70 to help form extended open air space 148. That space is shown to better advantage in this figure; and it should help to emphasize the importance of the invention so far as freezing the maximum amount of the heel of the reed for vibration or pulsation is concerned.

So far as I am aware the prior art does not disclose a release of that extended intermediate space for such purpose. Instead, the prior art shows the use of such space as additional reed clamping area. See, for example, Bonade, 2,791,929 (1957). It is not necessary for that purpose. Small space spot areas, such as described, are sufficient to hold the reed in playing position. Furthermore, the use of that extended intermediate space for reed-holding or clamping purposes is definitely detrimental. It prevents a very substantial heel portion of the reed from vibrating. The prior art, for the most part, thought it sufficient for the tapered or tip portion of the reed to vibrate; and hence advisable to keep much of the heel portion of the reed from vibrating. Greatly improved playing results are made possible with the extended intermediate air space 148. The improved ligature of the invention is finding quick public acceptance.

As already indicated, the reed-holding-lugs should be kept as small as practicable to increase the amount of reed free to vibrate or pulsate; but not so small as to do physical damage to the reed.

FIG. 13 is an embodiment showing a right corner end of a blank, as one views that figure (as well as FIGS. 1-6), with smaller reed-holding-lugs 58' protruding lengthwise from transverse-band-end-panel 34. The lugs are centrally disposed with respect to standards 84 and 86 of cross-bar-support 72 and thumb screws 100 and 102. The other ends of the blank, although not shown, are similarly constructed. The procedure for producing the ultimate ligature is the same, or substantially the same, as that already described.

FIG. 14 is an embodiment showing a right corner end of a blank, as one views that figure (as well as FIGS. 1-6), with a plurality of small serrated or dental (like teeth) reed-holding-lugs 58'' protruding lengthwise from trans-

verse-band-end-panel 34. The lugs are symmetrically disposed with respect to standards 84 and 86 of cross-bar-support 72 and thumb screws 100 and 102. The other ends of the blank, although not shown, are similarly constructed. The procedure for producing the ultimate ligature is the same, or substantially the same, as that above described.

FIG. 15 is an embodiment showing rigid cross-bar-support 72 of smaller width integrally secured to transverse-band-end-panel 34 of larger width. In fact the end-panel is shown extending to bend-line 162 of the flexible narrow mouthpiece-side-gripping-extensions 48 and 50.

FIG. 16 is an embodiment showing a scored reed-holding-lug 58'' integrally formed with transverse-band-end-panel 34. The side of the lug facing the center of the ligature, that is facing the reed when it is mounted on a mouthpiece, is scored so that it can firmly grip the top of the heel portion of the reed. Each of the corner lugs is similarly scored. This arrangement helps to keep the ligature from slipping toward the upper tip or beak portion of the mouthpiece.

If desired the interior surface of the ligature may likewise be scored, at least in part, to help keep the ligature from slipping toward the beak of the mouthpiece. Since the mouthpieces are usually made of hard rubber, although wood and plastics are often employed, the scored portions of the ligature would tend to grip or hold onto the mouthpiece. The amount of grip obviously would be less on glass mouthpieces. While the scored ligature would tend to scratch the exterior surface of the mouthpiece, that fact would not impair the usefulness of the ligature.

After the brass ligatures are formed into the desired size and shape, they are advantageously plated with an attractive bright metal. Nickel is the present metal of choice. To this end the surfaces of the brass ligatures are carefully cleaned; after which the nickel is applied to the clean surfaces in any desired manner, such as by immersion or by electrolysis.

Those skilled in the art will appreciate that the above designed ligature greatly improves playing results. The tension of the thumb screws can be adjusted by the player to control the pressure of the reed-holding-lugs on the heel of the reed, even though the outer surface contour of the reed is irregular, and he, if experienced, can tell by the "feel" of the instrument whether satisfactory vibration is being obtained. Thus, due to the fact that a reed requires a given amount of vibration for each note, the ligature of the invention gives the reed more freedom to attain its full vibration. This results in a substantially even scale throughout the playing range of the instrument.

It will be clear to those skilled in this art that what has been disclosed is merely illustrative of the invention, and that the practice of the invention lends itself to other useful modifications.

I claim:

1. In a stamped ligature blank, for a single-reed musical wind instrument, formed of a flat band of flexible spring sheet metal of predetermined size and shape having a cut out window extending near each end of the band to provide at each end of the blank a pair of oppositely located narrow flexible outer mouthpiece-side-gripping-extensions, the outer ends of the side-gripping-extensions and the outer ends of the windows terminating in a pair of opposed transverse-band-end-panels, the improvement in combination therewith which comprises: a small reed-holding-lug extends outwardly from, and longitudinally of, the band at each of the four band corner portions of the opposed pair of transverse-band-end-panels, the four reed holding lugs thereby being locatable in spaced opposed pairs, when the blank is brought to its normal ligature shape and is appropriately mounted on a reed positioned on the mouthpiece of the wind instrument, directly over and in bearing contact only with small areas near the ends of the thick outer mid-apex section

of the heel portion of the reed but with the opposed transverse - band - end - panels and the mouthpiece-side-gripping-extensions normally out of contact with the outer surface of the reed, and the lugs of each opposed pair being spaced transversely only a small distance from each other, so that the relatively thin longitudinal side portions as well as the mid-apex heel portion between the lower and upper pairs of lugs of the heel of the reed are free to vibrate in spite of the bearing pressures exerted by all of the lugs on the small areas near the upper and lower ends of the thick mid-apex section of the heel of the reed.

2. In a ligature or reed-holder for a single-reed musical wind instrument, formed of a flat band of flexible spring sheet metal of predetermined size and shape having a cut out window extending near each end of the band to provide at each end of the blank a pair of oppositely located narrow flexible outer mouthpiece-side-gripping-extensions, the outer ends of the side-gripping-extensions and the outer ends of the windows terminating in a pair of opposed transverse-band-end-panels, the improvement in combination therewith which comprises: at least one small reed-holding-lug is integrally secured to the inside portion of each of the four corners of the pair of opposed transverse-band-end-panels; an extended elongated air space is thus provided between the spaced lugs on each transverse-band-end-panel when a reed and the ligature are mounted on the instrument's mouthpiece; the four reed-holding lugs are located in spaced opposed pairs, when the ligature is appropriately mounted on the reed positioned on the mouthpiece of the wind instrument; the lugs are in bearing contact only with small areas near the ends of the thick outer mid-apex section of the heel portion of the reed but with the opposed transverse-band-end-panels and the mouthpiece-side-gripping-extensions normally out of contact with the outer surface of the reed; and the lugs of each opposed pair are spaced transversely only a small distance from each other so that the relatively thin longitudinal side portions as well as the mid-apex portion, between the lower and upper pairs of lugs, of the heel of the reed are free to vibrate in spite of the bearing pressures exerted by all of the lugs on the small areas near the upper and lower ends of the thick mid-apex section of the heel of the reed.

3. A ligature or reed-holder according to claim 2, in which the sides of the lugs facing the center of the ligature are knurled to provide a strong grip on a reed held in place on the instrument's mouthpiece by the ligature.

4. A ligature or reed-holder according to claim 2, in which the narrow flexible outer mouthpiece-side-gripping-extensions are creased along bend-lines spaced a suitable distance away from their adjacent transverse-band-end-panels to strengthen the spaced portions of the flexible extensions next to the end-panels and hence keep the extensions out of contact with a reed held in place on the instrument's mouthpiece by the ligature.

5. A ligature or reed-holder according to claim 2, in which each reed-holding lug is a continuous integral part

of its band-end-panel, and each lug extends inwardly from, and longitudinally of, the band at each of the four corner portions of the opposed pair of transverse-band-end-panels.

6. A ligature or reed-holder according to claim 2, in which a rigid elongated cross-bar-support is integrally secured to the outside of each of the two transverse-band-end-panels.

7. A ligature or reed-holder according to claim 6, in which the two rigid elongated cross-bar-supports are provided at each of their ends with an upright standard; the standards are provided with thumb screw holes; and the thumb screw holes of juxtaposed standards are in alignment with one another to facilitate tightening and untightening of the ligature and to assure substantially equal pressure of the reed-holding-lugs.

8. A ligature or reed holder according to claim 6, in which two rigid elongated cross-bar-supports are provided at each of their ends with an upright standard; each upright standard is in turn located opposite a reed holding lug to help place the lug directly under pressure; the standards are provided with thumb screw holes; and the thumb screw holes of juxtaposed standards are in alignment with one another to facilitate tightening and untightening of the ligature and to assure substantially equal pressure on the reed-holding-lugs.

9. A ligature or reed-holder according to claim 2, in which each reed-holding-lug is a continuous integral part of its band-end-panel; each lug extends inwardly from, and longitudinally of, the band at each of the four corner portions of the opposed pair of transverse-band-end-panels; a rigid elongated cross-bar-support is integrally secured to the outside of each of the two transverse-band-end-panels; the two rigid elongated cross-bar-supports are provided at each of their ends with an upright standard; the standards are provided with thumb screw holes; and the thumb screw holes of juxtaposed standards are in alignment with one another to facilitate tightening and untightening of the ligature and to assure substantially equal pressure on the reed-holding-lugs.

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