Feb. 4, 1941. R. CAIRE ET AL 2,230,933

VIBRATOR REED FOR MUSICAL INSTRUMENTS

Filed Sept. 13, 1939

Fig. 1.

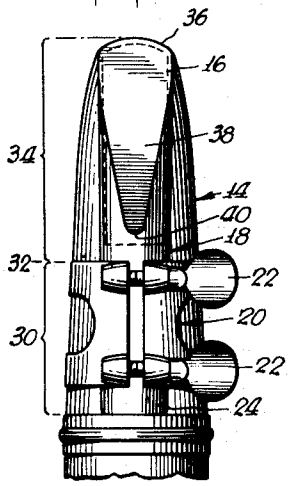


Fig. 2.

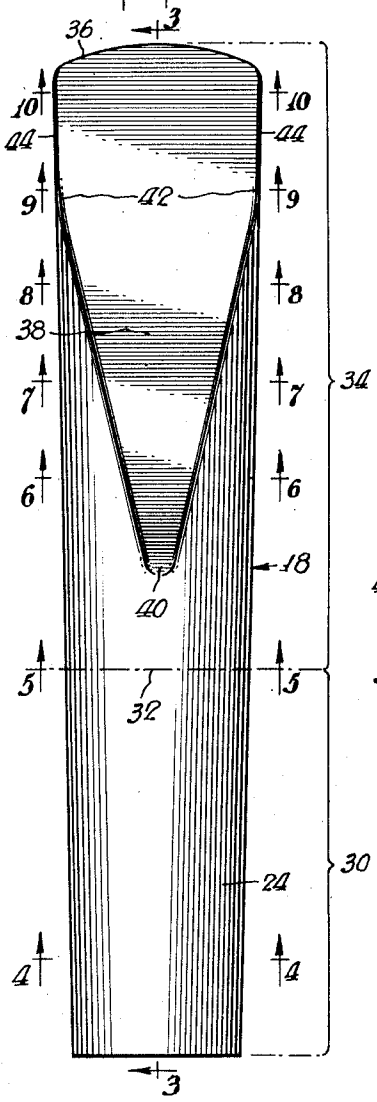


Fig. 3.

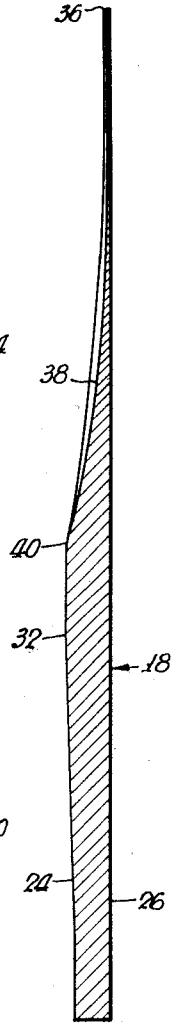


Fig. 4.

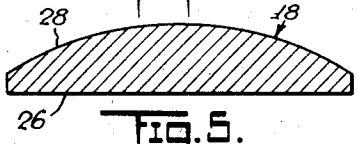


Fig. 5.

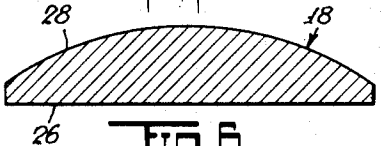


Fig. 6.

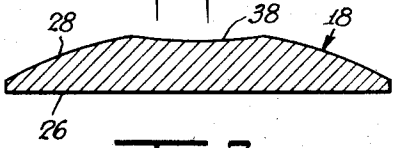


Fig. 7.

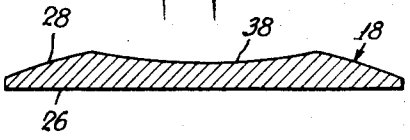


Fig. 8.

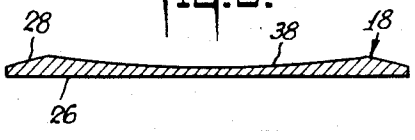


Fig. 9.

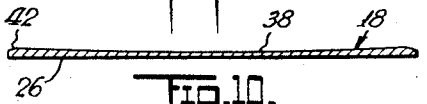


Fig. 10.



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UNITED STATES PATENT OFFICE

2,230,933

VIBRATOR REED FOR MUSICAL INSTRUMENTS

Raymond Caire, Yeadon, Pa., and Aaron J. Friedman, New York, N. Y.; said Friedman assignor to said Caire

Application September 13, 1939, Serial No. 294,622

10 Claims. (Cl. 84—383)

The present invention is directed to vibrator reeds, and it has particular relation to a vibrator reed that can be made from a synthetic plastic composition material that is suitable for use in musical wind instruments, such as the bassoon, clarinet, oboe and saxophone.

Reeds for these instruments are made, at the present time, from certain species of large water-loving grasses, commonly known as cane. The cane from which such reeds are made is specially grown in reed plantations in limited parts of the world where the soil and climatic conditions are found to be most satisfactory. These canes, being natural growths, are subject to all the whims of nature, and, as a result, are of varying characteristics. Reeds made from these canes are consequently different, and this is true even between reeds made from the same cane stalk. These cane growths are known to have different sexes. The female cane, which is considered the weaker, has only long parallel fibers. The male cane, which is the stronger of the two, and therefore considered the better grade for making reeds has, in addition to its long parallel fibers, cross-fibers in its grain. Reeds cut from the same stalk vary in characteristics and quality. Some reeds have very coarse grain and others have a very fine grain. Reeds cut from the sunny side of the stalk have been found to be superior to reeds cut from the shady side of the stalk. These canes, being vegetable growths, are subject to many variations due to changes in climatic conditions, soil conditions, ripening conditions, aging conditions, etc. until every reed produced is different in some respects from every other reed produced whether made from the same stalk or from different stalks. As a consequence, performers have tremendous difficulties in finding a reed suitable for their instruments and embouchure.

Reeds made from cane must be "conditioned" each time before they are to be used and before they are satisfactory for playing purposes. They must absorb certain amounts of moisture before they will function properly in an instrument, and the amount of moisture varies depending upon the characteristics of the cane. Reeds made of cane that is too fine a grain will not absorb enough moisture, and reeds made of cane having too course a grain will absorb too much moisture. It is unquestionably difficult, under such circumstances, to find a reed of good quality and exactly the right strength or degree of flexibility for an individual mouthpiece or performer. Performers, having an extensive knowledge of reeds, reed patterns and great skill in scraping, secure better results "working over" their new cane reeds to suit their own individual requirements. Few performers are thus blessed, however, and, with the majority of them, it is a case of buying a large number of reeds and selecting the few best for their requirements.

It is estimated in the musical profession that only about twenty-five percent of the cane reeds purchased are found suitable or satisfactory to the individual performer, and, even in this limited number of reeds, the performer must change his embouchure, or readapt his technique slightly for each new reed used. These cane reeds, even when found eminently satisfactory, have an extremely short life, generally not exceeding two or three weeks. They become water-logged from saliva; the cellular structure of the cane reed breaks down, either from action of the moisture and the acids carried thereinto by saliva, or from the growth of micro-organisms carried by the saliva into the interstices of the cane reed; the thin flexible edge becomes split either through contacting some foreign object, such as the clothing of the performer, the tongue, or the inability of such edge to withstand the constant vibratory action when in use. Also, through wear the thin flexible tip becomes "feathery", and the uneven "feathery" edge frequently sets-up off-tune vibrations along with the main vibration of the reed per se. Cane reeds frequently fail without warning while the performer is playing a piece, and for that reason constitute a constant source of annoyance or fear to the performer, which detracts from his playing ability. All of these disadvantages are factors that make the cane reed a questionable and expensive proposition for the performer, and places him at a serious disadvantage with his instrument. He is constantly required to change his embouchure or readapt his technique with each new reed used.

In order to overcome these difficulties which are inherent with the cane reed, numerous attempts have been made to provide a reed having permanent features and characteristics. Metallic reeds have been attempted, but it was found that metal has no satisfactory "feel" as compared to the cane reed. The metal reed not only irritated the tongue of the performer, but robbed his lips and tongue of their body heat through its ability to rapidly absorb heat as the result of its excellent thermal conductivity. Furthermore, metallic reeds give very poor tonal qualities, a very limited range of notes, poor timbre, etc. As a consequence, the metallic reed has never been

accepted by the musical profession for wind instruments of the class above described.

Other attempts have been made to correct the deficiencies of the cane reeds, such as for example, coating the cane reed with a water-resisting covering, impregnating the reed with water-resisting materials. All of these methods have not proven satisfactory because they materially increase the weight of the reed and resulted in unsatisfactory tonal qualities. Such reeds also made playing of the instruments extremely difficult, and a performer must literally "blow his lungs out" to produce any tones with such reeds. They could not be used for continuous playing over long periods of time as with dance bands and symphonic concerts. For the above reasons such reeds have never been accepted by the musical profession for the instruments herein described.

With knowledge of the above developments and difficulties in mind, it would seem but a logical step in the development of a vibrator reed to make it of a plastic material, but we have discovered that plastics generally are wholly unsuited for the making of reeds. Some plastics are too soft, other plastics are too hard and brittle to withstand the vibrations necessary to produce musical tones. Some are too heavy in weight to permit satisfactory playing, and others are too stiff and therefore do not vibrate quickly enough to be used in playing certain types of music. Other plastics are incapable of producing satisfactory tones over a musical scale or range. Some plastics are toxic and produce unsatisfactory tastes in the mouth of the performer. Most plastics are made with a so-called "plasticizer," such as for example, camphor, phthalates, etc., which not only produce a bad taste in the mouth of the performer, but are also toxic to the body. Furthermore, most plasticizers are volatile, and tend to vaporize over periods of time, causing shrinkage in some instances and producing brittleness in others that prevent their adoption and use for the making of music reeds of the vibrator type. After making a very diligent and thorough search of the art of making vibrator reeds, we know of no instance where plastic reeds have been found suitable for musical instruments of the types described above.

All of the disadvantages found in the cane and other types of vibratory reeds mentioned above have been obviated by the present invention, and, as a result of our discoveries, we have produced a synthetic plastic reed which is superior in all respects to the cane reeds. In all of the desirable characteristics which our plastic reed has in common with the cane reed, it is recognized by outstanding performers in professional musical circles to be far superior, and it has also been found that our plastic reed has many desirable attributes that cane reed or other types of prior art reeds have never had.

An object of the present invention is to provide a reed of synthetic plastic material for wind instruments which is of a simple and inexpensive construction, and which is permanent and durable when compared with cane reeds.

Another object of the invention is the provision of a reed of synthetic plastic material which is light in weight, durable in construction, and capable of exact duplication both chemically and physically at all times.

A further object of the invention is to provide a reed of synthetic plastic material of such shape and construction that its tonal qualities and range exceed those obtainable with a cane reed.

Another object of the invention is to provide a reed of synthetic plastic material of such construction that it is capable of producing fine tonal results without requiring excessive lip pressure on the part of the performer, and without requiring a difficult embouchure.

A further object of the invention is the provision of a permanent and durable reed of synthetic plastic material that is capable of producing full, clear tones of great brilliancy, fine timbre, good carrying power, accurate intonation and capable of speedy execution of tonal changes due to its smooth surface and flexibility.

Another object of the invention is to provide a reed of synthetic plastic material which is always ready for use and which will not require "conditioning" to make it ready for playing.

A further object of the invention is the provision of a synthetic plastic reed of such construction as to permit a smooth even tip of minute thickness, which will act as a valve with a rolling motion, thereby preventing chatter and the production of "slappy" or "whacky" tones when being used.

Another object of the invention is to provide a reed of synthetic plastic material that is not affected by normal temperature changes, thereby requiring correction either by a change in embouchure or readaption of technique on the part of the performer to off-set such temperature changes as in the case of cane reeds.

A further object of the invention is to provide a reed of synthetic plastic material that is capable of being ground or machined to a desirable shape and provide a very smooth surface having no "feathery" edges capable of setting up off-tune vibrations along with the main vibration.

Another object of the invention is to provide a reed of synthetic plastic material that will not absorb moisture or heat from the body of the performer; which will not be affected by the acids and alkalies in the saliva; and which will be highly sanitary and not provide a breeding place for micro-organisms normally found in human saliva.

Another object of the invention is the provision of a reed of synthetic plastic material of a character such that it can be readily altered to suit the individual characteristics or idiosyncrasies of the performer, if desired.

A further object of the invention is to provide a reed that will not "fatigue" and lose its playing characteristics over long periods of time, and which will not give out without warning in the middle of of a program.

Another object of the invention is the provision of a durable, synthetic plastic reed of a construction that is more sensitive than the present cane reed, and therefore capable of producing more delicate nuances of tone while maintaining better quality in the tones produced.

Various other and further objects and advantages of the invention, which result in simplicity, economy and efficiency, will be apparent from the following detailed description, wherein a preferred form of embodiment of the invention is shown, reference being had for illustrative purposes to the accompanying drawing, forming a part hereof, in which:

Fig. 1 is a top plan view of our reed shown secured within a conventional mouthpiece for a musical instrument of the class described;

Fig. 2 is a top plan view, on an enlarged scale, of the reed shown in Fig. 1;

Fig. 3 is a side elevational view of the reed shown in Fig. 2;

Fig. 4 is a cross-sectional view, on a slightly larger scale, of the reed shown in Fig. 2, the same having been taken substantially along the line 4—4 thereof;

Fig. 5 is a cross-sectional view, on a slightly larger scale, of the reed shown in Fig. 2, the same having been taken substantially along the line 5—5 thereof;

Fig. 6 is a cross-sectional view, on a slightly larger scale, of the reed shown in Fig. 2, the same having been taken substantially along the line 6—6 thereof;

Fig. 7 is a cross-sectional view, on a slightly larger scale of the reed shown in Fig. 2, the same having been taken substantially along the line 7—7 thereof;

Fig. 8 is a cross-sectional view, on a slightly larger scale, of the reed shown in Fig. 2, the same having been taken substantially along the line 8—8 thereof;

Fig. 9 is a cross-sectional view, on a slightly larger scale, of the reed shown in Fig. 2, the same having been taken substantially along the line 9—9 thereof; and

Fig. 10 is a cross-sectional view, on a slightly larger scale, of the reed shown in Fig. 2, the same having been taken along the line 10—10 thereof.

Referring now to the drawing, there is shown in Fig. 1 a conventional mouthpiece 14 for musical wind instruments of the class above-described, having an apertured facing portion 16 shown in dotted lines, which has mounted thereover a synthetic plastic vibrator reed 18 secured clampingly thereto by a common two screw ligature 20 of conventional design. By tightening or loosening the screws 22 of the ligature 20, the vibrator reed 18 may be fixedly mounted over the apertured facing 16 or removed therefrom as desired.

The vibrator reed 18, which is shown on an enlarged scale removed from the mouthpiece 14 in Fig. 2, is of integral construction, and formed either by molding and/or machining the same from a suitable piece of plastic stock material hereinafter described. The reed 18, having a flat base 26 and a curved convex upper portion 28, is provided with a suitable shank portion 30, which is adapted to fit standard facings and be secured thereover by standard ligatures on the mouthpiece for wind instruments of the class described. The shank or fastening portion 30 of the reed 18 is that portion which extends from the non-playing end of the reed 18 to its fulcruming axis 32, which extends transversely intermediate its ends. The fulcruming axis 32 is determined by the position of the back edge of the ligature 20, when holding the instrument in playing position. This shank portion 30 of the reed 18 may be conveniently referred to as the "non-vibratory" section.

The opposite or tongue end 34 of the reed 18 extends from the fulcruming axis 32 to the free end 36 thereof, and may be conveniently referred to as the "vibratory" or "playing" section thereof. The length of the vibratory section 34 of the reed 18 is broadly determined by the tone range of the instrument for which it is intended to be used, and will vary as the design of the instrument varies, as for example, from soprano, which has the shortest vibratory section, to base, which has the longest vibratory section.

We have discovered that plastic reeds made from the particular plastic materials hereinafter to be described in detail may be constructed in a large number of distinctive shapes ranging from convex to concave, and that all of them are capable, to some degree at least, of giving satisfactory tonal qualities under certain limitations. Generally, however, such plastic reeds have distinct and limited playing qualities and tonal ranges. Some are excellent only in high octaves, and others are excellent only in the low octaves. Some are excellent for pianissimo (very soft) playing, and others are excellent for fortissimo (very loud) playing. Some are excellent for legato (smooth and flowing) playing, and others are excellent for staccato (short and disjointed) playing. These qualities vary so greatly with the different shapes we have made that it is impossible for us to show and describe the playing characteristics of each of them herein. We have discovered further that a plastic reed of the particular construction shown illustratively in the drawing, gives good tonal qualities when used with various types of instruments. This construction furthermore gives good tonal ranges in these various instruments from the high octaves to the low octaves, which has heretofore been unattainable with an ordinary cane reed. We have also discovered that this particular construction for our synthetic plastic reed provides superior tonal qualities and timbre, and is equally well suited for all kinds and types of playing. The construction illustratively shown appears to be as general in its tonal qualities and playing characteristics as the other shapes have been found to be specific within their respective limited fields.

Referring now to Figs. 2 to 10 of the drawing, wherein the structural features of the reed 18 are shown in exaggeration, it will be noted that a portion of the playing or vibratory end 34 of the reed 18 is hollowed or dished out along its top side in a concave formation, as indicated at 38. Whenever reference is made to the "top side" of the vibratory end 34, it is meant to indicate that side of the reed which is away from the seat or facing 16 of the mouth piece 14. This concave portion begins at a point 40 spaced backwardly of the fulcruming point 32 and becomes divergently wider and increases proportionately in depth as it approaches the free end 36. The angle of divergence being so great that the concave portion 38 is substantially adjacent the sides of the reed 18 at a distance spaced from the extreme free end 36, as indicated at 42. From the point 42 of adjacency to the extreme free end 36 of the reed 18, the concaved surface extends conterminously with the outer sides of the reed 18, as indicated at 44. It will be noted that the concave portion 38, while increasing divergently in width along a portion of the vibratory end of the reed 18, nevertheless is always of less width than said reed 18 at its widest part, thereby providing reinforcing shoulders 44 which extend to the free playing end 36 along opposite sides thereof. These shoulders 44 provide increased sealing qualities over the facing aperture 16, permitting a thinner free end while providing increased strength to the vibratory section, giving the reed 18 greater flexibility where needed.

In our development of the present invention, we have discovered that most synthetic resinous materials were not suited for the making of reeds for musical wind instruments. We did find, however, in our search that synthetic resins of the propenoic or acrylate family are capable of

producing highly satisfactory reeds for such instruments. These resins may be further defined as being polymers of propenoic acid derivatives or acrylic acid derivatives, and of such resins it is obvious that we can use only those which are solid and form-retaining in their polymeric state. Of these generic resins we have found that methyl methacrylate, n-amylacrylate and secondary butyl acrylate have all the chemical and physical characteristics desirable for producing a satisfactory reed for musical instruments of the class hereinabove described.

By using these particular resins, we have obviated many disadvantages of the cane reed, retained all of its advantageous features, and have produced a synthetic reed that has new properties not heretofore found in the conventional cane reed. For example, reeds made in accordance with this invention are permanent. The materials from which they are made are not affected by moisture, saliva, body acids and alkalies, temperature changes, atmospheric conditions, etc. These materials are non-porous, are easily kept clean, and have no interstices capable of harboring bacteria, micro-organisms, etc. Such materials have a pleasant "feel" to the tongue and lips of the performer, have low heat conductivity and low coefficient of expansion. Consequently, they do not tend to rob the tongue and lips of the performer of the body heat, and the performer does not have to change his embouchure or readapt his playing technique to off-set any temperature changes within the range of normal atmospheric and body temperatures. The particular resins in question are non-toxic, contain no volatile ingredients which over a period of time might cause shrinkage or change in the degree of hardness, flexibility, etc. Such resins are also age-resisting. It is apparent that we have provided a reed that is inert to atmospheric conditions, changes, etc. These resins have been found to have the proper degrees of toughness, hardness, specific gravity, flexibility and elasticity to permit a performer to produce musical tones in such instruments with the greatest of ease and over the widest possible range of tones. In addition to all of the above qualities, these resins have extremely good molding, machining and grinding qualities, which permit exact duplication of the reeds without difficulty whenever desired.

By actual tests we have found that new tonal qualities are obtained with our reeds that were not obtainable with the cane type or other types of reeds mentioned above. Our reeds produce full, fine tones, of accurate intonation, with exceptional tone brilliance, of fine timbre and carrying power, having both vigor and vitality. For example, we have found that with our improved reed an instrument, such as a clarinet, can be played with a number of brass instruments, and because of its unusual tone qualities, the solo clarinet will have such timbre that it will "cut through" the brasses and be distinctly and clearly heard. Its tones, however, also blend with the brasses and other instruments in a way not heretofore obtainable with the conventional cane reed.

We have also found, by actually playing woodwind instruments of the class described equipped with a reed made in accordance with our invention, that the same tonal qualities are available over the entire tonal ranges of the instruments. This is new and unusual for reed instruments, as the conventional cane reed is best either at the lower or upper part of the instrument range, and at other parts of its range the tonal quality falls down.

While the exact scientific understanding of reeds and musical instruments is not complete, we believe that the finer characteristics of our reed are due to a number of causes. In the woodwinds and the saxophone the lips act by controlling the vibration of a single or double blade reed. There is necessarily a slight opening between the single reed and its mouthpiece. This opening is almost closed during vibration. The instrument acts as a tube stopped up at one end. With our type of reed, because of its material and structural form, this closing off of the vibrating column of air is positive. There is no leakage to permit the formation of additional edge tones, so that the fine tone of the instrument is not impaired by unharmonic overtones due to the edge tones of the escaping air. In our reed the edges are structurally strong enough, when closed, to resist setting up partial vibratory segments of themselves, and tend to remain closed. The only vibration, therefore, is that of the main reed. With our reed, we obtain a "rolling" closure of the air column, and therefore the tones are not "slappy" because the reed does not close the air inlet with a slap or sudden or abrupt closure. The "rolling" closure of our reed gives the very fine tonal character described in the instrument. This type of closure permits a performer to play with equal tone quality and ease either legato or staccato type of music.

One of the biggest advantages of the synthetic plastics of which we make our reeds is that they can be duplicated at all times, and this coupled with the fact that the material can be readily machined to reproduce its structural features, permits exact duplication of any reed once produced. Thus, a performer can always secure a duplicate of the reed of his liking, and is no longer required to change his embouchure or readapt his technique when using a new reed.

The materials from which the reeds are made, being amorphous in character, are the same throughout the product. Such materials have no grainy structure, fibers or cementitious materials therein, which vary greatly throughout and produce notable differences in the finished reed. Furthermore, reeds made in accordance with our invention are of uniform strength throughout, and have no vulnerable points which might cause failure without warning in the midst of a performance. Consequently, the performer may forget about the possible failure of his reed and keep his mind entirely upon his music without fear of failure. Such fear plays a very important part in the playing of a performer, and is constantly directing his attention away from his music although it is not apparent to the listeners.

Another reason why the tones of our present reed are superior to the tones of the cane reed is probably due to the fact that our materials are capable of taking a highly polished surface, which has no free bits or particles of material adhering thereto, producing a "feathery" edge that can be set into vibration along with the main part of the reed. The cane reed is too porous, grainy and has too many fibers in its structure to give a smooth, free surface, regardless of how finely it has been polished or finished. Each of these little fibers or threads of the cane reed has a natural period of vibration, and, when the main reed is set into vibration, these small pieces tend to vibrate at their own frequencies, and thus set up large numbers of different tones or partial tones

that have a tendency to cloud the true tone of the instrument. With our resins, the finished reed has no such adhering particles, and its tone is not clouded by such partial tones.

One of the most remarkable characteristics of the present reeds is that it is particularly susceptible to delicate nuances of tonal strength, ranging from pianissimo to fortissimo. Most remarkable to all is that no matter in what register of the instrument, in what degree of loudness or softness, or what style of music the performer is playing, the same beautiful, round, mellow and solid tones are reproduced. Even "subtones," a term and style known particular to "jazz" players, are readily obtained and do not require the use of the tongue on the reed, as in the case of the conventional cane reed.

Although we have only described in detail one form which our invention may assume, it will be apparent to those skilled in the art that the invent is not so limited, but that various modifications may be made therein without departing from the spirit thereof or from the scope of the appended claims.

What we claim is:

1. A reed of the class described which has its vibratory free end concaved along one face from a point spaced backwardly of its fulcruming axis, said concaved portion increasing in width substantially to the free end of the reed.

2. A reed of the class described which has the top side of its vibratory free end portion formed of concave shape from a point spaced backwardly of its fulcruming axis, said concaved portion increasing in width substantially to the free end of the reed.

3. A reed of the class described which has its vibratory free end concaved along one face from a point spaced backwardly of its fulcruming axis, said concave portion increasing in width substantially to the free end of the reed, but being always of less width than said reed at its widest portion so as to form reinforcing shoulders along opposite sides thereof substantially to its free end.

4. A reed of the class described which has the top side of its vibratory free end portion formed of concave shape from a point spaced backwardly of its fulcruming axis, said concaved portion increasing in width substantially to the free end of the reed, but being always of less width than said reed at its widest portion so as to form reinforcing shoulders along opposite sides thereof substantially to its free end.

5. A reed of the class described which has the top side of its vibratory end portion formed of concave shape from a point spaced backwardly of its fulcruming axis, said concaved portion increasing in width and depth as it approaches the free end of the reed.

6. A plastic reed of the character described composed of an acrylate resin that is solid in its polymeric form, said reed having its vibratory end portion concaved along one face from a point spaced backwardly of its fulcruming axis, said concaved portion increasing in width substantially to the free end of the reed.

7. A plastic reed of the character described composed of an acrylate resin that is solid in its polymeric form, said reed having the top side of its vibratory end portion concaved from a point spaced backwardly of its fulcruming axis, said concaved portion increasing in width substantially to the free end of the reed.

8. A plastic reed of the character described composed of an acrylate resin that is solid in its polymeric form, said reed having its vibratory end portion concaved along one face from a point spaced backwardly of its fulcruming axis, said concaved portion increasing in width substantially to the free end of the reed, but being always of less width than said reed at its widest portion so as to form reinforcing shoulders along opposite sides thereof substantially to its free end.

9. A plastic reed of the character described composed of an acrylate resin that is solid in its polymeric form, said reed having the top side of its vibratory end portion concaved from a point spaced backwardly of its fulcruming axis, said concaved portion increasing in width substantially to the free end of the reed, but being always of less width than said reed at its widest portion so as to form reinforcing shoulders along opposite sides thereof substantially to its free end.

10. A plastic reed of the character described composed of an acrylate resin that is solid in its polymeric form, said reed having the top side of its vibratory end portion formed of concave shape from a point spaced backwardly of its fulcruming axis, said concaved portion increasing in width and depth substantially to the free end of the reed.

RAYMOND CAIRE.
AARON J. FRIEDMAN.

CERTIFICATE OF CORRECTION.

Patent No. 2,230,933. February 4, 1941.

RAYMOND CAIRE, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, second column, line 49, claim 10, after "the" second occurrence, insert the word and period --reed.--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of July, A. D. 1941.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents

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(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents