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REED FOR WOODWIND INSTRUMENTS AND METHOD OF MANUFACTURE

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This application is a continuation-in-part of my co-pending application Ser. No. 364,268, filed May 1, 1964.

This invention relates to improved reeds for woodwind instruments, more particularly to such reeds which have substantially improved resistance to moisture absorption and chemical or bacterial degradation. In a further aspect the invention concerns methods of manufacturing reeds for woodwind musical instruments and methods for increasing the playing life of normally porous natural cane reeds for such instruments.

At present, the only reeds for woodwind musical instruments which are acceptable and satisfactory for use in high-quality professional performances are the reeds made from natural cane. However, these natural cane reeds are accepted by skilled professional musicians only because they happen to be the best reeds presently available. These reeds are subject to a number of well-known undesirable traits and defects such as the need for "conditioning" by wetting or moistening the tip each time before they are used and before they are satisfactory for playing purposes, the fact that they eventually become water-logged from saliva, the fact that the cellular structure of the cane reed is degraded, either from action of the moisture and the acids carried by saliva, from the growth of micro-organisms carried by the saliva, and plugging of the ducts and interstices of the reed by salts, etc., carried by the saliva which form hard deposits when the reed dries.

The aforesaid disadvantages of natural cane reeds have prompted a number of suggestions in the art for correcting such defects ranging from various methods of treating the natural cane reeds, e.g., U.S. 1,776,566, U.S. 1,790,167, substituting for the cane reed a metal reed (U.S. 1,133,868), a fibreglass reinforced plastic reed (U.S. 2,919,617), or specially shaped all-plastic reeds (U.S. 2,230,933, U.S. 2,296,737, U.S. 2,374,579, and U.S. 1,770,966). A particularly complete and detailed description of the problems associated with the use and manufacture of natural cane reeds is found in the U.S. Patent 2,230,933 mentioned hereinabove.

Although as indicated by the above listed U.S. patents, many attempts have been made to remedy the defects of natural cane reeds by special treatments or by substituting another material for the natural cane used in manufacturing the reeds, none of such treated or artificial reeds heretofore known or presently available are satisfactory for use in high quality professional performances, the use of reeds made of substances other than natural cane being almost wholly limited to beginning students and where the quality of the tone produced by such reeds is not so important as in the case of professional performances. The natural cane reeds which have been artificially treated in an attempt to remedy some of the aforementioned defects are especially disappointing from an aesthetic standpoint since these treatments generally either are ineffective for the purposes sought or result in ruining the subtle tonal qualities of the instrument in which the reed is employed.

I have now discovered that the aforementioned undesirable traits of natural cane woodwind reeds are remedied to a substantial extent in a new article of manufacture which I have invented comprising a normally porous natural cane woodwind reed impregnated with a cured plastisol whereby said reed is rendered substantially more resistant to moisture adsorption, chemical or bacterial degradation and the accumulation of solid deposits in the vascular ducts of the reed. Advantageously, the plastisol is disposed only within the pores of the reed so as to present exposed surfaces of natural cane, thus avoiding the formation of a "jacket" or "coating" upon the natural cane reed which materially interferes with the vibrational properties of the reed. It is also advantageous and therefore preferable that the plastisol substantially fill the pores of the reed adjacent to the surfaces thereof, thereby substantially sealing the pores and contributing, along with the longitudinal grain ribs of the reed, to the mechanical strength and integrity of the reed.

I have also now discovered that the properties of the plastisol impregnated reeds aforedescribed can be even further improved by treatment with a mineral oil containing a suitable wax sealant to seal the very small interstices which do not readily admit to sealing by the plastisol.

The novel reeds of my invention are manufactured by a method comprising impregnating the surfaces of a normally porous can woodwind reed with a plastisol to dispose the plastisol within the pores in said surfaces, carefully removing the plastisol from the surfaces of said reed and curing the plastisol dispersed within the pores. Advantageously, in order to increase the extent of penetration of the plastisol into the ducts of natural cane reed, the reed is first dried, for example at an elevated temperature, suitably in the range of about 212° F. for a length of time, suitably upwards of about 15 minutes, to remove a major portion of the naturally occurring moisture found in natural cane reeds. After the reed is dried, the "shaved" or playing end is coated with an excess of plastisol and external pressure is applied to force the plastisol into the pores and interstices of the reed. Preferably this is accomplished by disposing the reed on a flat bearing surface and applying pressure through mechanical means such as by troweling or rolling to force the plastisol into the interstices of the reed. In another embodiment of the invention, I dry the natural cane reed by heating to a temperature of about 212° F. for about 15 minutes and thereafter place the dried reed in an evacuated chamber wherein a pressure of about 1 p.s.i.a. is maintained above a vat of the plastisol. After exposure to the vacuum for a length of time sufficient to remove a substantial amount of air from the surface pores and interstices of the reed, for example, upwards of about 5 minutes, the dried evacuated reed is thereupon lowered into the plastisol bath and the vacuum above the bath is broken and a superatmospheric pressure of for example up to about 150 p.s.i.g. is maintained above the surface of the plastisol bath for a length of time sufficient to drive a substantial amount of the plastisol into the ducts and interstices of the reed, for example upwards of about 10 minutes or longer. In general, in order to prevent undue coagulation or agglomeration of the plastisol particles prior to entering the pores of the reed, it is preferred to employ somewhat lower pressures, e.g. about 25–50 p.s.i.g., and, correspondingly, somewhat longer immersion times, e.g. upwards of 30–60 minutes. After the impregnation of the reed with the uncured plastisol is accomplished by troweling, rolling or by the vacuum-immersion-pressure steps

set forth above, any excess plastisol adhering to the exposed surfaces of the reed is carefully removed, for example by careful wiping with a rubber "squeege" so as to prevent the formation of a coating on the exterior surfaces of the reed. The plastisol-treated reed is then heated to a temperature sufficient to cure the plastisol, for example, upwards of about 350–375° F. for about 5–7 minutes when the plastisol employed is the preferred plastisol hereinafter described. As will be appreciated by those skilled in the art the aforementioned specific temperatures, times, etc., can be varied considerably without materially affecting the end result by making proper adjustments in other variables. For example, the length of time that the reed is immersed in the plastisol bath can be materially shortened by employing even higher pressures than above specified if coagulation or agglomeration of the plastisol is avoided. Also the exact drying time, drying temperature, immersion time, immersion pressure, etc., will vary somewhat depending on the particular variety of natural cane employed to fabricate the basic reed and the curing time and temperature will vary somewhat depending upon the particular plastisol employed.

As mentioned above, the moisture absorption and chemical and bacterial resistance of the treated reeds can be even further improved by treating the plastisol impregnated reed (after the plastisol curing step) with a suitable wax sealant. This treatment is advantageous and commercially preferred as the reed often contains almost microscopic-size imperfections or interstices, particularly in the "shaved" or playing end, which permit a slow but nevertheless significant absorption of saliva moisture. These microscopic interstices are more difficult to fill and seal with plastisols than the relatively larger pores corresponding to the vascular ducts of the reed.

For application, I dissolve the wax sealant in a suitable oil, such as a mineral oil which will not support bacterial growth. The oil should be non-toxic, non-odiferous, have a relatively low surface tension and should contain or be compounded to contain a significant proportion of a suitable wax for sealing purposes. All factors considered, I have found that oils known as "white oils" are admirably suitable, particularly one such as No. 9 white oil U.S.P. or N.F. Such oils and high quality paraffin waxes such as that commercially available under the trade name "Aristowax" (trademark of Union Oil Company) or other mineral waxes of Classification XIV are generally mutually soluble and can be formulated to obtain optimum sealing and penetrating properties. Advisably, such formulations should also contain a non-toxic antioxidant such as tocopherol (vitamin E.)

In practice I place the reed impregnated with cured plastisol in an evacuated chamber (e.g. 1 p.s.i.a.) to remove air from the microscopic interstices, immerse the evacuated reeds in a bath of the "paraffin oil" and then apply a superatmospheric pressure, e.g. up to 150–300 p.s.i.g. to the surface of the oil, to force the oil into the microscopic interstices and seal them against moisture absorption. Subsequently the oil treated reeds are removed from the bath and carefully cleaned of any excess adhering oil and wax so as to expose only a natural cane playing surface.

It will be understood by those skilled in the art that the primary improvement of natural cane reeds is obtained by the plastisol treatment hereabove described and that the oil-wax treatment, although advantageous, is optional. The oil treatment can be completely omitted and yet the reeds impregnated only with cured plastisol will be significantly improved compared to ordinary natural cane reed.

The closest prior art of which I am presently aware is the Newton patent (U.S. 1,776,566) wherein the patentee discloses the impregnation of a natural cane reed with a solution of cellulose, preferably nitrocellulose, in a solvent such as acetic ether. However, the method described in

the Newton patent is to be clearly distinguished from the present method in that the nitrocellulose solution employed by Newton is extremely viscous and therefore unable to penetrate any significant distance into even the major pores of the cane. Furthermore, upon drying, the nitrocellulose is subject to a shrinkage of as much as 50% or more which reduces the efficacy of the treatment as a method of sealing to prevent moisture absorption; such reeds absorb water practically as fast as the untreated natural cane reeds. Furthermore, the nitrocellulose solutions, upon drying, become rather hard and brittle which detracts seriously from the playing quality of the reeds and contributes little, if anything, to the mechanical strength and integrity of the reed. Also, very significantly, the Newton patent envisages forming a coating or shell of nitrocellulose around the reed which seriously impairs its tonal qualities.

By contrast, I employ as the impregnating agent a plastisol having a shrinkage when cured of less than 10%, desirably and advantageously less than about 2%. These substances, when cured, are resilient and yet contribute materially to improving the homogeneity and the mechanical strength and integrity of the reed by supplementing the natural longitudinal grain ribs and cross fibers of the reed and also preventing cracking, splitting, fraying of the tip, etc.

As used herein the term "plastisol" means a dispersion and intimate mixture of a synthetic resin and a liquid plasticizer, advisably containing appropriate stabilizers. These plastisols are practically 100% total solids materials. Thus, there are no solvents or diluents to be evaporated and cause shrinkage problems. The only treatment required to cure such materials is heating for a period sufficient to bring the entire mass to the temperature at which fusion takes place, at which time the plasticiser is driven into the resin particle to form a tough, flexible, elastomeric homogeneous product which exhibits excellent chemical resistance and mechanical strength properties. At the present time the vinyl plastisols, particularly the polyvinylchloride plastisols, are particularly preferred. For example, such a plastisol is commercially available under the trade name "Ameran" (a product of American Anode Division of B. F. Goodrich Company), particularly those identified as "LA–32" and "LA–78." These plastisols have the following range of properties:

Tensile strength (p.s.i.)	2500–4000
Percent elongation	350–500
Shore Durometer A hardness	55–90
Modulus at 100% elongation (p.s.i.)	1000–1800

A particularly surprising and advantageous result accruing from the method of manufacturing set out and disclosed herein is that the reed so produced has a tone which is more brilliant and penetrating than the tone produced by such reeds which have not been treated according to my method. These treated reeds are particularly preferred for the rendition of music by concert, martial or dance bands where such brilliance is desired. However, this difference in tonal brilliance is not so marked as to render the treated reeds completely unsuitable for more sedate types of music whether chamber or symphonic music.

Having described my invention and the preferred embodiments thereof, I claim:

1. A new article of manufacture comprising a normally porous natural cane woodwind reed having exposed surfaces of natural cane and having a cured vinyl plastisol disposed within and substantially filling the pores adjacent the surfaces thereof thereby substantially sealing said pores and reducing moisture absorption to provide a reed of materially increased playing life.

2. A new article of manufacture comprising a normally porous natural cane woodwind reed having a cured plastisol disposed within the pores thereof to substantially

seal said pores thereby materially increasing the playing life of said reed.

3. Article of claim 2 wherein the microscopic interstices are sealed with a wax sealant.

4. A new article of manufacture comprising a normally porous natural cane woodwind reed having exposed surfaces of natural cane and having a cured vinyl plastisol disposed within and substantially filling the pores adjacent the surfaces thereof thereby substantially sealing said pores and a wax sealant sealingly disposed within microscopic interstices of the reed which plastisol and wax substantially reduce moisture absorption to provide a reed of materially increased playing life.

References Cited

UNITED STATES PATENTS

1,776,566	9/1930	Newton et al.	84—383
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