May 10, 1960 E. J. MARCINIAK 2,936,248

METHOD OF IMPREGNATING WOODEN GOLF CLUB HEADS

Filed Dec. 17, 1957

Fig. 1

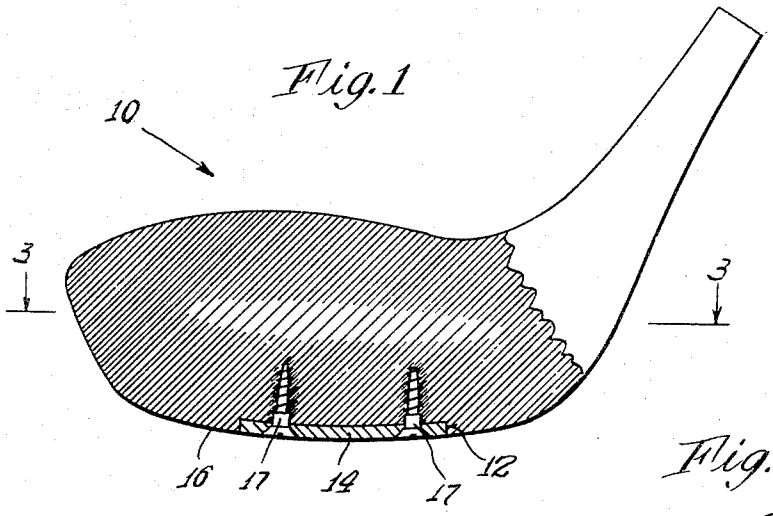


Fig. 2

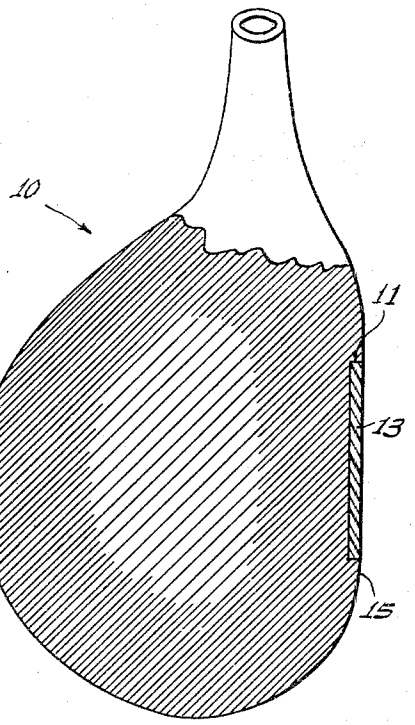
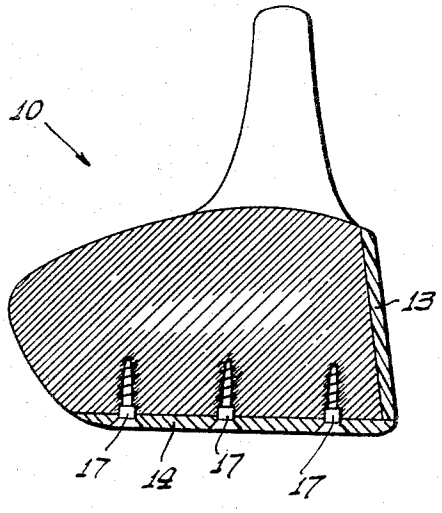


Fig. 3



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METHOD OF IMPREGNATING WOODEN GOLF CLUB HEADS

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7 Claims. (Cl. 117—59)

This invention relates to the method of impregnating wooden golf heads with vinyl resins for rendering the head resistant or immune to the effects of moisture such as swelling, deformation, and eventual deterioration, and otherwise to improve its physical character, to change its physical properties, to toughen it, and generally giving it those characteristics which it is desired to have imparted therto.

Heretofore heads have been impregnated with materials but they did not have a low moisture transmission and did not prevent swelling. Also a method has been employed in which a fluid polymerizable non-stabilized resin or monomer is used in such a manner as to allow the monomer to polymerize after it has penetrated into the wood, with the attendant difficulty of controlling polymerization.

This method has a major drawback, namely resin exudation, which may occur subsequent to penetration and after the heads have been removed from the impregnating bath to be dried, with undesirable surface tackiness accompanying such exudation. This has been a problem of long standing which heretofore required special and expensive finishing treatment steps.

It is among the objects of this invention to provide improved methods of impregnating a golf club head whereby the treatment is controllable to achieve uniform deep penetration into the head as well as optimum and lasting moisture-resistant resin impregnation of the article without the accompanying exudation and surface tackiness heretofore experienced.

This is accomplished by employing an impregnating resin in the form of a vinyl polymer or copolymer thereof in a mixture of solvents of the class of ketones and of the class of aromatic hydrocarbons, preferably such solvents having different vapor pressures and different evaporation rates at room temperature so as to provide an impregnating solution of low viscosity and high penetrating power and by subsequently controlling the rate of evaporation of the solvents from the club head in a manner to discourage and avoid resin exudation.

In one form of the invention employed for impregnating the heads, the heads are immersed in a bath of the impregnating solution at atmospheric pressure for a predetermined length of time sufficient to permit the desired penetration, after which the heads are removed and subjected to a partial drying at room temperature during which time the ketone solvent evaporates more rapidly than the aromatic hydrocarbon solvent from the surface of the head and, in effect, builds up a resin barrier which prevents exudation of the resin when the heads are thereafter subjected to a drying period at a high temperature to complete the evaporation of the solvents therefrom.

Another method of forming the heads is to subject the heads to vacuum until a stable condition is achieved and thereafter impregnating the head at high pressure with the impregnating solution. This procedure greatly shortens the time for treating the head and permits a

higher solid content of the solution to be used and still achieve the desired penetration. Thereafter the head is removed and partially dried at room temperature and then completely dried at an elevated temperature as before.

By so impregnating the head I am able to control the weight of the head so as to eliminate unnecessary coring in order to insert weights as has been the prior practice; I am able to produce a more stable head in that the fibers in the head are adequately coated with the resin; an improved toughness of the material of the head is achieved, all with the added result that the head has a low moisture transmission and is more resistant to taking on moisture and swelling in use.

Other features and advantages will be apparent from the specification and claims when considered in connection with the drawings in which:

Figure 1 is a side view, partly in section, of a wooden golf club head.

Fig. 2 is a top view, partly in section, of the head.

Fig. 3 is a sectional view taken on line 3—3 of Fig. 1.

The golf club head **10** is made of wood, preferably persimmon, and is shaped to the required shape. It is then impregnated with an impregnating solution comprising a polymerized resin and a mixture of solvents of the class of ketones and of the class of aromatic hydrocarbons, which solution has a low viscosity and high penetrating power so that the impregnation will extend into the head a substantial distance from all faces thereof as indicated by heavy shading in the sectional views of the drawings. After the solvents have been removed, there will be incorpororated in the head the polymerized resin so that the head has a low moisture transmission and is resistant to swelling in response to moisture surrounding the head.

Preferably, the polymerized resin comprises polyvinylidene chloride (Geon 222) although vinyl polymers and copolymers thereof such as polyvinyl chloride and copolymers thereof may be used. These resins are such that when impregnated into the body of the head tend to coat the wood fibers and to toughen the head. Also, heads impregnated with polyvinylidene chloride particularly have a low moisture transmission and substantially resist the passage of moisture into the head and the wood fibers thereof so as to prevent undesirable swelling of the head. The resin so incorporated in the head tends also to add weight to the head in desired amounts to control the weight of the head as required. With the heads of the present invention coring thereof, as now employed for the insertion of the usual weights in the head, is eliminated or greatly reduced.

The ketones used in the solution are those which dissolve the resin, reduce the viscosity of the solution, swell the wood to permit better penetration of the solution and have a high evaporation rate. While diethyl ketone, methyl ethyl ketone, methyl isobutyl ketone and the like may be used, it is at present preferred to use acetone.

The aromatic hydrocarbons used in the solution are those which have some solvent effect on the resin, cause the solution to have a greater penetration into the wood and act to stabilize the solution. Also they are the ones which can be readily evaporated from the head, although they have a lower evaporation rate than the ketones. Examples of such aromatic hydrocarbons are toluene aromatic and xylene aromatic.

It is at present preferred to have a solution with a predetermined solid content which will readily penetrate the heads and yet which will supply the necessary resin in the finished head to produce the desired results. For example, when the heads are impregnated at normal atmospheric pressure, a 12% solution has been found to be highly satisfactory. This, of course, can vary slightly

in either direction depending upon the density and nature of the wood of the head. When pressure impregnation is employed wherein the solution is forced into the pores of the head under substantial pressure, solutions of between 24 to 27% have been found most satisfactory. However, here again this percentage may vary slightly above and below these values depending upon the nature of the head, i.e., the density of the wood and other characteristics affecting the penetration of the resin.

It will be noted from the shading in the drawings that the impregnating resins extend a substantial distance in from each surface of the head. With this depth of penetration, the grooves **11**, **12** for the usual face plate **13** and sole plate **14** in the face **15** and bottom surface **16** can be safely cut since there is substantial resin content inwardly of these cuts so that passage of moisture into the head through the cuts is effectively prevented. Further the face plate can be cemented in position by means of an epoxy resin which not only adheres the face plate, which may be of plastic, fiber or the like material, to the head but also aids in sealing the cut and preventing moisture from passing into the head. Similarly, the sole plates can be adhered to the bottom by epoxy resin or they can be secured by screws **17**. When this is done, it is preferred to coat the screw with an epoxy or equivalent resin to seal the screw holes as indicated by the shading in Figs. 1 and 2 so that the passage of moisture along the screws and into the head is substantially eliminated.

It will be seen, therefore, that I have provided a novel golf head of the wood type which is impregnated with a polymerized resin, preferably polyvinylidene chloride, to an extent which effectively prevents the swelling of the head and which resin coats the fibers of the head to, in effect, seal them from moisture, and which is provided with a smooth outer surface since the impregnation of the head by my novel method prevents exudation of the resin from the head during drying thereof.

The head of the present invention can be produced by impregnation at atmospheric pressure or by a pressure impregnation process. Each of these processes will be described and in order to clearly understand the processes specific values utilized in each are being given by way of example.

In the process wherein the heads are impregnated at atmospheric pressure, the heads are permitted to stand and are air dried for a period of at least a week. They are then immersed in a tank of impregnating solution for a period of approximately 66 hours. The solution comprises a resin, preferably a polyvinylidene resin (Geon 222) dissolved in a solvent comprising half acetone and half toluene. The solution has a 12% solid content. Such a solution can be produced from 5 gallons acetone, 5 gallons toluene and 9.45 pounds of resin, which solution is vigorously agitated during the mixing thereof. The viscosity of the solution at 75° F. or room temperature is 19–20 seconds as determined by a Zahn No. 2 cup and the specific gravity is .881.

After the heads have been immersed for 66 hours they are removed from the solution and are partially dried at room temperature of between 60°–100° F. for from 4 to 12 hours and preferably for 12 hours at 75° F. I have found that this is an important step in preventing exudation from the heads. A possible explanation of this discovery is that acetone which has a relatively high evaporation rate, it being about 5–1 with respect to toluene, is evaporated slowly from the surface of the heads and the resin therein will set up a barrier to the exudation of the resin from the head as the remainder of the solvent is driven off from the head. Higher temperatures at this time would build up vapor pressures in the head and drive out the resin. The heads are thereafter finish-dried in a heating chamber or hot room having a good circulation of air therein and being at a temperature of approximately 150° F. for 24 hours or 125° F. for 40 hours, after which the heads are removed and processed into golf clubs.

If the heads are to be pressure impregnated they are inserted in a vessel and vacuum of up to 25 inches of mercury applied to the vessel and the vacuum is maintained on the vessel for a period of 10–30 minutes or until the reading becomes stable indicating a complete evacuation of the heads. The vacuum is shut off and the impregnating solution is placed in the vessel under a minimum of 90 pounds p.s.i. pressure. Since the impregnating material is being forced into the heads under pressure, it can have a higher solid content. At present, it is preferred to have a solid content of 24%. The heads are left under pressure for 24 hours and are then removed and air dried at room temperature for from 4–12 hours. Thereafter they are dried in the hot room at a temperature of 150° F. for 24 hours.

The feature of applicant's novel methods resides in the fact that a deep penetration is obtained and that the heads are partially dried at room temperature after they are taken from the solution which sets up a barrier in the surface of the heads which prevents exudation of the resin while permitting the solvents to be removed at the high temperature, thus producing an improved head.

Variations and modifications may be made within the scope of the claims and portions of the improvements may be used without others.

I claim:

1. The method of treating wooden golf club heads which comprises the steps of impregnating said head with a solution of resin dissolved in a solvent mixture comprising a solvent of relatively high evaporation rate and higher boiling point and another solvent of lower evaporation rate and lower boiling point for a period of time sufficient to attain a deep penetration of the solution into the head; partially drying the head at room temperature to effect evaporation from the surface of the head of the solvent of higher evaporation rate to form a barrier to exudation of resin from the head during a finish-drying operation; and then finish-drying the head by subjecting the head to an elevated temperature for a predetermined period to effect evaporation from the head of the solvent of lower evaporation rate.

2. The method of treating wooden golf club heads which comprises the steps of impregnating said head with a solution of vinyl resin polymer or copolymer thereof dissolved in a solvent mixture comprising a ketone and an aromatic hydrocarbon for a period of time sufficient to attain a deepen penetration of the resin; partially drying the head at room temperature to effect evaporation of solvent from the surface to form a surface barrier resistant to the exudation of resin from the head during a finish-drying operation; and then finish-drying the head by subjecting the head to an elevated temperature for a predtermined period to effect evaporation of the remaining solvent from the head.

3. The method of treating wooden golf club heads which comprises immersing the head at atmospheric pressure in a bath of a solution of polyvinylidene chloride dissolved in a mixture comprising acetone and toluene for a period of time sufficient to attain a deep penetration of the resin; partially drying the head at room temperature to effect evaporation from the surface head of the ketone to form a surface barrier resistant to exudation of resin from the head during a finishing-drying operation; and then finish-drying the head by subjecting the head to an elevated temperature for a predetermined period to effect evaporation from the head of the remaining solvent.

4. The method of treating wooden golf club heads which comprises the steps of subjecting the head to a vacuum to withdraw air therefrom until a stable condition exists; applying, under pressure, an impregnating solution of polyvinylidene chloride in a solvent mixture comprising a ketone and an aromatic hydrocarbon for a pe-

riod of time sufficient to attain a deep penetration of the solution; partially drying the head at room temperature to effect evaporation of the solvent mixture from the surface of the head to form a surface barrier to exudation of polyvinylidene chloride from the head during a finish-drying operation; and then finish-drying the head by subjecting the head to an elevated temperature for a predetermined period to effect evaportion of the remaining solvent from the head.

5. The method of treating wooden golf club heads which comprises the steps of immersing the head in a bath of a solution of polyvinylidene chloride dissolved in a solvent mixture comprising a ketone having a high rate of evaporation and adapted to lower the viscosity of the solution, swell the wood and increase the penetration of solution into the wood and an aromatic hydrocarbon having a lower rate of evaporation and adapted to increase the penetration of the solution into the head and to stabilize the solution, said heads being maintained in the solution for a period of time sufficient to attain a deep penetration of the resin into the head; partially drying the head at room temperature to effect evaporation from the surface of the head of the solvent mixture to form a surface barrier resistant to exudation of resin from the head during a finish-drying operation; and then finish-drying the head by subjecting the head to an elevated temperature for a predetermined period to effect evaporation from the head of the remaining solvent.

6. The method of treating wooden golf club heads which comprises subjecting the heads to impregnation in a bath of dissolved polymer substantially comprising vinyl resin in a solvent mixture of an aromatic hydrocarbon and a ketone providing a viscosity at 75° F. in the order of 19–20 seconds as measured in terms of Zahn No. 2 cup, and a concentration of the polymer in

the order of 12%; maintaining said impregnation substantially at room temperature for a period of time long enough to effect a deep penetration; partially drying the head at room temperature long enough to effect the evaporation of a significant portion of the solvent mixture from the surface to provide a surface barrier to prevent resin exudation from the article; and then subjecting the article to a period of finish-drying at an elevated temperature long enough to effect evaporation from the article of the residual solvent.

7. The method of treating wooden golf club heads which comprises the steps of subjecting the heads to a vacuum environment long enough to effect substantial evacuation from the wood of entrained air; subjecting the evacuated heads to pressure impregnation in a bath of a vinyl resin of a concentration of about 24% contained in a mixture of an aromatic hydrocarbon and a ketone substantially at room temperature and long enough to effect substantial penetration of the head with the resin; removing the heads from the bath and partially drying them at room temperature to effect the evaporation from the surface of a portion of the solvent mixture to form a surface barrier to prevent resin exudation from the head; and then subjecting the heads to a period of finish-drying at an elevated temperature long enough to effect evaporation from the article of residual solvent.

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CERTIFICATE OF CORRECTION

Patent No. 2,936,248 May 10, 1960

Emil J. Marciniak

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 49, for "deepen" read -- deep --; line 55, for "predtermined" read -- predetermined --; line 64, for "finishing-drying" read -- finish-drying --; column 5, line 16, for "of solution" read -- of the solution --.

Signed and sealed this 25th day of October 1960.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents