April 4, 1944. C. E. SMITH ET AL 2,345,775

MANUFACTURE OF PROTECTED WOODEN BARRELS

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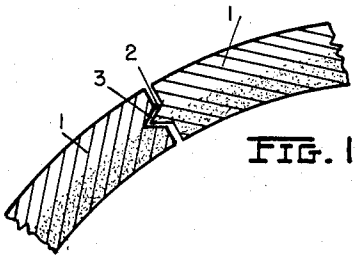


FIG. 1

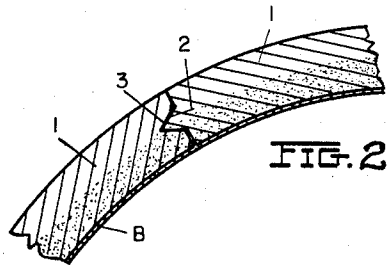


FIG. 2

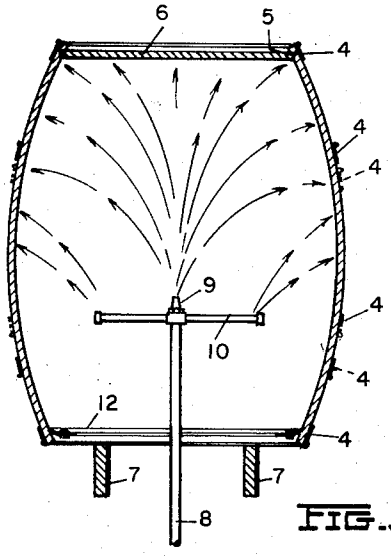


FIG. 3

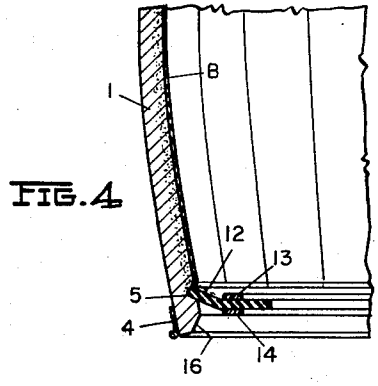


FIG. 4

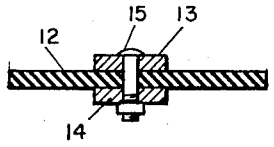


FIG. 5

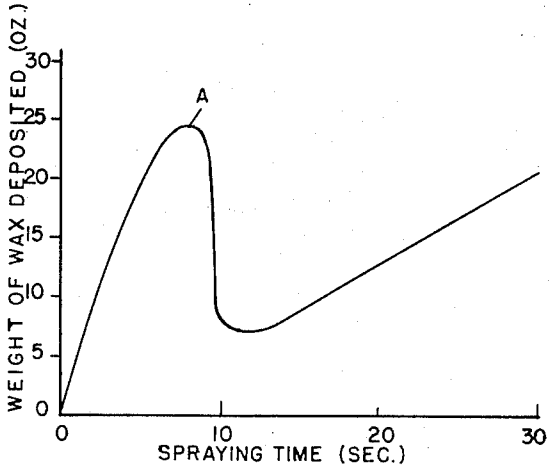


FIG. 6

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MANUFACTURE OF PROTECTED WOODEN BARRELS

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8 Claims. (Cl. 144—309)

The present invention relates to the manufacture of wooden barrels, to the interior of which a protective coating is applied to protect the wood of the barrel from contact with and attack by the material contained within the barrel. The present invention is particularly adaptable to the making of wooden barrels in which relatively strong alkalis such as caustic soda and sodium silicate compounds are packaged, shipped and stored.

The application of a protective coating to wooden barrels has, of course, been heretofore practiced. Protective coatings of such materials as resin, glue, gum, shellac, paint, varnish, paraffin wax, tar, bituminous materials and the like have in the past been employed. Such protective coatings have been applied to the barrel by either one of two general procedures; first, either by coating, dipping or brushing of the individual staves with the protective coating material before the assembly of the staves or the "setting up" of the barrel, and secondly, by applying the coating to the interior of the finished barrel.

In the first previously practiced procedure, as above mentioned, there is the economical disadvantage in that coating material is applied all over the staves, both inside and out, resulting in a substantial waste of coating on those portions of the barrel which need not be protected, and further, the difficulty is encountered in that there is coating material on the outside surfaces of the staves which results in preventing the proper frictional gripping of the hoops with the surfaces of the barrel staves, so that the hoops cannot be either driven on to the barrel tight enough, or even if driven on and nailed through the staves, the removal of the end hoop for the purpose of taking out the barrel head to obtain access to the contents, is rendered disadvantageous. In the second procedure, the relative movement of the individual staves with respect to each other during handling and use of the barrel, such as when it is rolled or loaded for shipping, breaks the film of the protective coating at points adjacent the stave joints, and permits the material contained in the barrel to come into contact with the wood.

The general object and nature of our invention is to overcome the above difficulties and disadvantages in applying a protective coating to wooden barrels. Briefly outlined, our invention involves the procedure of applying the protective coating, such as paraffin wax, at that stage in the barrel making operations wherein the staves, although assembled and drawn together, are not in their tightly drawn together and finally assembled position, whereby there is a slight clearance between the edges of the staves so that the fluid protective coating can enter into the spaces between such edges and can penetrate into the wood itself at areas adjacent those edges. This is followed by a final drawing or forcing together of the staves to close tightly such joints. The protective coating is preferably applied in two stages, in order to penetrate into the body of the wood for a substantial distance, and also to deposit a coating on the interior surface of the barrel. Thus the lateral edges or joints of the staves are protected against contact with the material contained in the barrel, even though there should be relative movement between the staves and a breaking of the interior protective coating layer; and further, the protective coating material is packed tightly between the stave joints so that it cannot be jarred or worked loose.

The application of the protective coating to the barrel, according to the principle of our invention, is in other words, applied to the interior thereof at a point in the barrel making process just prior to what is known to those skilled in the art as "rehooping."

Our invention also provides novel and useful means for insuring the proper and uniform application of the protective coating to the interior of the barrel, while at the same time preventing any excess coating material from coming into contact with the outside surfaces of the barrel staves. Additional objects and advantages of the invention shall become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims, the annexed drawing and the following description setting forth in detail certain means and one mode of carrying out the invention, such disclosed means and mode illustrating, however, but one of various ways in which the principle of the invention may be used.

In said annexed drawing:

Fig. 1 is a sectional view taken through the barrel staves (and slightly exaggerated for convenient illustration) at the point in the manufacturing process of our invention, where the protective coating has just been applied to the interior of the barrel;

Fig. 2 is a sectional view similar to that of Fig. 1 but illustrating the barrel staves and the protective coating material after "rehooping" and after the final coating operation;

Fig. 3 is a vertical sectional view showing the barrel in inverted position and ready for the spraying operation of the protective coating to its interior;

Fig. 4 is an enlarged detailed sectional view of the barrel protective sealing ring as assembled in the bottom end of the barrel during the spraying operation;

Fig. 5 is an enlarged detailed cross-sectional view of the sealing ring; and

Fig. 6 is a diagram illustrating the relationship between the period of time of application of the paraffin wax coating and the amount of wax penetrating into and deposited upon the wooden barrel.

The art of barrel making involves essentially the operations of "setting up" or assembling the staves in a circular supporting form; "trussing," wherein temporary iron hoops are drawn over the staves to force them to assume their barrel shaped form; "crozing and chamfering" where the crozed groove is cut around the inside end of the barrel and the ends of the staves beveled off; and finally heading and rehooping, at which stage the barrel head or heads are inserted in the crozes. Permanent hoops are placed on to the barrel in place of the temporary hoops at any preferred one of the foregoing stages of operation. In the rehooping operation, the hoops are forcibly driven tightly onto the barrel, whereby the staves are drawn into finally and tightly assembled position.

A heating operation is usually performed in connection with the above operations, and is for the purpose of aiding the staves to assume their curved form. Such a heating operation simply involves the placing of the barrel in a vertical position over a circular heating stove.

At the point in the barrel making operations just prior to rehooping, we apply the protective coating to the interior of the barrel, according to the principle of our invention. Fig. 1 illustrates the assembled staves 1 which have their edges in the form of tongue and groove joints, comprising the tongues 2 and the grooves 3 disposed on alternate sides of each stave. The hoops 4 have drawn the staves 1 into nearly, but not fully, assembled position, so that the tongues 2 extend partially into the grooves 3. This leaves a slight clearance space (slightly exaggerated in the drawing) between the body edges of adjacent staves.

Thus, the preliminarily hooped barrel, after being crozed and having one head 6 assembled in the crozed groove 5, is then placed in inverted position with its open end downwardly and resting upon the supporting frame members 7, as shown in Fig. 3.

A protective coating, such as of paraffin wax, heated to molten condition, is then sprayed into the interior of the barrel. As shown in Fig. 3, such a spraying device consists of a conduit 8, leading from a pressure pump (not shown) supplying the fluid paraffin wax under adequate pressure, to the cone nozzle 9 and the rotary or whirling spraying arms 10. As illustrated by the arrows in Fig. 3, the nozzle 9 projects the liquid coating against the head 6 of the barrel and the upper portions of the interior thereof, and the rotating arms 10 project their streams against the lower portion of the interior of the barrel.

We have discovered that the application of the protective coating to the bare wood of the barrel staves is of two different types, which in turn are determined by conditions of the temperature of the barrel, the temperature of the coating and the time of contact of the coating with the barrel. As a molten paraffin wax coating is applied to a "cold" barrel, viz., one at atmospheric temperature, the resultant coating is in the nature of a surface-deposited film or layer. Where the temperature of the wood itself is higher and more closely approaches the melting point of the coating, it is found that the latter actually penetrates into the body of the wood. Thus, in Fig. 1, the stippled area represents the depth of penetration of the molten paraffin wax coating into the wood. Preferably this penetration, as shown, is to a depth corresponding to a point adjacent the ends or tips of the tongues 2 and to the bottoms of the grooves 3 on the sides of each stave, or approximately half-way through the staves and their tongues and grooves.

The curve of Fig. 6 illustrates the manner in which the molten paraffin wax coating, as it is applied during a period of time, viz., during the continuation of the spraying operation, to the wooden barrel. At first it will be noted that the curve rises as a straight line function. This represents the first few seconds of time in which the wax, upon coming into contact with the wooden barrel surface, solidifies and deposits as a surface coating, in direct proportion to the amount of wax applied. It will next be seen that the curve then undergoes a sudden drop. This drop represents that point at which the initially deposited surface coating of solidified wax is again rendered molten due to the rise in temperature derived from the heat of the additional body from molten coating material applied. In other words, at the drop in the curve, the initially deposited coating runs back out of the barrel. Next the curve again reverses itself and begins to rise. This is the point at which the temperature of the wood is such that the molten coating penetrates into the wood rather than being merely deposited upon its surface.

Preferably, our coating process is so arranged as to begin at the end of the first rise of the curve, viz., at the point A and to continue therefrom, depending upon the amount of penetration desired and subsequently the amount of surface coating to be applied over such penetrated layer. If a cold barrel is used for the coating operation, one must necessarily start at the beginning of the curve in Fig. 6; i. e., it is first necessary to heat the wood of the barrel by the sensible heat from the body of applied coating.

Preferably, the wood of the barrel, at the beginning of the paraffin wax, spray coating operation, is at a temperature of 110° to 150° F., a temperature condition which is easily attainable from the heat still retained in the barrel from the previous heating operation during the barrel assembly.

This means that the spraying operation, insofar as the manner of deposition of the protective material on the wood is concerned, begins substantially at the point A on the curve of Fig. 6.

During this coating operation, excess coating material or molten paraffin wax runs down the inside surface of the staves and on reaching the lower ends thereof, tends to creep around to the outside surfaces. As previously pointed out, any coating upon the outside surfaces of the staves is highly undesirable because it acts as a lubricating medium, preventing the end hoop from gripping with the outside surface of the barrel with sufficient frictional force as to hold itself in position and to draw the staves together for

holding the head in position in the crozed groove. This tendency of the wax coating to run around the lower ends of the staves and to come into contact with the outside surfaces thereof is overcome by a sealing ring in the form of a rubber annulus 12 whose outer edge is of slightly greater diameter than the inner diameter of the crozed groove 5 of the barrel, and is flexed so as to fit tightly into such groove. Metal rings 13 and 14 are provided as reinforcements on each side of the rubber ring 12 and all are assembled by means of suitable fasteners such as the nuts and bolts 15.

Referring to Fig. 4, it will thus be seen that excess coating material, flowing down the interior surface of the staves 1, is caught by the outer edge of the rubber ring 12 and directed to the interior edge of the latter; and thus is prevented from flowing around the bottom ends of the staves, such as at the chamfer 16, and becoming deposited upon the outer surface of the staves where the end hoop 17 is driven on to finally assembled position.

After the paraffin wax coating is applied to the interior of the barrel for a sufficient period of time to permit the wax to penetrate into the wood to a depth corresponding substantially to the tips of the grooves 2, it is then subjected to the rehooping operation. During this latter operation, the staves are drawn tightly together by forcible movement of the hoops 4, substantially as indicated by the respective positions of the solid and dotted lines, representing such hoops, in Fig. 3. Fig. 2 represents the "rehooped" position of the barrel staves. The barrel is then allowed to cool, suitably for a period of 15 to 20 minutes, to atmospheric temperature.

In order to impart a solid, surface layer or film of protective coating on the interior of the barrel, it is then subjected to a second spray coating treatment. The resultant layer is indicated at B in Fig. 2. This second layer coating operation is conducted for a relatively shorter period of time than that of the first coating, because otherwise the same result of "melting out" the initially deposited surface coating on a continued application of the molten paraffin wax, will result.

The following example will serve further to illustrate and explain to those skilled in the art the manner in which our invention is to be performed, and will convey in detail an understanding of the principle thereof:

A barrel 28" high, having a 19 5/8" head diameter at the croze and composed of kiln dried gumwood staves 30" long and 3/8" thick, with tongue and groove joints of the form as shown in Figs. 1 and 2, was set up, hooped, heated and a yellow pine head inserted in one end. This barrel, while still at a temperature just bearable to the human touch, viz., in the range of 110° to 150° F., was then subjected to the wax spraying operation for a period of 25 seconds. The wax was composed of a mixture of microcrystalline wax and crude white paraffin, heated to a temperature of 300° F. The average weight of the wax deposited upon the barrel (average taken over a series of such barrels), after such spraying operation, was found to be 1 pound, 6 ounces. The average depth of penetration of the wax into the barrel staves was 1/8 of an inch, i. e., about half-way through their thickness.

After rehooping and cooling the barrel to atmospheric temperature, a second coating of the same mixture of wax, but heated to 220° F., was applied to the interior of the barrel for a period of 5 seconds. The average weight of the second coat so applied was 7 ounces and its thickness, as measured from the surface of the wood, was .009 inch. The total weight of the wax coating applied to the barrel in both operations was 1 pound, 13 ounces.

The weights of applied coatings as given in the above example include that applied to the second head of the barrel which is merely dipped or floated on its inside surface in a wax bath, before installation.

Barrels manufactured according to the above described process are capable of properly containing such wood-attacking materials as caustic soda and sodium silicates, without damage or deterioration, and even under conditions of severe handling and use. Even though the staves might undergo relative movement with respect to each other during handling of the barrel, and thus cause a rupture of the inner surface coating B along the stave joints, permitting some of the wood-attacking material to enter therebetween, the impregnated or penetrated protective material in the body of the staves and immediately adjacent their joint surfaces is still available to protect the wood against deteriorating action. Further, it will be noted, that by reason of the procedure of our process, that while the protective material is deposited in regions adjacent the lateral edge surface of the staves, it is also prevented from being deposited upon those regions where it is undesired and wasteful, i. e., on the outer and end surfaces of the barrel staves. The spray protecting ring 12 and the tongues 2 partially projecting into the grooves 3 both contribute to the achievement of this beneficial result, the tongues acting as baffles preventing the egress of the molten paraffin wax out through the slight clearance spaces between the staves during the initial spraying operation when the staves are substantially in the position as shown in Fig. 1.

Other modes of applying the principle of our invention may be employed instead of the one explained, change being made as regards the means and the steps herein disclosed, provided those stated by any of the following claims or their equivalent be employed.

We therefore particularly point out and distinctly claim as our invention:

1. The method of coating a barrel comprising, the steps of providing a loose barrel with the staves spaced slightly apart to expose the edges, coating the interior of the barrel and the inner portion of the edges of the spaced staves, and, before the coating sets, tightening the barrel to bring the staves together edge to edge to produce an integrated interior coating, which penetrates the joint between the saves to some extent.

2. The method of coating a wooden container composed of a plurality of strips, abutted edge to edge, comprising the steps of providing the wooden container in loose condition with strips spaced slightly apart to expose their edges, coating the interior surface of the strips and a portion of the adjacent edges, and, before the coating sets, tightly bringing the strips of the container together edge to edge to produce an integrated interior coating and one that penetrates the joints between the strips to some extent.

3. The method of coating a barrel comprising the steps of providing a loose barrel with the staves spaced slightly apart to expose the edges, and to project the tongues on the staves partially into the grooves of the adjacent staves, coating

the interior of the barrel and the inner portion of the edges of the spaced staves, and, before the coating sets, tightening the barrel to bring the staves together edge to edge and the tongues to their full extent into said grooves, to produce an integrated interior coating, which penetrates the joints to some extent.

4. The method of coating a wooden barrel comprising the steps of providing a loose barrel in approximately finally assembled position with the staves spaced slightly apart to expose the edges, placing said barrel in a vertical position, coating the interior of the barrel and the inner portion of the edges of the spaced staves, draining excess fluid material from the lowermost end of said barrel, protecting the bottom ends of the staves from contact of such coating material during this operation, and, before the coating sets, tightening the barrel to bring the staves together edge to edge to produce an integrated interior coating, which penetrates the joints between the staves to some extent.

5. The method of coating wooden barrels, comprising the steps of providing a loose barrel with the staves slightly apart to expose the edges, applying a body of protective coating material onto the interior of the so assembled barrel at a sufficient temperature and for a sufficient period of time to impregnate the staves therewith to a depth equal to substantially one-half their thickness and whereby the fluid protective coating enters the spaces between the edges, tightening the barrel to bring the staves together edge to edge to produce an integrated interior coating, which penetrates the joints between the staves to some extent.

6. The method of coating wooden barrels, comprising the steps of providing a loose barrel with the staves slightly apart to expose the edges, and to project the tongues on the staves partially into the grooves of the adjacent staves, applying a body of protective coating material onto the interior of the so assembled barrel at a sufficient temperature and a sufficient period of time to impregnate the staves therewith to a depth adjacent the tips of the tongues, and whereby the fluid protective coating enters the spaces between the edges, tightening the barrel to bring the staves together and the tongues to their full extent into said grooves to produce an integrated interior coating, which penetrates the joints between the staves to some extent.

7. The process set out in claim 3 wherein the material is molten paraffin wax.

8. The method of coating wooden barrels comprising the steps of providing a loose barrel with the staves spaced slightly apart to expose the edges, placing the barrel in a vertical position, spraying molten paraffin wax onto the interior thereof and at a sufficient temperature and for sufficient time to effect penetration of the wax into the body of the said staves and to coat the inner portion of the edges of the spaced staves, draining excess molten wax from the lowermost end of the said barrel, protecting the bottom ends of the staves from contact with said molten wax, and before the coating sets, tightening the barrel to bring the staves together edge to edge to produce an integral coating which penetrates the joints between the staves to some extent, cooling said barrel and then applying a second wax coating over the interior surface of said barrel, and similarly protecting the bottom ends of said staves from contact therewith.

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