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METHOD OF PRODUCING SEAMLESS CELLULOID ARTICLES FROM BARS OF CELLULOID

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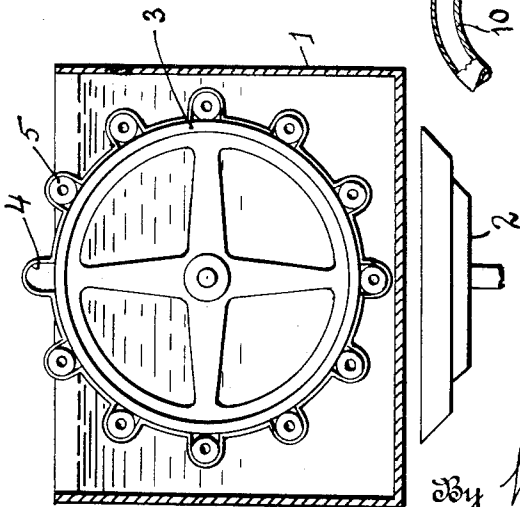


Fig. 1.

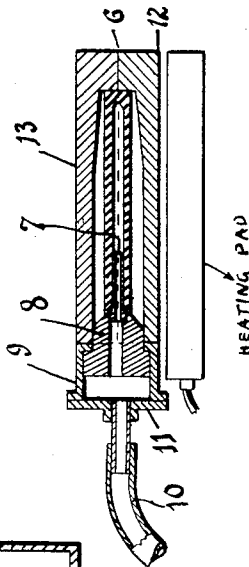


Fig. 2.

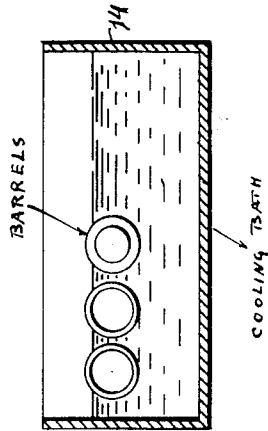


Fig. 3.

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METHOD OF PRODUCING SEAMLESS CELLULOID ARTICLES FROM BARS OF CELLULOID

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15 Claims. (Cl. 18—51)

My invention relates to a method for mainly expanding a celluloid bar, without materially increasing its length. This method is particularly designed for work on decorative celluloid, such as pearl effect celluloid, without destroying its beauty by the expansion.

An object of the invention is to permit the use of semi-cured celluloid of the type mentioned for the production of articles by expansion of the bars, mainly laterally, as the article is formed.

Another object of the invention is to provide such articles without any seams and, therefore, resulting in articles of greater strength.

This method is particularly suitable for the production of fountain pen barrels and caps from celluloid bars of smaller diameter than the barrel and cap to be obtained therefrom.

In the appended drawing, Figure 1 is a vertical section through a heating bath.

Figure 2 is a vertical section through a die or form, and

Figure 3 is a vertical section through a cooling bath.

In the present manufacture of fountain pen barrels and caps from pearl effect celluloid or any celluloid, it is necessary to order rod slightly larger than the size of which the cap or barrel is to be machined. The reason is that the celluloid material must be cured sufficiently not to collapse from heat generated by forming the bore in the rod as it is machined into a cap or barrel, for the thickness of the wall of the barrel and cap is not great enough to prevent collapsing if the material is not sufficiently cured.

In my method, as distinguished from the present method, the rod used for making the cap and barrel is smaller in diameter than the cap or barrel it is to be made into. Generally, the diameter of the rod is smaller than the bore of the cap or barrel that it is to be made into. In such a rod, a tiny bore is formed, the size of bore depending on the size of the rod used. The size of the bore is such that the cross sectional area of the ring of such a bored rod is substantially equal to the cross section of the ring of a finished barrel or cap. In view of the fact that only a tiny bore is made in the rod, the thickness of the wall is sufficiently large that it may be handled in a semi-cured state, for it will not collapse during the formation of the bore, thereby reducing the time necessary for placing the order for the purchasing material, and in addition reducing the cost per barrel by about half, as a smaller rod is used for a larger size product.

The bored rod or bar must be softened by heat before it may be enlarged. By softened, I mean made pliable. If the celluloid material is semi-cured, any hot fluid may be used for softening the bored bar or rod intended for the cap or barrel. On the other hand, if totally cured stock is to be used, or what is known in the trade as "old stock" it must first be softened with a solvent, such as alcohol, before it is made pliable in a hot fluid.

The time the material is kept in the hot fluid is determined by a few samples from the stock to be operated on. The bar, so bored, is then shaped in a form larger than the bar to which a compressed fluid is supplied so that the compressed fluid will enter into the bore to enlarge it, the expansion being limited by the form of the die. The so shaped article from the celluloid bar is sufficiently rigid to be ejected from the form without any deformation. Although the article may leave the form, as it is, it is preferably cooled off in a cooling bath when it is removed from the form.

To more specifically describe the method, its application to the manufacture of fountain pen barrels and caps and also mechanical pencils will be described herein. The appended drawing illustrates diagrammatically an arrangement for that purpose. In it 1 is a tank that may be heated by suitable heating means 2, preferably through the bottom. Mounted to revolve within the tank is a wheel 3 provided with suitable pockets 4 for receiving bored bars 5. The wheel is so mounted within the tank that the major part of the same is substantially immersed in the fluid when the tank is substantially filled. The fluid used in this particular case is water and it is maintained at a substantially boiling point by means of the heater 2. The time necessary for maintaining a rod 5 in the fluid is determined by a few samples of the stock to be operated on. The bars are previously cut to the length desired, depending on the size of a cap or barrel to be enlarged and bored according to what the outer diameter of the rod is, and what the cross sectional area of the pen cap or barrel is to be.

When a bar in the wheel has reached the state considered to be sufficiently pliable to be placed into a form in the shape of a split die 6, the operator pushes the bar out from its pocket 4 and places the open end of the bore upon a tubular extension 7 of a nozzle 8. The nozzle is preferably mounted to slide axially in a housing 9 to which compressed fluid, such as air, is supplied through a hose 10 from any suitable means not

shown. By placing the bored, heated bar on to the tubular extension 7, the operator pushes the nozzle 8 against the head 11 of the nozzle 9, thereby facilitating the introduction of the bar into the die 6, the upper half 13 being in a raised position, not shown in the drawing. As the upper half of the die 13 is closed on to the lower half 12, as shown in the drawing, and air is supplied through the hose 10, the nozzle 8 is moved in the position shown in said drawing, bringing the closed end of the bar or rod 5 against the end of the closed die. It will be noted that the only contact the bar 5 has with the die is at one end and with the nozzle 4. Laterally, there is no contact whatsoever. The pressure of the air supplied through the nozzle into the bar forces the bar to expand laterally, filling the form. The pressure used for this particular purpose is between 60 and 80 lbs. per square inch, which I have found to be satisfactory. The pressure is maintained for about one-half minute and then it is cut off and the die opened, and the article is at this time sufficiently rigid, although warm, to be ejected from the die to be cooled either in the air, or preferably in a cooling medium, such as water, provided in a suitable receptacle 14, as indicated in the drawing.

As it will be noted from the drawing, there is no lateral contact between the form and the bar. In consequence, it cannot be heated within the die satisfactorily as the material is a non-conductor of heat. Uniform expansion of the bar is of prime importance, and, therefore, thorough softening of the bored material is of prime importance, and this I obtain by heating it in hot water where the heat is able to permeate the material both from the exterior and the interior. If the body of the material of the bar is not uniformly softened by heat an uneven lateral expansion takes place, in consequence, the resulting cap or barrel is not of uniform cross section.

By my method of softening the celluloid bored bar before placing it into the form of the die, if I do get any irregularities of an uneven expansion, it is mostly due to the inherent defect of the material of which the bar is formed. If its expansion is uniform, it expands uniformly under the air pressure applied. But such deformations that are due to the unequal lateral expansion of the material can be disregarded as they are very small, but the unequal expansion that may be due to improper softening of the body of the material of the bar to be enlarged is so pronounced as to render the article nearly useless.

Although the drawing illustrates and the description refers to a method where the enlargement of the bar is limited to the lateral expansion only, a slight longitudinal expansion may be given to the bar not exceeding about $\frac{1}{3}$ of its length, by providing means to hold the end of the bar at which the bore is formed, and permitting the other end to expand longitudinally in addition to laterally. But in view of the fact that pearl effect and other mottled celluloid loses a considerable amount of its beauty if the rod is permitted to elongate materially—that is more than $\frac{1}{3}$ —it loses the beauty due to the elongated deformation of the patches forming the decoration. On the other hand, by expanding the rod mainly laterally, the patches are increased in width and the beauty of the article is enhanced.

Although the bored bar placed into the die is very pliable, as soon as it is expanded to fill the form, it becomes rigid. Whether it is due to the pressure or to both pressure and cooling effect I

do not know, or whether to a change in the structure of the body of the material forming it I cannot say, but it is rigid enough to be ejected from the die without any fear of distortion or injury thereto. Although the description and drawing show cylindrical shape, prismatic or pyramid shapes may be used, or a combination of any or all, for the outer appearance will depend on the form of the die used for the purpose.

In manufacturing by my method of seamless articles from celluloid bars, it is only necessary to form in the bar a recess or pocket for permitting the introduction therein of a compressed fluid for the purpose of expanding it in a form larger than the recessed bar. In some cases, where the resulting article is not symmetrical with reference to an axis, but asymmetrical with reference thereto, the bar naturally will not expand uniformly with reference to its axis. Certain parts thereof will expand more and others less. In consequence of such relation between the original block or bar, or rod and the finished article, although certain parts thereof expand more than others, the expansion takes place through the entire lateral area, and in some cases partially lengthwise. But the article resulting therefrom is seamless since it is made from a solid celluloid piece. The expansion of such a bar or rod of celluloid, although not symmetrical in respect to the original axis of the bore, will in all other respects be identical with what has been described with reference to fountain pen barrels and caps.

In cases where the recess is not of circular cross section in the bar or rod, the nozzle supplying compressed air in the form will have to have the shape of the recess of the bar or rod which is to be enlarged in the form.

The form, at the beginning of the operation, is warmed up and subsequently maintained warm by the heated rods enlarged therein. The form does not need to have the temperature of the bars to be enlarged therein, but it must only be warm, not to chill the rods or bars placed therein to be enlarged.

I claim:

1. In a method of producing seamless articles from celluloid, steps which consist, in recessing the bar of celluloid, softening the recessed bar, placing the softened recessed bar into a form larger than the recessed bar, and introducing a compressed fluid into the recess of the bar while the bar is in the form to expand the bar to fill the form.

2. A method of producing seamless articles from celluloid which consists, in recessing a bar of celluloid, rendering said recessed bar pliable, placing the pliable recessed bar into a form larger than the recessed bar, and introducing into the recess of the bar within the form a compressed fluid to expand the bar to fill the form, and removing the expanded bar from the form.

3. A method of producing seamless articles from celluloid, which consists in recessing a bar of celluloid, rendering said recessed bar pliable by heat, placing the heated pliable recessed bar into a form having a larger size than the recessed bar, and introducing into the recess of the bar within the form a compressed fluid to expand the bar to fill the form, and ejecting the expanded bar from the form.

4. A method of producing seamless articles from celluloid, which consists in recessing a bar of celluloid heating the recessed bar in a hot fluid to render the recessed bar pliable, placing the heated pliable bar into a form having a larger size than

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the recessed bar, and introducing into the recess of the bar within the form a compressed fluid to expand the bar to fill the form, and ejecting the expanded bar from the form.

to be formed therefrom, softening the bored rod by maintaining it in hot water until the rod is pliable, placing the pliable bored rod into a form having the shape of a cap or barrel, subjecting it within the form through its bore to a compressed fluid to expand the rod to fill the form, and then removing the so formed cap or barrel from the form.

5 5. A method of producing seamless articles from celluloid, which consists in forming a bore in a bar of celluloid, maintaining the bored bar in a hot fluid to render it pliable, placing the heated bar into a form having a larger diameter than the bar, subjecting the bar within the form to a compressed fluid entering into the bore, so as to expand the bar to fill the form, and ejecting the formed article from the form.

11. A method of producing seamless celluloid caps and barrels for fountain pens, which consists in taking a partially cured celluloid rod of a diameter smaller than the cap or barrel to be made, forming a bore in the rod from one end only so that the resulting cross sectional area of the bored rod will be substantially the same as the cross sectional area of the barrel or cap to be formed therefrom, placing the bored rod into water at substantially boiling point to render it pliable, placing the pliable bored rod into a form having the shape of the cap or barrel, and subjecting it within the form to compressed fluid entering the bored rod to expand the rod to fill the form, and then removing the so formed cap or barrel from the form.

15 6. A method of producing seamless articles from celluloid, which consists in boring a bar of celluloid, placing the bored bar in a hot fluid to render it pliable, placing the heated bored bar into a form larger than the bar, supplying compressed air to the bore of the bar in the form to expand the said bar to fill the form, and then ejecting the expanded bar from the form.

20 7. A method of producing seamless celluloid fountain pen barrels and caps, which consists in taking a rod of celluloid of a diameter smaller than the cap or barrel to be made therefrom, forming a bore therein of a size such that the cross sectional area formed by the bored bar will be substantially the same as the cross sectional area of the barrel or cap to be made therefrom, rendering the so bored rod pliable, placing it into a form having the shape of the desired barrel or cap, subjecting the bored rod within the said form to fluid pressure through the bore while it is in pliable shape so that it will expand to fill the form, and then ejecting it from the form.

25 8. A method of manufacturing seamless barrels and caps for fountain pens, which consists in taking a rod of celluloid of a diameter smaller than the cap or barrel to be formed, forming a bore therein from one end so that the cross sectional area of the bored rod will be substantially equal to the cross sectional area of the barrel or cap to be formed, softening the rod so that the same will expand under fluid pressure, placing it into a form having the desired shape of the cap or barrel to be formed, and applying fluid pressure into the bore of the rod until the rod fills the form, and ejecting the so formed cap or barrel from the form.

30 9. A method of producing seamless celluloid caps and barrels for fountain pens, which consists in taking a celluloid rod of a diameter smaller than the cap or barrel to be made, forming a bore therein from one end only so that the resulting cross sectional area of the bored rod will be substantially the same as the cross sectional area of the barrel or cap to be produced, placing the so bored rod into a hot fluid to render it pliable, placing the heated pliable bored rod into a form having the shape of the cap or barrel, and subjecting it within the form through its bore to a compressed fluid to expand the rod to fill the form, and then removing the so formed cap or barrel from the form.

35 10. A method of producing seamless celluloid caps and barrels for fountain pens, which consists in taking a partially cured celluloid rod of a diameter smaller than the cap or barrel to be made, forming a bore in the rod from one end only so that the resulting cross sectional area of the bored rod will be substantially the same as the cross sectional area of the barrel or cap

100 12. A method of producing seamless celluloid caps and barrels for fountain pens, which consists in taking a partially cured celluloid rod of a diameter smaller than the cap or barrel to be made therefrom, forming a bore in the rod from one end only so that the resulting cross sectional area of the bored rod will be substantially the same as the cross sectional area of the barrel or cap to be formed from the rod, placing the bored rod into water at substantially boiling point and maintaining it therein until the rod is pliable, placing the pliable bored rod into a form having the shape of the cap or barrel, subjecting the rod through its bore within the form to compressed air of about 60-80 lbs. pressure per square inch to expand the rod to fill the form, and then removing the so formed cap or barrel from the form.

115 13. In a method of producing seamless articles from celluloid, steps which consist in recessing a bar of partially cured celluloid, softening the recessed bar in hot water at about boiling point until the bar is pliable, placing the pliable bar into a form permitting mainly lateral expansion through the entire cross sectional area of the bar, introducing into the recess of the bar, while it is in the form, compressed air at a pressure of about 60-80 lbs. per square inch to expand the bar to fill the form.

120 14. A method of producing seamless articles from celluloid, which consists in recessing a bar of celluloid, placing the recessed bar in hot water to render it pliable, introducing the recessed pliable bar into a form larger than the bar mainly laterally, supplying compressed air to the recess of the bar in the form to expand the bar to fill the form, and then removing the expanded bar from the form.

125 15. A method of producing seamless articles from celluloid bars, which consists in forming a recess in a bar of celluloid, maintaining the recessed bar in hot water to render it pliable, placing the heated bar into a form having no lateral contact with the bar, introducing compressed fluid into the recess of the bar while the same is in the form to expand the bar to fill the form, and ejecting the enlarged bar from the form.

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