

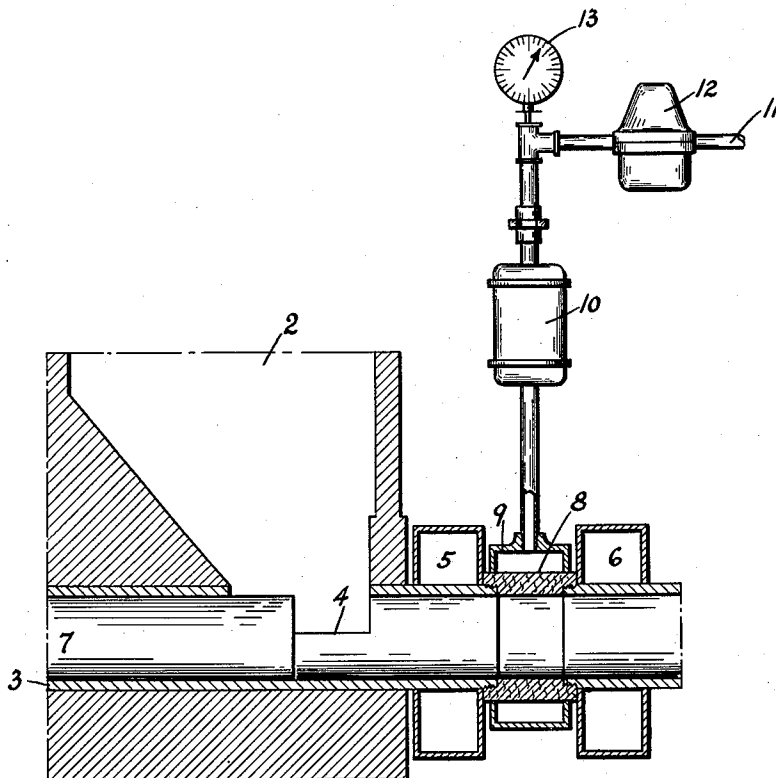
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METHOD AND APPARATUS FOR THE EXTRUSION OF CORK COMPOSITIONS

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METHOD AND APPARATUS FOR THE EXTRUSION OF CORK COMPOSITIONS

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This invention relates to the formation of bodies from plastic materials, such as cork composition, rubber, "neoprene," and the like, by that method which is generally referred to as "extrusion" and relates more particularly to a method and apparatus for the extrusion of plastic materials by means of which an anti-frictional material is applied to the interior of the extrusion tube or barrel so as to facilitate the extrusion process. The invention finds particular usefulness in the extrusion of cork composition.

In the formation of articles of cork composition by extrusion, the natural cork is ground or shredded into small granules. These granules are then coated with a binding agent such as gelatine glue or phenolic resin and, if desired, glycerine or other plasticizer. The cork granules, after the binder has been distributed thereover, are relatively dry and at room temperatures have very little tendency to cohere. The cork particles with the binder distributed uniformly thereover are charged into a hopper at the base of which is an extrusion tube or barrel, the cross section of which determines the cross sectional configuration of the finished article. A plunger reciprocates back and forth, into and out of the entrance end of the extrusion tube. On each forward stroke the plunger pushes some of the material in the hopper into the extrusion tube and as this continues the material is compacted in the tube and is carried therethrough, the compacted mass being forced out of the open end of the extrusion tube as a continuous length of more or less densely compacted character. Heat is applied to the cork mass as it moves through the extrusion tube and this serves to set the binding agent. Cork, as is well known, has a relatively high coefficient of friction and, because of its cellular nature, expands materially upon becoming heated. The combination of the high coefficient of friction and the expanding of the cork particles creates a tremendous resistance to free movement of the cork through the extrusion tube and, while a relatively high resistance is required in order to attain the necessary density in the finally bound mass, an excessive amount of friction between the cork and the walls of the barrel will prevent the mass from moving along the tube and, as further increments of cork and binder are forced into the tube, the tube is expanded and destroyed. The proper control of density in the final product is also difficultly controllable for the same reasons.

To prevent the excessive resistance to move-

ment through the extrusion tube, it is common practice to apply with the binder for the cork granules a lubricating material which serves to lessen the amount of friction developed between the cork and the walls of the tube, thus preventing "freezing" and permitting better, more accurate density control.

This method for lubricating the extrusion tube is objectionable for several reasons. First, the lubricant must be applied throughout the entire mass in order to insure that there will be lubricant at the tube surface and much of the lubricant is retained in the body of the mass being formed. Its presence in the final product is objectionable in some instances. Second, a lubricant and a bond cannot be compatible and, therefore, the presence of lubricant interferes to some extent with the effectiveness of the binder which is used to bond the granules of cork together.

In the co-pending application of Francis B. Menger and myself, filed Aug. 23, 1939, Serial No. 291,614, there is disclosed a method and apparatus wherein the lubricant is applied directly to the interior wall of the extrusion tube or barrel and, in the preferred embodiment therein disclosed, the lubricant is applied to the interior of the tube by the plunger used to force the cork granules into and through the extrusion tube.

According to my invention, the lubricant is "sweated" or similarly deposited directly onto a portion of the interior surface of the extrusion tube or barrel and is picked up by the cork granules engaging that surface, thus lubricating the outer surface of the body in its movement through the extrusion tube. The zone in which the lubricant is applied may be relatively limited in length and only a minor amount of lubricant is required since it is disposed at the surface of the cork granules forming the outer skin or surface of the body being formed where the only frictional engagement with the extrusion tube wall occurs. The outer surface of the molded article which carries the lubricant may thus be trimmed or shaved off so that none or very little of the lubricant need remain in the finished article.

For convenience in describing my method and apparatus, reference will be made to the attached drawing illustrating more or less diagrammatically a sectional view of a cork extrusion apparatus of the horizontal type. In the drawing there is shown a hopper 2 for the reception of a charged mass of cork granules and binder. A horizontal extrusion tube 3 passes through the

hopper 2 and is cut away as indicated at 4 in order that the binder coated cork granules may flow into the tube. The extrusion tube 3 extends beyond the end of the hopper 2 and a cooling jacket 5 surrounds the tube 3 adjacent the hopper 2 and a heating jacket 6 surrounds the tube 3 at a point forwardly of the cooling jacket 5. The jacket 6 is adapted to supply heat to cork granules disposed into the tube 3 sufficient to set the binder disposed at the surfaces of the granules so as to bond the same into a more or less dense, homogeneous mass, and the cooling jacket 5 is provided to arrest the transmission of heat from the heating chamber 6 along the tube 3 and avoid the application of heat to the binder coated cork granules disposed in the hopper 2.

An extruding plunger 7 is slidably fitted into the tube 3 and reciprocating means (not shown) is effective for imparting a movement to the plunger 7 to carry cork granules deposited in the tube through the opening 4 therein into engagement with the mass of granules compacted in the tube. When the plunger 7 moves a charge of material into the tube, it cuts off the further entrance of material into the tube through the opening 4 and compresses the charged mass against the material previously forced into the tube. With each reciprocation of the plunger 7 additional material is forced into and compressed in the tube and the mass as a whole is forced toward the right or discharge end of the tube 3.

There is no substantial setting of the binder applied to the cork granules until the zone of the heating jacket 6 is reached and, since a major portion of the frictional engagement of the granules with the wall of the tube occurs after entrance into the heating zone, there is no need for lubricant on the surface of the tube materially in advance of that point, but it is advantageous to apply the lubricant just in advance of entrance of the cork granules into the heating zone for there the granules are not under the expansive force of heating and sweating out of the lubricant is therefore facilitated. According to the preferred embodiment of my invention, the tube 3 is made in sections and there is provided between the cooling and heating jackets 5 and 6 a lubricating section 8 which has the same internal diameter as the remaining portions of the tube 3 and is secured thereto by screw threading as shown in the drawing. Since the tube must withstand considerable pressure encountered in extruding, the section 8 may be formed of what is known as porous bronze, which, while it is of such character that liquid or semi-liquid materials may be passed therethrough, such materials sweating out substantially uniformly over the inner surface thereof, it is nevertheless strong enough to withstand the pressure encountered, without requiring any material increase in the cross sectional area of its wall.

Disposed about the periphery of the lubricating section 8 is a jacket 9 adapted to receive a lubricating material under pressure from a tank 10, and air or similar fluid under pressure is applied thereto from a pipe line 11, through a reducing valve 12. The amount of pressure applied will depend upon the viscosity of the lubricant employed and upon the character of the section 8, greater pressure being required where the porosity of the section 8 is relatively fine and the lubricant relatively viscous than where a more open body and relatively less viscous lubricant is being forced therethrough.

With such arrangement the lubricant is forced

through the metal of the section 8 and sweats out relatively uniformly over the entire inner surface thereof. As each increment of cork granules is moved along this surface by the plunger 7, the surface granules pick up the lubricant thus deposited on the inner tube surface and further movement of such increments through the tube, even though the frictional force be greatly increased upon entrance into the zone of the heating jacket 6, is facilitated. The amount of lubricant applied may be conveniently controlled by the amount of pressure applied through the valve 12 and for purposes of control a pressure gauge 13 is provided in the line to indicate to the operator the amount of applied pressure at the tank 10. With the apparatus shown, the lubricant is applied continuously to the inner surface of the tube and, as it is picked up by the cork granules disposed at the surface, fresh lubricant is sweated out to replace it. If desired, an intermittent control may be inserted in the system whereby the lubricant will be periodically forced through the lubricating section of the extrusion tube. This may be effected by synchronization of the fluid pressure supply through valve 12 with the reciprocation of plunger 7 or by a piston arrangement mechanically linked with the plunger reciprocating mechanism.

Lubricants of a somewhat thermoplastic character may be used and the heat from the heating jacket 6, transmitted into the metal of the lubricating section 8, relied upon for rendering such lubricants of proper consistency for application.

A lubricant which has been found satisfactory for use in connection with the extrusion of cork composition may comprise a mixture of petroleum jelly or paraffin and a rubber containing material such as latex of a viscosity such that the same may be sweated through a porous bronze section. If other materials are being extruded such as rubber, for example, it may be desirable to apply water to the lubricating section under pressure and sweat the same through to the inner surface as a lubricant. The type of lubricant employed will be dependent to some extent at least upon the materials being extruded, the temperature of curing, the porosity of the lubricating section, etc., and the quantity of lubricant applied will likewise depend upon similar factors.

The term "liquid lubricant" is used as a word of general definition and comprehends any liquid or semi-liquid material capable of reducing the frictional engagement between the material being operated upon and the walls of the extrusion tube or barrel.

The particular apparatus illustrated has been chosen because of the selection of cork composition as a typical material to be extruded. Extrusion machines similar to those employed in the formation of rubber tubing and similar articles are contemplated by the present invention. In extrusion of rubber, for example, a porous lubricating section may be provided substantially at the point of entrance of the material from the hopper into the extrusion tube and a lubricant such as water may be sweated through that section to lubricate the further movement of the rubber through the extrusion tube.

While in the embodiment illustrated, the extrusion tube is provided with a separate lubricating section, it is possible to form the entire tube of porous metal and suitably limit the zone of lubricant application if desired.

From the foregoing it will be evident that the method and apparatus of this invention is simple

and results in the controllable application of lubricating agents to the surface only of the material being extruded, thus obviating the problems heretofore encountered where the lubricant has been applied with the binder throughout the mix being extruded; providing better density control; and facilitating extrusion of products in which lubricants cannot be incorporated.

While I have illustrated certain specific embodiments of my invention and disclosed a particular method for practicing the same, it will be understood that various changes and modifications may be made in the apparatus and the method within the scope of the following claims.

I claim:

1. Apparatus for the extrusion of cork composition bodies from comminuted cork and a binder comprising an extrusion tube, means for moving said comminuted cork and binder into the entrance end and through said tube to the exit end thereof, means for heating said comminuted cork and binder in a limited zone of said extrusion tube to form a bonded body, a porous metal capable of withstanding extrusion pressures forming a portion of the inner surface of said tube intermediate the entrance end thereof and the zone of the heating means, and means for applying liquid lubricant under pressure to said porous metal portion of said tube to sweat the same onto the inner surface thereof to be engaged by the comminuted cork being extruded prior to its entrance into the heating zone.

2. Apparatus for the extrusion of cork composition bodies from comminuted cork and a binder comprising an extrusion tube formed in sections, one section constituting a heating zone, another section constituting a lubricating zone, and a third constituting a cooling zone, means for moving said comminuted cork and binder into the entrance end and through said tube to the exit end thereof, means for heating said comminuted cork and binder in the section of said tube constituting the heating zone to form a bonded body, the lubricating section of said tube being formed of porous bronze capable of withstanding extrusion pressure and forming a portion of the inner surface of said tube intermediate the cooling and heating sections thereof and between the heating zone and the entrance end of the tube, a jacket surrounding a portion at least of said porous bronze section and in fluid tight engagement therewith, a source of supply of liquid lubricant connected to said jacket, and means for supplying fluid pressure to said lubricant to sweat the same through said porous section onto the inner surface thereof to be engaged by the cork composition being extruded prior to its entrance into the heating section.

3. Apparatus for the extrusion of cork composition bodies from comminuted cork and a binder comprising an extrusion tube, means for supplying comminuted cork coated with a binder to said tube, means for moving said comminuted cork into the entrance end and through said tube to the exit end thereof, means for supplying heat to said tube in a limited zone thereof to set the said binder as said comminuted cork passes through said tube under pressure to form a bonded body, a porous metal capable of withstanding extrusion pressures forming a portion of the inner surface of said tube between said supplying means and said heating means, and means for applying liquid lubricant under pressure to said porous portion of said tube to sweat the same

onto the inner surface thereof to be engaged by the comminuted cork being extruded prior to its entrance into the heating zone.

4. Apparatus for the extrusion of cork composition bodies from comminuted cork coated with a binder comprising a hopper, an extrusion tube opening into said hopper, a reciprocable plunger slidable within said tube, means for heating and means for cooling said tube, said cooling means being disposed adjacent said hopper to arrest the flow of heat from the heat zone, a porous metal section formed in said tube between said heating and cooling means, and means for applying liquid lubricant under pressure to said porous portion of said tube to sweat the same onto the inner surface thereof to be engaged by the material being extruded prior to its entrance into the heat zone.

5. Apparatus for the extrusion of cork composition bodies from comminuted cork and a binder comprising an extrusion tube formed in sections, one section constituting a heating zone, and another section constituting a lubricating zone, means for moving said comminuted cork and binder into the entrance end and through said tube to the exit end thereof, means for heating said comminuted cork and binder in the section of said tube constituting the heating zone to form a bonded body, the lubricating section of said tube being formed of porous bronze capable of withstanding extrusion pressure and forming a portion of the inner surface of said tube and disposed in heat conducting relationship with respect to the heating section thereof, means for supplying liquid lubricant to said lubricating section, heat conducted by said porous metal section from said heating section being effective for conditioning the lubricant to be sweated there-through.

6. In the method of forming cork composition bodies by extrusion of comminuted cork and a binder through a tube, the steps which comprise intermittently introducing increments of cork granules coated with a heat activatable binder into said tube and forcing the same therethrough, applying heat to said granules while confined in said tube to expand the same, activate said binder, and form a bonded body, and continuously sweating a liquid lubricant onto said granules in engagement with a portion of the inner surface of the tube prior to entrance into the heating zone to facilitate passage of the compacted granules through the heating zone after expansion of the cork granules induced by heat.

7. In the method of forming cork composition bodies by extrusion of comminuted cork and a binder through a tube, the steps which comprise intermittently introducing increments of cork granules coated with a heat activatable binder into said tube and forcing the same therethrough, applying heat to said granules while confined in said tube to expand the same, activate said binder, and form a bonded body, and continuously sweating a heat sensitive liquid lubricant onto said granules in engagement with a portion of the inner surface of the tube prior to entrance into the heating zone to facilitate passage of the compacted granules through the heating zone after expansion of the cork granules induced by heat, and utilizing the binder activating heat to reduce the viscosity of the heat sensitive lubricant and thereby facilitate the step of sweating the same onto the granules.

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