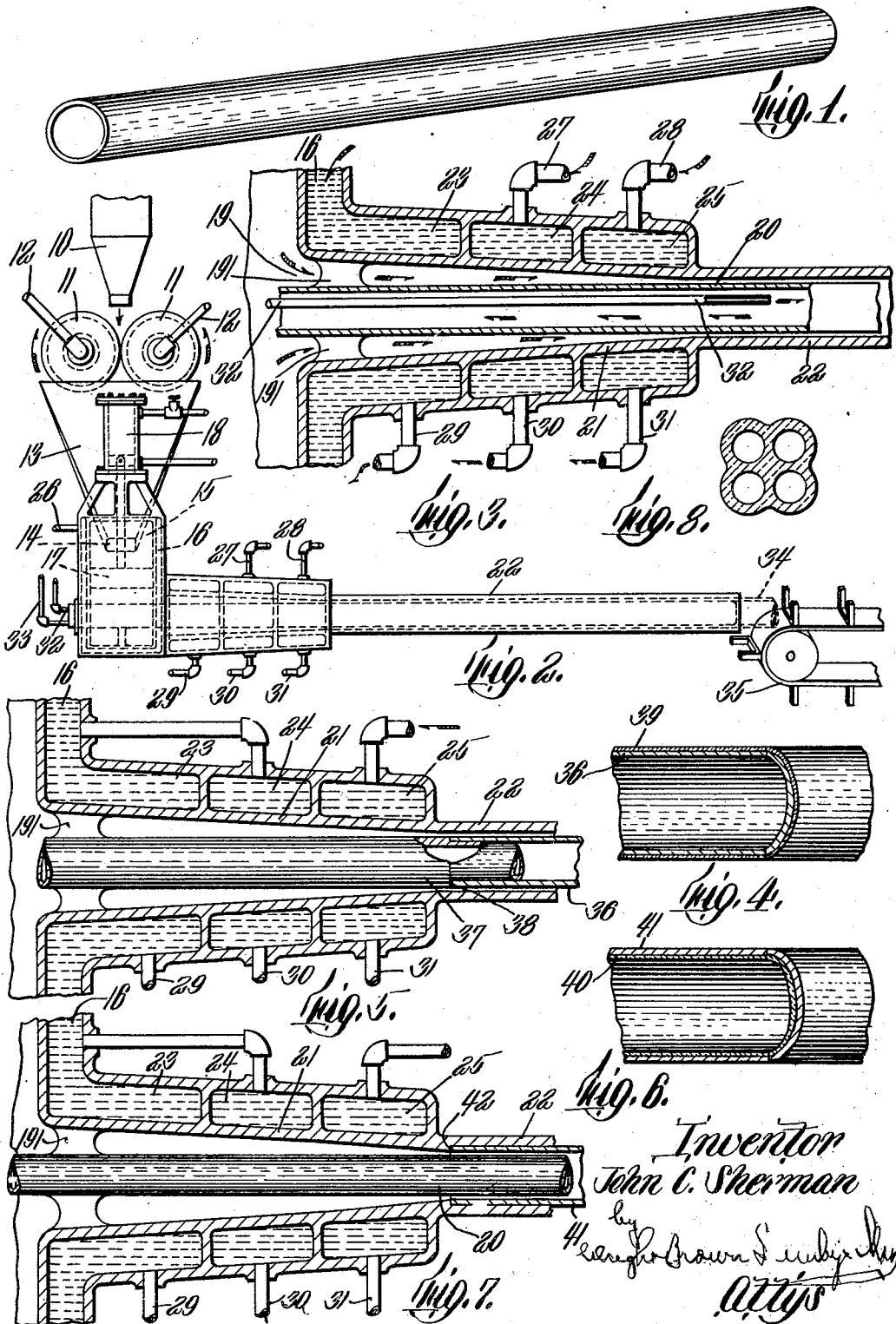


J. C. SHERMAN

METHOD OF AND APPARATUS FOR MAKING CONDUITS BY EXTRUSION



UNITED STATES PATENT OFFICE

JOHN C. SHERMAN, OF GORHAM, MAINE, ASSIGNOR TO BROWN COMPANY, OF BERLIN, NEW HAMPSHIRE, A CORPORATION OF MAINE

METHOD OF AND APPARATUS FOR MAKING CONDUITS BY EXTRUSION

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This invention relates to articles formed by extrusion, and a method and apparatus for making the same, special reference being had to tubing or conduit made by extruding a plastic waterproof compound. There are many demands in various industries, such as the telephone industry, for a waterproof conduit which is relatively light, durable and inexpensive. It is an object of this invention to supply a conduit having these and other advantages as will appear from the disclosure given hereinafter. By my invention, I make conduit consisting of fibers with which is incorporated a cementitious or plastic binder preferably of a type which hardens upon cooling. Any kind of fiber may be utilized such for example as rag or asbestos fibers or a mixture of these with each other or with other kinds of fiber. The plastic binder may consist of asphalt, pitch, wax, oil or any equivalent material which softens under the action of heat or can be vulcanized. I have found that partially oxidized linseed oil is a binder which has excellent properties especially when used with a suitable amount of flowers-of-sulphur to harden it. In order to obtain maximum qualities of strength, toughness and durability, I use from sixty to seventy-five per cent. of asbestos or other fiber combined with forty to twenty-five per cent. of partially oxidized linseed oil. In addition to the sulphur, I also may add a small amount of lamp black to impart a smooth grain and external finish to the conduit. This material when set can readily be turned in a lathe or threaded. Instead of a thermoplastic or vulcanizable binder, I may use cements, if desired, such cementitious material being suitably mixed with other ingredients to form a thick plastic mass which can be extruded through an orifice and will hold its shape. With the cement I may mix sawdust, wood flour, crushed coke, or any other finely divided material suitable for the purpose. The cementitious binder may comprise such substances as silicate of soda and lime which with sawdust will harden into a water-resistant body.

In mixing the plastic mass of fiber and binder for extrusion, I preferably grind the

fibrous material, such as old rags or asbestos mill waste or the like, on heated rolls with sufficient adhesive material to keep the mass on the rolls. The grinding breaks up the fibrous material and works the adhesive binder thoroughly into the fibers. More adhesive binder is then added until the desired proportions of fiber and adhesive are obtained. This results in a far more thorough impregnation of the fibrous body with the water-proofing binder than can possibly be obtained where a tube or other object is first made of fibrous material, as for example by rolling up a sheet of paper or by forming a fiber tube directly from a Fourdrinier roll, and then saturating the dried fibrous tube with waterproofing compound. This is evidenced by the fact that where fibrous tubes are made and subsequently saturated, the saturation is most complete in the cases where the fibers constituting the tube have been most completely destroyed in the process of making the tube, as for example where the tube is made of newspaper fiber or ground wood. While by my process the grinding of the fibrous material on the rolls destroys the fibers to a small extent, yet the intimate intermixture of the plastic binder with the fibers during the process of rolling produces a high degree of saturation or impregnation of the fibrous structure with the adhesive with a relatively small degree of destruction of the fibers.

Further advantageous features of my invention will appear from the following description and on the drawing, of which:—

Figure 1 is a perspective of a length of conduit formed according to my invention.

Figure 2 is a diagrammatic elevation of apparatus for carrying out the invention.

Figure 3 is a sectional detail of a part of the apparatus shown in Figure 2.

Figure 4 is a fragmentary view of a length of conduit on which a sleeve of waterproof material has been formed by extrusion.

Figure 5 is a modified form of the apparatus shown in Figure 3 adapted to extrude a sleeve upon a core, as shown in Figure 4.

Figure 6 is a fragmentary view of a section of conduit having a lining extruded therein.

Figure 7 is a modified form of apparatus for extruding the lining, as shown in Figure 6.

Figure 8 is a cross section view of a multiple conduit which can be formed by extrusion.

Referring to the drawings in detail, 10 represents a hopper through which the raw materials may be fed to a pair of rolls 11 which are heated as by steam pipes 12 and driven by any suitable means (not shown). The fibrous material, such as rags or asbestos mill waste, are mixed with sufficient adhesive material, such as partially oxidized linseed oil with or without rubber or other equivalent, and fed to the rolls 11 through the hopper 10. After a thorough grinding of the mixture on the hot rolls, more adhesive, together with a suitable amount of flowers-of-sulphur, powdered mica and lamp black, if desired, is added to the mixture on the rolls to form a soft, workable mass of proper consistency. When the mass has been thoroughly intermixed, it is scraped from the surface of the rolls and allowed to drop down through a hopper 13 which opens as at 14 into a suitable cylinder 15 which is preferably steam-jacketed at 16 to maintain it at a suitable temperature. In order to apply pressure to the plastic mass for the purposes of extrusion, I provide a piston 17 which may be raised or lowered by any desired means, such as a screw shaft or a hydraulic press indicated at 18. This press may be of any desired type such as can be bought on the open market suitable for the service required. An extrusion orifice 19 is formed at any suitable point in a wall of the cylinder 15, through which the plastic mass may be extruded. In order to provide for the hollow center of the tubular conduit, I locate in the orifice 19 a mandrel 20 which preferably extends to the further wall of the cylinder 15. This mandrel 20 is preferably hollow for purposes to be described, and is supported by any suitable means, such as struts or fins 191, preferably located near the mouth of the orifice 19. Multiple conduit such as that illustrated in Figure 8 can be made by shaping the orifice in accordance with the desired outline of the cross section. This may be as illustrated to minimize weight and cost of material, or may be rectangular or any other desired shape. A number of mandrels 20, one for each duct in the conduit, may extend through the orifice and be supported in spaced relation to the sides of the orifice and to each other.

When plastic material of the nature described is extruded into the open air, it has a tendency to cool rapidly and to shrink slightly toward the median line of the material. The cooling is usually more rapid on the outer surface than the inner surface and consequently internal strains are set up in the material which render the conduit brittle and liable to crack. Another frequent cause of

brittleness of conduit of this type is the tendency of the extruded material to form in laminations under the influence of pressure used in forcing the material through the orifice. Such laminations are apt to form in planes substantially normal to the applied pressure, instances of this tendency in nature being found in the case of slate and shale formation. In order to produce a conduit of maximum durability and minimum brittleness, it is necessary first to use proper materials in correct proportion; second, to mix the ingredients thoroughly and evenly; third, to apply the pressures on the material in the course of extrusion in such a way as to minimize the tendency to laminate in any one direction; and fourth, to control the cooling of the mass in such a way as to avoid the setting up of internal stresses in the material of the conduit. I provide for the first two of these considerations, above mentioned, by selecting ingredients as hereinbefore described and by mixing the same on the steam-heated rolls 11. In order to provide against undue laminations in any one direction, I provide a conical member 21 which may be formed integrally with a wall of the cylinder 15 and extends outwardly from the orifice 19 with a constantly decreasing diameter. This member 21 also surrounds and is concentric with the mandrel 20. The function of the member 21 is to cause the plastic mass which is pressed through the orifice 19 to be contracted in thickness by the decreasing clearance between the member 21 and the mandrel 20 as it passes along. Thus in addition to the longitudinal pressure which causes the mass to move forward, a radial reactive pressure is supplied by the taper of the member 21 which prevents excessive tendency of the mass to develop radial laminations. I may also accomplish the same purpose by giving the member 21 a cylindrical shape, but tapering the mandrel 20 in the other direction so that it increases in diameter to its maximum at the outer end of the member 21.

In order to prevent the extruding tubing from piling up on the mandrel 20 as it might do if allowed to emerge from the narrowest portion of the member 21 into the open air, I provide a cylindrical extension 22 of the member 21 which is preferably formed integrally therewith and is also concentric with the mandrel 20. The mandrel 20 and the extension 22 are constructed of suitable length to maintain the conduit in proper shape while it sets sufficiently to hold its shape as it leaves the end of the extension. The surfaces of the mandrel 20 and the extension 22 on which the extruding mass slides are preferably of polished steel as plastic mixtures of the class described readily separate from such surfaces.

In order to provide for suitable temperature control so as to enable the extruding

conduit to cool in a manner designed to leave it with the least possible internal stresses, I surround the member 21 with a jacket having a series of compartments 23, 24 and 25. Any number of these consecutive compartments may be supplied according to the needs of the material used, the three compartments shown being by way of example only. As shown in Figure 3, the compartment 23 opens into the jacket surrounding the cylinder 15 so that the cylinder temperature is maintained on the exterior surface of the mass in the course of extrusion until it reaches the second compartment 24 which is preferably maintained at a somewhat lower temperature. The compartment 25 is maintained at a still lower temperature, the extension 22 having no jacket at all. As an example of the temperatures at which the compartments may be maintained when a conduit is being made of a mixture of fiber and partially oxidized linseed oil with sulphur, as previously described, the steam jacket 16 and the compartment 23 may be maintained at a temperature of approximately 250°, the chamber 24 at about 200°, and the chamber 25 at about 100°. These temperatures may be maintained by any suitable means, such as steam and water, heated air, oil or other fluid, or by electric resistance coils. The heated fluid may be fed through the various chambers as by suitable inlet pipes 26, 27 and 28 for the respective chambers and by corresponding outlets 29, 30 and 31. In the cooling of the conduit, it is found advantageous to allow the interior surface of the conduit to cool somewhat more rapidly than the exterior surface. To this end I introduce into the hollow mandrel 20 a suitable pipe 32 which may pass through the closed end of the mandrel 20 and extend to any desired distance within the mandrel. An outlet 33 is placed at the end of the mandrel so that air which is introduced at a suitable temperature circulates from the open end of the pipe 32 and travels back through the conduit 20 and out through the exhaust pipe 33. The temperature of the air or other fluid which is introduced through the pipe 32 is preferably at or slightly below the melting point of the adhesive used in the extruded material. This serves to bring the material near the inner surface of the tube close to the congealing point before the temperature of the material near the outer surface has been reduced to that extent, so that the tube hardens from the inside out. This process is duly retarded by the heated jacket and the extension 22 which is warmed by the material itself, so that internal stresses are largely avoided, but by the time the tube has reached the open air at the end of the mandrel 20, it has sufficiently set to hold its shape and to complete the hardening process without becoming brittle.

As the conduit 34 emerges from the ex-

tension 22, it may be cut off by any suitable means into the desired lengths and carried off as by a conveyor 35.

This method of extrusion is capable of being used to form a coating on a pre-formed tube of the same or of different material, such as iron or fiber pipe, or it may be used to form a liner in such a pipe. For this purpose, I may use a cylinder 15 and a tapering extrusion member 21 constructed as previously described, and illustrated in Figures 5 and 7. The extrusion members 21 are preferably jacketed for temperature control, the chamber 24 in these cases being shown as also connected with the jacket 16 in order to maintain the mass at its extrusion temperature until a later point is reached than in the case of the extrusion of plain conduit. This keeps the material more plastic and enables it to slip more readily on the pipe or core 36 on which the plastic material is to form a sleeve or covering layer. As shown in Figure 5, a mandrel 37 is provided with a suitable shoulder 38, this shoulder being formed to receive the end of a pipe 36 over which the plastic material is to be extruded. The further steps of extruding the mass over the pipe 36 are as previously described for the making of plain conduit. As shown in Figure 4, the finished product comprises the pipe or tube 36 with a substantial even layer 39 of the plastic material covering its upper surface. In like manner, a liner 40 of plastic material may be formed in a tube or pipe 41 by forming a shoulder 42, as shown in Figure 7, in the inner wall of the extension 22 so that the pipe 41 may be inserted into the extension 22 against the shoulder 42 and the plastic material will be extruded between the mandrel 20 and the pipe 41. The process of coating or lining pipes, as illustrated in Figures 4 and 6, is intermittent, the extruding pressure in the cylinder 15 being applied after a pipe is put in position against the shoulder 38 or 42 and being removed when the plastic matter has been squeezed through to the further end of the extension 22, after which the lined or coated pipe may be withdrawn and another one inserted.

Having thus described an embodiment of my invention, it should be evident to those skilled in the art that many changes and modifications may be made therein without departing from its spirit or scope as defined by the appended claims.

I claim:

1. The method of making tubular conduit, which comprises hot-grinding rags with a thermo-plastic binder, and extruding the mass in tubular form.

2. The method of making tubular conduit, which comprises hot-mixing fibers with a waterproof plastic binder, and extruding the mass in the form of a tube, the walls of

the tube in the course of extrusion being progressively and gradually diminished in thickness and progressively cooled.

3. Steps in the method of making tubular conduit, which comprise extruding a hot mass of thermo-plastic material into tubular form, and cooling the inner surface of the tube more rapidly than the outer surface.

4. Apparatus for making conduit by extrusion, comprising an extrusion chamber having a fixed core therein extending longitudinally thereof, the clearance between the wall of the chamber and the core progressively and gradually diminishing in the direction of extrusion, and means for progressively cooling the conduit in the course of extrusion.

5. The method of making tubular conduit, which comprises heating and grinding a quantity of fiber with a thermoplastic binder, extruding the hot mixture into tubular shape, cooling the inner surface of the tube quickly to the congealing point, and cooling the exterior surface of the tube more slowly.

6. The method of making tubular conduit, which comprises hot-mixing fiber and a binder to form a plastic mass, and extruding the mass into tubular form, the thickness of the tube walls being gradually decreased and the tube being progressively cooled from within during extrusion thereof.

7. The method of making tubular conduit, which comprises hot-mixing fiber and a binder into a plastic mass, and extruding the mass into tubular form, the tube in the course of extrusion being rapidly cooled from within and slowly cooled from without.

8. The method of making tubular conduit, which comprises hot-mixing fiber and a binder into a plastic mass, and extruding the mass into tubular form, the tube in the course of extrusion being rapidly cooled from within and slowly cooled from without, and having its thickness of wall gradually decreased.

9. Apparatus for making conduit comprising a container having an orifice, a core extending through said orifice, means for extruding plastic material through said orifice into tubular form, a tubular shaper extending from around said orifice and surrounding said core, said shaper having a tapering internal diameter with its maximum diameter adjacent to said orifice, and means for maintaining and separately controlling a series of temperature zones along said shaper.

10. Apparatus for making conduit comprising a container having an orifice, a core extending through said orifice, means for extruding plastic material through said orifice into tubular form, a tubular shaper extending from said orifice and surrounding said core, said shaper having a tapering internal diameter with its maximum diameter adjacent to said orifice, a series of peripheral

jackets about said shaper, and means for separately supplying said jackets with fluids.

In testimony whereof I have affixed my signature.

JOHN C. SHERMAN. 70

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