Oct. 6, 1931. H. P. WILLIAMS 1,826,586

METHOD AND APPARATUS FOR MANUFACTURING SEWER PIPE AND SIMILAR ARTICLES

Filed Jan. 27, 1930

Fig. 1.

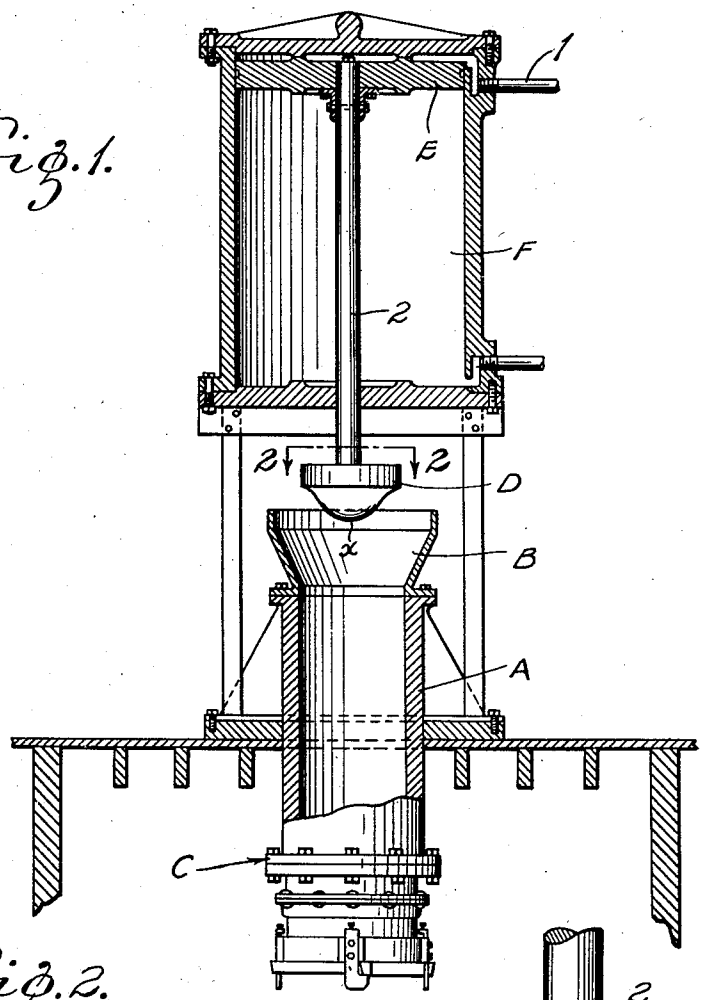


Fig. 2.

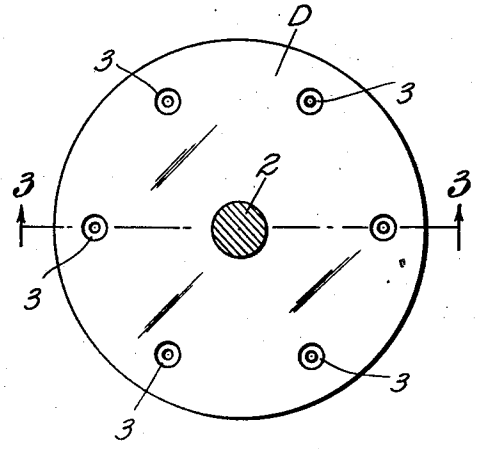
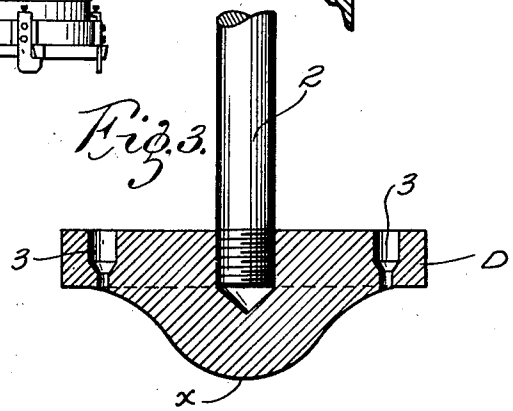


Fig. 3.



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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR MANUFACTURING SEWER PIPE AND SIMILAR ARTICLES

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This invention relates to the manufacture of ceramic articles, and has for its main object to eliminate or reduce the tendency of highly compressed air becoming trapped in material that is being compressed to form a ceramic article.

I have herein illustrated my invention embodied in a method and apparatus for manufacturing sewer pipe and similar articles of the kind that are produced by compressing mud or tempered clay, and then forcing said material through an extruding die. While my invention is particularly applicable to the manufacture of sewer pipe, in that it overcomes an inherent objection or defect of conventional methods and apparatus used in the manufacture of sewer pipe, I wish it to be understood that my invention is applicable to the manufacture of various other ceramic articles, as my broad idea consist in subjecting loose material that is being converted into a ceramic article, to a compressing operation, which is of such a character that during the first portion of the operation air which may be mixed with or trapped in said material will be effectively expelled from same.

Figure 1 of the drawings is a vertical sectional view of an apparatus embodying my invention for manufacturing sewer pipe and similar articles,

Figure 2 is an enlarged top plan view of the plunger of the clay cylinder, taken on the line 2—2 of Figure 1, looking in the direction indicated by the arrows; and

Figure 3 is a vertical sectional view of said plunger, taken on the line 3—3 of Figure 2.

The conventional press or apparatus used in the manufacture of sewer pipe or similar articles that are produced by forcing highly compressed plastic material through an extruding die, comprises a cylinder, usually referred to as a clay cylinder, open at one end and provided at its opposite end with an extruding die, a reciprocating plunger fitting loosely in said cylinder and provided with a flat face adapted to act on loose or unpacked mud or clay in said cylinder and disposed at right angles to the side wall of the cylinder, and an actuating mechanism for said plunger which usually consists of a steam cylinder having a piston of considerably greater area than the plunger of the clay cylinder and rigidly connected to said plunger by a piston rod. Loose or unpacked mud or clay that has been tempered, mixed or subjected to such treatment as to make it plastic, is fed by a suitable feeding apparatus into a hopper mounted on the open end of the clay cylinder, and the reciprocating movement of the plunger of the clay cylinder causes the material in said cylinder to be compressed, moved longitudinally through the clay cylinder and then forced through the extruding die at one end of said cylinder. The loose material that is delivered to the hopper of the clay cylinder is in the form of lumps or particles of irregular shape and size, and as the pressing face of the plunger is flat or disposed at right angles to the side wall of the cylinder, gobs or slugs of air are liable to become trapped in the voids or spaces between the particles of material during the first portion of the operation of compressing or compacting the particles of loose material together, which trapped air subsequently becomes compressed to a high degree during the final compressing operation or during the operation of forcing the compressed material through the extruding die. These gobs or slugs of highly compressed air remain trapped in the material until the shaped or formed article leaves the die, whereupon said gobs or slugs expand, and often produce disastrous results to the article being formed. If an article having a relatively thin wall is being produced, there is not sufficient material around an air pocket to withstand the internal pressure of the pocket after the portion of the material containing said pocket has passed through the extruding die, and the result is, that said portion will be ruptured by the expansion of the air, thus making the article unfit for commercial use. If the article being produced has a relatively thick wall, there may be sufficient material in the wall to prevent the wall from being ruptured by an internal air pocket, but even in thick walled articles internal air pockets are highly objectionable, as they produce weak spots or spots in which the material is of laminated structure.

In order to overcome or remedy the above mentioned defects or objections to the conventional method and apparatus used in the manufacture of sewer pipe and similar articles, I propose to subject the loose material from which such articles are made to a compressing operation of such a nature that air which is mixed with said material will be positively expelled from same prior to the final compressing operation and forcing of the compressed material through the extruding die. Usually, the loose, tempered material that is introduced into the clay cylinder will be subjected to pressure by the action of a reciprocating plunger provided with a pressing surface of such shape or form that the pressure will be first applied to the center of the mass of material in the clay cylinder and then applied progressively towards the side wall of said cylinder, thereby causing any air which may be mixed with the material at the center of the mass on which pressure is exerted to escape to a point of exit, and hence, not become trapped in a pocket, and thereafter subjected to a dangerous pressure or excessively high pressure as the material continues to move longitudinally through the clay cylinder towards the extruding die.

The material travels longitudinally through the clay cylinder and the density of said material increases progressively as the mass of material approaches the lower end of the clay cylinder. Hence, the loose material that is introduced into the upper end of the clay cylinder will be supported by or sustained by a mass of highly compressed or dense material which forms in effect an opposing wall for the reciprocating plunger, and at each downward stroke of said plunger the loose material which the plunger engages or acts upon will be subjected to considerable pressure that is applied to same, first at the center of the mass of loose material and thereafter progressively towards the side wall of the clay cylinder, as above described. From the foregoing it will be seen that the loose material which is introduced into the clay cylinder is not compressed by a single stroke of the reciprocating plunger, but that on the contrary, said material is compressed progressively by successive strokes of the plunger, and moved progressively through the clay cylinder towards the extruding die of the lower end of said cylinder, the repeated actions of the plunger and the shape of said plunger causing any air which may be mixed with or trapped in the loose material introduced into the upper end of the clay cylinder, to be removed before the material in the clay cylinder becomes dense or highly compressed.

Various means may be employed to attain the highly desirable result above described, but I have found that if the plunger of the clay cylinder is provided with a substantially cone shaped pressing face or is provided with a pressing surface whose central portion protrudes beyond its peripheral portion, that the reciprocating movement of said plunger causes lumps or relatively large particles of material supported by the compressed mass of material in clay cylinder to be first distributed more or less uniformly throughout the circumference of the cylinder and then subjected to a compressing operation which causes air mixed with said material to be expelled and forced upwardly around the peripheral edge of the plunger or through openings in the plunger, during the final steps of compressing the material to a high degree and forcing it through the extruding die, any remaining air in the material will be effectively expelled from same.

In the accompanying drawings which illustrate an apparatus constructed in accordance with my invention, A designates a cylinder, which, for convenience, I have referred to as a clay cylinder, that is arranged vertically and provided with an open upper end that communicates with a hopper B into which tempered clay or other suitable loose material is adapted to be fed by a suitable feeding apparatus (not shown). At the lower end of the cylinder A is an extruding die C of any suitable type or kind through which highly compressed material in the cylinder A is adapted to be forced by pressure exerted on said material by a plunger D, which is reciprocated longitudinally of the cylinder A by a piston E mounted in a cylinder F that has supply pipes 1 connected to the opposite ends of same so as to permit an operating medium to be admitted to and exhausted from the cylinder F, the operating piston E being rigidly connected with the plunger D by means of a piston rod 2.

The plunger D, instead of having a flat pressing face disposed at right angles to the side wall of the cylinder A, has a tapered or inclined pressing surface whose central portion x protrudes beyond the peripheral edge of the plunger, as shown clearly in Figure 3. The plunger D fits fairly loose in the cylinder A, and when said plunger moves downwardly on its compression stroke, the loose plastic material that has been introduced into the cylinder A will be subjected to pressure that is applied to or exerted on said loose material progressively from the longitudinal center of the cylinder towards the side wall of same. If the loose material in the cylinder A is in the form of lumps or relatively large particles, the downward stroke of the plunger D causes the loose material at the upper end of the cylinder A to be arranged more or less uniformly throughout the circumference of the cylinder, due, of course, to the fact that the tapered protruding portion of the pressing surface of the plunger D, upon coming in contact with the loose material, spreads the

same or throws it laterally towards the side wall of the cylinder. As the downward movement of the plunger D continues, the center portion of the mass of loose material in the cylinder A will first be subjected to pressure, with the result that any air which may be in the voids or spaces at the center of the mass will be displaced or expelled, and thus forced laterally or radially through that portion of the loose material on which pressure has not yet been exerted by the plunger. In this way each downward stroke of loose plunger D causes the material in the upper portion of the clay cylinder to be compressed by pressure that is applied progressively from the center towards the side wall of the cylinder, instead of uniformly throughout the entire area of the mass, as is the case with an apparatus having a flat faced plunger. By the time the plunger D reaches the end of its compression stroke any air which may have been mixed with the loose material in the upper end of the cylinder A will have been expelled from same and forced upwardly through the space between the peripheral edge of the plunger D and the side wall of the cylinder A. If desired, the plunger D may be provided with relief ports or openings 3 located near the peripheral edge of the plunger up through which expelled or displaced air can flow during the progressive compressing action of the plunger D on the material in the cylinder A. After the compressing operation just described in which any air mixed with the loose material in the upper portion of the cylinder A is expelled from the material, said substantially air free material travels downwardly through the cylinder towards the die C, and in its downward passage through the cylinder said material becomes compressed to a high degree, as is usual in apparatus of this general type. From the foregoing it will be understood that in my improved method of manufacturing ceramic articles, loose tempered clay or the like is fed progressively or intermittently into the upper end of a cylinder, and is subjected to a compressing operation in said cylinder by a reciprocating plunger whose repeated actions expel air from the loose material that is fed into the upper end of said cylinder, and thereafter compress said air free material to a high degree and force it through an extruding die at the lower end of the cylinder.

The compressing surface of the plunger D may be varied, and said plunger may or may not be provided with relief holes 3. It is also of course immaterial what means is used to reciprocate or actuate the plunger or other part that is utilized to partially compress the material and expel air from same preparatory to the final compressing operation.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A method of manufacturing sewer pipe and similar articles, characterized by introducing loose material into a cylinder subjecting the material in the receiving end portion of the cylinder to pressure that is applied to said material progressively from the center towards the side wall of the cylinder, thereby causing air that is mixed with said loose material to be expelled from same, and thereafter compressing said material to a high degree and forcing it into a shaping die.

2. A method of manufacturing sewer pipe and similar articles, characterized by intermittently introducing loose material into a cylinder that contains a mass of compressed or dense material, and causing the loose material in the receiving end portion of said cylinder to be acted on by a reciprocating member that progressively exerts pressure on said loose material from the center of the mass towards the side wall of the cylinder.

3. A method of manufacturing sewer pipe and similar articles, characterized by introducing loose plastic material into a cylinder on top of a mass of compressed or dense material in said cylinder, and exerting pressure on the material in the receiving end portion of said cylinder in such a way as to first distribute said loose material substantially uniformly around the circumference of the cylinder, and thereafter cause said loose material to be compressed progressively from the center of the mass towards the side wall of the cylinder, whereby air that may be mixed with said loose material will be expelled from same.

4. A method of manufacturing sewer pipe and similar articles, characterized by introducing a loose plastic material into a cylinder on top of a mass of dense material in said cylinder, and subjecting the loose material in the receiving end portion of said cylinder to the action of a reciprocating compressing device that progressively compresses said loose material and causes air mixed with the portion of the material which is first compressed, to be expelled from same and forced towards a point of exit.

5. An apparatus for producing sewer pipe and similar articles, comprising a vertically-disposed cylinder that is adapted to have loose material introduced intermittently into the upper end of same onto a mass of dense or compressed material in said cylinder, a reciprocating plunger operating in said cylinder and provided with a pressing surface shaped so that the pressure which said plunger exerts on the loose material will be applied progressively from the center of the mass of loose material in the cylinder towards the side wall of the cylinder, and relief openings in said plunger located within the marginal edge of the plunger, through

which air expelled from said loose material can escape from the cylinder.

6. An apparatus for producing sewer pipe and similar articles, comprising a vertically-disposed cylinder open at its upper end, an extruding die at the lower end of said cylinder, a plunger provided with a substantially cone-shaped pressing surface, and means for reciprocating said plunger so as to withdraw it from the open upper end of the cylinder, thus permitting plastic material to be introduced into the cylinder and thereafter introduce said plunger into the cylinder so as to compress the material in the upper end of the cylinder and expel air from said material.

7. An apparatus for producing sewer pipe and similar articles, comprising a vertically-disposed cylinder open at its upper end, a hopper communicating with the upper end of said cylinder into which plastic material is adapted to be fed, an extruding die at the lower end of said cylinder, a vertically reciprocating plunger arranged to travel downwardly through said hopper and enter said cylinder, a pressing surface on said plunger having a tapered central protruding portion, and means for reciprocating said plunger.

8. In the manufacture of ceramic articles, the procedure consisting of subjecting a confined mass of loose material to pressure applied in a direction to substantially expel air that is mixed with or incorporated in said material, and thereafter subjecting said substantially air free material to sufficient pressure to convert it into a dense mass that is substantially free from highly compressed, trapped air.

9. In the manufacture of ceramic articles, the procedure consisting of subjecting a mass of loose material to pressure applied in such a way as to substantially expel air that is mixed with or incorporated in said material, and thereafter converting said substantially air free material into a dense body and forcing it into a shaping die.

10. In the manufacture of ceramic articles, the procedure consisting of subjecting a confined mass of loose material to pressure exerted on the central portion of the mass and thereafter applied progressively towards the peripheral portion of the mass for the purpose of expelling air from said material, and thereafter compressing said substantially air free material to a high degree and forcing it into a shaping die.

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