No. 890,293. PATENTED JUNE 9, 1908.

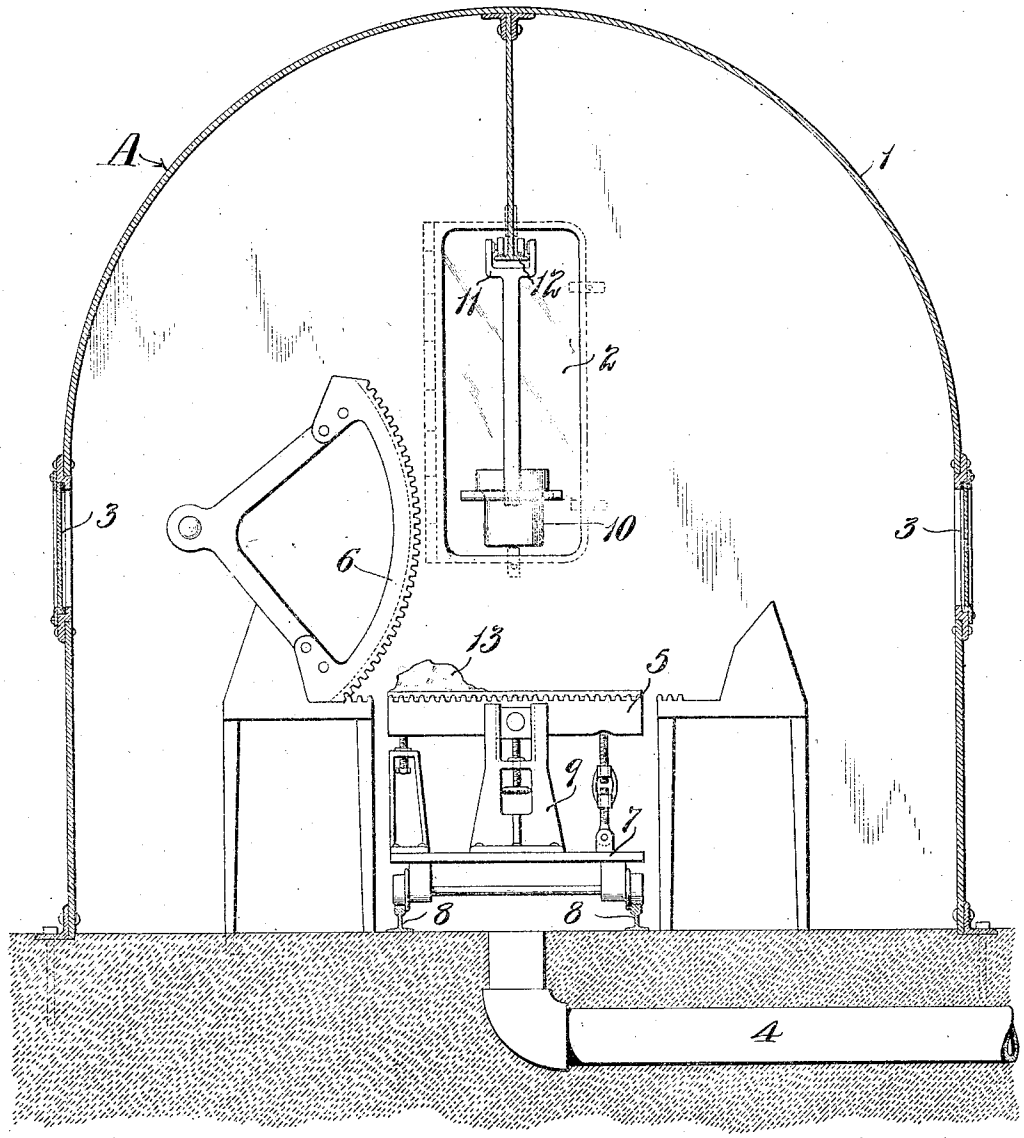
D. J. MURNANE.

METHOD OF CASTING ARTICLES.

APPLICATION FILED DEC. 24, 1906.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

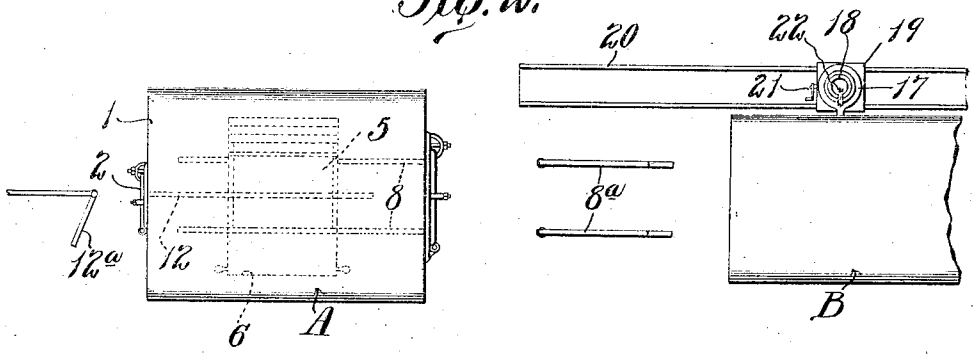


Fig. 3.

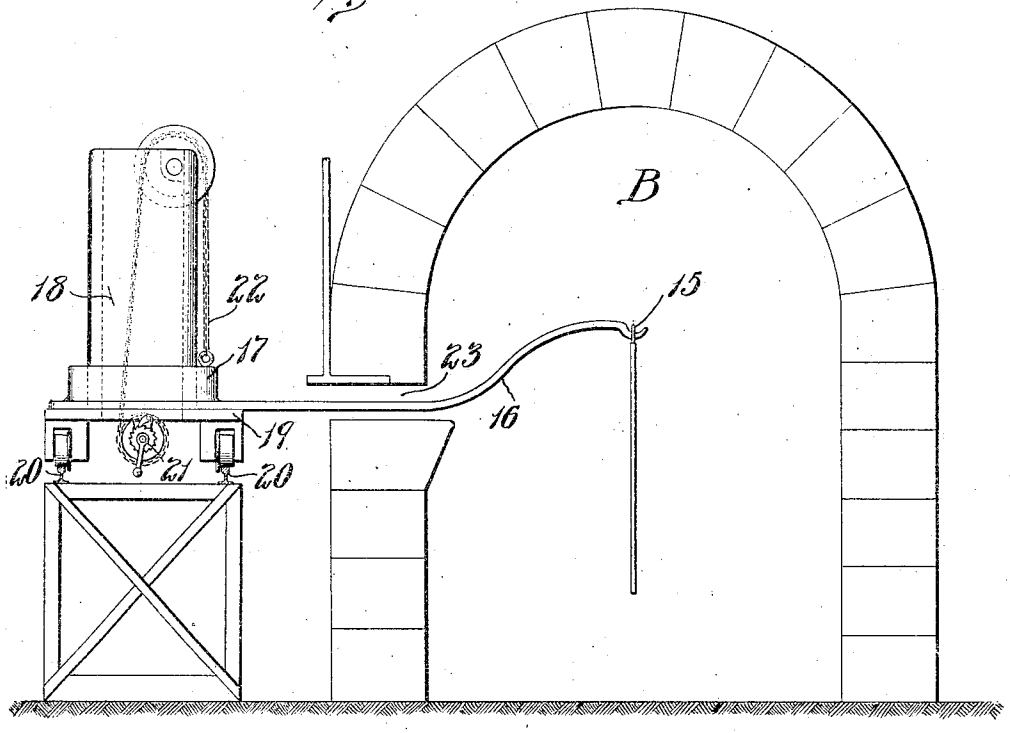
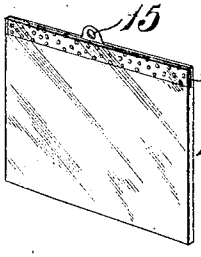


Fig. 4.



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UNITED STATES PATENT OFFICE.

DANIEL J. MURNANE, OF KIRKWOOD, MISSOURI.

METHOD OF CASTING ARTICLES.

No. 890,293. Specification of Letters Patent. Patented June 9, 1908.

Application filed December 24, 1906. Serial No. 349,294.

To all whom it may concern:

Be it known that I, DANIEL J. MURNANE, a citizen of the United States, residing at Kirkwood, Missouri, have invented a certain new and useful Improvement in Methods of Casting Articles, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a cross sectional view through the vacuum chamber of the apparatus which I have herein shown for practicing my method; Fig. 2 is a plan view of the apparatus; Fig. 3 is a cross sectional view through the annealing furnace; and Fig. 4 is a detail perspective view of the finished sheet.

This invention relates broadly to a method of casting articles from molten metals.

One object of my invention is to provide a method by which I am enabled to produce cast articles or objects having surfaces that are perfectly smooth and free from air bubbles.

I have herein described my method as being employed for casting sheets of glass but it should be understood that the broad principle of my invention could also be utilized in the manufacture of cast steel articles.

In the manufacture of articles or objects formed by casting molten metals, the faces of the article are usually rough and very often the articles are filled with air bubbles or blow-holes which make them defective. These rough faces are caused by the air which gets between the molten metal and the surface onto which the metal is poured and the air bubbles or blow-holes are caused by the air which is trapped by the molten metal and thus prevented from escaping so that it expands and consequently produces bubbles.

In the manufacture of cast sheets of glass, after the sheets have been formed the faces thereof are so rough that it is necessary to grind off the faces and then polish them to produce a transparent plate of glass having perfectly smooth surfaces. These grinding and polishing operations add greatly to the cost of producing cast sheets of glass, commonly known as plate glass, due to the fact that about one-half of the sheet is consumed or ground off as well as necessitating the employment of special machinery and operatives for running the machines.

By my improved method I am able to produce sheets of transparent glass having perfectly smooth faces, without grinding and polishing the sheet after it has been cast or rolled, thereby greatly reducing the cost of manufacture. Furthermore, my method enables me to produce finished sheets of transparent glass of any desired thickness.

One other object of my method is to produce a sheet of cast glass in which both faces have a fire finish.

Broadly stated, my method consists in casting an article from molten metal in a sealed chamber or inclosed space from which air has been exhausted previous to pouring the metal so that the metal is poured in a partial vacuum. It is, of course, desirable to remove as much air as possible from the sealed chamber but it is not absolutely necessary that every particle of air be removed as a small quantity of air in the chamber will not affect my process. By pouring the metal in a partial vacuum I reduce to a minimum the possibility of air lodging between the molten metal and the surfaces with which it comes in contact and also becoming trapped by the molten metal as it is being poured so that I obtain an article which has smooth surfaces and which is free from blow-holes. Furthermore, my method facilitates the flowing of the metal and enables me to pour it at a lower temperature than when it is poured in the atmosphere which quickly chills the metal.

I have herein illustrated one form of apparatus which may be employed for practicing my method in the manufacture of cast sheets of glass, but I wish it to be understood that various other kinds of apparatus could be used for carrying out my method without departing from the spirit of my invention.

The apparatus herein shown consists of a vacuum chamber, namely, an inclosed space which is sealed and has air exhausted therefrom prior to the operation of casting the mass of molten glass, an annealing furnace, and means for suspending the sheet of glass in an approximately vertical or upright position in the annealing furnace so that both faces thereof will be subjected to heat and thus receive what is commonly termed a "fire finish". By the term "vacuum chamber" I mean a specially constructed chamber or inclosed space which is of great enough dimensions to receive the casting table and the other members used in forming the sheet so that it forms the "work-shop" in which

the casting operation takes place, and wherever I have used said term I wish to be understood as meaning an inclosed space of great enough dimensions to receive the members used in the casting operation and not a small inclosed space such as a hollow mold into which metal is poured to form an article.

Referring to the drawings, A designates the vacuum chamber which is formed by a shell 1 provided with air-tight doors and windows 2 and 3. This shell is air-tight and is so constructed that it will withstand the pressure to which it is subjected when the air is exhausted therefrom. I have not illustrated the details of construction of this shell, however, as it is immaterial, so far as my broad idea is concerned, in what manner the shell is constructed, the term "shell" being used merely for the purpose of designating the member or members which form the sides and top of the vacuum chamber. Communicating with the interior of the shell is a conduit 4 that is adapted to be connected to a pump for exhausting air from the interior of the shell. A casting table 5 having a polished surface is arranged inside of the vacuum chamber, and coöperating with said table is a member 6 having a polished surface which forms the mass of molten glass into a sheet, the table being provided along its side edges with tangs which determine the thickness of the sheet. The member 6, as herein shown, is of segmental shape and is adapted to be rocked over the table 5, said member and table being provided with coöperating rack teeth which prevent said member from slipping. A roller or any other suitable device, however, could be used in place of the member 6.

The table 5 is preferably mounted on a carriage 7 which travels on tracks 8, and said table is pivotally mounted between supports 9 on the carriage for a purpose hereinafter described. The mass of molten glass is carried into the vacuum chamber A in a pot or ladle 10 supported by a carriage 11 which travels on an overhead track 12, said track comprising a movable portion 12ª arranged on the outside of the shell which can be swung into an inoperative position, as shown in Fig. 2, to permit the door 2 in the shell to be closed and sealed after the pot of molten glass has entered the interior of the shell.

The various members which are used in casting the sheet, namely, the member 6, table 5, and ladle or pot 10, can be operated from the outside of the shell 1 by suitable devices connected thereto and extending through stuffing boxes in the shell, but I prefer to have these members operated by workmen inside of the shell dressed in air-tight suits and helmets to which air is supplied by tubes extending from a source of air supply outside of the shell, such, for example, as the suits used by divers.

In carrying out my method, a pot of molten glass is carried on the track 12 into the interior of the shell 1 and the doors and windows of said shell are then securely sealed so that no air can penetrate into the shell 1. Air is then exhausted from the shell through the conduit 4 so that a partial vacuum or as perfect a vacuum as practicable is created inside of the shell 1. The pot 10 is then dumped to discharge the mass of molten glass 13 onto the casting table 5 and after said pot is moved out of the way, the member 6 is actuated to form said mass into a sheet. Air is then admitted to the vacuum chamber and the door in one end of the shell is then opened and the carriage 7, on which the table 5 is mounted, is drawn out of the shell 1 or vacuum chamber, the tracks 8 inside of the vacuum chamber alining with tracks arranged outside of said chamber, the outside tracks comprising movable portions 8ª which can be swung into an inoperative position, as shown in Fig. 2, to permit the end door of the shell to be securely sealed.

Preferably, a piece of wire mesh or rod 14 provided with an eye 15 is embedded in one edge of the sheet of glass during the operation of forming same to enable the sheet to be gripped by the member which supports it in a vertical position in the annealing furnace B which is arranged adjacent to the vacuum chamber, as shown in Fig. 2.

As previously stated, the casting table 5 is pivotally mounted. The object in constructing the table in this manner is to enable it to be tilted into an approximately vertical position after it has been moved out of the vacuum chamber so that the sheet of glass can be drawn off same in a vertical position and thus not mar the surface of the glass which is in a semi-plastic condition after the casting operation has been completed and accordingly has to be removed therefrom, while in this state. While I prefer to remove the sheet from the table after the table has been moved out of the vacuum chamber it may prove practicable to remove the sheet from the table while the table is still in the vacuum chamber and I therefore do not wish it to be understood that this step of my method; namely, removing the sheet from the casting table, has to be performed outside of the vacuum chamber.

The mechanism herein shown for drawing the sheet from the casting table and holding it suspended in a vertical position in the annealing furnace, consists of an arm 16 provided at its outer end with a hook which engages the eye 15 on the piece of mesh or other object that is embedded in the edge of the sheet. This arm is connected to a sleeve 17 that encircles a hollow standard 18 on a carriage 19 which travels on elevated tracks 20 extending parallel to the tracks 8 and also along the outside of the annealing furnace.

Said carriage is provided with a winding shaft 21, and a chain or cable 22 is connected to said shaft and to the sleeve 17 to which the arm is secured so that said sleeve can be elevated and thus draw the sheet from the casting table. After the arm 16 has removed the sheet from the casting table said table is moved out of the way and the arm is returned to its normal position. The carriage is then moved alongside of the annealing furnace, the side wall of which is provided with an opening 23 so that the arm can project into the interior of the furnace, as shown in Fig. 3, and as the sheet is suspended in an upright or vertical position while it is in the annealing furnace both of its faces will be subjected to heat and thus receive a fire finish.

From the foregoing description it will be seen that my method enables me to produce a cast sheet of transparent glass of any desired thickness and having perfectly smooth faces without grinding off and polishing the faces of the sheet, due to the fact that the sheet is cast in a partial vacuum so that air bubbles cannot form in the glass or get between the molten metal and the smooth and polished surfaces with which it comes in contact to cause the faces of the sheet to be rough. Furthermore, my method enables me to produce a cast sheet of glass in which both faces have a fire finish due to the fact that the sheet is suspended in a vertical position in the annealing furnace so that both of its faces are subjected to heat at the same time.

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

The method of making cast sheets of glass which consists in conveying a mass of molten glass into an air-tight chamber, exhausting air from said chamber to create a vacuum or partial vacuum therein, dumping said mass of molten glass onto a casting table and thereafter spreading said mass over said table and subjecting it to pressure to form a sheet; substantially as described.

In testimony whereof I hereunto affix my signature in the presence of two witnesses, this twenty-second day of December 1906.

DANIEL J. MURNANE.

Witnesses:

WELLS L. CHURCH,

GEORGE BAKEWELL.