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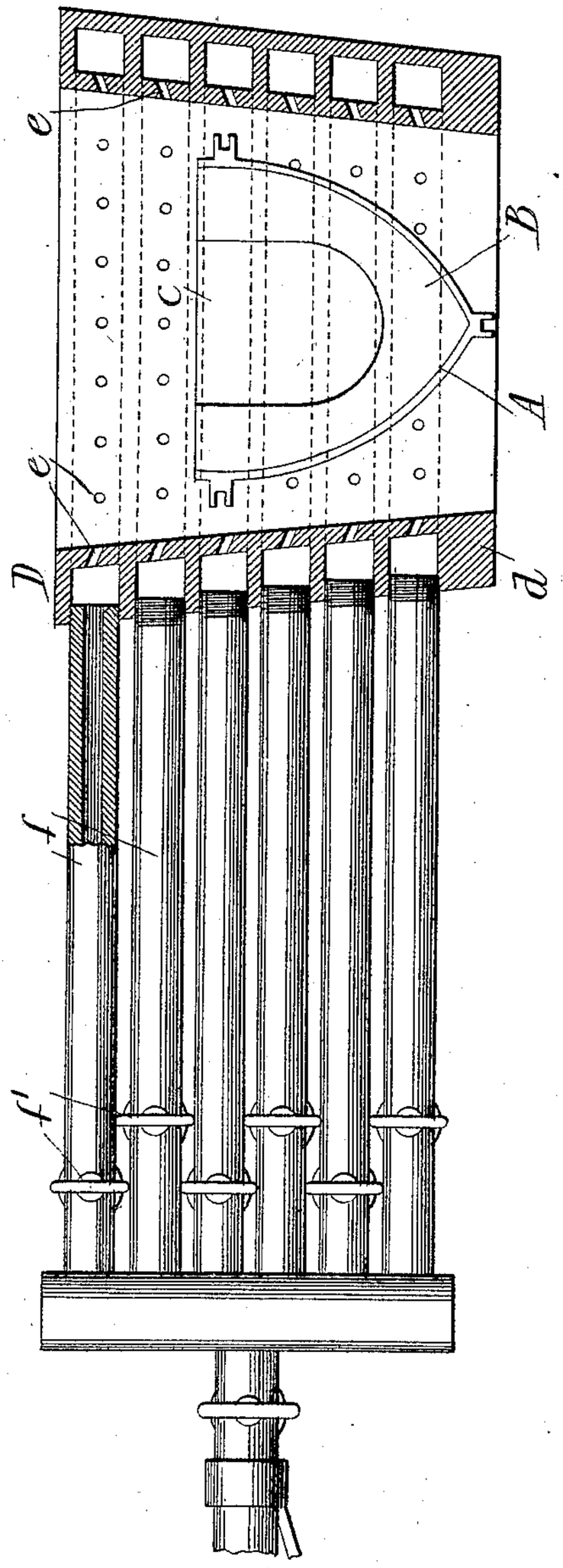
W. D. ALLEN.

METHOD OF MAKING METALLIC CASTINGS.

(Application filed July 22, 1899.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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METHOD OF MAKING METALLIC CASTINGS.

SPECIFICATION forming part of Letters Patent No. 639,130, dated December 12, 1899.

Application filed July 22, 1899. Serial No. 724,815. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM D. ALLEN, a citizen of the United States, residing at Huntsville, in the county of Madison and State of Alabama, have invented certain new and useful Improvements in Methods of Making Metallic Castings; and I do declare the following to be a full, clear, and exact description of the invention, 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, and to the letters of reference marked thereon, which form a part of this specification.

This invention contemplates an improved method of making metallic castings, the object of the invention being the attainment in the finished article of perfection of conformation to the matrix of the mold and freedom from crystallization, fissures, "pipes," "blow-holes," or other flaws and defects which, if present, render it liable to distortion and fracture and otherwise impair its strength, durability, and effectiveness.

My invention, which is applicable to the making of all kinds of metallic castings irrespective of their form, size, and weight and of the material of which they are composed, consists, broadly, in heating throughout its entire body an open-top mold or the like to a degree approximating that of the molten metal when run, maintaining such degree of temperature during the pouring operation and after pouring withdrawing the applied heat from the mold or the like, commencing at the base and continuing gradually toward the top, the heat being finally confined to the exposed molten metal. This method differs from those universally practiced in that by the withdrawal of the heat in the manner stated the casting is caused to cool from the bottom gradually upward, whereas heretofore the cooling has been from the top downward, notwithstanding the practice which is sometimes resorted to of applying heat temporarily to the top of the casting to prevent chilling at that point. This reversal in the direction of cooling of the casting results in a product free from the above-enumerated defects, inasmuch as my improved method contemplates the pouring of a surplus of metal into the mold, which surplus contributes to the loss through shrinkage which the metal in cooling sustains, and the withdrawal of the heat in the manner stated causes the casting to cool and set first at the bottom, and thence gradually toward the top, the molten metal through gravitation compensating for the contraction, the result being an article perfect throughout and conforming exactly to the matrix.

In the following detailed description my improved method is set forth in connection with the manufacture of artificial dentures—articles which are difficult of production in view of their peculiar shape and the degree of thinness made necessary at certain portions in order to afford comfort to the wearer. In the production of dentures and other like articles by my improved method I prefer to employ metals and metallic alloys which have the property of contracting to a considerable degree in casting, and in this respect there is presented a radical departure from the methods heretofore practiced, more especially in connection with dental articles, all of which previous modes, so far as I am aware, contemplating the use of metals and alloys in which the degree of contraction in casting is the minimum. Metals and alloys, which are employed by reason of their comparative non-liability to contraction in casting, are well known to be weak under tensile strain, such weakness being largely due to the greater or less absence of molecular cohesion, and to overcome this difficulty it has been the practice to augment the cross-sectional dimension of the structure to better resist the strain to which it is subjected. In addition to the great discomfort arising from the use of a denture or the like of disproportionate thickness there are also present other disadvantages, due to the failure to compensate for the shrinkage which naturally results from the practice of previous methods, even though the metals or alloys employed are, comparatively speaking, non-contracting. The shrinkage or contraction of a metal or alloy during cooling, though it may be slight, results in a casting which is more or less non-conformable to the part to which it is designed for application, and especially is this true in the case of a full upper denture, where, as is well known, the maximum contraction takes place

at the center, or that part which receives the greatest strain, both in cooling and in the use of the finished article. It is obvious, therefore, that a denture or the like made from a metal or alloy which is naturally weak in tensility and which contracts unequally, even to a slight degree, in cooling is in many ways undesirable, and, on the other hand, that a method employing a metal or alloy which naturally is of comparatively great tensile strength and involving steps which result in proper compensation for contraction is of great value and constitutes a distinct and advanced step in the art.

The details of the method are hereinafter fully set forth, and in connection with this detailed description attention is directed to the accompanying drawing, in which is shown in longitudinal sectional view a casting apparatus by which the method may be carried into effect.

Referring to the said drawing by letter, A denotes a flask or mold containing an investment B, in which is formed the matrix. The opening *c* to the matrix is of sufficient dimensions to enable a surplus of the metal to be poured, the metal being exposed through said opening. The furnace D comprises a casing *d* of sufficient internal dimensions to accommodate the mold A. In the inner wall of the casing, or what may be termed the "mold-chamber," are a plurality of burners *e e*, preferably arranged to project jets of flame in a downwardly-inclined direction, said burners being located in a number of planes, as shown, and each plane of burners being supplied with fluid through a separate pipe *f*, the pipes having each a valve *f'*, by which the supply of fluid may be controlled.

In operation all of the burners in all of the planes are ignited and the mold, being placed in the chamber of the furnace, is first subjected to a gentle heat to thoroughly dry the investment, after which by manipulating the valves the temperature is raised sufficiently high to heat the mold to a degree approximating that of the molten metal when run. With the mold in this highly-heated condition the metal is poured, the uppermost plane of burners being preferably so disposed as that the flame-jets are caused to impinge against the stream, whereby chilling is avoided. The matrix proper terminates some distance below the top of the investment to enable what I have termed a "surplus" of metal to be poured, and it is this surplus which is exposed through the opening *c* to direct contact with the flame-jets of the top plane of burners, which jets, as before stated, are directed downwardly. The jets of flame are caused to impinge, preferably, at an angle against the entire outer surface of the mold before and during the pouring of the metal, and thereafter the burners are successively extinguished, commencing at the lowermost plane, whereby the heat is withdrawn first from the base of the flask and thereafter gradually toward the top, and lastly the exposed molten metal is alone subjected to the direct action of the jets of the uppermost burners. The effect of the withdrawal of the heat in the manner stated is to preserve the fluidity of the metal at successive portions of the casting, whereby any contraction or shrinkage is at once compensated for by the molten metal, which through gravitation fills the spaces as they are formed, the surplus provided being sufficient to contribute to the making of a complete casting. The remarks with reference to the manufacture of artificial dentures by my process are equally applicable to the making of other articles, inasmuch as in all castings there are present defects, due to shrinkage or other cause, which impair their strength, effectiveness, and durability, but which by my invention are entirely avoided. My invention is also applicable to the making of castings from metals or alloys which are, relatively speaking, non-contracting, by which is meant materials in which shrinkage in cooling is the minimum. The maintenance of the molten condition of the metal in the mold in addition to preventing the formation of fissures, pipes, blow-holes, and like defects has the advantage of prolonging the period of cooling, whereby there is secured a perfectly-homogeneous structure and one that is exactly comformable to the matrix.

While I have described and illustrated my invention as applicable to the making of castings, such as dentures, it is obvious that the method and means of accomplishment are applicable to the making of metallic castings generally, and I do not therefore limit myself to the specific adaptation set forth.

I do not in this application make claim to the means for practicing the above-described method, said means forming the subject-matter of a divisional application filed by me on the 14th day of November, 1899, Serial No. 736,908.

I claim as my invention—

1. The herein-described method of making metallic castings which consists in subjecting an open-top mold or like vessel into which the metal is poured to the action of independent flames impinging on the mold at different heights, pouring the metal and successively extinguishing the flames, commencing with the lowermost, whereby the heat is withdrawn commencing at the base of the mold and continuing gradually toward the top, the heat being finally confined to the exposed molten metal.

2. The herein-described method of making metallic castings which consists in subjecting an open-top mold or like vessel into which the metal is poured to a degree of heat approximating that of the molten metal when run by impinging thereagainst independent flames at different heights, introducing into the heated mold or like vessel molten metal in excess of the amount necessary to fill the matrix, and successively extinguishing the flames,

commencing with the lowermost, whereby the heat is withdrawn commencing at the base of the mold and continuing gradually toward the top, the heat being finally confined to the exposed molten metal.

3. The herein-described method of making metallic castings which consists in subjecting an open-top mold or like vessel to the action of independent flames impinging on the mold at different heights to dry the investment, raising the degree of heat approximately to that of the molten metal when run, introducing into the heated mold or like vessel molten metal in excess of the amount necessary to fill the matrix, and successively extinguishing the flames, commencing with the lowermost, whereby the heat is withdrawn commencing at the base of the mold and continuing gradually toward the top, the heat being finally confined to the exposed molten metal.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM D. ALLEN.

Witnesses:
A. L. RISM,
J. W. MCALLISTER.