

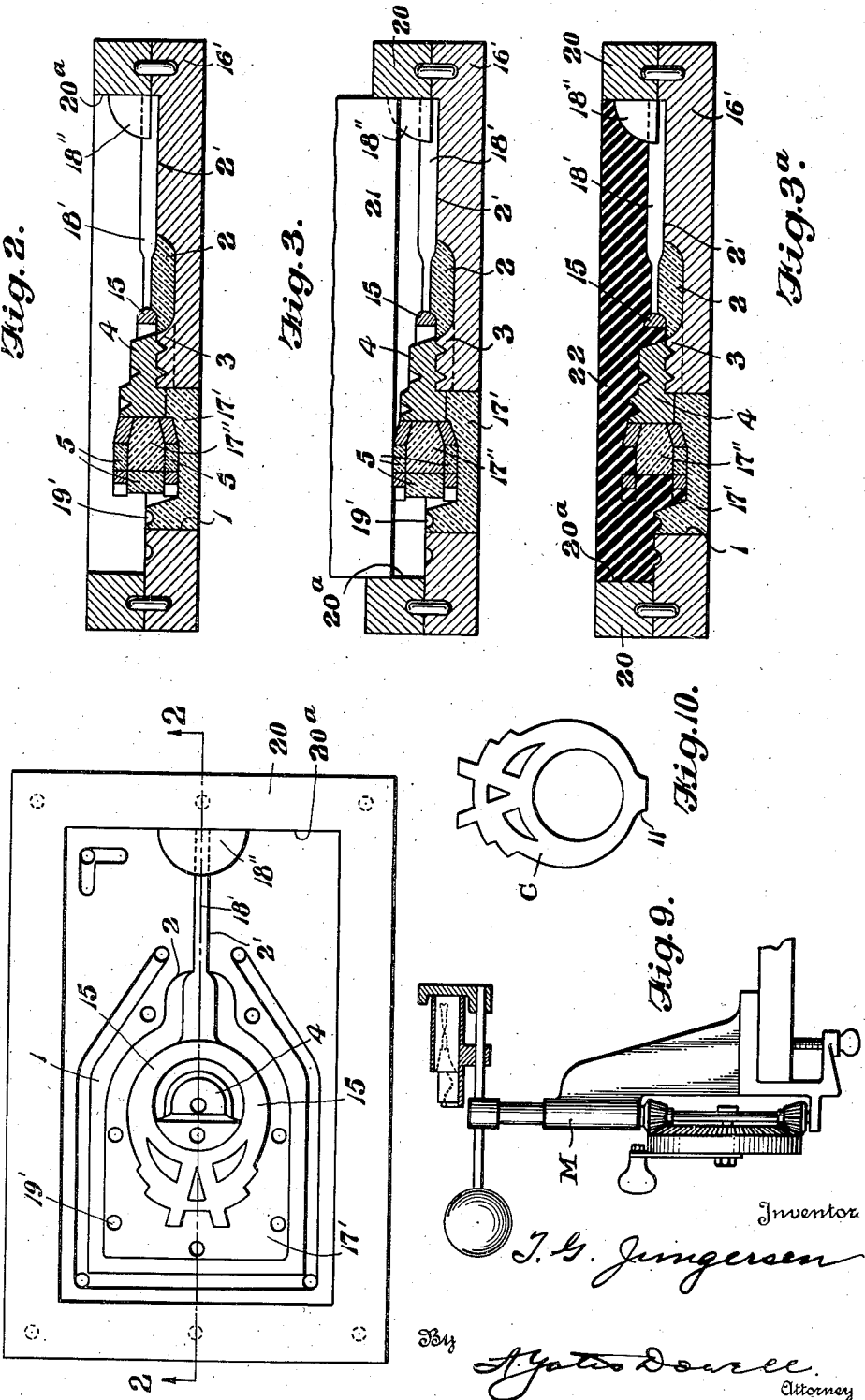
July 18, 1944.

T. G. JUNGENSEN
CASTING

2,354,026

Filed Jan. 11, 1940

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

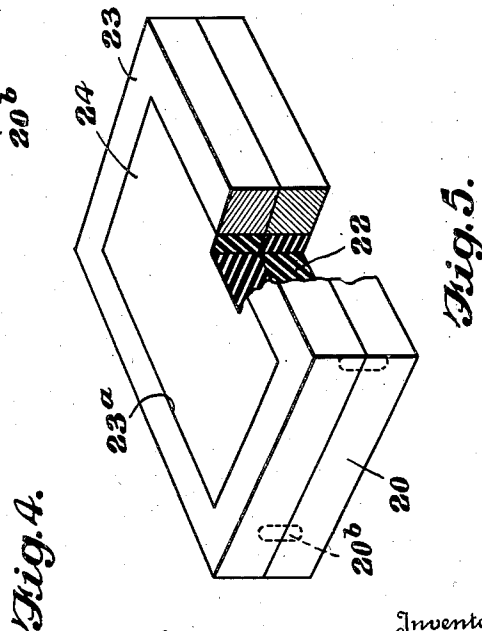
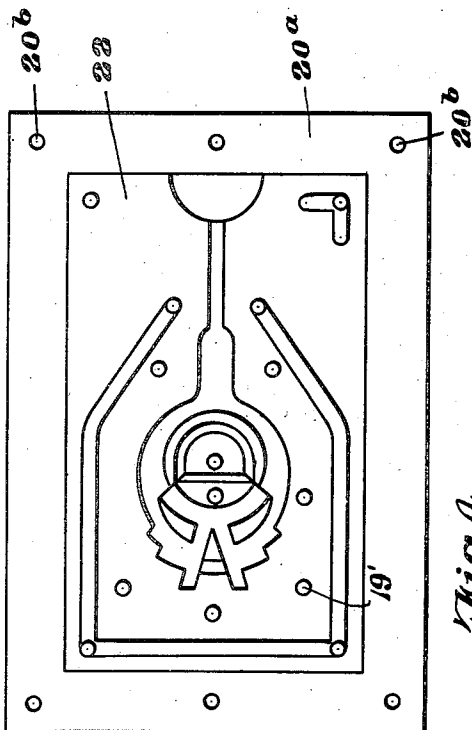
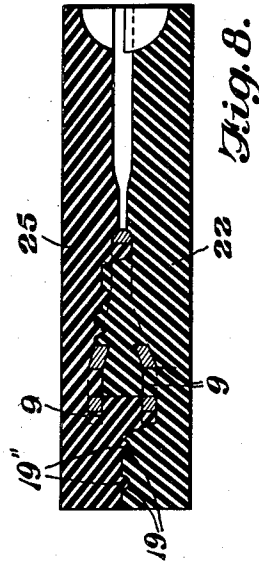
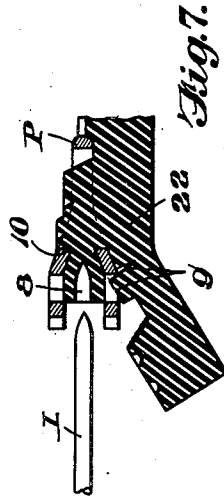
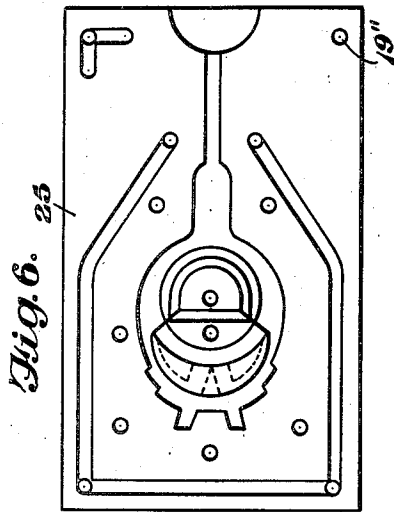


Fig. 4.

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UNITED STATES PATENT OFFICE

2,354,026

CASTING

Thorger G. Jungersen, Summit, N. J.

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In Canada April 16, 1937

9 Claims. (Cl. 22—200)

The present invention relates to the art of making jewelry and other small metal articles of intricate design and fine detail, and among other objects, aims to provide an improved process or method of casting such articles.

A further object of the invention is to enable the formation of intricate castings which will so closely resemble the original and finished product that the slow and tedious work of patterning and detail cutting required in connection with present casting methods is eliminated.

It is still a further object of the instant invention to provide a process of casting low temperature fusing metal and other materials directly into a plural part mold which may be of rubber to form objects of intricate design suitable for commercial or other use including relatively inexpensive jewelry.

Other objects and features of the invention will be evident, including the various steps of the improved process and attendant advantages over anything heretofore known, as set out in the foregoing description of a method and apparatus suitable for reproducing inexpensive low temperature fusing metals and other materials, articles, and jewelry especially of intricate design, such as articles containing hollows, undercut portions, and perforations, and of certain apparatus and material preferred for use in practicing the invention.

This application is a continuation in part of my copending application Serial No. 139,629, filed April 28, 1937 (now matured into Patent No. 2,200,449 granted May 14, 1940) which in turn is a continuation in part of application, Serial No. 745,893, filed September 28, 1934, which has now matured into Patent No. 2,118,468.

Figure 1 is a plan view of a model arranged in a mold casing ready for the making of a mold section thereabout;

Figure 2 is a sectional view taken along line 2—2 of Figure 1 and looking in the direction of the arrows;

Figure 3 is a view similar to Figure 2 illustrating the application of mold material to the model;

Figure 3a is a view similar to Figure 3 illustrating the mold material in place about the model;

Figure 4 is a plan view of a part of the mold within a mold casing section;

Figure 5 is a view in perspective with parts cut away of the mold parts within mold casing sections;

Figure 6 is a plan view of a mold part which complements that shown in Figure 4;

Figure 7 is a fragmentary sectional view of a mold part burned by a hot pointed instrument in order to facilitate removal of the "setting" portion of the ring mold;

5 Figure 8 is a sectional view of a pair of complementary mold parts one of which is cut to facilitate removal of the model;

Figure 9 is an elevational view of a centrifugal casting machine; and

10 Figure 10 is an elevational view of the casting made in the mold parts illustrated in Figures 5 and 8.

The model 15 which may be first dipped in melted wax to fill all perforations, and treated as by scraping to remove any excess wax at any desired point is placed on the plastic material 17', and may be pressed down until it is embedded in it as shown in the drawings. Then a sprue or gate former 18' may be partly embedded in the plastic material in contact with the model, 15, as illustrated in Figures 1 and 2. A series of holes, grooves, projections, or the like, such as indicated in general at 19', may be arranged in the exposed plastic material either before or after it has set. These holes or the like preferably surround the model itself. The cavity 2 formed in the frame or mold casting section 16' contacts with the main cavity 1 which is also formed therein, and encircles a hub portion 3 of the base on which a removable mandrel core piece 4 is adapted to be positioned as by interfitting projections or dowels as shown. This hub portion 3 may be shaped to snugly fit against the inner periphery of the head of the ring model, and if desired the hollow interior setting portion of the model may first be filled to a suitable or predetermined depth with a quantity of plastic base material, as shown at 17''. The perforations or piercings of the setting may be temporarily filled with wax as illustrated in Figures 2, 3, and 3a.

40 The removable mandrel core piece 4 may be omitted causing the formation of an integral core on the mold part 25 instead of on the mold part 22.

45 After the base mold section has been completed and suitably parted about the model, by blocking out with plaster of Paris, the space surrounding said model with the exception of that portion for which a mold section is to be made, the entire assembly may be heated sufficiently to remove or disperse the wax 5 from the perforations or piercings of the model.

50 A groove 2' may be formed in the mold casing section 16' leading from the cavity 2 to receive and position the sprue former 18'. As illustrated,

this sprue former has its inner end widened where it abuts the model and is embedded in the plastic material 17'. A spherical segment or other enlarged shape sprue throat former 18' cooperates with the sprue former 18' and may be a part thereof. This throat flatly abuts the inner face of the mold casing section 20 which is shown as interfitting directly with the mold casing section 16' at its marginal edges.

Unvulcanized rubber, which may be in the form of a block 21 cut to fit the opening 20a of mold casing section 20, is laid inside the mold casing section, as illustrated in Figure 3, in contact with the model 15 and the now hardened plastic material 17', and the whole assembly comprising the rubber 21 and mold section casing 20 is heated to a vulcanizing temperature while subjecting the exposed rubber surface to an applied pressure for a period necessary to insure the flowing of the rubber around the model, and effecting the casting of a mold section 22 in rubber, see Figure 4 which illustrates the mold section and the mold section casing. This rubber, which is preferably of a soft gum type, must be of a character which will not injure the model, if of metal, and it must also separate cleanly from the model for it is cast in contact therewith.

After vulcanizing of the rubber, or completing the first part of the mold, whatever the mold section material may be, the mold section casting 16', the plastic material 17'', the plastic material 17', and the temporary mandrel or core piece 4 are removed to expose a second portion of the model, and the completed mold casting section 22 is inverted, as illustrated in Figure 4. The mold section 20 is then cleaned to remove all traces of the plastic bedding material 17' and a parting composition such as an oil or powder which will not injure the rubber, is spread over the parting surface of the clean rubber mold section 22. In the next step a frame or mold section casing 23, which is similar to and matches mold section casing 20 is placed over the latter and preferably interlocked therewith as by suitable pins entering predisposed openings 20b, see Figure 5. A second sphere segment is then associated with the outer end of the gate former 18' to form the complete funnel shaped inlet for the pattern forming material. Then a second mass of unvulcanized rubber 24 is placed in the opening 23a of the mold section casing 23, and is vulcanized while pressed in close contact with the now exposed portion of the model and the treated parting surface of the previously vulcanized mold section illustrated in Figure 4. It is contemplated that synthetic rubber such as polymerized chloro 2 butadiene 1,3 be utilized in place of natural rubber as the mold material.

The product of this second vulcanizing process is a second mold section 25, see Figure 6, which may or may not be a substantial duplicate of the first depending upon whether or not the model itself is symmetrical. In any event, the second mold section fits the other first invested or embedded side of the model, which may not be symmetrical with respect to the parting plane, and has dowel holes or the equivalent 19'' so arranged as to register with the interlocking means which were formed in the first mold section as a result of the holes or equivalent surface modifications 19' in the plastic material.

The next step therefore, is to cut the two rubber mold sections at various selected points, so

that they may be easily removed from the casting formed therein.

If the casting is quite plain in design, cutting may not be necessary as the flexibility of the mold section may be sufficient to permit their manual separation from the casting. If the casting is intricate such cutting becomes necessary. The location and direction of the cuts, and their number, will be indicated by the particular design, the object being to insure separation of the rubber mold from the casting, which may be of low temperature fusing metal without any distortion or other injury whatever to the latter, and without detrimentally affecting the accuracy or details of the mold. As an example, there is shown in Figure 7, a rubber mold portion 22, with a deeply undercut or hollowed model P, the actual volume of which may be reduced by the insertion of a heated pointed instrument I to form a cavity 8 therewithin. Moreover, a plurality of slits 9 are cut into the opposite sides to extend part way across the mold body, so that the respective portions will be free to flex easily in being withdrawn through the opening 10 of the model P.

The two registering rubber mold sections thus formed about the model are depicted in Figure 8 of the drawings. According to the preferred embodiment of the invention, these two sections are intended to be used to cast therewithin a low temperature fusing metal or other material to produce a casting of intricate design.

Prior to the casting of the low temperature fusing metal or other material the registering surface of the two mold sections may be covered with a fluid or other suitable substance or lubricant for facilitating their separation. Such a substance is preferably an oil, which will not injure the mold, such as for example, castor oil. If the casting is to be formed from a readily fusible metal, such as "Wood's" metal, the separating material may assume the form of a dry powder. The mold sections are brought together and sufficiently tightly clamped to prevent their distortion, yet firmly enough to assure a faithful reproduction of the original model and the flexible mold is now ready for the casting therein of the low temperature fusing metal or other material.

The flexible mold is now preferably put in a centrifugal casting machine. These machines are already available machines of commerce, and an illustration of such a typical machine M is found in Figure 9, diagrammatically showing a mold in position therein. Instead of employing such a machine, the article to be formed may be cast by centrifugal force exerted manually, as by whirling the mold on the end of a string or cord. It is to be understood that other force sufficient to effect the entrance of the material within the intricacies of the mold may be utilized without departing from the spirit of the invention.

It is preferred to employ centrifugal force when casting readily fusible metal or other material in a rubber mold, for the reason that centrifugal force acts in a peculiar way to cause the molten material to completely fill the mold space and yet permit escape of all the air through the center of the mold cavity while the molten material is still liquid with the result that the casting is a perfect reproduction of the cavity in the mold. Thus any air which may be trapped in a recess of the mold will be crowded back into the fluid body under the pressure applied thereto and the fluid material will progress into the recess

of the mold as it crowds the air therefrom and will progressively congeal against the wall of the recess until the extreme limits are reached so that the finest of cavities will be completely filled. Either centrifugal force or an applied pressure is very essential in the production of perfect castings in readily fusible material, especially where the castings are of small dimensions and/or of intricate design.

The resultant casting C, whether of readily fusible metal or other material requires nothing but extremely simple finishing operations to be ready for the market. The only part of the casting requiring any rough finishing work at all is the part 11, see Figure 10, where the sprue joins the casting, which may be smoothed by filing, grinding, cutting or otherwise. The final buffing and polishing operation may thus be performed directly on the article as removed from the mold. Thus the process effects very large savings especially in the manufacture of jewelry of intricate design.

With known processes of casting small articles of intricate design such as the cuttlefish process, for example, it may take an expert workman several hours to finish the article to a commercial standard, while with the present process only a few minutes are required to finish the article to the same standard.

It is to be understood that it is within the scope of the invention to utilize the casting C as a model to make further castings, if desired.

It will be obvious to those skilled in the art that various changes may be made in this device without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. A process of casting an article intricate to the extent of having one or more small projections or depressions, comprising: arranging a model of the ultimate article to be cast within a mold casing having walls forming a space surrounding said model and with blocking out form taking material in all of said space with the exception of that portion of the space which is adjacent a portion of the model for which a mold section is to be made thus leaving a portion of the model exposed, then filling said space adjacent said model with a flexible mold forming material under the influence of heat and pressure to form a mold section over the exposed portion of said model which mold section remains permanently flexible, then while leaving the model and mold section already formed in place, removing an adjacent portion of the blocking out material to expose a different portion of the model and filling the space formed by removing the blocking out material with flexible mold forming material under the influence of heat and pressure to form a separate mold section for said portion of the model contiguous to the first mold section which latter mold section remains permanently flexible, successively casting articles corresponding to said mold with an applied force sufficient to fill said mold including its intricate detail.

2. The process recited in claim 1, said mold forming material which under the influence of heat and pressure forms a permanently flexible mold being rubber.

3. The process recited in claim 1, the articles corresponding to said mold being cast in that metal group consisting of tin and tin alloys.

4. The process recited in claim 1, the articles corresponding to said mold being cast in that metal group consisting of lead and lead alloys.

5. A process of casting articles intricate to the extent of having one or more small projections or depressions comprising making a plural part mold of relatively rigid though flexible slabs by molding mold forming flexible material about a portion of a model to be reproduced and within a confined space with the application of heat and pressure to produce a relatively rigid though permanently flexible slab mold section having a portion of the mold cavity therewithin, providing said slab mold section with an inter-locking or registering formation on that face of the slab having the portion of the mold cavity formed therein and in spaced relation from said cavity, applying separating material to the said face of said slab, molding additional flexible material about another portion of said model against the face of said slab and within a confined space with the application of heat and pressure to form another relatively rigid though permanently flexible slab mold section having its face formed with a portion of the mold cavity therein and corresponding inter-locking or registering formations thereon, removing the model from the mold and successively casting articles corresponding to the model within the mold with an applied force sufficient to fill the mold in all its detail.

6. The process recited in claim 5, said mold forming material which under the influence of heat and pressure forms a permanently flexible mold being rubber.

7. The process recited in claim 5, the articles corresponding to said mold being cast in that metal group consisting of tin and tin alloys.

8. The process recited in claim 5, the articles corresponding to said mold being cast in that metal group consisting of lead and lead alloys.

9. A process of casting metal articles intricate to the extent of having one or more small projections or depressions, comprising: arranging a model of the ultimate article to be cast within a mold casing having walls forming a space surrounding said model and with blocking out form taking material in all of said space with the exception of that portion of the space which is adjacent a portion of the model for which a mold section is to be made thus leaving a portion of the model exposed, then filling said space adjacent said model with a flexible mold forming material under the influence of heat to form a mold section over the exposed portion of said model which mold section remains permanently flexible, then while leaving the model and mold section already formed in place, removing an adjacent portion of the blocking out material to expose a different portion of the model and filling the space formed by removing the blocking out material with flexible mold forming material under the influence of heat to form a separate mold section for said portion of the model contiguous to the first mold section which latter mold section remains permanently flexible, successively casting metal articles corresponding to said mold with an applied force sufficient to fill said mold including its intricate detail.

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