J. KRALUND.

METHOD OF MAKING MOLDS FOR FINISHED CASTINGS.

APPLICATION FILED NOV. 30, 1918.

1,335,509. Patented Mar. 30, 1920.

3 SHEETS—SHEET 1.

Fig. 1.

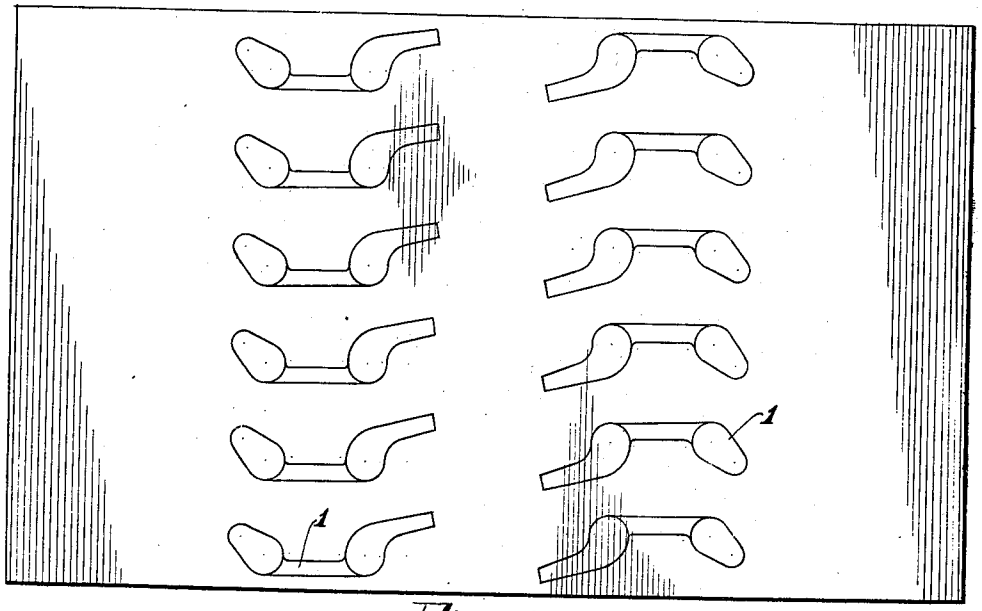
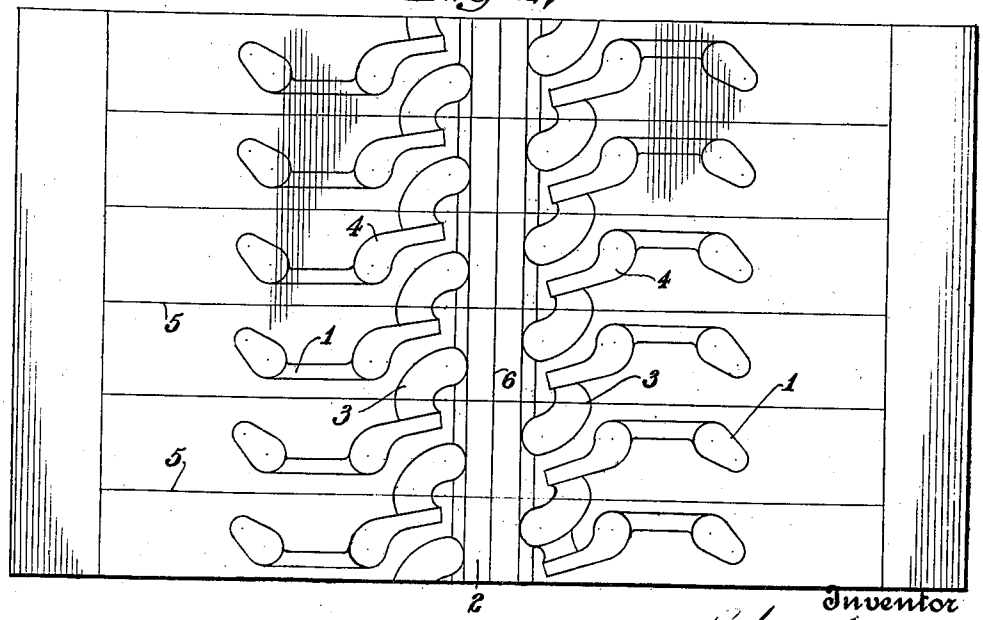



Fig. 2.




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3 SHEETS—SHEET 2.

Fig. 3.

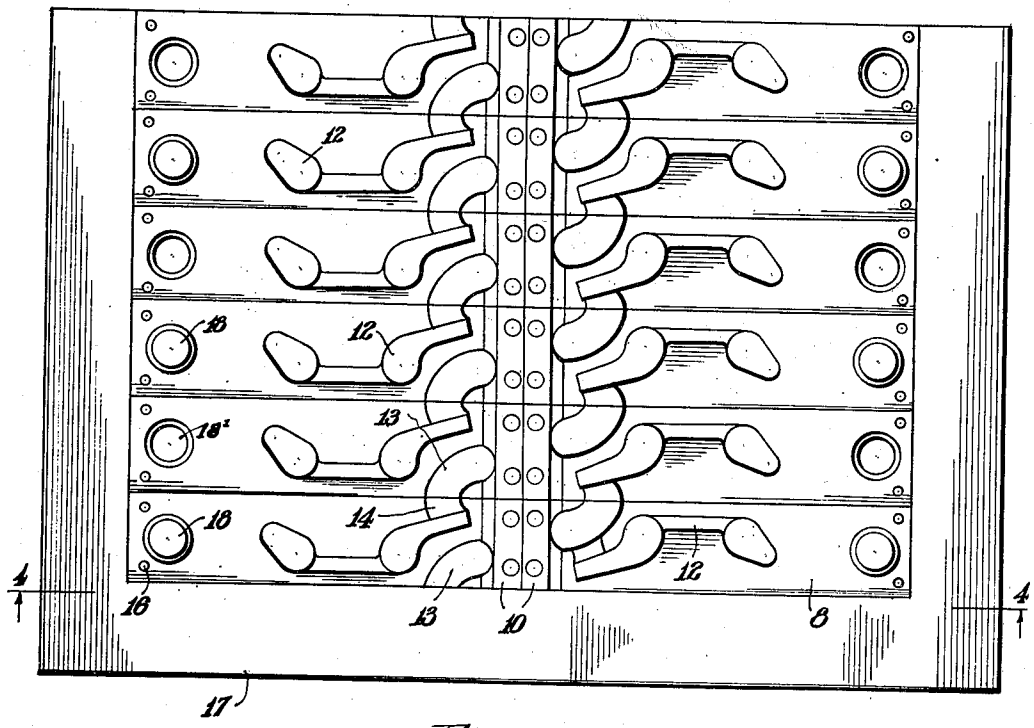



Fig. 4.

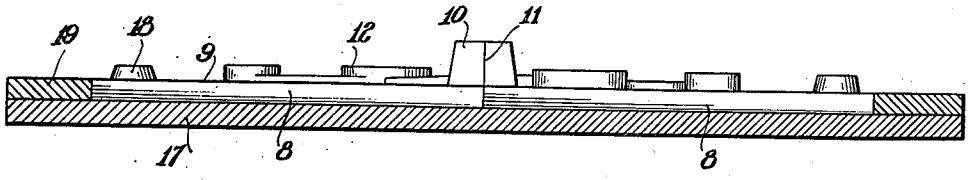
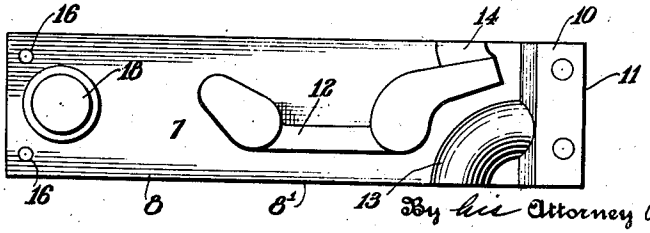



Fig. 5.




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3 SHEETS—SHEET 3.

Fig. 6

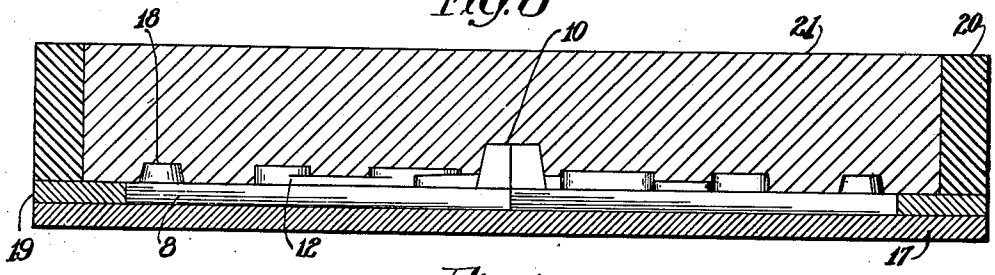



Fig. 7.

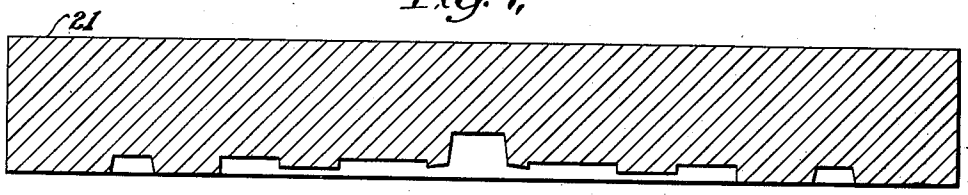



Fig. 8.

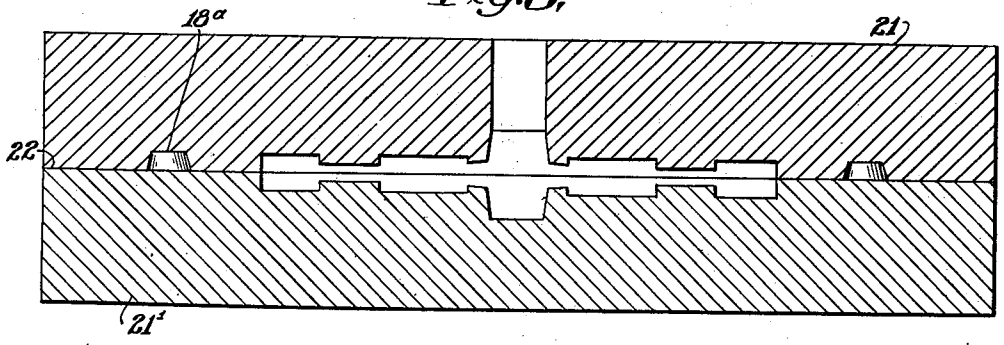
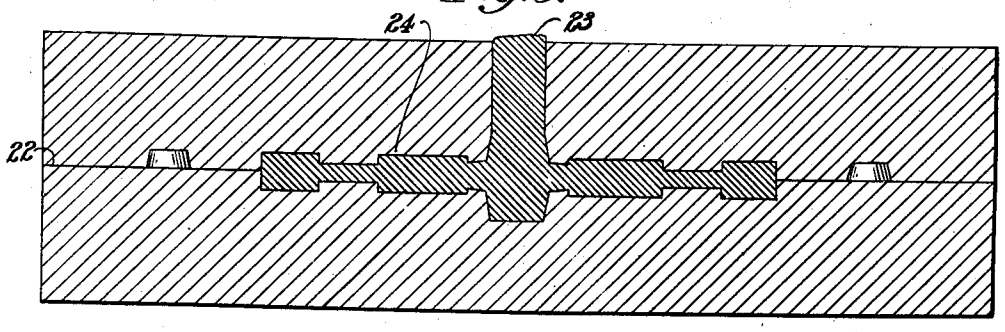



Fig. 9.




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By his Attorney

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# UNITED STATES PATENT OFFICE.

JOHN KRALUND, OF BROOKLYN, NEW YORK, ASSIGNOR TO DOEHLER DIE CASTING COMPANY, OF BROOKLYN, NEW YORK, A CORPORATION OF NEW YORK.

## METHOD OF MAKING MOLDS FOR FINISHED CASTINGS.

1,335,509. Specification of Letters Patent. Patented Mar. 30, 1920.

Application filed November 30, 1918. Serial No. 264,780.

*To all whom it may concern:*

Be it known that I, JOHN KRALUND, a citizen of the United States, residing in the borough of Brooklyn, in the city of New York, county of Kings, and State of New York, have invented certain new and useful Improvements in Methods of Making Molds for Finished Castings, of which the following is a specification.

My invention relates to the multiple production of finished castings, the method being so devised as to produce a plurality of articles, all of which, or all of each of various series of which, are exact duplicates, with a minimum expenditure of time, money and labor. The invention also involves a method of preparing a match plate as a series of steps involved in the method of making the finished castings.

By my method match plates are produced by casting molten material in suitable dies of a hard, permanent character, preferably metal dies. The match plates have base plate portions with smooth upper surfaces, adapted to form the parting surfaces of molds to be made from the plates. They also have integral raised portions to constitute patterns for mold cavities, and preferably have raised integral portions to constitute patterns for runs and branches. The match plates are preferably formed by the pressure die-casting process. Preferably each match plate is formed of a plurality of units each of which has a base plate portion and one or more raised integral patterns, each unit being cast in a metal or other permanent die, these units being readily assembled together to form a complete match plate. Each match plate may be and preferably is formed of units cast in the same die, or in dies which are substantially duplicates, the raised mold-cavity patterns on these units being exactly alike and positioned in exactly the same relation to the edges of the units, and the run and branch patterns, which are preferably integral with the base plates, being exact duplicates on each unit, and alining with each other in the complete match plate. Or the units may be cast from different dies, having raised patterns adapted to form mold cavities for producing castings which are not duplicates of each other, the units being adapted to be secured together to form complete match plates as in the other case, and preferably having similar base-plate outlines and duplicate integral run and branch patterns, adapted to aline with each other in the complete match plate. The desired mold sections are formed by flowing plastic material onto the match plates, and the castings are made by casting molten metal in the molds thus formed and breaking away or otherwise removing the molds from about the castings thus formed.

By casting the match plates from metal or similar dies, in the manner indicated, and making the molds therefrom of a suitable plastic composition which may afterward be destroyed, finished castings may be produced on a large scale with a degree of uniformity and accuracy which is essential in the manufacture of the class of articles contemplated herein. Likewise the process involves a minimum of time, expense and skill of labor after the dies have been prepared. The most economical results are obtained when the match plates are formed from a considerable number of units having integral run and branch patterns. The manufacture of match plates by machining processes, or by affixing separate mold-cavity patterns to base plates, requires great skill, and the accurate registration and uniformity which I obtain cannot be had. The same holds true in the case of sand-cast match plates. Also, it is essential for my invention that the finished molds be formed of plastic composition, such as one containing plaster of Paris, in contradistinction to sand molds.

Considering the formation of a match plate having a plurality of units, in order to make the die or dies from which the match plate units are to be cast, it is necessary to first arrange a layout of the articles which are to be cast from the finished mold. This layout may comprise the use of models or pictorial representations of the articles to be cast, and these are arranged in such relation to each other in the layout that the whole layout may be divisible into a desired number of units which will be exactly alike, or which will properly fit together, and which will altogether form a replica of the completed match plate. The arrangement to be made must be such that each of the units may readily be cast by the pressure die casting, or other desirable casting process, with a due regard to the economy of

material and space so that the portions of the patterns for the articles to be reproduced and also for the various runs and branches of the mold will lie closely together in a compact relation. Having made such a layout from the considerations above noted, the same is divided into units and a suitable die or dies are prepared from which these units may be cast.

The reference to the dies from which the match plates are cast as "metal or similar dies" is intended to indicate that the dies are formed of a hard, smooth-surfaced metal, such as steel, or other material of a hard, permanent, heat resistant character, having a smooth surface, that is, a material which is not deformed by the heat incidental to the casting of the match plates. The match plates, or match plate units cast in said dies, are of a suitable hard heat resistant metal or equivalent hard smooth permanent heat-resistant material, that is, a metal or equivalent die which can be used repeatedly with the plaster molds without being in the least deformed or affected.

In the preferred process, the units, when cast, are assembled into a complete match plate by placing the same side by side in proper alinement on a suitable slab or plate to which they are secured in such manner as to cause accurate alinement of the various patterns for the runs, branches, etc. A section of a mold is then formed by flowing a suitable plastic composition such as one containing plaster of Paris over the match plate and permitting the mold section to dry and harden. The opposite mold section is then formed in exactly the same manner from a similar match plate, if the articles to be reproduced are of such character as to require duplicate mold cavities on opposite sides of the parting line. This second mold section is made from a match plate which is an exact duplicate of the first match plate, except for the fact that one match plate has alining lugs and the others corresponding alining cavities formed thereon to insure exact registration of the two mold sections when the same are put together, these lugs or cavities being produced from correspondingly located cavities or lugs formed on or secured to the die or dies from which the match plate units were made.

Having produced the desired mold or plastic material, molten brass or other desired metal is caused to flow into the mold cavities of the same to produce the desired plurality of identical castings after which the plastic mold is removed as by breaking the same away from the castings and the latter are suitably trimmed, etc.

It will be noted that the process above briefly described establishes a procedure by which mathematically accurate match plates may be formed and finished castings produced rapidly and in large quantity from plastic material molds, which are destroyed after a single use and which should, therefore, be susceptible of rapid and accurate and economical manufacture. The process described may only be carried out with good results and extreme accuracy when the molds from which the finished castings are produced are formed of plastic material having sufficient strength to permit the separation of the various mold cavities by walls which are in many cases quite thin.

In order that my invention may be more clearly understood, attention is hereby directed to the accompanying drawings forming part of this application and illustrating one manner in which my invention may be carried out.

In the drawings, Figure 1 represents a plan view of a layout for a match plate partially completed. Fig. 2 is a similar view illustrating the complete layout subdivided into units. Fig. 3 is a plan view of an assembled match plate formed in accordance with my invention. Fig. 4 is a vertical section taken on line 4—4 of Fig. 3. Fig. 5 is a plan view of one of the units of the match plate. Fig. 6 is a vertical section through the match plate and a section of a plastic mold being formed thereon. Fig. 7 is a similar section of the finished plastic mold section. Fig. 8 is a vertical section taken through the finished plastic material mold, and Fig. 9 is a view similar to Fig. 8 showing one of the finished castings therein.

Referring to the drawings, Fig. 1 represents a layout such as a drawing or model in which a desired number of small identical articles 1 to be reproduced are represented. These articles are shown as positioned in two rows with their adjacent ends separated a suitable distance to permit the formation of a central run pattern between them, and one of the rows is shown as formed of articles in inverted position in relation to those of the other row so that run patterns may be provided on the same ends of each of the units to be formed. In Fig. 2, the layout is shown completed, the main run 2 being shown between the two rows of articles 1 and suitably arranged branches 3 being shown connecting the representation of each article 1 with the representation of the main run 2. The branches 3 are represented as being approximately parallel to the adjacent portions 4 of the articles 1 for the purpose of economizing space, and in order that a suitable length of branch may be obtained to permit the height of the projection to diminish at a proper rate from the main run to the pattern 1 with which it connects. This arrangement being completed, the various exactly duplicate units may be formed by dividing the layout

in the manner indicated by the parallel lines 5 and the central line 6, intermediate the sides of the main run representation 2. With this arrangement it will be evident that each of the units bounded by the lines 5 and 6 and the outside lines of the figure may readily and economically be reproduced by the die-casting process or other suitable casting process, as stated.

A suitable die is next constructed from which the various identical units such as that represented at 7 in Fig. 5 may be reproduced, each of these units bearing an exact reproduction of the patterns indicated by the units of the layout. This die is formed of metal or other suitable hard heat resistant material having a smooth finish. As thus formed, it is seen that each of the units has a base plate portion 8. The base plate portions are preferably rectangular and have finished upper surfaces 9, as a result of the casting process by which the units were produced. In the example disclosed in the drawings, an upwardly extending projection 10 is formed at one end of each unit extending across the unit and having its outer end surface 11 a finished surface, which is co-extensive with the end surface of the base plate portion. It will be noted that the surface 11 corresponds with the line 6 of the preliminary layout and that the projection 10 corresponds with the portion of the main run layout 2 which belongs to each unit.

The pattern for the casting or part of a casting to be produced by each unit takes the form of the upwardly extending projection 12, corresponding to the representation 1 of the layout. Each projection 12 is integral with the base plate portion of the unit, and all of these projections 12 are necessarily identical and are positioned on the base plate portions of the units in exactly the same relation to the boundaries of the units. In the form of my invention shown in the drawings, an upwardly extending projection 13 extends from the run pattern 10 to a side edge 8′ of the unit and another shorter projection 14 extends from a portion of the pattern projection 12 to the opposite edge of the base plate portion 8, the projections 13 and 14 corresponding to the parts of the branches represented in the layout. It will thus be seen that when the units are placed side by side in proper position, the projection 13 of one unit will aline with the projection 14 of the next adjacent unit to form the pattern of a complete branch extending from the run pattern of one unit to the pattern 12 of the next unit. It will also be noted that all of the run or gate patterns 10 of one series aline with each other to form a continuous gate pattern. In the example shown in the drawings, the match plate is formed of two series of units, the two series being placed together end to end and the units of each series being placed together side by side, the units of the two series having their end surfaces 11 contacting with each other so that the complete run or gate pattern has a width equal to that of two of the projections 10. The height of the projections 13 and 14 decreases from the run patterns 10 to the patterns 12, the metal of the projections 14 joining the metal of the projections 12 with neck portions which extend only a short distance above the surfaces 9.

The units are provided with various holes 16 extending therethrough, at exactly the same points in each, through which pins may be extended to rivet or secure the units to the flat plate or slab 17 upon which the match plate is assembled. The base plate portions 8 of the units are also provided with conical cast projections or cavities 18 adapted for forming alining lugs on the plaster mold sections for securing the same together in proper registration when the mold is formed from the match plate. These projections or cavities are all placed at identical positions on the various units, and the cavities and projections are so arranged as to form alining lugs on some mold sections which will register with corresponding openings on the opposite mold sections. Preferably, the units are arranged with a conical projection such as 18 on one unit and a corresponding conical recess 18′ on the next adjacent unit of a match plate. The units may be assembled into a complete match plate in the manner indicated in Fig. 3, a frame 19 being mounted on slab 17 about the outside edges of the match plate thus formed. A section of a mold is next formed by placing a suitable frame 20 about the match plate and flowing a suitable plastic composition over the match plate to form a mold section 21, as shown in Fig. 7. A suitable material to be used is one containing plaster of Paris, the finished mold section being sufficiently hard and strong to prevent rupture or chipping of the walls between the various mold cavities, it being noted that some of the cavities such as those for producing portions of the finished castings and adjacent branches of the runs may be spaced quite closely together.

If the articles to be formed are of such a character as to require mold cavities in two sections of a plaster mold, a second mold section 21′ is formed and secured to mold section 21 to form a complete mold, as is shown in Fig. 8. Mold section 21′ is an exact duplicate of section 21, except for the fact that mold section 21′ has conical alining lugs $18^a$ at each position where section 21 has conical recesses and vice versa, the conical lugs and recesses of the mold sec-

tions fitting accurately together to accurately aline the mold sections. Mold section 21′ may be formed in exactly the same manner as mold section 21 above described from a match plate which is an exact duplicate of that which has been described, except that it is provided with conical lugs 18 wherever the match plate shown in Fig. 3 is provided with conical depressions 18′ and vice versa, the second match plate being formed of units which are exact duplicates of those which make up the match plate shown in Fig. 3, except that the units having conical lugs and those having conical depressions are interchanged.

The parting line of the mold is indicated at 22 in Fig. 8, the mold surfaces abutting on this line being formed from the smooth upper surfaces 9 of the base plate portions of the match plate units. A gate 23 is suitably formed in the upper mold section in alinement with a suitable point on the main run of the mold corresponding to the pattern 10, 10 of the match plates and suitable metal is poured into the mold to form the castings represented at 24 in Fig. 9. When the castings are sufficiently set, the mold is moved therefrom as by breaking the same away from around the castings.

It will be noted that my invention provides a method by which exact registration of all the patterns to be used in manufacturing plastic molds is insured with a minimum of labor and skill after the die for forming the match plate units has been prepared, and that all of the patterns and accordingly all of the portions of the mold will be spaced, every time the process is carried out, in an exactly identical manner.

What I claim is:

1. A method of making a mold for finished castings, by constructing a suitable metal die or dies, pouring molten metal therein to produce a match plate, match plates or portion thereof, the said metal being hard and heat resistant when it has solidified, and making a mold from one or more of such match plates, of plastic composition, having mold cavities therein formed by such match plate or match plates.

2. A method of making a mold for finished castings, by constructing a suitable die or dies of hard smooth permanent heat-resistant material, forming therein a match plate, match plates or portion thereof of a hard smooth heat resistant material, and making a mold from one or more of such match plates, of plastic composition, having mold cavities therein formed by such match plate or match plates.

3. A method of making a mold for finished castings, by constructing a suitable die or dies of hard smooth permanent heat-resistant material, casting therein by the pressure die-casting process a match plate, match plates or portion thereof of a hard smooth heat resistant material, and making a mold from one or more of such match plates, of plastic composition, having mold cavities therein formed by such match plate or match plates.

4. A method of making a mold for finished castings, by constructing a suitable die or dies of hard smooth permanent heat-resistant material, forming therein units of a hard smooth permanent heat-resistant material, constituting portions of a match plate or match plates, securing said units in proper alinement with each other to form a complete match plate or plurality of match plates, and making a mold from one or more of such match plates, of plastic composition, having mold cavities therein formed by such match plate or match plates.

5. A method of making a mold for finished castings by constructing suitable dies of hard smooth permanent heat-resistant material, forming therein match plates or portions thereof, said dies having, respectively, similarly positioned lugs and recesses, and said match plates accordingly having cast recesses and lugs, adapted to register with each other, flowing plastic composition on a pair of said match plates, to form mold sections, and securing said mold sections together in registration with the alining lugs and recesses of the mold sections engaging, the mold thus formed having mold cavities therein formed by said match plates.

6. A method of making a mold for finished castings, involving the production of a match plate or match plates, in which molten metal is cast in a suitable metal die or dies, the said metal being hard and heat resistant when it has solidified, the match plates having base plate portions with smooth flat upper surfaces and a plurality of integral raised portions on each match plate as patterns for mold cavities, and making a mold from one or more of such match plates, of plastic composition.

7. A method of making a mold for finished castings, involving the production of a match plate or match plates, in which the match plate material of a hard, heat resistant character, is formed in a suitable die or dies of hard smooth heat-resistant material, the match plates having base plate portions with smooth upper surfaces and a plurality of integral raised portions on each match plate as patterns for mold cavities, and making a mold from one or more of such match plates, of plastic composition.

8. A method of making a mold for finished castings, comprising, forming a suitable die or dies of hard smooth heat-resistant material, casting therein heat resistant metallic units each having a base plate portion with a smooth upper surface and a raised portion integral therewith, constituting a pat-

tern for a mold cavity in which a desired casting or part thereof is to be formed, securing said units in proper alinement with each other to form a complete match plate, and making a mold from said match plate, or from a plurality of such match plates, of plastic composition.

9. A method of making a mold for finished castings, comprising, forming a suitable die or dies of hard smooth heat-resistant material, casting therein by the pressure die-casting process heat resistant metallic units each having a base plate portion with a smooth upper surface and a raised portion integral therewith, constituting a pattern for a mold cavity, securing said units on a flat plate in proper alinement with each other to form a complete match plate, with run and branch patterns alining and connecting with the mold cavity patterns, and making a mold of plastic composition from said match plate, or from a pair of such match plates adapted to form registering mold sections.

10. A method of making a mold for finished castings, comprising, forming a suitable die or dies of hard smooth heat-resistant material, forming therein units each having a base plate portion with a smooth upper surface and a raised portion integral therewith, constituting a pattern for a mold cavity, securing said units on a flat plate in proper alinement with each other to form a complete match plate, with run and branch patterns alining and connecting with the mold cavity patterns, and making a mold of plastic composition from said match plate, or from a pair of such match plates adapted to form registering mold sections.

11. A method of making a mold for finished castings, comprising, so arranging on a flat surface, reproductions of a plurality of articles to be cast, together with the necessary runs and branches, that the layout thus made will have its parts arranged symmetrically, closely together, and be divisible into units, each of which is readily capable of reproduction by casting; constructing dies of hard smooth permanent material, forming therein units corresponding to the units of the layout, assembling said units to form a match plate or match plates, corresponding to the layout, and making a mold from said match plate, or said match plates, of plastic composition.

12. A method of making a mold for finished castings, comprising, so arranging on a flat surface, reproductions of a plurality of duplicate articles to be cast, together with the necessary runs and branches, that the layout thus made will have its parts arranged symmetrically, closely together, and be divisible into exactly duplicate units, each of which is readily capable of reproduction by casting; forming a suitable die of hard, smooth permanent material, forming therein duplicate units, corresponding to the units of the layout, each unit having a smooth, flat base plate portion and a raised portion integral therewith, constituting a pattern for a mold cavity in which a desired casting or part thereof is to be formed, and patterns for portions of the main run and branches thereof; securing said units to a flat plate, in proper alinement with each other to form a complete match plate, with the run pattern portions alining to form a complete unitary run pattern and the branch pattern portions connecting the run pattern with all of the patterns for the mold cavities; and making a mold from said match plate, or from a pair of such match plates, of plastic composition.

13. A method of making a mold for finished castings, comprising, so arranging on a flat surface, reproductions of a plurality of duplicate articles to be cast together with the necessary runs and branches, that the layout thus made will have its parts arranged symmetrically, closely together, and be divisible into exactly duplicate units each of which is readily capable of reproduction by casting; forming a pair of dies of hard, smooth material, exact duplicates of each other except that one is provided with an alining lug portion and the other with a similarly positioned alining recess; forming in said dies duplicate units, corresponding to the units of the layout, each unit having a flat base plate portion and a raised portion integral therewith, constituting a pattern for a mold cavity in which a desired casting or part thereof is to be formed, said units having cast alining lugs and recesses, corresponding to said lug and recess portions of said dies, and being provided with raised patterns for portions of the main run and branches thereof; securing a plurality of said units to a flat plate, in proper alinement with each other to form a complete match plate, with the run pattern portions alining and the branch pattern portions connecting the run pattern with all of the patterns for the mold cavities; flowing plastic composition on said match plate to form a mold section; forming a similar match plate from the same units, or from other units cast from the same dies, with the units so arranged that alining lugs will be in the same positions as alining recesses on the first match plate, or vice versa; flowing plastic composition on said match plate to form a second mold section; and securing said mold sections together in registration with the alining lugs and recesses of the mold sections engaging.

14. In a method of making finished castings, the steps involved in making a match plate, comprising, making a layout for a complete match plate to be used in multiple

reproduction of duplicate articles, so arranged as to be divisible into exactly duplicate units, each of which is readily capable of reproduction by casting, so dividing the layout, forming a suitable die of hard, smooth material, forming therein duplicate units, corresponding to the units of the layout, each unit having a smooth, flat base plate portion and a raised portion integral therewith, constituting a pattern for a mold cavity in which a desired casting or castings or part or parts thereof is or are to be formed, and patterns for portions of the main run and branches thereof, providing said units with openings extending therethrough, and securing said units, by pins extending through said openings, to a flat plate, in proper alinement with each other, so that the run pattern portions will aline to form a complete unitary run pattern, and the branch pattern portions will connect the run pattern with all of the patterns for said mold cavities.

15. In a method of making finished castings, the steps involved in making a match plate to be used in multiple reproduction of duplicate articles, comprising, casting units of hard, smooth material, which units are exact duplicates except that some may have alining lugs and others alining recesses adapted to register with said lugs, each unit having a flat base plate portion and a raised portion integral therewith, constituting a pattern for a mold cavity in which a desired casting or castings or part or parts thereof is or are to be formed, a pattern for a portion of a main run at one edge of the unit, and patterns for portions of branches of the run, and arranging and securing said units to a flat plate, in proper alinement with each other, so that the run pattern portions will aline to form a complete run pattern, and the branch pattern portions on adjacent units will aline to form complete branches connecting the run pattern with all of the patterns for said mold cavities.

16. In a method of making finished castings, the steps involved in making a match plate to be used in multiple reproduction of duplicate articles, comprising, casting units of hard, smooth material, which units are exact duplicates except that some may have alining lugs and others alining recesses adapted to register with said lugs, each unit having a flat rectangular base plate portion and a raised portion integral therewith, constituting a pattern for a mold cavity in which a desired casting or castings or part or parts thereof is or are to be formed, a pattern for a portion of a main run at one end edge of the unit, and patterns for portions of branches of the run, and arranging and securing said units to a flat plate, in two parallel series with the units of each series side by side, and the two series end to end, so that the run pattern portions will aline to form a complete run pattern of twice the width of the run pattern on each unit, and the branch pattern portions on adjacent units will aline to form complete branches connecting the run pattern with all of the patterns for said mold cavities.

17. In a method of making finished castings, the steps involved in making a match plate to be used in multiple reproduction of duplicate articles, comprising, forming a suitable die of hard smooth material, forming therein duplicate units of a hard heat resistant material, each having a smooth flat base plate portion and a raised portion integral therewith, constituting a pattern for a mold cavity in which a desired casting or castings or part or parts thereof is or are to be formed, and arranging and securing said units on a flat plate in proper alinement with each other to form a complete match plate.

18. In a method of making finished castings, the steps involved in making a match plate to be used in multiple reproduction of duplicate articles, comprising, forming a suitable die of hard smooth material, forming therein duplicate units, each having a smooth flat base plate portion and a raised portion integral therewith, constituting a pattern for a mold cavity in which a desired casting or castings or part or parts thereof is or are to be formed, and patterns for portions of the main run and branches thereof, and securing said units in proper alinement with each other, so that the run pattern portions will aline to form a complete unitary run pattern, and the branch pattern portions will connect the run pattern with all of the patterns for said mold cavities.

This specification signed and witnessed this 27th day of November, 1918.

JOHN KRALUND.

Witnesses:
CHARLES PACK,
ALFRED C. RAUTSCH.