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3,472,311

PATTERN PLATE

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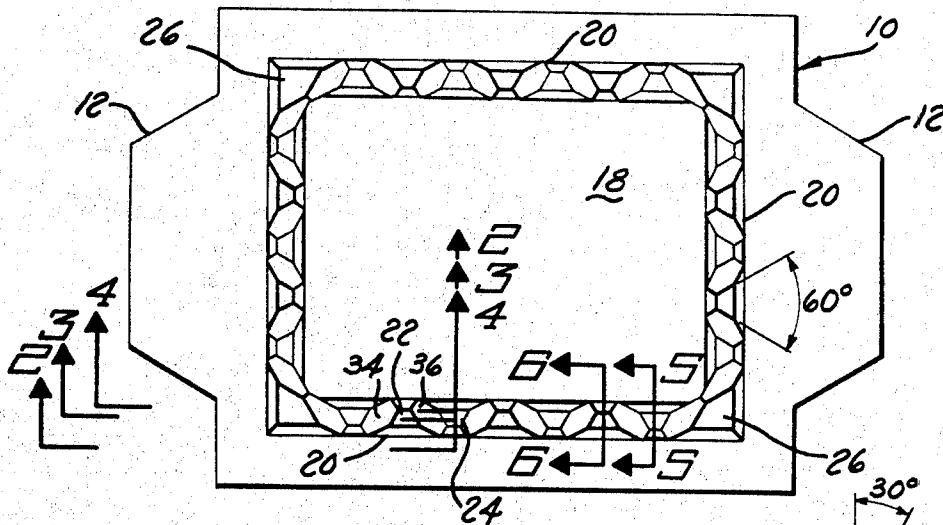


FIG. 1.

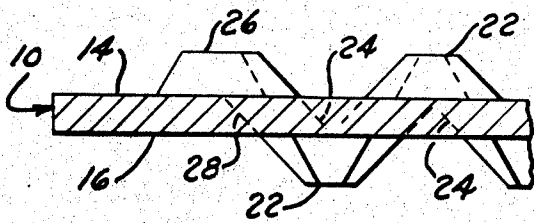


FIG. 2.

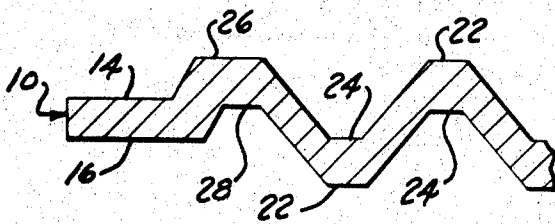


FIG. 3.

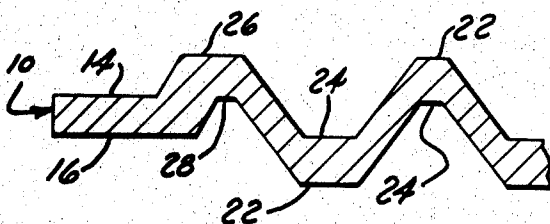


FIG. 4.

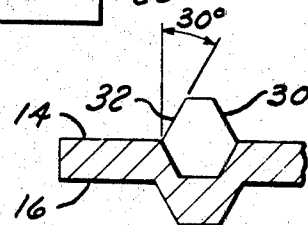


FIG. 5.

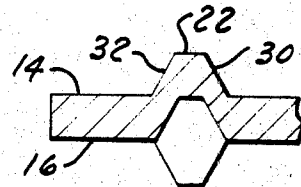


FIG. 6.

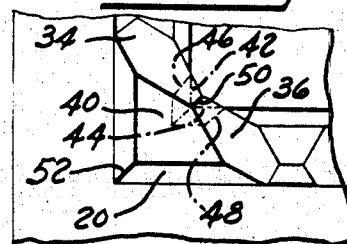


FIG. 7.

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PATTERN PLATE

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5 Claims

ABSTRACT OF THE DISCLOSURE

Pattern plates of a type which will produce cope and drag sections of sand molds which accurately lock against relative sliding movement in any direction.

BACKGROUND OF THE INVENTION

The metal founding art produces metal objects by pouring molten metal into a mold having a cavity therein of the same shape as the desired object. Where the object is a surface of revolution or has re-entry portions, the mold is made in two half sections, the top section of which is called a cope, and the bottom section of which is called a drag. The cope and the drag separate on a plane corresponding with the major diameter or section of the object to be produced, so that the cavities in the cope and drag will have their largest cross section at the parting surface, and so that the side walls taper toward or converge at the bottom of the cavity. By arranging the parting surface in this manner, the cavities of the cope and drag can be made by packing sand and the like around half sections of a pattern that is identically shaped with the desired object, and by thereafter lifting the half section of the pattern out of the packed sand.

The cope and the drag section of the mold must be made to accurately align before molten metal is allowed to fill the cavity, otherwise the finished object will have top and bottom portions which are laterally displaced relative to each other. The art has long known how to mount the top and bottom half sections of a pattern accurately on opposite sides of a plate (commonly called a pattern plate) and thereafter mold sand around the pattern section. The cope and drag sections of the mold are made by placing a four sided open top and bottom box called a flask on the top side of the pattern plate and tamping sand therein to produce the cope section. Thereafter, the assembly is turned over, another flask is placed on the bottom side of the pattern plate and sand is tamped therein to form the drag section. In some instances, alignment pins are provided on the flasks which extend through suitable openings in the pattern plates to receive and hold the flasks in alignment. When the flask includes alignment means, the cope and drag sections are automatically aligned when the pattern plate is removed and the flasks reassembled. Flasks that include alignment means are usually sufficiently expensive that cope and drag sand molds produced therein are removed from their flasks once the sand has been tamped around the patterns. Thereafter, the unreinforced cope and drag sand molds are sent down conveyors to the metal pouring stations where jackets are placed over the sand molds to reinforce the sand molds prior to the time that heavy molten metal is poured therein. This procedure wherein the flasks are removed and inexpensive jackets installed is generally known as slip-flask molding.

Where the slip-flask molding procedure is used, some means must be provided for properly aligning the cope and drag sections of the molds, because the aligning devices of the flasks are no longer present. Interlocking projections and depressions formed in the sand of the cope and drag sections have been used heretofore to

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accomplish the alignment. Sand projections and depressions have been made by suitable configurations of the pattern plates from which the cope and drag sections have been made, but the configuration of the sand projections and depressions which have been produced heretofore have required clearances to be provided to accommodate the manufacturing tolerances necessary to assure that the projections would fit the depressions in the matching mold section. This has allowed a degree of shifting of the cope and drag sections relative to each other sufficient to produce noticeable offsets in the finished cast pieces. In addition, the sand projections have not been strong enough to eliminate breakage thereof during the vibration and rough handling which occurs when the assembled cope and drag sections bump down gravity roller conveyors from the mold forming stations to the pouring stations. In addition, horizontal surfaces on the alignment portions of the cope and drag sections have permitted loose sand to stand thereon when the cope and drag sections are assembled together, and these loose particles of sand act like roller bearings to facilitate shifting of the cope and drag sections relative to each other.

SUMMARY OF THE INVENTION

The present invention relates to a configuration of pattern plate for producing projections and depressions in the sand of the cope and drag sections of a mold which will accurately interlock the cope and drag sections against movement in any direction. The configuration of pattern plate is such that it is both light and strong enough to prevent breakage of the pattern plate during the rough usage normally encountered in a foundry. At the same time, the configuration is such as to provide interlocking projections of packed sand in the cope and drag sections which are sufficiently strong as to prevent shifting movement of the cope and drag during the rough handling which they encounter in a foundry. A further feature of the configuration is that it produces interlocking surfaces on the cope and drag which are substantially devoid of horizontal surfaces on which free particles of sand can rest to act as "roller bearings" between the interlocking surfaces.

An object of the present invention is the provision of a new and improved pattern plate which when sand is packed thereon will produce projections and depressions in one section of a mold which will accurately lock with depressions and projections of another section of the mold in a manner preventing off-set of the sections in any direction.

A further object of the invention is the provision of a new and improved pattern plate of the above described type which produces projections of sand which separate easily from the pattern plate without damage, and which are of such a shape as to have sufficient strength to withstand the abuse normally given sand molds, even when not encased by a flask.

A still further object of the invention is the provision of a pattern plate of the above described type having projections and depressions of a configuration which will achieve the above objects without weakening the pattern plate to a degree where it falls or cracks during hard and prolonged usage.

Further objects and advantages of the invention will become apparent to those skilled in the art to which the invention relates from the following description of a preferred embodiment described with reference to the accompanying drawing forming a part of this specification.

DESCRIPTION OF THE DRAWING

FIG. 1 is a plan view of a pattern plate embodying the present invention;

FIG. 2 is a fragmentary sectional view taken approximately on the line 2—2 of FIG. 1;

FIG. 3 is a fragmentary sectional view, similar to FIG. 2, but taken approximately on the line 3—3 of FIG. 1;

FIG. 4 is a fragmentary sectional view, similar to FIG. 2, but taken approximately on the line 4—4 of FIG. 1;

FIG. 5 is a fragmentary sectional view taken approximately on the line 5—5 of FIG. 1;

FIG. 6 is a fragmentary sectional view, similar to FIG. 5, but taken approximately on the line 6—6 of FIG. 1; and

FIG. 7 is a fragmentary view of a corner of the pattern plate shown in FIG. 1, and in which dot-dash lines are used to outline half sections of a tooth which are rotated 90 degrees to each other about a vertical line through the midpoint of their top inner side edge and their sides extended to produce the corner tooth configuration shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The shape of the projections and depressions in the pattern plate of the invention is extremely complicated and expensive to produce. The patterns that are used to produce the pattern plate of the invention, therefore, is extremely expensive. The cost of the patterns used to make the pattern plates, therefore, must be amortized over the number of pattern plates that can reasonably be expected to be sold. This necessitates that the cost of the pattern plates of the invention will be considerably more than prior art pattern plates, and therefore pattern sections, instead of being stored on the pattern plates are removed, new pattern sections installed, and the pattern plates used over and over again in substantially continuous service. In order that the pattern plates of the present invention will be economical, the pattern plates must be capable of withstanding this increased amount of usage without braking or cracking. Life tests have been necessary and these tests have now proven the adequacy of the pattern plate configuration to meet the objects of the invention.

The pattern plate shown in the drawing generally comprises a rectangularly shaped plate 10 of predetermined thickness, usually $\frac{3}{8}$ inch or $\frac{1}{2}$ inch, and usually made of cast aluminum. The plate will usually include lateral projections 12 on its opposite ends which serve as handles. The top and bottom major surfaces 14 and 16 respectively of the plate are flat and parallel, and include a center portion 18 on which a pattern section is to be mounted. The center portion 18 is surrounded by rows 20 of projections 22 (hereafter called teeth) of predetermined configuration separated by depressions 24 of substantially identical configuration. The height of the teeth 22 is slightly greater than the depth of the depressions 24. The rows 20 parallel the side edges of the plate and are joined by corner teeth or depressions later to be described in detail.

Because the teeth 22 and depressions 24 are of substantially identical configuration, only a tooth 22 will be described in detail. The tooth 22 is a truncated pyramid of regular trapezoidal cross section, with the parallel sides of the cross section paralleling the side edges of the plate and the other two sides forming an angle of approximately 60 degrees with each other. The inner and outer side surfaces 30 and 32 respectively of the tooth may be inclined at an angle to a normal of the major surfaces of the plate of from 20 to approximately 40 degrees, but in the preferred embodiment is an angle of approximately 30 degrees. Because the pyramid is a regular tetrahedron, the other side surfaces 34 and 36 have corresponding shapes differing in only that they are of opposite hand. The side surfaces 34 and 36 may likewise be inclined to a normal of the surface 18 at an angle of from 20 to 40 degrees, but in the preferred embodiment is approximately 30 degrees. The height of the teeth 22

may be from $\frac{1}{2}$ to $\frac{3}{4}$ of the thickness of the plate, but in the preferred embodiment is approximately $\frac{5}{8}$ of the thickness of the plate for reasons which will later be apparent.

The configuration above described is such that depressions 24 can be formed in one side of the plate opposite the teeth 22 on the other side of the plate. The narrow side of the tooth may face inwardly or outwardly, and in the preferred embodiment shown in the drawing, the teeth on the cope side of the plate have their narrow surface facing inwardly, while the teeth on the bottom side of the plate have their narrow surface facing outwardly.

The four rows 20 of alternate teeth and depressions may end in flat areas so that the rows do not connect directly with one another. In the preferred embodiment shown in the drawing, however, the rows are connected by the corner teeth 26 and the corner depressions 28 so that flat areas of the interlocking surfaces of the mold sections produced therefrom are not provided on which sand may rest to separate the cope and drag. The corner teeth 26 and depressions 28 are of substantially identical configuration, and are conveniently formed by two half sections of a tooth 22 when rotated 90 degrees about a vertical through their adjacent inner top edge 40, and suitably beveled to bring these corners together. The side surfaces of the half sections are then extended until they intersect. The outline of one-half of the tooth used to construct the corner tooth 26 is designated by the dot-dash line 42 in FIG. 7, while the other half section of tooth is designated by the dot-dash line 44 of FIG. 7. The half tooth section designated by the section lines 42 and 44 would have inner surfaces corresponding with the dotted lines 46 and 48, but these surfaces 46 and 48 do not actually appear since the side surfaces 34 and 36 of the half sections are extended until they intersect at the line 50. The outer quarter section of the tooth 26 shown in the lower left corner of FIG. 7 is formed by extending the sides 20 of both half sections until they intersect at the line 52, and the top of the tooth is a flat surface formed by the common plane of the top surface of both half sections. It has been found that the corner teeth 26 and depressions 28 materially aid in locking mold sections together. The height of the corner teeth 26 is also slightly greater than the depth of the depressions 28.

The pattern plate 10 is used by placing a rectangular box, having open top and bottom sides, against the top and bottom surface of the pattern plate 10 with the sides of the boxes positioned outwardly of the rows 20. This allows sand to be packed between the sides of the box and the rows of teeth. A pattern section is positioned on the center portion 18 of both the top and bottom 14, and 16, major surfaces of the plate in proper alignment with each other. Sand or the like is packed in the box to fill the depressions 24 and depressions 28 and closely surround the pattern sections as well as the teeth 22. Thereafter the sand is packed or hardened and the hardened sand is removed from the boxes to form the cope and drag sections of the mold. The cope will now have a configuration identical with the shape of the teeth and valleys in the bottom surface of the pattern plate while the drag will have a configuration identical with the teeth and depressions on the top side of the pattern plate. The cope and the drag, therefore, have a multiplicity of angular surfaces which face in all directions. The teeth and valleys that are formed in the molded sand, therefore, have surfaces normal to relative sliding movement of the cope and drag in any direction. These same surfaces, while perpendicular to the sliding movement, are tapered relative to each other so that they wedge together and accurately align the cope and the drag.

As previously indicated, pattern plates to be commercially acceptable must withstand rough continuous usage indefinitely without cracking. In order that the pattern

plate can be manually lifted and handled conveniently, the thickness of the plates must be limited. In the preferred embodiment, these pattern plates are approximately $\frac{1}{2}$ inch thick and are made of a light alloy, as for example cast aluminum. Pattern plates having a thickness up to approximately 1 inch may be necessary for producing molds having a dimension greater than 18 inches. It has been found that optimum conditions are achieved when the inner and outer side surfaces, as well as the remaining side surfaces of the teeth, are inclined at an angle of approximately 30 degrees relative to a normal from the surface of the plate. The teeth should be on approximately 2 inch centers, and the height of the teeth should be no more than approximately $\frac{3}{16}$ of an inch. Pattern plates of this design have indefinite life. It will be seen that the side surfaces 34 and 36 of the projections are coextensive with the side surfaces of the depressions so that no horizontal surfaces are produced in the cope or drag on which free particles of sand may rest. It is further seen that in the preferred embodiment, the rows 20 are joined by corner teeth which make the key forming surfaces of the pattern plate continuous around the pattern plate, and that the configuration thus provided is substantially free of horizontal surfaces. The only horizontal surfaces that are provided in the preferred embodiment are at the tops of the teeth and bottom of the depressions, and as previously explained the height of the teeth on the pattern plate is slightly greater than the depth of the depressions in the pattern plate so that the depressions formed in the sand molds will be deeper than the projections formed on the sand molds. Any free particles of sand, therefore, that drop into the depressions of the sand mold will not interfere or prevent the cope and drag sections from locking together.

It will be apparent that the objects of the invention have been achieved and that there has been provided a new and improved pattern plate which lasts indefinitely without cracking and which produces sand mold sections having teeth and valleys which do not crumble during use.

While the invention has been described in considerable detail, I do not wish to be limited to the exact embodiment shown and described, and it is my intention to cover hereby all novel adaptations, modifications, and arrangements thereof which come within the practice of those skilled in the art to which the invention relates.

What is claimed is:

1. A pattern plate comprising: a plate of predetermined thickness with first and second parallel opposing major surfaces, said first major surface of said plate having

aligned alternately spaced teeth and depressions of substantially identical shape, said teeth being a truncated pyramid of trapezoidal cross section with its sides inclined at an angle of approximately 30 degrees to a normal from the surface of said plate, and the adjacent sides of adjacent teeth forming an angle of approximately 60 degrees with each other, said sides of said teeth being coextensive with the sides of adjacent depressions, and said other major surface of said plate having depressions which match said teeth on said one major surfaces of said plate with the teeth on said one major surface being positioned directly opposite the depressions in said other major surface.

2. The pattern plate of claim 1 wherein said teeth project approximately $\frac{3}{16}$ " from the surface of said plate and are located at approximately 2" intervals.

3. A pattern plate comprising: a plate of predetermined thickness with both major surfaces of said plate having alternately spaced teeth and depressions of substantially identical shape, said teeth being a truncated pyramid of trapezoidal cross section and with the teeth on one major surface positioned opposite the depressions in the other major surface, said sides of said teeth being coextensive with the sides of adjacent depressions, and said teeth and depressions being joined in a continuous pattern on each major surface of said plate to provide a continuous key forming configuration in a mold that is substantially devoid of horizontal surfaces between the teeth and depressions.

4. The pattern plate of claim 3 having four rows of teeth and depressions each parallelly a side edge of the plate, with said rows being connected by a corner tooth or corner valley having a shape corresponding to half sections of said trapezoidal teeth when rotated 90 degrees to each other and the surfaces of the sections are extending until they intersect.

5. The pattern plate of claim 4 wherein the sides of the teeth are inclined at an angle of approximately 30 degrees to a normal from the surface of the plate, and the adjacent sides of adjacent teeth form an angle of approximately 60 degrees with each other.

References Cited

UNITED STATES PATENTS

3,213,496 10/1965 Waite et al. ----- 164-241

J. SPENCER OVERHOLSER, Primary Examiner

ROBERT D. BALDWIN, Assistant Examiner