Feb. 22, 1955 H. W. MINER 2,702,418

METHOD OF AND APPARATUS FOR MAKING CORES

Filed June 30, 1952 2 Sheets-Sheet 1

Fig. 1

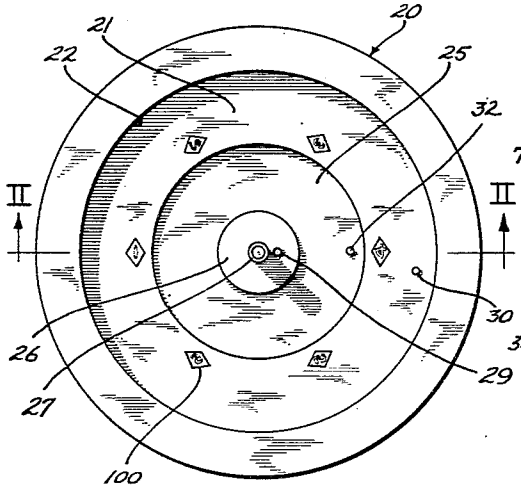

Fig. 3

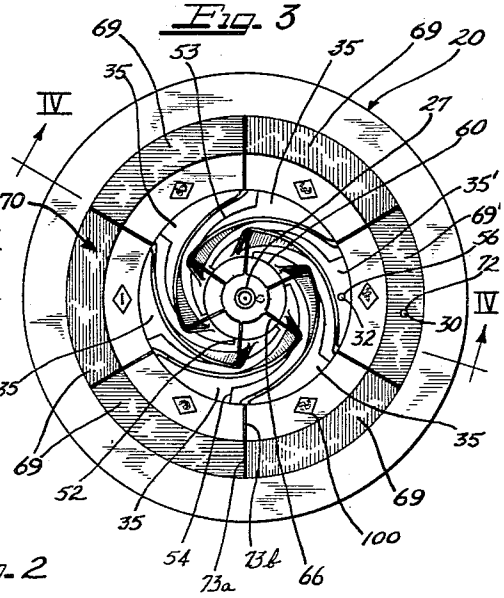

Fig. 2

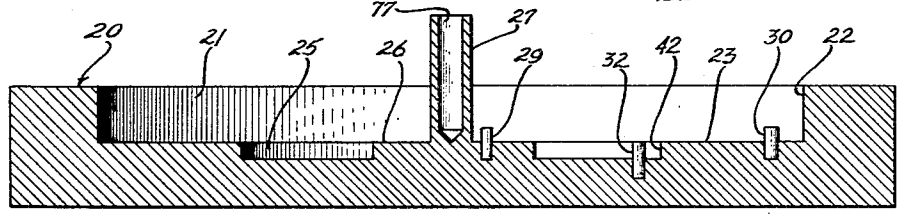

Fig. 4

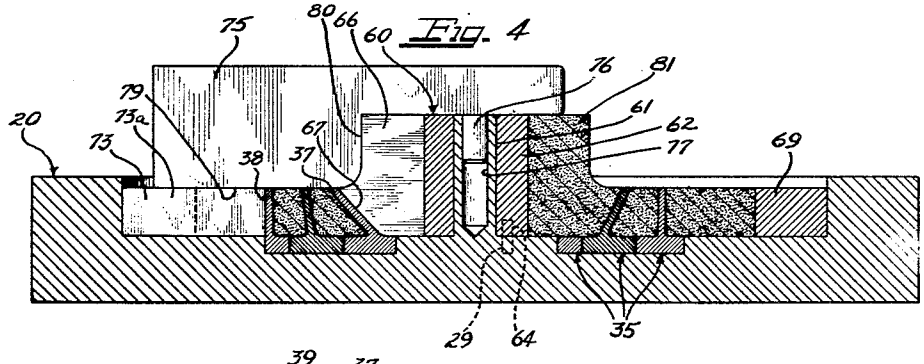

Fig. 5

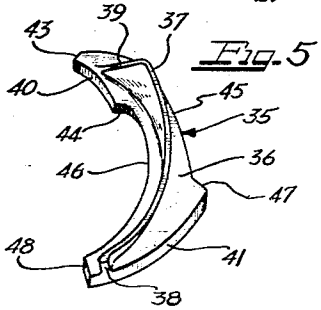

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Fig. 6

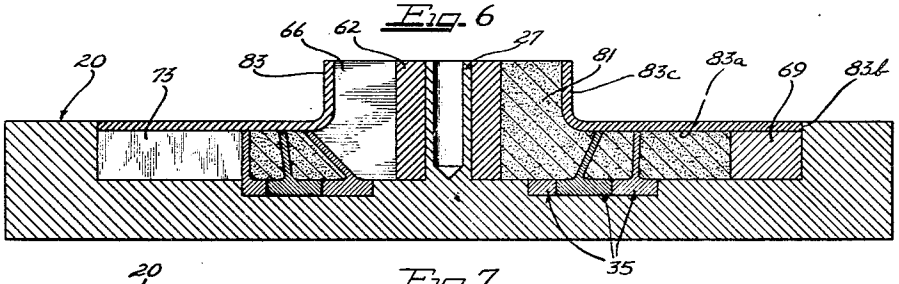


Fig. 7

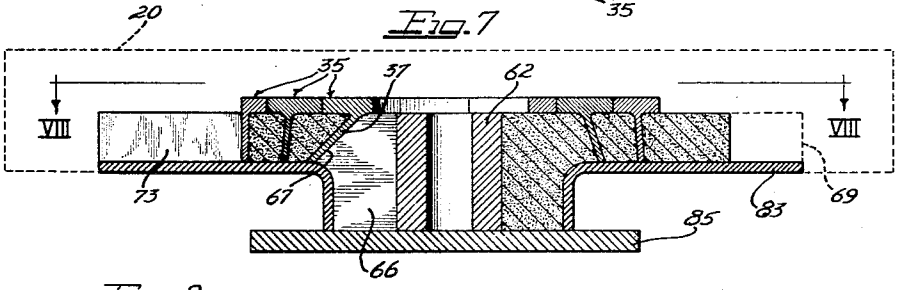


Fig. 8

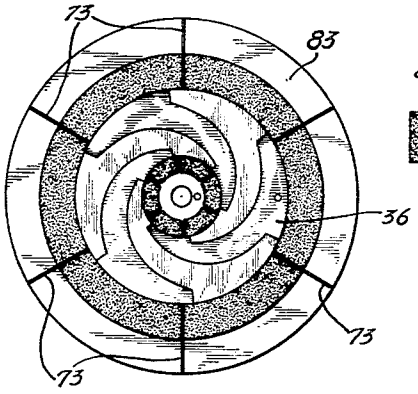


Fig. 9

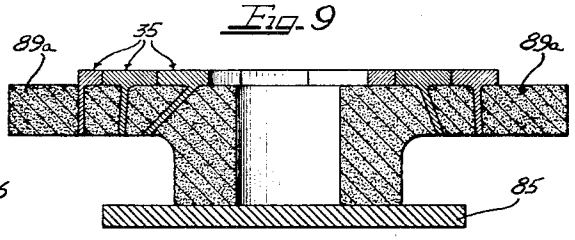


Fig. 11

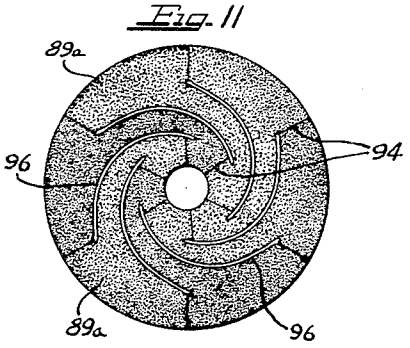
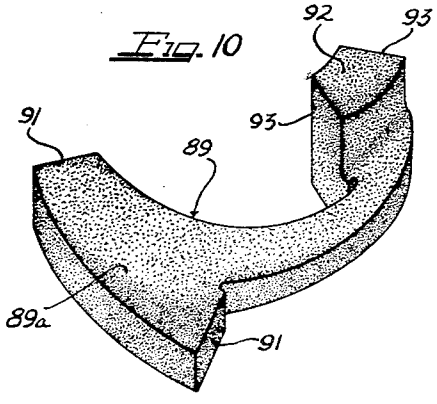


Fig. 10



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METHOD OF AND APPARATUS FOR MAKING CORES

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Application June 30, 1952, Serial No. 296,333

8 Claims. (Cl. 22—13)

This invention relates to improvements in the preparation of cores for use in foundry molding. More particularly it has to do with an improved method of preparing a dry-sand core which, due to its intricate conformation, must be formed by joining together several small core sections.

When several core sections are pasted together to form a single unitary core, the final size and shape of the finished core will depend upon the dimensions of each individual section. If the individual sections are not accurately formed, due to a worn or mis-shaped core box, it is often necessary to file, scrape, or grind the individual sections before the desired shape of the unit is obtained.

It is therefore an important object of the present invention to provide a method of forming a dry-sand core from a number of core sections, so that a predetermined size and shape of the assembled core may be obtained without filing or grinding the individual sections.

According to the general features of the present invention, there is provided a novel method of preparing a core for use in casting for example, a centrifugal pump impeller which has a plurality of curved water passages. These passages, which are effective to draw water from a central inlet eye and discharge it outwardly by centrifugal action, are identical with each other and are disposed symmetrically around the central inlet eye. In the novel core-making method of the present invention each water passage is defined by a separate core section as in the previous, conventional method of making such a core. However, the method of the present invention differs from previous practice in that, instead of forming each passage-defining core section in a separate core box, all the core sections are formed in the same core box. Suitable patterns, placed between adjacent core sections, are shaped to correspond to the curved walls between the water passages in the impeller. After the core is baked, the patterns are withdrawn leaving curved openings in the core to receive the molten metal which forms the impeller wall.

A special feature of the present improved method is the provision of flat confronting faces on adjacent core sections which assure the correct and accurate assembly of the final core. Pairs of confronting faces are formed on the core sections near the center of the core by thin, radially-extending arms of a spider-shaped pattern, and pairs of faces are formed near the periphery of the core by thin spacer members. The spider and the spacers are withdrawn from the core box after baking, leaving openings between the core sections at the confronting faces. When the core is assembled in final form, the openings are filled with paste and the sections are pressed together to form a unitary core. Thus, in final assembly, when the confronting flat faces of adjacent core sections are pasted together, the core will have both an accurate shape and the desired final dimensions.

Other and further features, objects, and advantages of the present invention will be apparent to one skilled in the art from the following detailed description taken in connection with the attached drawings:

On the drawings:

Figure 1 is a top plan view of the core box used in the core-making method of the present invention.

Figure 2 is a vertical sectional view taken on line 2—2 of Figure 1.

Figure 3 is a top plan view, similar to Figure 1, but illustrating the position of wall-defining blades, spacers and a central spider member in the core box.

Figure 4 is a vertical sectional view, taken on line 4—4 of Figure 3, showing sand packed in the core box around the pattern members therein.

Figure 5 is a perspective view of an impeller wall-defining pattern.

Figure 6 is a vertical sectional view, similar to Figure 4, illustrating a dryer cover in place over the core box preparatory to placing the box in an oven for baking.

Figure 7 is a vertical sectional view, similar to Figure 6, illustrating the core in an inverted position, with the core box removed.

Figure 8 is a top plan view taken on line 8—8 of Figure 7.

Figure 9 is a vertical sectional view, similar to Figure 8, showing the baked core in condition for the removal of the pattern members.

Figure 10 is a perspective view of a separate, water passage-defining core section.

Figure 11 is a top plan view of a core assembled in final form according to the method of this invention.

As shown on the drawings:

Referring to Figures 1 and 2, the reference number **20** indicates a core box having a generally cylindrical configuration. A first, large-diameter recess **21**, defined by a sidewall **22** and a bottom wall **23**, is formed centrally in the core box. A second recess **25**, of annular shape, is provided in the bottom wall **23** forming a central hub **26**. At the axis of the core box a hollow post **27** projects upwardly from the hub **26**. Two positioning pins **29** and **30** are secured in an upright position in the bottom wall **23** of the recess, the pin **29** being close to the post **27** while the pin **30** is spaced outwardly therefrom and near the sidewall **22**. A third positioning pin **32** is secured in the annular recess **25**.

To define the partition walls between water passages of the impeller, a plurality of patterns **35** are positioned in the core box **20**. Each pattern **35**, one thereof being shown in Figure 5, has a curved, substantially flat base **36** and a blade **37** which is of constant height from a vertical outer end surface **38** to a slanted inner end surface **39** and is progressively inclined from an upright position at surface **38** to an inclined position at surface **39**. The base **36** has an inner end portion **40** that is curved to conform to the circumferential surface of the hub **26** and an outer end portion **41** that is curved to conform to the curvature of the outer wall **42** of the annular recess **25**. As best seen in Figures 3 and 4, six patterns **35** are positioned in the annular recess **25** in mutually supporting, complementary position to completely fill the recess. Each pattern has a flat leading surface **43**, Figure 5, that abuts a similarly shaped trailing surface **44** of the adjacent pattern, a curved leading surface **45** that abuts a similarly curved trailing surface **46** of the adjacent pattern, and a substantially flat leading surface **47** that abuts a trailing surface **48** of the adjacent pattern. The abutting lines of contact of the above pairs of surfaces are indicated by lines **52, 53,** and **54** respectively in Figure 3.

In assembling the patterns **35** in the annular recess **25**, a key pattern **35'**, Figure 3, which has a pilot hole **56** therein, is first positioned in the recess with the positioning pin **32** extending into the pilot hole **56**. Then the other patterns are fitted snugly into place.

Next, a spider **60**, Figures 3 and 4, is positioned over the upright post **27**, with the post extending through an axial opening **61** in the hub **62** of the spider and the positioning pin **29** extending into a pilot hole **64** in the hub **62**. The spider **60** has six equi-spaced, flat, radiating arms **66** each of which has an outer edge **67** slanted to conform to the slant of that portion of the sidewall of the upstanding blade **37** of the pattern **35**, near the end **39**, which it abuts in supporting contact. Six individual segments **69** of a segmental ring **70** are positioned against the sidewall **22** of the recess **25**. One of the segments **69'** is a key member being provided with a pilot hole **72** which receives the positioning pin **30**. The segments **69** are used to support spacer members **73** in upright position. Each spacer is very thin and of generally rectangular shape, Figure 4, and has one portion **73*a*** fitting snugly between adjacent segments **69** and an-

other portion 73*b* that spans the space between the segments 69 and the flat end surface 38 of the pattern 35.

With the patterns 35, the spacers 73, and the spider 60 in place as shown in Figure 3, sand is packed in the core box 20 to a height above the upper edges of these members. The sand is then struck off at the upper edges of the members, as by a rotatable sweep 75 that has a pivot pin 76 arranged to fit in a central opening 77 in the post 27. The sweep has a lower edge 79 arranged to clear the sand off to the level of the blades 37, and an inner edge 80 arranged to define a hub 81 for the core.

It is to be noted that, at this point, the sand core is divided into sections by partitioning walls, each wall being made up of a thin spacer 73, a curved blade 37, and a thin flat spider arm 66.

After the sand has been struck off, a dryer 83 is placed over the core box, as illustrated in Figure 6. The dryer has a surface 83*a* of the same configuration as the surface of the sand defined by rotation of the sweep 75. The dryer is properly positioned by its radially outer edge 83*b* closely fitting against the sidewall 22 of the core box cavity. An annular wall 83*c* of the dryer provides a support stand for the core when it is inverted as will appear presently. Then a plate 85, Figure 7, is placed on top of the dryer 83, and the entire assembled core box is inverted and set down on the plate 85, as seen in Figure 7. The core box 20, indicated in dotted lines in Figure 7, is then lifted upwardly away from and off the dryer and the unbaked core. The segments 69 are then removed, and the core 88, as illustrated in Figures 7 and 8, is ready to be put in the oven for baking. The dryer 83 supports the core and holds it together during baking.

After the core has been baked and cooled, the dryer 83 is removed by temporarily returning the core to the upright position of Figure 6 and then lifting the dryer off the core. The core 88, which is made up of the individual, separable sections 89, then is returned to the position indicated in Figure 9. In this position the outer portion 89*a* of each core section 89 is unsupported and has a tendency to pivot downwardly due to its own weight. This pivoting action causes the sections to move away from each other, thereby permitting ready and easy withdrawal of the patterns 35.

To assure that each core section 89 is reassembled in the same position relative to the other core sections 89, numbered plates 100 are secured on the bottom wall 23 of the core box as seen in Figure 1. The numerals on the plate are raised and are in an upside-down position so that an indentation is formed in each core section 89 in the form of a right-side-up numeral.

When the patterns are withdrawn, the core sections are separated from each other. As seen in Figure 10, each of the separated core sections has an outer portion 89*a* presenting opposite radially extending end faces 91 formed by the spacers 73, and an inner portion 92 which has a pair of radially extending faces 93 formed by the arms 66 of the spider 60. When the core is reassembled, the faces 91 and 93 of adjacent core sections are placed in confronting, abutting relation and a thin layer of paste is inserted between the surfaces, as indicated at 94 in Figure 11. All of the core sections 89 are then pressed together to form a unitary core assembly. It is to be particularly noted that the abutting faces 91 and 93 determine the final diameter of the core, as well as the uniformity of the openings 96 formed by the patterns 35. Referring to Figure 11, it will be seen that the core sections can assume only one position relative to each other because the amount of radial inward movement of each core is limited by the wedging engagement of its inner portion 92 with the portions 92 of the adjacent cores. Further, the radial inward movement of the portions 92 toward wedging engagement causes the surfaces 91 of the outer portion 90 to be moved into abutting contact. With this arrangement the width of each opening 96 is determined by positively abutting surfaces at the inner and outer ends of the core elements.

From the foregoing description it will be seen that there is provided in the present invention a novel method of forming a dry-sand core from a number of core sections so that a predetermined size and shape of the final core is attained. It will be apparent that unitary cores of a wide range of sizes and shapes can be made from a plurality of core sections by this novel method which encompasses, in a broad sense, the novel idea of first forming in a single core box a sectionalized core with the shape of the final core but with partitioning members defining reference abutment surfaces between the sections which assure the final accurate alignment of the fabricated core, baking the sections, and pasting the sections together. This novel method makes it possible to assemble more cores during a workday than was hitherto possible since all filing and grinding of the core sections is eliminated.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim:

1. Core making apparatus comprising a core box having a cavity, a plurality of removable partition walls disposed in said cavity in equi-spaced relation, each wall including an inner radially-extending flat upright fin, an outer radially-extending spacer, and an intermediate blade-like member extending between said fin and said spacer.

2. Core making apparatus comprising a core box having a cavity defined by a cylindrical sidewall and a flat bottom wall, a post projecting upwardly from said bottom wall at the center of said cavity, a hollow hub disposed over said post, a plurality of equi-spaced partition walls disposed in said cavity, each wall including a fin projecting radially outwardly from said hub, a spacer extending radially inwardly from said sidewall and a blade-like member extending between said fin and said spacer, and segments of a ring disposed between adjacent spacers, removal of said ring segments after sand is packed in said core box permitting removal of said spacers.

3. Core making apparatus comprising a core box having a cavity defined by a cylindrical wall and a bottom wall with an annular recess concentric with said sidewall, a plurality of removable partition walls disposed in said cavity in equi-spaced angular relation relative to the axis of the cavity, each partition wall including an inner radially-extending upright fin, an outer radially-extending spacer, and an intermediate blade-like member extending between said fin and said spacer, the blade-like member of each partition wall having a base portion disposed in the annular recess of said cavity, each base portion having flat contact surfaces adapted to abut similar surfaces on adjacent base portions in supporting engagement, the bases of the blade-like members of said plurality of partition walls being constructed to completely fill said annular recess.

4. Core making apparatus comprising a core box having a cavity defined by a cylindrical sidewall and a flat bottom wall having an annular recess concentric with said sidewall, an upstanding post at the center of said bottom wall, a first pattern member having a hollow cylindrical body disposed over said post and a plurality of equi-spaced fins extending radially away from said body, a plurality of second pattern members having bases disposed in mutually supporting engagement in the annular recess in said core box and curved upstanding wall members with substantially radially extending inner end portions abutting the outer ends of said fins, and a plurality of spacer members disposed in said cavity with inner end portions abutting outer end portions of said wall members and outer ends in contact with the cylindrical sidewall of said cavity, each wall portion cooperating with an adjacent fin and an adjacent spacer to define a removable partition dividing sand, disposed in said core box, into sections.

5. Core making apparatus comprising a core box having a generally cylindrical cavity, a plurality of generally radially extending removable partition walls in said cavity in equi-spaced angular relation about the axis of the cavity, each partition wall including an inner, flat, upright fin, an outer thin upright spacer member displaced angularly relative to said fin, and an intermediate curved blade member extending between said fin and said spacer member, the blade member of each partition wall having flat contact surfaces each adapted to abut a surface on an adjacent blade member in supporting, positioning engagement, and means for locating the fins, the spacers, and the blade members in said core box to assure proper alignment of the parts of each sectional partition wall.

6. The method of producing a unitary core from a plurality of core sections produced in a core box having a cavity with an inner wall defining the outer surface of the core and an upstanding post defining the center of the core, comprising, positioning thin pattern members in the core box cavity such that they extend radially outwardly from the center post, placing partitioning pattern means in said cavity between the outer ends of said pattern members and the inner wall of said core box, packing sand in the cavity about the pattern members and partitioning pattern means, baking the packed sand, removing said pattern members and said partitioning pattern means to result in core sections, and filling with paste the openings left by the removal of the pattern members and the partitioning pattern means to join together the core sections in a unitary core.

7. The method of producing a unitary core from a plurality of separate core sections produced in a core box comprising, placing thin-walled pattern members in said core box separating the core box into sections and forming wedge-shaped adjacent sections, packing sand in said sections to form wedge-shaped core sections, baking said sand, removing said pattern members, filling with paste the openings left by the removal of said pattern members, and pressing said wedge shaped portions together, said core sections being thereby joined together in a unitary core.

8. The method of producing a unitary core from a plurality of separate core sections produced in a core box, comprising, placing thin-walled pattern members against the bottom of the core box and in a direction extending toward the center of the core box to divide the core box into sections, packing sand in said sections of the core box, baking the sand in the core box, removing the pattern members, filling with paste the openings left by the removal of the pattern members, and pressing the core sections radially inwardly toward the center of the core box, said core sections being thereby joined together in a unitary core.

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