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**Kawai**

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[54] **PATTERN ASSEMBLY FOR A FOUNDRY CORE UNIT FOR CASTING A CYLINDER BLOCK OF A MULTI-CYLINDER INTERNAL COMBUSTION ENGINE**


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[30] **Foreign Application Priority Data**

Sept. 7, 1970 Japan ..... 45/78321

[52] **U.S. Cl.** ..... **164/230**, 164/137, 164/368

[51] **Int. Cl.** ..... **B22c 7/06**, B22c 13/12

[58] **Field of Search** ..... 164/137, 230, 369, 164/23, 28, 365, 368



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[57] **ABSTRACT**

The core-making pattern assembly is comprised of two side pattern members having a plurality of recesses corresponding to the number of cylinders in a V-type internal combustion engine. A movable member is mounted in each recess and carries a core section for shaping an engine cylinder bore.


**1 Claim, 4 Drawing Figures**

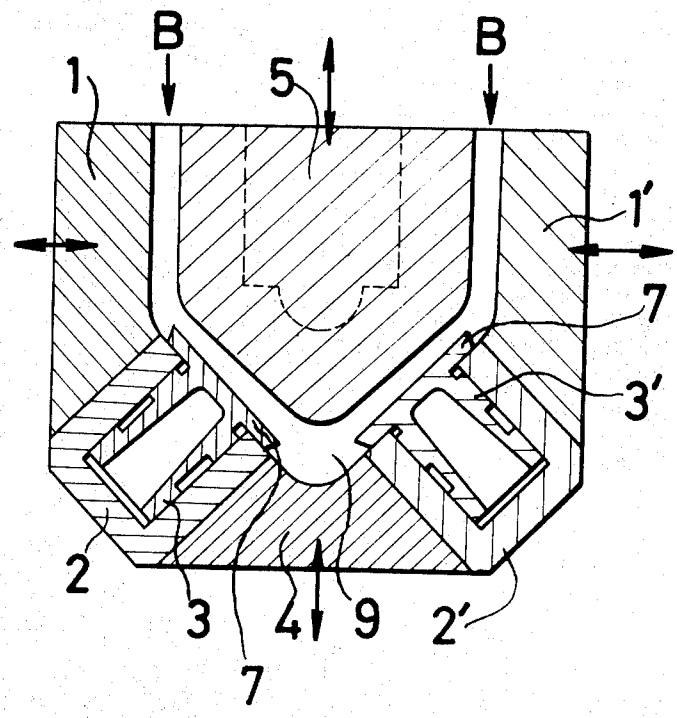


FIG. 1

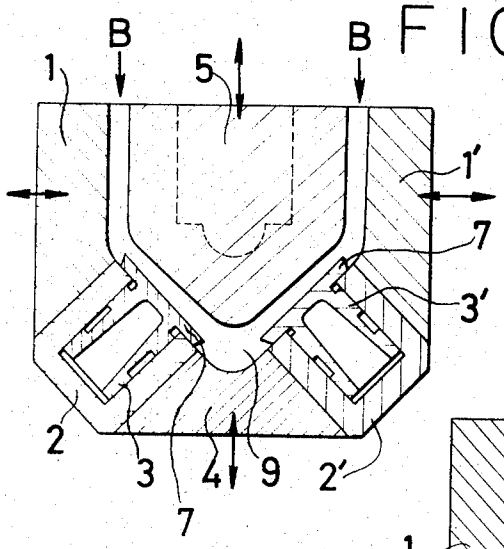
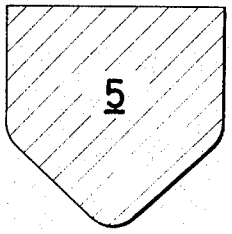



FIG. 2



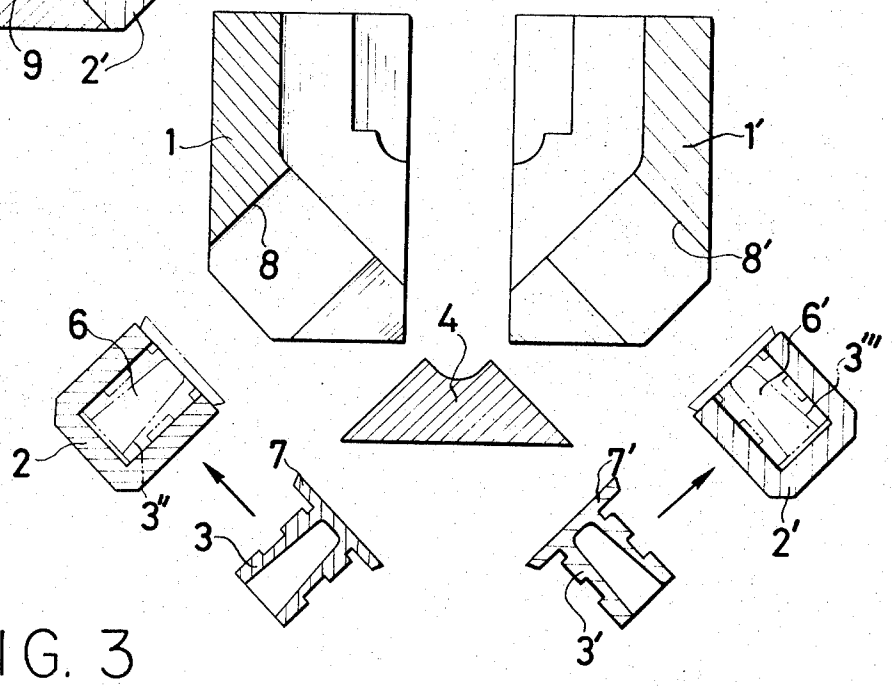




FIG. 3

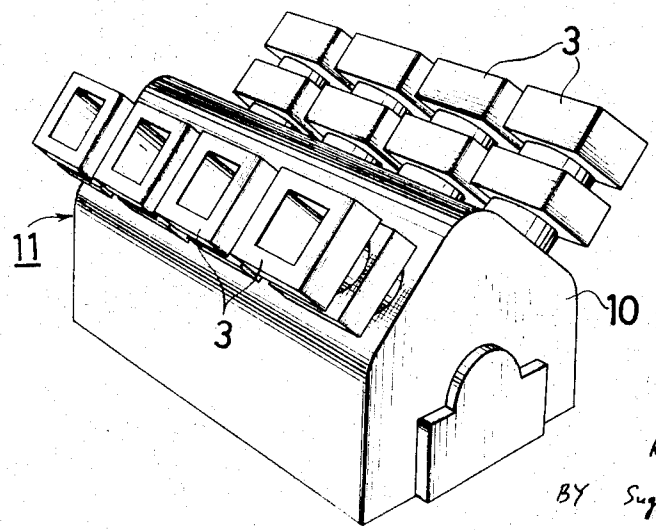
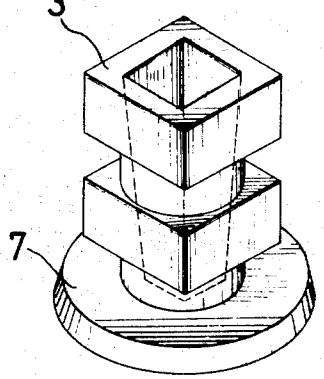



FIG. 4

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# PATTERN ASSEMBLY FOR A FOUNDRY CORE UNIT FOR CASTING A CYLINDER BLOCK OF A MULTI-CYLINDER INTERNAL COMBUSTION ENGINE

This invention relates to improvements in and relating to a pattern assembly for the manufacture of a foundry core unit for casting a cylinder block of a multi-cylinder internal combustion engine.

Separate and attachable cylinder core pieces or other core parts are frequently manufactured and secured to a core main body so as to provide a composite core and avoid the difficult problem of drawing the core out into unusual configurations.

In the case of the composite core adapted for use in the manufacture of the cylinder block casting including the crankcase part of an internal combustion engine having V-arranged working cylinders. A problem will appear in the region where the cylinder core elements are attached to the core main body.

In most cases, these cylinder core elements are assembled to the core main body through high precision male and female mating surfaces and through the glueing technique.

It is one of the objects of the present invention to provide a pattern assembly for the manufacture of a composite core adapted for molding a V-arranged multi-cylinder block for an internal combustion engine, capable of avoiding the aforementioned conventional drawback.

These and further features, objects and advantages of the invention will become more apparent as the description proceeds by reference to the accompanying drawings.

In the drawings:

FIG. 1 is a cross-sectional view of a preferred embodiment of the pattern assembly according to the present invention.

FIG. 2 is an exploded sectional view of the pattern assembly shown in FIG. 1, yet being shown on an enlarged scale.

FIG. 3 is a schematic perspective view of a composite core prepared by the pattern assembly according to the invention and as a representative embodiment thereof.

FIG. 4 is a perspective view of an engine cylinder-making core used in the composite core manufactured by the pattern assembly according to the invention.

In the following, a detailed description of the invention will be set forth.

In FIG. 1, essential parts of the core-making pattern assembly according to a preferred embodiment are shown in section. The illustrated position is the closed position of the pattern assembly, defining a closed cavity within the assembly ready for blow-in molding of the core unit.

Numerals 1 and 1' represent a pair of side pattern members which can be moved from their working position shown to their sidewardly retracted position by respective operating pneumatic or hydraulic piston-cylinder units, not shown, which are conventional.

A number of cup-shaped separate pieces 2 and 2' arranged in line and each containing a core member 3 or 3' are attached to these pattern members 1 and 1', respectively, as shown in FIG. 1. Core members 3 and 3' are previously and separately shaped from shell-forming resin-coated sand. These core members 3 and 3' correspond to those parts of the composite core which are extremely difficult to draw.



Separate pieces 2 and 2' each have an external axial taper so as to be movable axially relative to respective side pattern pieces 1 and 1', respectively, for easy attachement thereto and detachment therefrom.

Lower pattern member 4 and upper pattern member 5 are arranged to be moved vertically pneumatically or hydraulically from their working position shown in FIG. 1 to their retracted off-service position.

In FIG. 2, the aforementioned main constituent parts of the pattern assembly are shown in their schematically exploded sectional view. This exploded arrangement corresponds to the retracted off-service position except for of core members 3 and 3'.

Before bringing these pattern members into their working position shown in FIG. 1, the core members 3 and 3' are positioned within the inside hollow spaces 6 and 6', respectively, as shown at the lower corners of FIG. 2 by chain-dotted lines 3'' and 3''', respectively.

As will be described more fully hereinafter, the core members 3 and 3' are formed with end flanges 7 and 7', respectively, which are to be embedded within the shell-forming material of the main body 10 of the composite core unit generally shown at 11. Thus, it will be clear that these end flanges 7 and 7' are positioned so as to protrude from within the inside spaces 6 and 6' of the separate pieces 2 and 2' when assembled in position as above referred to. It is necessary to select the direction of insertion of the core members 3 and 3' into respective separate pieces 2 and 2' and the direction of relative movement of separate pieces 2 and 2' relative to the side pattern members 1 and 1', respectively, into axial coincidence with each other.

Upon assembly of the core member 3 or 3' destined for molding an engine cylinder bore, with the separate piece 2 or 2', respectively, the elemental assembly 2;3 or 2';3' is then brought from outside into engagement with receiving recess 8 or 8' formed in the side pattern member 1 or 1' and these parts are locked in their relative position by means of proper conventional fixing means, such as bolts and nuts, although not shown only for simplicity of the drawing.

In the case of the specific embodiment, shown, adapted for casting the cylinder block for a V-arranged eight-cylinder engine, each side pattern member 1 or 1' carries each four separate pieces 2 or 2', as shown schematically in FIG. 3.

For manufacturing the composite core according to this invention, side pattern members 1 and 1' carrying the core members 3 and 3' respectively, are advanced oppositely towards each other from their off-service position substantially shown in FIG. 2 to their operating position shown in FIG. 1. Then, the lower and upper pattern members 4 and 5 are similarly advanced oppositely towards each other from their off-service to working position. In this way, a mold cavity 9 is formed in the thus completed pattern assembly.

In an alternative way, the separate pieces 2 and 2' combined with respective core members 3 and 3' may be positioned at the receiving recesses 8 and 8' and then, the upper and lower pattern members can be closed.

In FIG. 1, arrows B are shown for illustrating the direction of introduction of shell-molding resin-coated sand in the manufacture of the composite core.

Upon the closure of the pattern unit in the above mentioned way, the shell-forming material is blown from the supply source, preferably a hopper, not shown, positioned at a higher level, into the molding cavity **9** defined by the inner operating surfaces of the pattern members.

An example of the material composition is as follows: siliceous sand:

| | |
|---|---|
| 40 mesh | 10 wt. %; |
| 65 mesh | 40 wt. %; |
| 100 mesh | 40 wt. %; |
| 150 mesh 10 wt. % | |
| total | 100 wt. % |

| | |
|---|---|
| binder : | |
| phenolic resin | 2.5 wt. % of said sand; |
| hardening agent : | |
| hexamethylenetetramine | 15 wt. % of said binder; |
| dispersing agent : | |
| calcium stearate | 0.1 wt. % of said sand. |

The blow-in pressure amounted to about 3 kg/cm$^2$.

Subsequent to the blow-in molding and baking, the upper pattern member **5** is moved upwards in FIG. **1** and then separate pieces **2** and **2'** are withdrawn from position. Next, the lower pattern member **4** is lowered and the side pattern members **1** and **1'** are opened. In this way, the composite core **11** for a cylinder block casting can be taken out from the core-making pattern assembly.

It is thus seen from the foregoing description that by employing the improved technical idea proposed by the present invention, the following advantages may be obtained.

1. Glueing steps can be obviated, so as to increase the core manufacturing efficiency.

2. High precision machining at the glueing surfaces can be avoided.

3. Transportion damage of the composite cores can be reduced to a possible minimum.

4. Unintentional disengagement of engine cylinder bore-making core elements can be reduced to a minimum.

5. Floating disengagement of said core elements from the core main body during of the cylinder block casting may be avoided almost absolutely.

6. Casting fins can substantially be avoided.

7. Positioning and fixation of said core elements can be carried out in a highly simplified and highly reliable way.

The embodiments of the invention in which an exclusive property or privilege is claimed are as follows:

**1**. A core-making pattern assembly comprising a plurality of opposingly movable pattern members including side pattern members adapted for preparing a composite core for casting a V-arranged multi-cylinder type internal combustion engine, said assembly being characterized in that each of said side pattern members detachably carries a separate piece positioned in a positioning recess formed in each of said pattern members, said separate piece carrying in turn a core section adapted for shaping an engine cylinder bore.

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