Oct. 30, 1956 J. DOLZA 2,768,414

FLASK AND MOLD FOR V-6 CYLINDER BLOCK

Filed Dec. 8, 1954 4 Sheets-Sheet 1

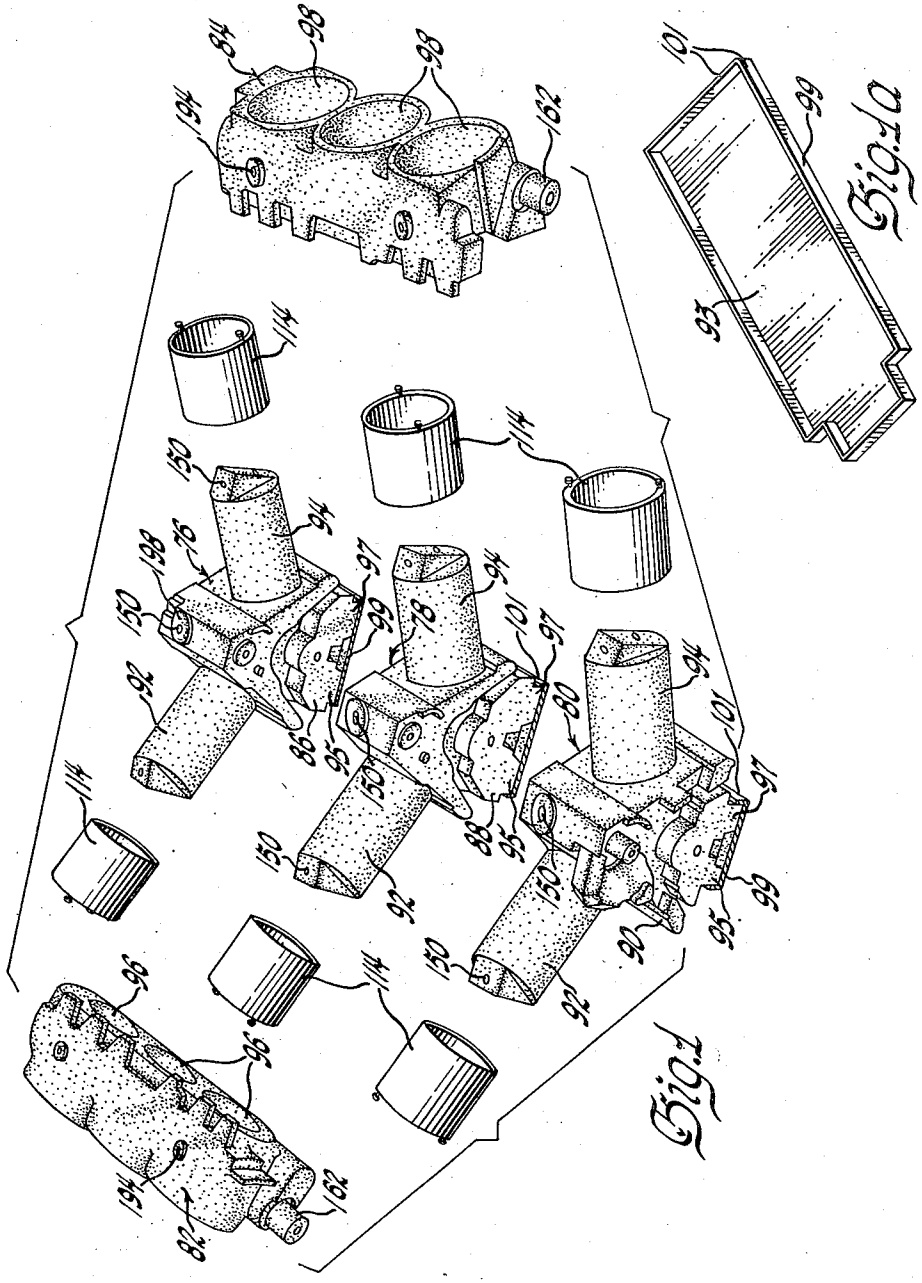


Fig. 1

Fig. 1a

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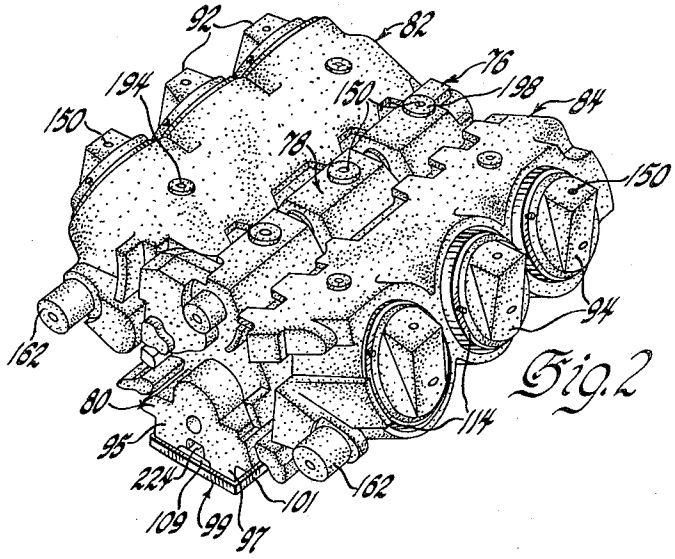


Fig. 2

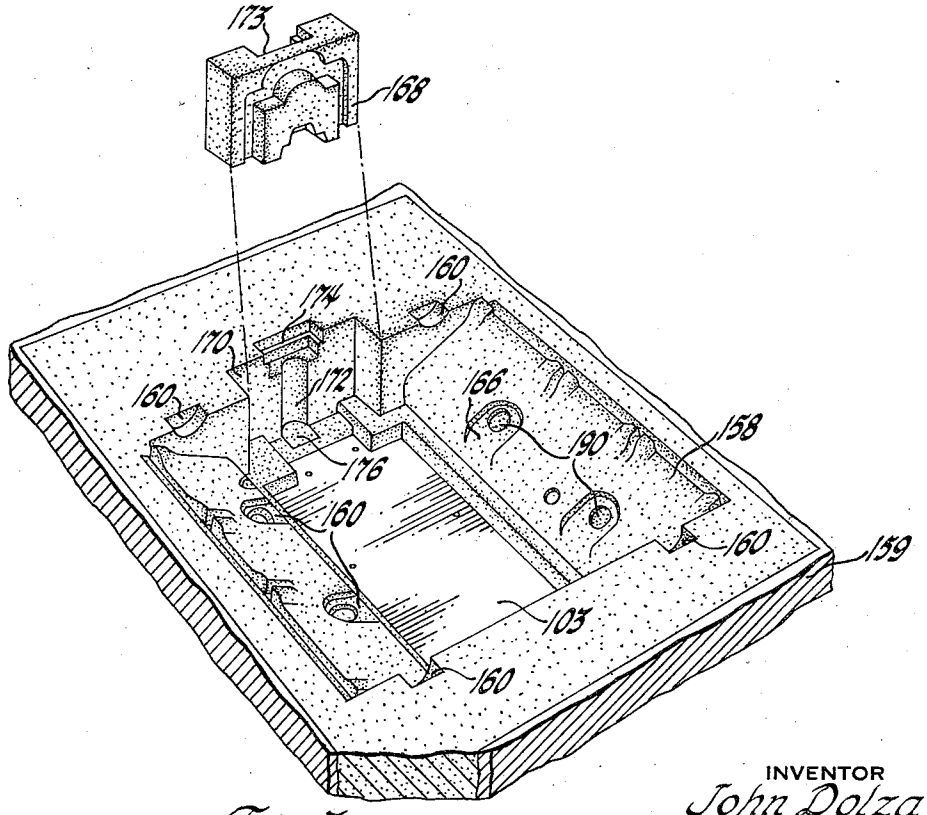


Fig. 3

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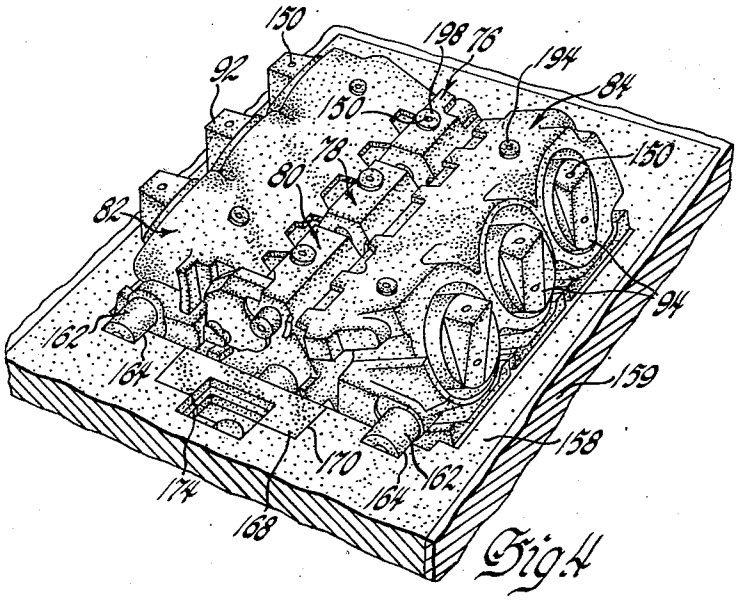


Fig. 4

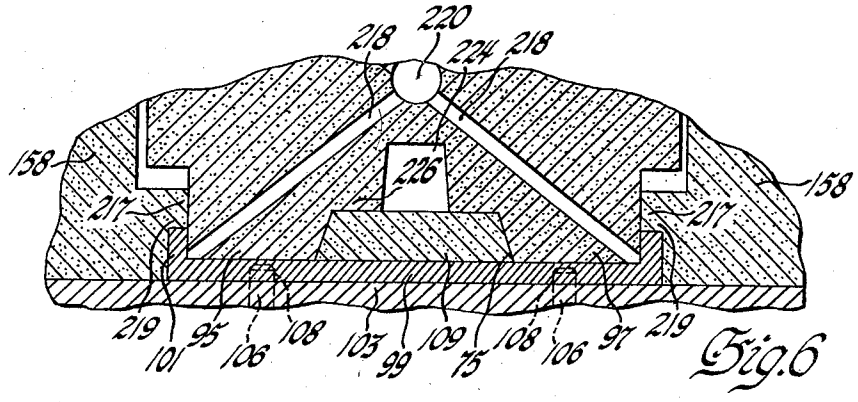


Fig. 6

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FLASK AND MOLD FOR V-6 CYLINDER BLOCK

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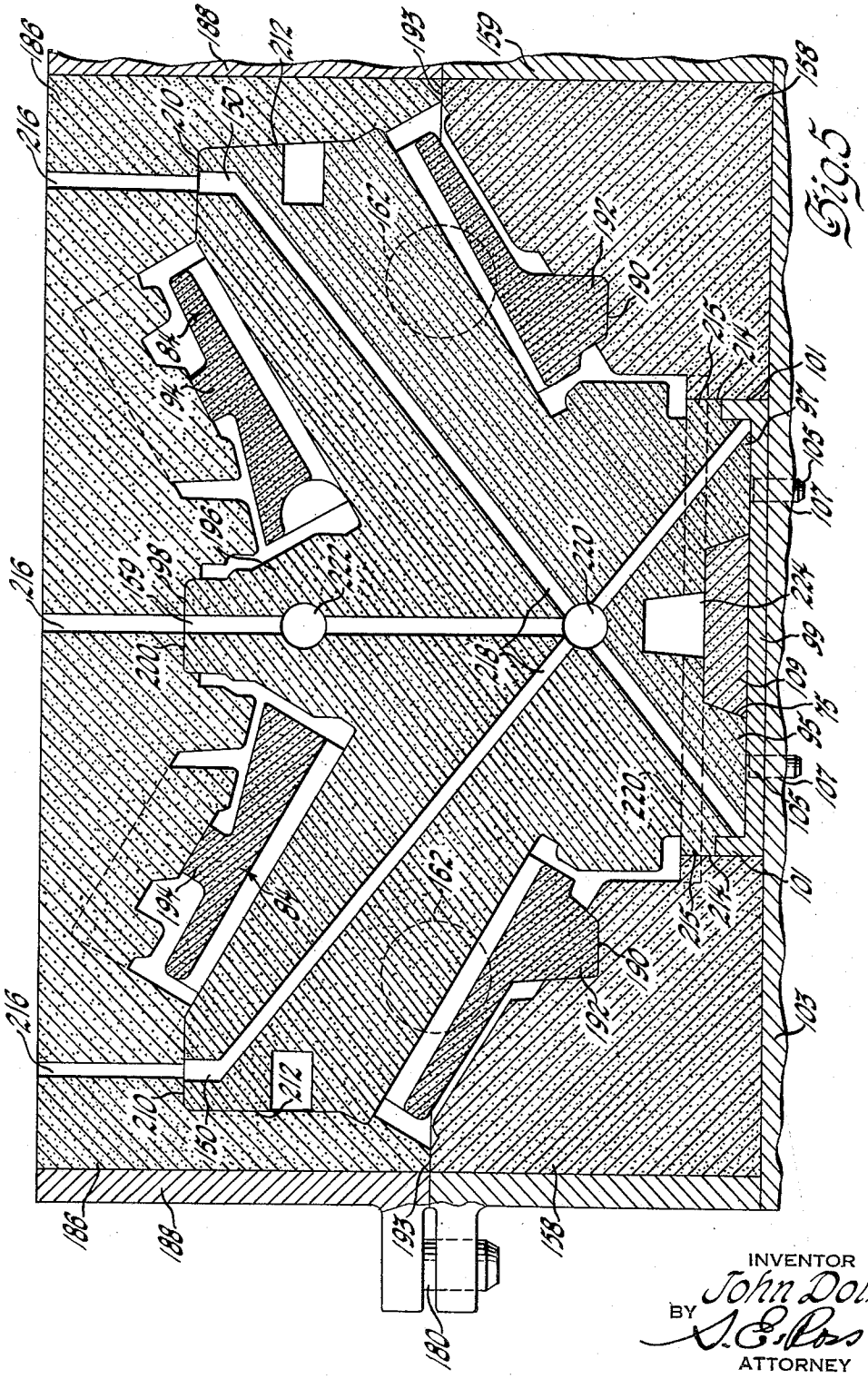


Fig. 5

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FLASK AND MOLD FOR V-6 CYLINDER BLOCK

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Application December 8, 1954, Serial No. 473,869

9 Claims. (Cl. 22—101)

This invention relates to foundry casting operations and more particularly to a flask and mold construction for use in casting cylinder blocks of internal combustion engines.

In the past, conventional methods of arranging and assembling cores preparatory to casting cylinder blocks of internal combustion engines have required the forming, handling and assembling of a multiplicity of cores to form the final coring assembly. This problem is a particularly complicated one with respect to casting V-type engines. For example, typical eight cylinder V-engines normally have required approximately 19 or 20 cores for the cylinder block.

A cylinder block coring arrangement which results in a substantial reduction in the number of cores which need be employed is disclosed and claimed in co-pending patent application S. N. 339,098, filed February 26, 1953, in the names of John Dolza and John B. Burnell. The coring arrangement disclosed in this patent application also eliminates excessive handling and sub-assembly, including wiring, nailing and pasting of the cores.

Despite the manifold advantages resulting from the invention described in the aforementioned patent application, some difficulty has been encountered on occasion with accurately locating the core assembly in the green sand of the drag half of the mold. Moreover, more accurate and complicated core transfer fixtures must be employed in production because of the elimination of the base slab core.

A principal object of the present invention, therefore, is to provide a flask which permits accurately locating a cylinder block coring assembly in the drag half of the mold and at the same time also eliminates the need for a conventional large base slab core. This is accomplished by a novel construction of the drag half of the flask.

A further object of this invention is to provide a foundry mold, particularly the drag half thereof, having a reusable metallic supporting plate in place of green sand or the conventional base slab core. This new arrangement affords accurate alignment of cores in the drag half of the mold and at the same time facilitates transfer of the coring assembly to the mold.

These and other objects are attained in accordance with the present invention by a simple an inexpensive flask and/or mold construction in which an assembly plate, preferably formed of a ferrous base metal, is positioned on the bottom wall of the drag half of the flask and supports the coring assembly. The metallic plate may be either a permanent part of the flask or it may be used as a loose piece which is located accurately with respect to the flask by means of dowel pins or similar locating means. When the assembly plate is a loose piece, the cores may be first located on the plate and the plate thereafter employed as a base for transferring the cores to the drag half of the mold.

Regardless of whether the assembly plate is used as a core transfer base of merely performs a core locating function, it is provided with locating means which permits

accurate positioning of the final core assembly on its upper surface. Inasmuch as this plate is reused for an indefinite period of time, care must be exercised in gating the mold and in handling the shake-out so that the plate will remain free from metal flash and handling damage.

Other objects and advantages of this invention will more fully appear from the following detailed description of preferred embodiments of the invention shown in the accompanying drawings, in which:

Figure 1 is an exploded perspective view, showing the cores used to form a cylinder block of a V-type six cylinder internal combustion engine and the relationship of these cores to the assembly plate employed in accordance with the present invention;

Figure 1*a* is a perspective view of the assembly plate shown in Figure 1;

Figure 2 is a perspective view showing the cores of Figure 1 in position on the assembly plate;

Figure 3 is a perspective view, with parts broken away and in section, of the drag half of the green sand mold, together with an end slab core which may be used in conjunction therewith;

Figure 4 is a fragmentary perspective view of the drag half of the green sand mold in which the assembled cores and plate are placed preparatory to the positioning of the cope half of the mold and the pouring of the molten casting metal;

Figure 5 is a sectional view of the assembled flask, green sand mold and coring arrangement shown in Figure 4; and

Figure 6 is a fragmentary sectional view of a modification of the flask, mold and coring arrangement shown in Figure 5.

Referring more particularly to the drawings, in Figure 1 is shown six cores used in casting a V-type cylinder block of a 120° six-cylinder internal combustion engine. Three combined barrel and bulkhead cores **76**, **78** and **80** and a pair of water jacket cores **82** and **84** constitute all the cores that are essential. If it is desired to cast a V–8 cylinder block, instead of a V–6 engine block, this can be done by employing the same basic cores in conjunction with an additional barrel-bulkhead core. Of course, slightly longer water jacket cores could be used, each containing an additional opening for receiving the two extra barrels.

As shown in Figure 1, the barrel-bulkhead cores **76**, **78** and **80** comprise body or bulkhead-defining portions **86**, **88** and **90**, respectively, which are approximately triangular in vertical transverse cross section, and generally cylindrical barrel portions **92** and **94**, which define the left and right cylinder banks, respectively. Large longitudinally extending core locators **95** and **97** are provided at the bottom of each bulkhead-defining portion to permit the accurate locating of the barrel-bulkhead cores on an assembly or transfer plate **99**. The assembly of these cores results in a coring arrangement in which the body or bulkhead-defining portions **86**, **88** and **90** of the barrel-bulkhead cores have their adjacent end surfaces abutting one another and the bottoms of the core locators **95** and **97** resting on the upper surface **93** of the assembly plate. This plate in turn is seated on the bottom wall of the drag half of the flask.

The water jacket core **82** is positioned so that the adjacent generally cylindrical barrel portions **92** of the barrel-bulkhead cores extend through a plurality of openings or bores **96** formed in the water jacket core **82**. Likewise, the water jacket core **84** is provided with a plurality of openings **98** which extend through the core and into which the adjacent barrel portions **94** of the barrel-bulkhead cores project. In this manner the various

segments of the water jacket cores each, in effect, forms a sleeve having internal, generally cylindrical walls which are spatially separated from the barrel portions **92**. Figure 5 best shows this arrangement of the cores after they are assembled in the green sand mold.

In order to maintain the barrel-bulkhead cores **76**, **78** and **80** in proper position on the upper surface of the assembly plate **99**, this plate is provided with an upwardly extending flange **101** around its edge. As shown in Figures 1*a* and 2, the ends of the assembly plate, as well as its side edges, are formed with this flange, which preferably is integral with the plate. With this construction, the outer side surfaces of the core locators **95** and **97** on the bottoms of the three barrel-bulkhead cores engage the inner vertical surfaces of the side portions of the flange **101**, while the outer end surfaces of the barrel-bulkhead cores **76** and **80** contact the inner surfaces of the end portions of this flange. In this manner the assembled cores are retained in proper position within the mold since they aer prevented from moving either longitudinally or laterally relative to the flask and the green sand therein.

As hereinbefore indicated, the assembly plate **99** may be a permanent part of the drag half of the flask. Hence this plate may be formed integral with the bottom wall of the drag or it may be secured thereto by bolts or other appropriate means. However, when the assembly plate **99** is not a permanent part of the mold but is employed as a loose piece, in accordance with the preferred embodiment of the invention, it may serve as a core transfer fixture as well as for locating the assembled cores in the mold. Under these circumstances, it is desirable to provide the assembly plate **99** with downwardly extending dowel pins **105** or their equivalent which engage suitable mating openings or recesses **107** in the bottom wall **103** of the drag half **159** of the flask. This relationship between the flask and the assembly plate is best shown in Figure 5. With this arrangement, when the assembly plate **99** with the various cores positioned thereon is transferred to the mold, the plate and assembled cores can be aligned properly with respect to the mold by engagement of the pins **105** with the openings **107**. Alternatively, as shown in Figure 6, dowel pins **106** could be attached to the bottom wall of the drag and extend upwardly therefrom, the openings **108** for receiving the dowel pins being provided in the assembly plate. It is not necessary to have the dowel-receiving openings **107** and **108**, whether formed in the flask wall or in the assembly plate, extend completely through that part. Mere recesses which mate with the dowel pins, if the mating parts are formed with sufficient accuracy, normally will suffice.

As shown in Figures 1, 2 and 5, a small base core **109** is employed when the assembly plate **99** is used to transfer the cores to the mold. Such a base core is necessary to provide proper gating of the engine block casting while preventing the molten casting metal from contacting the assembly plate. On the other hand, when the assembly plate is to be used as a permanent or semi-permanent part of the mold, as shown in Figure 6, this base "core" may be formed of green sand.

A preferred method of assembling the cores in the green sand mold, when the assembly plate **99** is to be used as a core transfer base, is as follows. The small base core **109** is first positioned on the upper surface of the assembly plate **99** with the barrel-bulkhead cores **76**, **78** and **80** placed over the base core. As shown in Figure 2, the bottom surfaces of the core locators **95** and **97** thus are seated on the upper surfaces **93** of the assembly plate, while the outer side surfaces of these core locators abut the inner, vertical surfaces of the upstanding flange **101** at the edge of the assembly plate. The inner, longitudinally extending surfaces **75** of the core locators **95** and **97** are in surface engagement with the sloping side surfaces of the small base core **25**. Hence, when molten metal is poured through the longitudinal gates **224**, as is hereinafter more fully explained, it does not come into contact with the assembly plate.

Figure 2 shows the exact positions of the barrel-bulkhead cores on the metal assembly plate. Since the adjacent end faces of the barrel-bulkhead cores abut one another and the lower lateral edges of these cores are in contact with the flange **101**, the cores are prevented from sliding on the assembly plate.

After the barrel-bulkhead cores **76**, **78** and **80** are positioned on the assembly plate or core transfer plate **99**, a plurality of metallic spacer sleeves **114** may be employed to properly space the water jacket cores **82** and **84** from the barrel portions **92** and **94** of the barrel-bulkhead cores. These sleeves, which are best shown in Figure 1, are preferably slightly conical in shape, and their smallest internal diameters are somewhat smaller than the outside diameters of the barrel portions of the barrel-bulkhead cores. Thus, when the spacer sleeves are assembled over the barrel portions of the barrel-bulkhead cores, the outward taper of their inner surfaces prevents their sliding downwardly on the barrel portions to an excessive extent. Hence these sleeves are of such a shape and length that their inner or lower edges are spatially separated from the sloping side surfaces of the body or bulkhead-defining portions **86**, **88** and **90** of the barrel-bulkhead cores. When the spacer sleeves **114** are securely in position around the barrel portions **92** and **94** of the barrel-bulkhead cores, the two water jacket cores **82** and **84** are placed over the sleeves and the barrel portions so that the latter protrude completely through the openings **96** and **98** in the water jacket cores, as shown in Figure 2.

When the various cores are properly arranged on the assembly plate or core transfer plate **99**, these cores are in condition to be transferred to the green sand **158** in the drag half **159** of the metal flask. As shown in Figure 3, the green sand in the drag has been molded so as to form core prints **160** in which core print projections **162** at the ends of the water jacket cores **82** and **84** may rest. Likewise, as can be seen from Figure 5 core prints **190** are also provided for core locators **192** at the bottom of the water jacket cores. Various other indentations, such as recesses **166**, are printed in the sloping side surfaces of the green sand in the drag to form appropriate crankcase parts of the cylinder block casting.

A sprue core **168** is shown in Figure 3 as insertable within a generally rectangular recess **170** in the green sand in the drag. A vertically extending groove **172** formed in the end wall of the green sand mold cooperates with a similar groove **173** in the sprue core to form a sprue for the molten casting metal. This sprue, of course, is open to the atmosphere at its enlarged, rectangular upper end **174** and communicates with the mold cavity at its lower end by means of the longitudinally extending recess **176** in the green sand of the drag. The sprue core **168** is provided with a similar recessed design to form a generally cylindrical gate and sprue. When the sprue core is inserted within the recess **170** and the other cores are in assembled position within the mold, the inner face of the sprue core abuts the adjacent end or rear face of the end barrel-bulkhead core **80**, as shown in Figure 4. These two cores provide an interjacent cavity which forms the rear main bearing block of the cylinder block.

When the assembled cores and assembly plate **99** are thus properly located within the mold cavity, the base of the assembly plate **99** is seated on the upper surface of the bottom wall **103** of the drag half **159** of the flask. Also the core locators **162** and **192** on the water jacket cores **82** and **84** are supported by the core prints **160** and **190** respectively, in the green sand in the drag.

The spacer sleeves **114** may then be withdrawn from the openings **96** and **98** in the water jacket cores and from around the barrel portions **92** and **94** of the barrel-bulkhead cores. As hereinafter more fully explained, the support provided at appropriate locations by the bottom surfaces of the green sand maintains the barrel-bulkhead

cores in proper position. Similarly, the core prints 160 which support the core print projections 162 help retain the water jacket cores in assembled position and spatially separate these cores from the barrel portions 92 and 94 of the barrel-bulkhead cores. In this manner annular cylinder walls having equal thicknesses throughout their circumferences are formed in the cylinder block. Although spacer sleeves 114 are employed in the embodiment of the invention shown in the drawings, it will be understood that a transfer fixture could equally well be designed to retain the spatial relationship between the water jacket cores and the barrel-bulkhead cores without the use of such spacer sleeves by the provision of suitable retractible locating pins. Such a construction generally would be preferable to one using spacer rings and would facilitate assembly of the cores and mold.

Of course, if the assembly plate 99 is not used as a core transfer base, the small base slab "core" 109 may be formed of green sand, as hereinbefore indicated. Under these circumstances, the assembly plate is positioned on the bottom wall 103 of the drag half 159 of the flask before any of the cores are located on the plate and before the green sand 158 is in the mold. As previously explained, the assembly plate actually may be constructed as a permanent part of the flask. The green sand is then dumped or otherwise introduced into the drag half of the flask and printed into the proper contour. The small base slab "core" 109 would thus be formed in the same manner as the rest of the green sand in the drag. Of course, with this latter method, it is usually advisable to make various minor changes in the shape of the core locators 95 and 97 and the adjacent green sand to effect minor economies. This modification of the flask, mold and coring assembly is shown in the fragmentary sectional view of Figure 6. The construction and arrangement of the mold, flask and cores are otherwise similar to the construction and arrangement shown in Figure 5 and hereinafter described in greater detail.

The arrangement of the cores after being assembled in the green sand in the drag 159 is shown in Figure 4. The cope half 188 of the flask containing green sand 186 is then placed in position over the drag and retained in alignment by the locating pins or dowels 180, as shown in Figure 5. Thus assembled, the green sand mold and cores are in condition for pouring of the molten casting metal. The formed sprue and gate 176—172—173—174 may be connected to another sprue portion in or through the green sand in the cope. The exact positioning of the cores relative to the green sand in both the cope and the drag is best shown in the sectional view of Figure 5. Thus it will be seen that the water jacket cores 82 and 84 are supported by means of core prints 190 in the sloping side walls of the green sand of the drag, these core prints engaging the core print projections or core locators 192 formed on the lower surfaces of the water jacket cores 82 and 84. This support is in addition to that provided by the longitudinal core print projections 162 which are seated in core prints 160 formed in the green sand on the mold parting line 193 at both ends of the mold cavity.

As shown in Figure 5, generally cylindrical projections or mold locators 194 are shown as formed on the upper surfaces of the water jacket cores and, when these cores are assembled within the mold, engage lower, sloping surfaces of the green sand 186 in the cope. These locators prevent floating of the water jacket cores during the metal pouring operation. If desired, recesses for the core locators 194 may be printed into the cope in order to perform a further locating function. Likewise, the top surfaces of the upper camshaft gallery-defining portion 196 of the barrel-bulkhead cores may be provided with vertically extending, generally cylindrical projections or core locators 198 which, as shown in Figure 5, may be adapted to engage a core print 200 formed in the green sand of the cope. Horizontal surfaces of the green sand in the cope near the sides thereof rest upon the upper horizontal wall surfaces 210 of the barrel portions of the barrel-bulkhead cores, while adjacent vertical surfaces of this green sand abut the generally vertical end walls of the barrel portions, as shown at 212.

The only other areas of contact between the green sand and the coring assembly are where the vertical outer surfaces 214 of the longitudinally extending projections 213 at the bottom of the barrel-bulkhead cores 76, 78 and 80 abut the parallel surfaces of the green sand 158 in the drag half 159 of the flask. The side projections or ridges 215, which overlap the upper edges of flange 101 of the assembly plate 99, prevent the molten casting metal from contacting the plate 99. For the sake of simplicity and to more clearly show the relationship between the core locators 95 and 97 and the plate 99, these ridges have been omitted from the perspective views of Figures 1 and 2. In the arrangement shown in Figure 6, the ridges 215 are not necessary since the green sand in the drag extends inwardly at 217 over the flange 101 and into abutment with the outer surfaces of the core locators 95 and 97. This construction likewise prevents the molten casting metal from contacting the plate 99.

Referring again to Figure 5, a plurality of appropriate vertically extending vents 216 are formed in the cope to permit the escape of the core gases generated during and after pouring of the casting metal. These vents communicate with the openings 150 extending through the upper surfaces of barrel portions 92 and 94 and camshaft gallery-defining portions 196 of the barrel-bulkhead cores 76, 78 and 80. The openings 150 in each of the barrel portions of the barrel-bulkhead cores are angularly extended, as indicated at 218, through the barrel portions to the bottom of these cores. With the arrangement shown, these openings or passages preferably intersect at a lower longitudinally extending vent 220. Likewise, each of the openings or vents 150 in the bulkhead portions of the barrel-bulkhead cores preferably extends vertically through almost the entire height of the barrel-bulkhead core in which it is formed, intersecting an upper horizontal, longitudinally extending vent 222 and terminating at the lower longitudinal vent 220. It will be noted that the venting arrangement in this coring assembly is exceedingly simple and requires no special venting or breather cores as have heretofore normally been used in engine block coring.

Interconnected, longitudinally extending gates 224 are shown in Figures 5 and 6 as being provided in the bases or bottom portions of the barrel-bulkhead cores 76, 78 and 80. These gates communicate with the sprue 176—172—173—174 to distribute the molten casting metal through laterally extending gates 226 in the barrel-bulkhead cores. Of course, the gating can be varied to suit the needs of the particular foundry using this coring assembly, the gating system shown being merely an example of one arrangement which has proved to be highly satisfactory.

In order to reduce the amount of cast iron required and to simplify the cooling problem, in some instances it may be desirable to add a rear end slab core and/or a front end slab core. Moreover, if the fly wheel housing and front cover for the timing mechanism housing are desired to be incorporated in the cylinder block casting, a fly wheel housing core as well as a front end core should be included in the coring assembly.

While specific embodiments of this invention have been shown and described, it will be understood that various changes in the details of construction of the cores, mold and flask, as well as variations in the method of assembling the cores and mold, may be made without depart-

ing from the scope of the invention as set forth in the following claims.

I claim:

1. A flask for use in casting a cylinder block of an internal combustion engine, said flask comprising a drag half having a horizontal bottom wall and generally vertically extending side and end walls, said bottom wall having a plate provided with upwardly extending, longitudinal flanges for maintaining a coring assembly in proper position on said bottom wall.

2. A metallic flask for use in sand molding operations, said flask comprising a drag half having a bottom wall and a detachable assembly plate positioned on the upper surfaces of said wall, said plate being provided with projections adapted to maintain a coring assembly in position on the upper surface of said plate, said plate and bottom wall being provided with mating recesses and projections for retaining said plate in proper position on said wall.

3. A flask construction for use in foundry casting operations, said flask comprising a metallic drag half having a generally horizontal bottom wall and a detachable metallic assembly plate positioned on the upper surface of said wall, said plate having a plurality of upstanding flanges adjacent its outer edges for maintaining a coring assembly in position on the upper surface of said plate, said plate and bottom wall being provided with dowel pins and recesses for receiving said dowel pins for retaining said plate in proper position on said wall during metal casting operations.

4. A molding assembly for use in metal casting operations, said assembly comprising a metallic flask having a drag half provided with a generally horizontal bottom wall and generally vertical side and end walls, said bottom wall being provided with a plurality of longitudinally and laterally extending upstanding flanges, green sand packed within said drag half between said vertical walls and said flanges, and a plurality of cores positioned on the upper surface of said wall between said flanges.

5. A molding assembly for use in casting a cylinder head of an internal combustion engine, said assembly comprising a metallic flask having a drag half provided with a generally horizontal bottom wall, a metallic assembly plate seated on said bottom wall and having means engaging the upper surface of said wall for maintaining said plate in proper longitudinal and lateral position with respect to other portions of said flask, said plate having upstanding flanges provided adjacent its peripheral edges, green sand packed within said drag half of the flask and surrounding said assembly plate, and a plurality of cores positioned in a cavity defined by said green sand and having depending core locators seated upon the upper surface of said assembly plate, said core locators engaging the inner surfaces of said flanges for maintaining said cores in position with respect to the drag half of the mold.

6. A molding assembly for use in casting a cylinder block of an internal combustion engine, said assembly comprising a metallic flask having a drag half provided with a metallic plate seated on its bottom wall, said plate having upstanding flanges formed adjacent its outer edges, green sand within said drag half of the flask forming the casting-defining side and end surfaces of said mold, a plurality of sand cores having downwardly projecting locators positioned on the upper surfaces of said assembly plate and engaging inner surfaces of said flanges for maintaining said cores in proper longitudinal and lateral position with respect to said flask, a lower surface of said cores being provided with a passage extending longitudinally relative to said flask for conveying molten casting metal poured into said molding assembly, a molding member formed of sand and a suitable binder positioned on the upper surface of said assembly plate interjacent said core locators, said molding member providing the lower wall of said passage, and a cope half of a green sand mold positioned over said drag half and assembled cores.

7. A molding assembly for use in casting a cylinder block of an internal combustion engine, said assembly comprising a metallic flask having a drag half provided with a metallic plate seated on its bottom wall, said plate having upstanding flanges formed adjacent its outer edges, green sand within said drag half of the flask forming the casting-defining side and end surfaces of said mold, a plurality of sand cores each provided with a pair of laterally spaced, downwardly projecting core locators positioned on the upper surfaces of said assembly plate and engaging inner surfaces of said flanges for maintaining said cores in proper longitudinal and lateral position with respect to said flask, a lower surface of each of said cores between said pair of core locators being provided with a passage extending longitudinally relative to said flask, and a molding member formed of sand and a suitable binder positioned on the upper surface of said assembly plate beneath said cores and interjacent said core locators, the adjacent surfaces of said cores forming the upper and side walls of said passage and the upper surface of said molding member forming the lower wall of said passage, said passage thereby being adapted to function as a gate for the distribution of molten casting metal poured into said molding assembly.

8. A method of forming a mold and coring assembly for use in metal casting operations, said method comprising packing green sand into a drag half of a metal flask, positioning a plurality of cores on a metallic assembly plate, thereafter transferring said assembly plate and cores positioned thereon to said drag half of said flask, and subsequently positioning said assembly plate and cores in said drag half so that the bottom surface of said plate abuts the upper surface of the bottom wall of said flask.

9. A method of casting a cylinder block of an internal combustion engine, said method comprising packing green sand into a drag half of a metal molding flask, positioning a plurality of cylinder block cores on a metallic assembly plate between upstanding side walls thereof, transferring said assembly plate and cores positioned thereon to said drag half of said flask so that the lower surface of said plate is seated upon the upper surface of the bottom wall of said drag half, thereafter positioning a cope half of a green sand mold over said drag half and assembled cores, pouring molten casting metal around said cores and into the mold cavity formed between the drag half and the cope half of the green sand mold, and permitting said molten metal to solidify.

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