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J. H. KIEFER ETAL

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MULTIPLE WHEEL WEIGHT CASTING DIE

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5 Sheets-Sheet 1

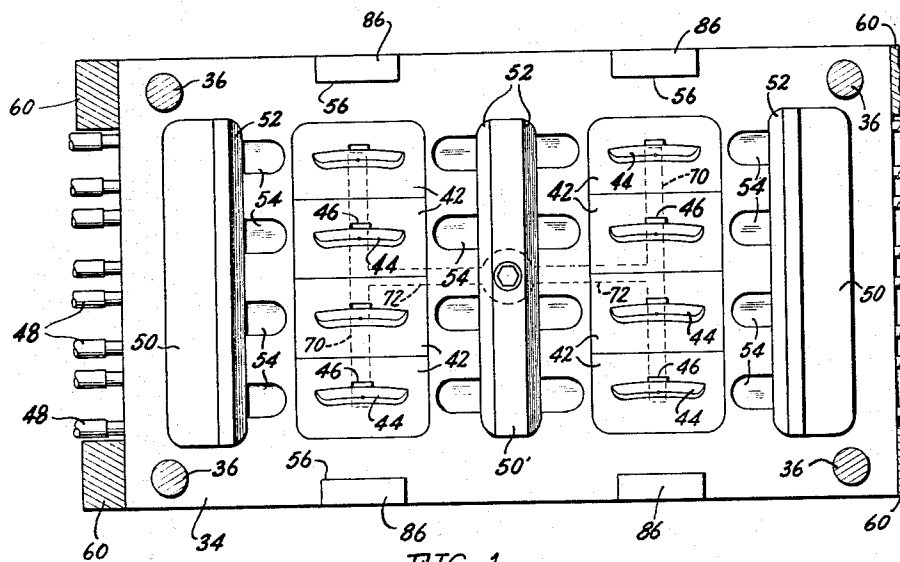


FIG. 1

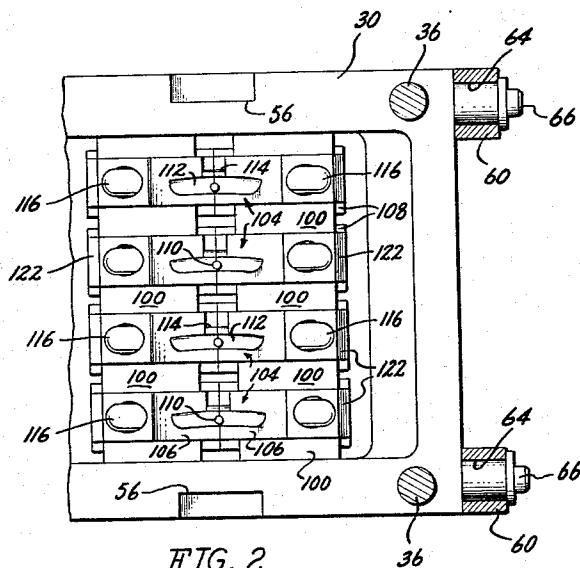


FIG. 2

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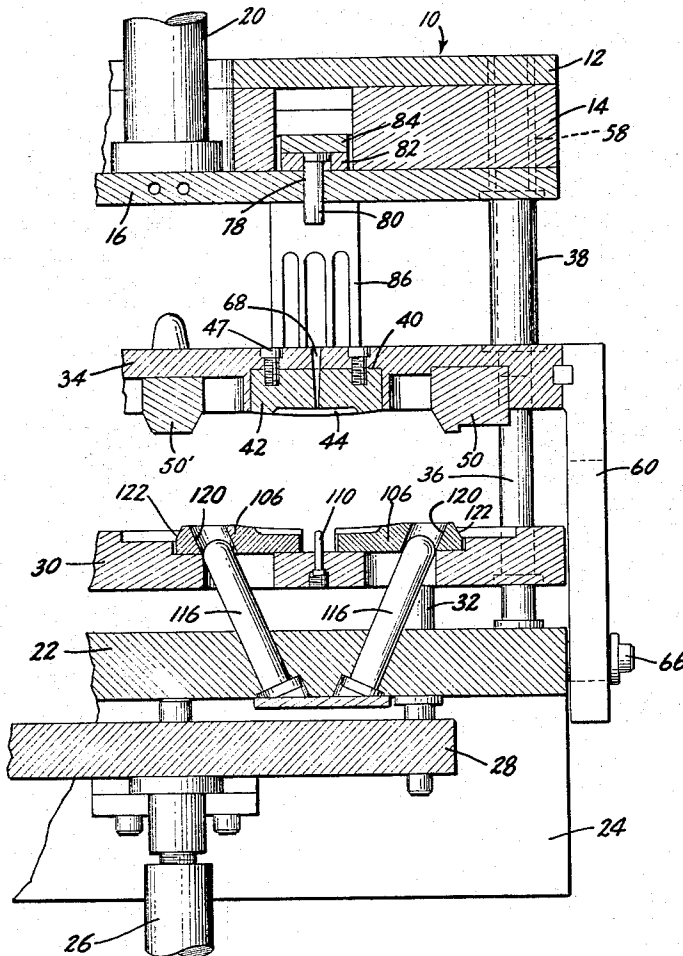


FIG. 7

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MULTIPLE WHEEL WEIGHT CASTING DIE

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9 Claims. (Cl. 22—92)

The invention pertains to die structure for injection die-casting machines, and particularly relates to a die structure capable of casting wheel weights.

Wheel weights, such as are commonly employed to balance vehicle wheels, consist of a body or mass portion, usually of lead, and a retaining clip, whereby the weight may be attached to a wheel rim. Such wheel weights are normally formed on die-casting machines, wherein lead is injected into the die cavity, and the retaining clip has been previously located within the die cavity so as to be partially embedded in the lead body to produce a rigid connection and assembly between the body and clip. In that the retaining clip must be accurately located within the die cavity prior to casting, and as the configuration of the clip is such that it is not readily released from the die, it has been the conventional practice to cast wheel weights one at a time. Normally, the operator manually loads the retaining clip into the die cavity and, after the wheel weight has been formed by molding, the operator removes the single assembled wheel weight from the cavity.

It is a basic object of the invention to provide injection die structure having a sequence of operation which is suitable for either single or multiple wheel weight casting, wherein removal of the wheel weight from the die cavity and ejection of the sprue may be accomplished automatically.

Another object of the invention is to provide die-casting structure capable of simultaneously casting a plurality of wheel weights wherein the retaining clips may be automatically loaded into all of the die cavities simultaneously, if desired, and wherein the retaining clips are automatically released from the die cavity after completion of the casting operation, due to relative movement between the die parts retaining the clip with the cavity.

A further object of the invention is to provide a die-casting apparatus capable of producing wheel weights wherein a minimum of actuating means are required to produce sequential operation of the die structure, and lost motion interconnecting means are employed between several of the die components to provide the desired sequential operation.

Yet a further object of the invention is to provide a die structure for simultaneously casting a plurality of wheel weights wherein a wheel weight retaining clip is located on a ledge defined on one of the die elements, and wherein such die element consists of a plurality of die parts capable of being separated on their common support means, whereby separation of the die parts releases the retaining clip from the ledge.

These and further objects of the invention arising from the details and relationships of components of an embodiment thereof will be apparent from the following description and accompanying drawings wherein:

FIG. 1 is a front, sectional, elevational view of one of the support plates on which die structure is mounted, as taken from the direction of the opposed die along section I—I of FIG. 9,

FIG. 2 is a front, elevational, sectional view of the other support plate on which the retainer clip supporting dies are mounted as taken along section II—II of FIG. 9,

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omitting the clip loader, only one-half of the support plate being shown, the other half of the support plate being similar to that die half illustrated,

FIG. 3 is a longitudinal, elevational, sectional view of the die structure of the invention, as related during the casting operation, as taken along section III—III of FIG. 4,

FIG. 4 is a detail, enlarged, plan, sectional view illustrating the relationships of a pair of cooperating dies during the casting operation, as taken along section IV—IV of FIG. 3, a detail, sectional, cutaway portion of the sprue port being illustrated,

FIG. 5 is a detail, plan, sectional view similar to FIG. 4, illustrating the first phase of die structure operation after casting,

FIG. 6 is a detail, plan, sectional view similar to FIG. 5, illustrating the second phase of die structure operation after casting,

FIG. 7 is a detail, plan, sectional view similar to FIG. 6, illustrating the die structure relationship during the third and fourth phases of structure operation after casting, wherein the sprue is ejected from the die structure and the wheel weight is released from the die,

FIG. 8 is a detail, plan view as taken from the upper side of FIG. 3, illustrating the relationship of the die components during casting, which provide the lost motion connection for ejecting the sprue,

FIG. 9 is a longitudinal, elevational, sectional view illustrating the die structure in its "open" position, wherein wheel weight retaining clips are being loaded into the dies, and

FIG. 10 is an enlarged, detail, perspective view of the clip supporting ledge die structure therefor, and the clip is shown in phantom lines.

The die structure of the invention is intended to be used with any conventional injection die-casting machine capable of producing the clamping pressures and material injection capacities necessary to meet the die requirements. The die structure is employed with a machine capable of casting lead, and the conventional machine structure will include a movable platen in opposed relation to a stationary platen through which the molten lead is injected into the die. While any conventional die-casting machine may be employed with the die structure of the invention, by way of example, a Lester 125 ton die-casting machine Model No. HP-1/2Z-SF is suitable.

With reference to FIGS. 3, 4, and 9, the die structure of the invention includes a backing plate 10, composed of plates 12, 14, and 16, affixed together. The backing plate 10 is adapted to be attached to the stationary platen of the die-casting machine. The backing plate 10 includes a centrally disposed opening 18 through which the injection supply conduit 20 extends.

The die structure also includes a die-operating plate 22 which is affixed to the die-casting machine movable platen by means of attachment plates 24, having transversely extending grooves for cooperation with the die-casting movable platen structure. As the die-casting machine movable platen is moved toward and away from the stationary platen, the die-operating plate 22 will move therewith. An expansible motor, such as the fluid or compressed air type, not shown, is mounted upon the movable platen for movement therewith, and is connected by means of an actuating rod 26 to a plate 28. The plate 28 is directly connected to a die support plate 30 by means of connecting rods 32 which slidably extend through the die-operating plate 22. Thus, it will be appreciated that, upon the die-casting machine movable platen being translated toward and away from the stationary platen, the plates 22, 28, and 30, will normally move as a unit therewith.

A second die support plate 34 is located adjacent backing plate 10 in parallel opposed relation to die support plate 30, and to maintain alignment between the plates 30 and 34, four guide rods, 36, FIG. 1, are mounted upon the plate 30 and slideably cooperate with bores defined within guide sleeves 38 mounted upon plate 34.

The die structure illustrated is capable of simultaneously casting eight wheel weights, and it will be appreciated that the inventive concept may be employed in the simultaneous casting of a fewer or greater number of weights.

The die support plate 34 is provided with a pair of vertically extending rectangular recesses 40, FIG. 7, defined on the side facing the die support plate 30. The recesses 40 are located symmetrically with respect to the vertical center line of the support plate 34, and each recess receives a plurality of wheel weight dies 42, having a wheel weight body-defining cavity 44 defined therein adjacent a clip-receiving cavity 46. The dies 42 are maintained within the recesses 40 by screws 47, and each of the dies is provided with internal passages, not shown, which communicate with cooling water conduits 48, FIG. 1, whereby cooling water may be circulated through the dies. The die support plate 34 is also provided with vertically extending recesses in which abutment members 50 are affixed. The abutment members 50 each include a wedge abutment surface 52 which cooperates with the die parts mounted upon the plate 30, as will be described. An abutment member 50' is centrally located on plate 34 and includes a pair of wedge abutment surfaces 52. Horizontally extending recesses 54 are also defined on the support plate 34 in substantial horizontal alignment with the center of the dies 42. The recesses 54 provide a clearance for the ends of the die-actuating cam elements mounted upon plate 22 when the die structure is in the casting relationship. Recesses 56 are defined within the upper and lower edges of the plate 34 for slidably supporting sprue-ejecting apparatus, as will be described later. The tubular guide sleeves 38 affixed to the support plate 34 slideably cooperate with bores 58 defined in the backing plate 10 to guide the plate 34 relative to the backing plate.

Four bar elements 60 are affixed to the support plate 34 by rectangular dowel pins 62, and extend toward the movable platen of the die-casting machine. Each bar 60 is provided with a slot 64 through which a headed bolt 66, mounted within the ends of the plate 30, extends. The bolts 66 and the slots 64 thereby establish a lost motion connection between the plates 30 and 34, as will be described later. Each of the dies 42 is provided with a conical sprue passage 68 communicating with a recess 70 defined in the surface of the backing plate portion 16 adjacent the back of the support plate 34. The small end of the sprue passage 68 communicates with the die cavity 44.

The vertically extending recesses 70 each communicate with the four dies and the sprue passages thereof mounted upon each side of the vertical center of the support plate 34. Horizontally extending primary recesses 72 are also defined in the face of the back-up plate portion 16 adjacent the support plate 34, establishing communication between the primary sprue port 74 and the recesses 70. The configuration of the recesses 70 and 72 will be appreciated from the dotted lines shown in FIG. 1. The seat 76 mounted upon the backing plate 10 forms the sprue port and cooperates with the injection supply conduit 20, FIG. 4, whereby the lead may be injected into the die structure.

The sprue-ejecting apparatus includes an opening 78 defined through the backing plate portion 16 in alignment with each of the sprue passages 68 defined in the dies 42. A cylindrical plunger 80 is slideably located within each of the openings 78, and is closely fitted therewith to prevent the flow of lead past the plunger. The outer ends of the plungers 80 are provided with enlarged heads and are affixed to a plate 82 by a plate 84. Rectangular connecting rods 86 are affixed to the plate 84, FIG. 3,

and are slideably received within the recesses 56 defined on support plate 34 and extend toward plate 30. As will be apparent from FIG. 8, each of the rectangular rods 86 is provided with three longitudinally extending slots. The slots 88 are provided with shoulder portions so as to slideably receive a pair of headed bolts 90 threaded into the support plate 30. Thus, the headed bolts 90 prevent movement of the rods in a direction away from the support plate 30. The central slots 92 cooperate with dowel pins 94 mounted in the support plate 30. The length of the slot 92 is slightly less than that of the slots 88, whereby the engagement of the dowel pins 94 with the ends of the slots 92 produces a lost motion connection between the support plate 30 and the sprue ejection apparatus.

The support plate 30 includes a recessed surface 96 in which a plurality of parallel, horizontally extending grooves 98 are defined for receiving die guide members 100 on which shoulders 102 are defined. Bolts, not shown, extending through the back of the support plate 30 maintain the guide members 100 within their recesses. Four die assemblies 104 are mounted in vertically disposed relation on each side of the center line of the support plate 30. It will be appreciated that in FIG. 2 and FIGS. 4 through 7 only one-half of the support plate 30 is illustrated. In that both halves of the support plate 30 are identical, a description of the components on one-half of the support plate suffices for the entire support plate. Each die assembly 104 consists of two die parts 106 of similar configuration. However, one die part constitutes a right-hand part, while the other part constitutes a left-hand part. The die parts of a die assembly engage at a vertically disposed parting line, centrally disposed with respect to the die assembly, FIG. 2. The die parts are provided with a rear planar face which engages the support plate surface 96, and the horizontally disposed edges of the die parts are provided with a shoulder 108 which is overlapped by the shoulders 102 of the guide members 100. In this manner, the die parts 106 of each die assembly are slideably mounted upon the support plate 30 and are capable of movement in a horizontal direction.

A locating pin 110 is mounted within the support plate 30 and extends through openings defined in the die parts at the opposed ends thereof which define the parting, whereby the pointed end of the locating pin projects into the die cavity 112 defined in the die parts. The locating pin 110 is located immediately below the retainer clip supporting ledge 114, FIG. 10, which is also defined on each of the die parts 106 of each die assembly. The purpose of the locating pin 110 is to engage the retaining clip and maintain the clip at the proper location within the die cavity after the clip has been placed on the ledge 114, whereby the portion of the clip received within cavity 112 will be completely embedded in the lead.

Pairs of cylindrical pins 116, FIG. 4, are mounted upon the die-operating plate 22 and are symmetrically related to each associated die assembly and the die parts thereof. The cylindrical pins 116 of a pair are obliquely related with respect to each other in a horizontal direction. As will be apparent from FIG. 4, the pins diverge in the direction of the support plate 30. Openings 118 are provided within the support plate 30 to permit the pins 116 to extend therethrough, and obliquely related bores 120 are defined within the die parts 106 whereby the pins 116 may cooperate with the die parts. As the bores 120 are also cylindrical and closely, slideably receive the pins, they constitute cam surfaces relative to the pins. Thus, the pins 116 and bores 120 function as cam elements due to their interrelationship.

The outer vertically disposed edges of the die parts 106 are each provided with an obliquely related surface 122 which is adapted to cooperate with the abutment surface 52 of an abutment member mounted upon the support plate 34. Thus, as will be apparent from FIG. 4, when the die structure is closed, the engagement of the abutment surfaces 52 and 122 with the abutment surfaces of the die

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elements, will maintain the die parts 106 of each die assembly 104 in a tight abutting relationship at the parting line thereof, and in a positive manner prevent the die parts from separating. From the above described cooperation between the pins 116 and the bores 120, it will be appreciated that upon the support plate 30 and the die-operating plate 22 separating, the movement of the pins within the bores will cause the die parts 106 of a common die assembly to separate due to the interrelation of the pins with the bores.

The loading of the die structure previously described takes place when the die components are in an open relationship, such as that shown in FIG. 9. With the die in the open position, i.e., when the movable platen of the die-casting machine is at its greatest distance away from the stationary platen, the support plates 30 and 34 will be separated by a considerable distance and permit a wheel weight retaining clip loader 124, FIG. 9, to be inserted between the support plates. The loader 124 may include a plurality of magnets 126, each magnet adapted to hold a retainer clip 128 thereon, and by positioning the loader so that the clips are "hooked" over the ledges 114 and drawing downward upon the loader, the clips may be stripped from the loader and will be properly positioned on the die assemblies 106. The loader 124 may be manually operated, if desired, or may be mounted upon suitable automatically operated actuating means, not shown. It will be appreciated it is intended that, in a die capable of casting eight wheel weights, the loader 124 includes eight magnets 126, whereby all of the die assemblies 104 will be simultaneously provided with a wheel weight retaining clip.

When the die-casting machine movable platen is located at its minimum distance with respect to the fixed platen, the die components assume the relationships shown in FIGS. 3 and 4. Thus, during casting it will be appreciated that the recesses 70 and 72 and the back of the support plate 34 define passageways whereby communication is established between the complete die cavity formed by the die cavities 44 and 112, and the injection supply conduit 20. At this time the plungers 80 will be located within the openings 78, as shown in FIGS. 3 and 4.

During the casting operation, the abutment surfaces 52 will be engaging the inclined surfaces 122 of the die parts 106 and, thus, the die assembly 104, in effect, functions as an integral component. When the die structure is fully closed, as shown in FIGS. 3 and 4, the lead is injected through the conduit 20 into the recesses 70 and 72 and, thus, into the wheel weight die cavities through passages 68. The lead enters the cavities and forms the wheel weight 130. The portion of the wheel weight clip 128 within the cavity will be embedded within the lead and, thus, a firm assembly is accomplished between the body of the wheel weight and the retainer clip. As previously mentioned, the locating pins 110 insure that the portion of the retainer clip 128 within the die cavities is so located as to be properly embedded within the lead wheel weight body.

After casting has taken place and adequate cooling has occurred, the movable platen of the die-casting machine is withdrawn from the stationary platen. As viewed in FIGS. 4 through 7, such withdrawal would be in a downward direction.

As the die-operating plate 22, the support plate 30, and the plate 28 are all mounted upon the movable platen, these three plates will move away from the support plate 34. Due to the engagement of the wheel weight retaining clips 128 with the ledges 114, the wheel weight 130 will remain within the cavities 112 of the die assemblies 104, and the wheel weight sprues break at the opening wherein the sprue passages 68 intersect the die cavities 44.

The plates 22, 28, and 30, are withdrawn from the support plate 34 without the occurrence of movement of the support plate 34 until the position shown in FIG. 5 is

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reached. At the position shown in FIG. 5, the bolts 66 engage the ends of the slots 64 located the greatest distance from the support plate 34. It will be appreciated that a lost motion interconnection between the plate 30 and the bars 60 exists until the relationship shown in FIG. 5 is accomplished.

Upon the bolts 66 engaging the ends of the slots 64, further withdrawal of the movable die-casting machine platen produces movement of the support plate 34 away from the backing plate 10. Such action withdraws the sprue passages 68 from the sprue and causes the support plate 34 to move relative to the rods 86. Thus, as the support plate 34 moves away from the backing plate 10, the bolts 90 and pins 94 will be sliding within the slots 88 and 92, respectively. FIG. 6 illustrates the maximum position of the support plate 34 from the backing plate 10, which may take place before the sprue ejection apparatus is activated. In FIG. 6 the bolts 90 and the pins 94 would be located adjacent the right ends of the slots 88 and 92, as appearing in FIG. 8.

Further movement of the movable platen and the plates 30 and 34 away from the stationary platen causes the pins 94 to move the rods 86 in the direction of movement of the support plate 34. This action moves the plungers 80 within the openings 78 to eject the sprue within the recesses 70 and 72, and the sprue then falls to the lower regions of the die-casting machine in the well-known manner. The relationship of the components of the sprue ejection structure, at the completion of the sprue ejection operation, will be as shown in FIG. 7.

After the sprue has been removed from the die structure, the fluid motor operatively associated with the actuating rod 26 is actuated to move the plate 28 and, thus, the support plate 30 toward the support plate 34, as shown in FIG. 7. This action produces a relative movement between the bores 120 of the die parts 106 and the cylindrical pins 116. Such relative movement moves the die parts 106 of each die assembly 104 away from each other separating the die parts along the central parting line. The movement of the support plate 30 toward the support plate 34 is sufficient to cause a separation between the associated die parts 106 greater than the width of the wheel weight retaining clip 128. It will be appreciated that as the die parts 106 separate, the associated ledge 114 retaining the wheel weight parts is also separating. Since the locator pins 110 project into the die cavity 112, the locator pin forms a small depression within the wheel weight 130, which is sufficient to maintain the wheel weight in its original position, relative to the support plate 30, as the die parts 106 are separating. Thus, upon the die parts 106 separating to an extent whereby the width between the die parts becomes slightly greater than the width of the wheel weight retaining clip 128, the wheel weight assembly falls from the die cavity 112 into a container below the die structure.

Therefore, it will be appreciated that all eight of the die assemblies 104 are simultaneously actuated to release the wheel weights therefrom. After the wheel weights have dropped from their die cavities, the fluid motor actuating rod 26 is reversed to bring the support plate 34 back into engagement with the die-operating plate 22, and pins 116 will then bring the die parts 106 of each assembly 104 together. At this time the die components will be of the relationship shown in FIG. 9. The loader 124 is again inserted between the support plates 30 and 34, and new wheel weight retaining clips 128 are mounted on the ledges 114 of the die assemblies 104, and the die-casting machine movable platen is again moved to the minimum position with respect to the stationary platen, whereby the die structure relationship shown in FIGS. 3 and 4 is again produced. The cycle has thus been completed and it will be appreciated that during each casting and unloading operation eight wheel weights will be simultaneously formed.

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By interconnecting the support plate 34 to the plate 22 by the lost motion connection produced by the bolts 66 and the slots 64, proper sequence of movement of the support plate 34 is assured. Likewise, by interconnecting the sprue-ejecting apparatus with the support plate 34, by means of the pins 94 and the slots 92, the sprue-ejecting apparatus will be properly timed. As both operations are powered by the movement of the die-casting machine movable platen, no special power or motive means is required. The only separate actuating means necessary in the practice of the invention is the small expansible chamber motor mounted on the movable platen which actuates the rod 26.

While the die structure of the invention has been illustrated and described as forming a plurality of wheel weights, it will be understood that the inventive concepts may be employed in similar die structure forming a single weight. In such instance only one die would be mounted on the plates 30 and 34, and the recesses 70 and 72 need not be employed, as the sprue port would directly communicate with the single passage 68.

It will be appreciated that various modifications to the disclosed embodiment will be apparent to those skilled in the art without departing from the spirit and scope thereof, and it is intended that the invention be defined only by the scope of the following claims.

We claim:

1. Apparatus for simultaneously casting a plurality of wheel weights comprising, in combination, a first support plate having first and second sides, a second support plate having first and second sides, means mounting said support plates for relative movement toward and away from each other, said first sides of said plates being in opposed relation and adapted to be adjacently disposed during casting, a movably mounted die-operating plate disposed adjacent said second side of said first support plate, a backing plate disposed adjacent said second side of said second support plate, means connected to said first support plate adapted to move said first support plate and die-operating plate away from said second support plate, a plurality of die parts movably mounted on said first side of said first support plate, cavities and wheel weight clip-retaining means defined in said die parts whereby a pair of said die parts define a first wheel weight cavity upon the die parts of a pair being disposed adjacent each other, positioning means interconnecting said die parts and said die-operating plate whereby separation of said first support plate and said die-operating plate separates the die parts defining a common first cavity and releases the wheel weight and clip assembly retained therein, actuating means adapted to selectively separate said die-operating plate and said first support plate, a plurality of second wheel weight cavities defined in said first side of said second support plate in opposition to and aligned with said first wheel weight cavities whereby upon said support plates being contiguously disposed during casting and first and second wheel weight cavities define a complete wheel weight cavity, a plurality of injection passages defined in said second support plate, a passage communicating with each second wheel weight cavity, a primary passage recess defined in said backing plate adjacent said second side of said second support plate communicating with said injection passages, a primary injection port defined on said second support plate communicating with said primary passage recess, and sprue-ejecting means extending through said backing plate adapted to engage a sprue within said backing plate primary passage, and operating means connected to said sprue-ejecting means.

2. In an apparatus for simultaneously casting a plurality of wheel weights, as in claim 1, wherein said positioning means interconnecting said die parts and said die-operating plate comprises a cam surface defined on each of said die parts, a plurality of cam elements mounted on said die-operating plate, each of said cam elements cooperating with a cam surface, said cam surfaces and

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elements being obliquely related to the direction of relative movement of said first support plate and said die-operating plate.

3. In an apparatus for simultaneously casting a plurality of wheel weights, as in claim 2, wherein said cam surfaces constitute a cylindrical bore defined in each of said die parts and said cam elements constitute a cylindrical pin received within each of said bores.

4. In an apparatus for simultaneously casting a plurality of wheel weights, as in claim 1, wherein lost motion means operatively interconnect said first support plate and said second support plate, whereby movement of said first support plate a predetermined distance from said second support plate moves said second support plate away from said backing plate.

5. In an apparatus for simultaneously casting a plurality of wheel weights, as in claim 4, wherein said operating means connected to said sprue-ejecting means includes a lost motion linkage interposed between sprue-ejecting means and said second support plate, whereby said sprue-ejecting means ejects a sprue from said backing plate on predetermined movement of said second support plate away from said backing plate.

6. In an apparatus for simultaneously casting a plurality of wheel weights, as in claim 1, wherein a first abutment surface is defined on each of said die parts, second abutment surfaces defined on said second support plate, said first and second abutment surfaces engaging and maintaining said die parts together defining a common first cavity during casting upon said first and second support plates being adjacently disposed.

7. Apparatus for casting wheel weights comprising, in combination, a backing plate, a first die support plate movable toward and away from said backing plate, a second die support plate interposed between said backing plate and said first die support plate movable toward and away from said backing plate, a die cavity defined on said second support plate, a pair of die parts mounted on said first support plate for movement toward and away from each other in a direction transverse to the relative direction of movement of said support plates, said die parts defining one-half of a mold cavity when contiguously related and adapted to align and cooperate with said die cavity to define a complete die cavity upon said first and second support plates being adjacently disposed, a clip ledge portion defined on each of said die parts together defining a clip-receiving ledge when said die parts are contiguous, a die-operating plate disposed adjacent said first support plate on the side thereof remote from said second support plate and movable toward and away from said first support plate, a pair of cam pins mounted on said die-operating plate and extending through guide openings defined in said die parts, each of said pins being associated with a die part, said pins and openings being obliquely related to the direction of movement of said die-operating plate relative to said first support plate and to each other whereby movement separating said first support plate and said die-operating plate separates said die parts and relative movement of said first support plate and die support plate toward each other moves said die parts toward each other, an injection passage defined in said backing plate and said second support plate communicating with said die cavity, first means adapted to move said first support plate and die-operating plate relative to said backing plate, second means adapted to move said first support plate relative to said die-operating plate, and first lost motion means interconnecting said second support plate and said die-operating plate, whereby predetermined movement of said first support plate and die-operating plate away from said second support plate removes said second support plate from said backing plate, movement of said die parts away from each other releasing a wheel weight clip mounted upon said ledge.

8. Apparatus for casting wheel weights as in claim 7 wherein sprue ejection means is mounted upon said back-

ing plate communicating with said injection passage, and second lost motion means interconnecting said sprue ejection means and said second support plate operating said sprue ejection means upon said second support plate moving a predetermined distance from said backing plate.

5 9. Apparatus for casting wheel weights as in claim 7 wherein a pair of oblique abutment surfaces are defined on said second support plate, an oblique cam surface defined on each of said die parts adapted to engage an abutment surface when said first and second support plates are adjacently disposed, said abutment surfaces and cam surfaces being so disposed to the relative direction of movement of said first and second support plates that engagement of said surfaces forces said die parts toward each other.

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