

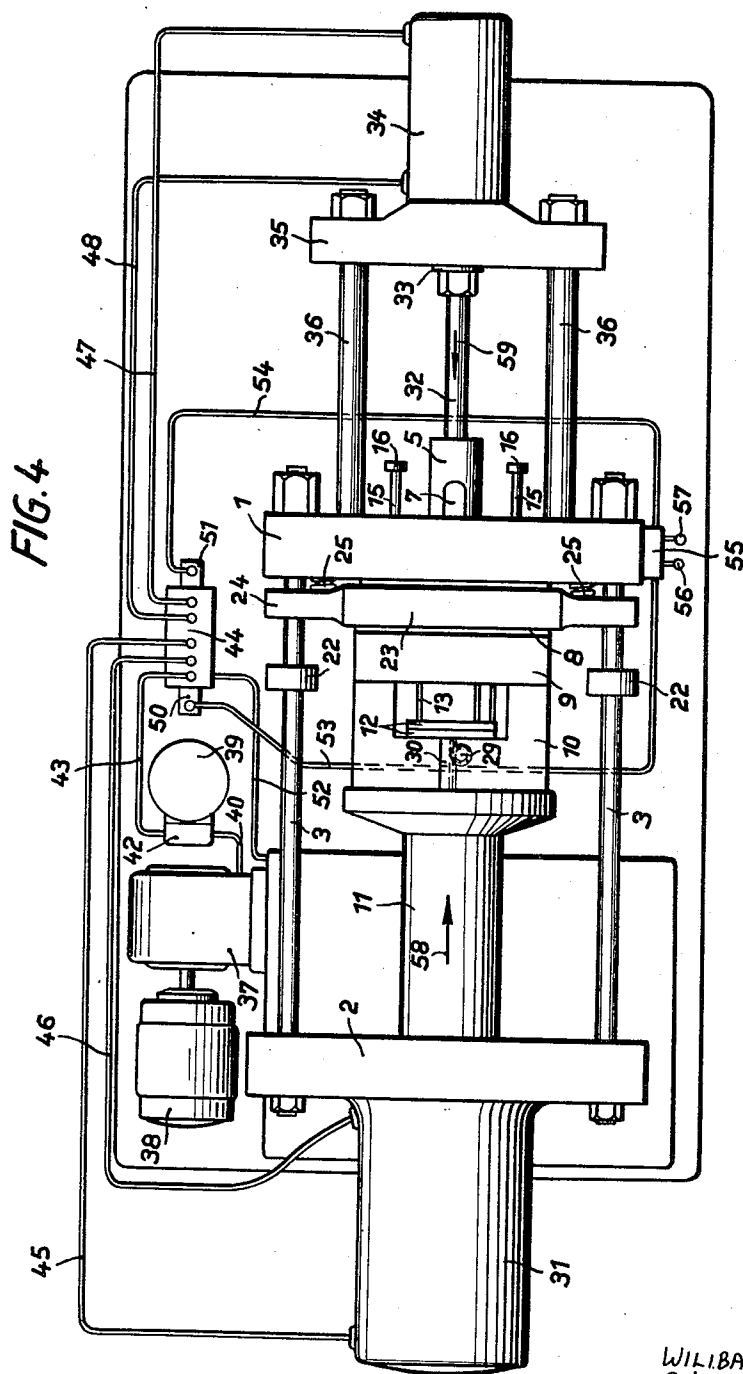
Oct. 8, 1957

W. VENUS
DIE CASTING APPARATUS

2,808,627

Filed April 20, 1954

2 Sheets-Sheet 2



INVENTOR:
WILIBALD VENUS
BY:

Indael [Signature]
281

1

2,808,627

DIE CASTING APPARATUS

Willibald Venus, Munich, Germany, assignor to Hahn & Kolb, Werkzeugmaschinen und Werkzeuge, Stuttgart, Germany

Application April 20, 1954, Serial No. 424,423

Claims priority, application Germany April 25, 1953

11 Claims. (Cl. 22—68)

The present invention relates to improvements in die-casting apparatus of the "cold-chamber" type, and more particularly to such apparatus with a pressure chamber or "shot sleeve" which is disposed substantially vertically to the parting face of the two halves of the die.

Die-casting apparatus of this type generally consist of a two-part die comprising a cover die and an ejector die, and a pressure chamber or shot sleeve with an opening therein into which the molten metal is poured by a ladle, then being forced under high pressure by a plunger out of such shot sleeve and through a gate in the outer half of the die, i. e. the cover die, and thence through suitable distributing channels into the die cavity. Inasmuch as it is practically impossible to predetermine the exact amount of molten metal required to fill the die cavity as well as the distributing channels leading to such cavity and the gate in the cover die, a certain excess of molten metal must be poured into the shot sleeve. When all the cavities in the die are completely filled, a certain residue of molten metal thus remains at the point where the shot sleeve is pressed against the cover die and where the cross sectional size of the gate is the smallest. Such molten metal upon cooling forms into a slug which must be removed before the next casting operation can take place. For such removal various means have been suggested, such as, for example, a knock-off rod operated by a hydraulic cylinder to move in a direction transverse to the axis of the die so as to knock or shear off the slug from the outer face of the cover die when the casting operation has been completed.

It is the principal object of the present invention to devise a mechanism which permits the removal of the slug by very simple and effective means and does not require any complicated machinery for such purpose.

Another object of the invention resides in devising a mechanism which automatically severs the slug from the residue or plug of metal remaining in the gate of the die, and which thereby facilitates the removal both of the slug as well as such plug from the die, and considerably increases the speed of operation, and thus the output of the die.

Another object of the invention is to design a die-casting apparatus to be provided with a horizontal pressure chamber which can also be used for dies which were principally designed for apparatus with a vertical pressure chamber and a lateral gate.

The principal feature of the invention for carrying out these objects resides in providing a slug removing element intermediate the mouth of the pressure chamber or shot sleeve and the outer face of the cover die, and in mounting such element so as to be movable in axial direction of the die. Such element is provided according to the invention with a gate which continues the narrow gate of the cover die and during the actual casting operation is pressed tightly against the relatively wide mouth of the pressure chamber or shot sleeve so that, when the cover die is subsequently moved away from the shot sleeve, such element will also separate from the mouth of the

2

shot sleeve and retain the metal residue until, near the end of its own inward stroke, it will tear off the plug formed in the gate of the cover die, and the gate within such element, from the remaining metal slug which will then drop off the outer face of such element of its own accord and without requiring any special knock-off rod or similar mechanism. Such automatic removal of the remaining slug is greatly facilitated by making the gate of the smallest cross sectional size at its extreme outer end facing the shot sleeve. When the metal plug formed in the gate is then torn off, the slug remains on the flat outer face of the closing element in the shape of a flat metal disk which, as there is no web or other retaining residue to hold it, will then drop off of its own accord.

A supplemental feature of the invention is to design the gate of the cover die of a size and shape which gradually increases in width toward its inner end, and preferably to make the gate in the slug-removing element of a similar shape but smaller cross sectional size.

Another feature of the invention is to provide a very simple means for first permitting the cover die together with the slug-removing element to separate, and move away from the shot sleeve when the casting operation has been completed, then to block the further movement of the slug-removing element while continuing the movement of the cover die for a short distance, whereby the plug is torn off from the relatively thin stem of metal formed in the gate or gates, and then to block further movement of the cover die to permit the plunger operating the ejector die to withdraw the latter together with the casting and the remaining stem from the cover die.

Still another feature of the invention resides in a simple mechanism for ejecting the casting from the die cavity in the ejector die.

Further objects, features, and advantages of the present invention will appear from the following detailed description thereof and the accompanying drawings in which

Fig. 1 illustrates, more or less diagrammatically, a longitudinal section through the die with a horizontal shot sleeve shown in the casting position;

Fig. 2 is a view similar to Fig. 1 but showing the die opened after the casting operation is completed;

Fig. 3 shows a similar view of a modified apparatus in the casting position; while

Fig. 4 is a general layout of the entire molding apparatus.

Referring particularly to Figs. 1 and 2 of the drawings, the apparatus consists primarily of a stationary front plate 1, a back plate 2 carrying the ejector die, and tie bars 3 connecting the two plates 1 and 2. The front plate 1 has fitted therein a horizontal shot sleeve 5, which forms a cylinder in which a plunger 6 is movable under hydraulic pressure to force the molten metal which is poured into the opening 7 through the front part of the shot sleeve, constituting a pressure chamber, and then through a gate in the cover die 8 into the die cavity intermediate the cover die 8 and the ejector die 9. The ejector die 9, together with the die base 10, is mounted on the plunger 11. At the rear of the ejector die 9 an ejector plate 12 is mounted and connected with the die cavity by ejector pins 13 so as to be movable under hydraulic pressure in an axial direction toward the die cavity 20.

According to the invention, a special slug-removing element is provided intermediate the mouth of the shot sleeve 5 and the cover die 8 and consisting of a plate 14 and a central insert 17 therein which, during the casting operation, is adapted to enter the mouth of the shot sleeve 5. Plate 14 is mounted on the rods 15 which pass through bores in the front plate 1 and have heads 16 at their outer ends to restrict their inward movement away from the shot sleeve 5.

In the embodiment of the invention shown in Figs. 1 and 2, the plate 14 has conical outer edges adapted

3

to fit into a corresponding recess in the cover die 8 provided with a conical seat 27. The gate is formed by axial bores 18 and 19 in the insert 17 and the cover die 8 respectively, and these bores are conically enlarged toward the die cavity 20 and communicate with the die cavity 20 through distributing channels 28 in a core 21 which is removably secured in the die plate 9.

The cover die 8 is mounted in a frame 23 which is horizontally movable on eyes 24 along the tie bars 3, such movement of the frame 23 and the cover die 8, however, being limited in an inward direction, i. e. away from the mouth of shot sleeve 5, by stops 22 on the tie bars 3. Stops 22 are secured to tie bars 3 at such a distance from the front plate 1 that the heads 16 of the tie rods 15 of the unit 14, 17 abut against the front plate 1 shortly before the cover die 8 has completed its reverse or inward movement, so that, as shown in Fig. 2, toward the end of such movement the plate 14 with the insert 17 is separated from the cover die 8 and slightly spaced therefrom. Such reverse movement of the cover die 8 is accomplished through the action of springs 25 intermediate the front plate 1 and the frame 23.

For actuating the ejector 12 and 13, the invention provides a pinion 29 cooperating with a rack 30, such pinion being rotated at the end of the opening or rearward stroke of the ejector die 9 either by suitable manually operated means or by hydraulic means, to push the ejector 12, 13 forwardly and thus to eject the ready casting from the die cavity 20.

For a better illustration of the operation of the new apparatus and the process carried out thereby, the entire system required therefor is shown in Fig. 4. The plunger 11 for opening and closing the die is connected to a double-acting hydraulic cylinder 31 mounted on the back plate 2. The plunger 6 which forces the molten metal out of the shot sleeve 5 into the die, is secured by a connecting rod 32 to a plunger 33 in the double-acting hydraulic cylinder 34 which is mounted on a plate 35 which, in turn, is rigidly secured to the front plate 1 of the apparatus by tie bars 36. The two hydraulic cylinders 31 and 34 are supplied with compression fluid by a pump 37 which may be driven, for example, by an electric motor 38. Pump 37 acts in the usual manner upon an hydraulic accumulator 39 through a pipe 40 leading to the check valve 42 of the accumulator 39, from which a pipe 43 then leads to the housing 44 of a control valve. Pipes 45 and 46 then lead from the control valve 44 to the double-acting hydraulic cylinder 31, with the compression fluid flowing through the pipe 45 to carry out the forward stroke of the plunger 11 to close the die 8, 9, and through the pipe 46 to carry out the return stroke of plunger 11. Also connected to the control valve 44 are pipes 47 and 48 leading to the double-acting hydraulic cylinder 34 for carrying out the compression stroke and the subsequent return stroke of the plunger 33. The control valve 44 also carries auxiliary cylinders 50 and 51 for controlling the supply of compression fluid to the hydraulic cylinder 31 for opening and closing the die, and to the hydraulic cylinder 34 for operating the plunger 32. The drain pipe of the control valve 44 is shown at 52. The auxiliary cylinders 50 and 51 are connected by pipes 53 and 54 to a remote control valve 55 located at the operator's stand of the apparatus and provided with control levers 56 and 57 for operating the double-acting hydraulic cylinders 31 and 34, respectively. In place of such remote hydraulic control, it is also possible to use an electric control by means of push buttons, magnets, or pilot motors.

The operation of the apparatus as shown in Fig. 4 is as follows:

The two parts 8 and 9 of the die are closed by the plunger 11. For this purpose, control lever 56 is actuated whereby the piston of the auxiliary cylinder 50 is moved so as to supply pressure through the pipe 45 to the double-acting hydraulic cylinder 31 to move the

4

plunger 11 forwardly in the direction indicated by the arrow 58. By such forward movement, the ejector die 9 is moved against the cover die 8 and proceeds with the latter toward the front plate 1 of the apparatus. Near the end of such forward movement, the plate 14 together with the conical insert 17 comes in contact with the inner surface of the front plate 1 so that insert 17 tightly closes the mouth of the shot sleeve 5. In this position, plunger 6 is in its rear position, free of the opening 7.

Next, molten metal is poured, for example, by a ladle, through the opening 7 into shot sleeve 5. Then, by actuating the control lever 57, the plunger of the auxiliary cylinder 51 is moved so as to supply pressure through pipe 47 to the double-acting hydraulic cylinder 34 to move plunger 6 inwardly to force the molten metal through the gate 18, 19 into the die cavity 20. After completely filling die cavity 20, the residue of metal remains in the form of a slug 26 in the forward end of the shot sleeve 5, but under the entire pressure of the plunger 33.

By adjusting the control lever 56 the plunger of the auxiliary cylinder 50 is then moved so as to supply pressure through pipe 46 to the double-acting hydraulic cylinder 31 to move plunger 11 including the die base 10 and the ejector die 9 in a direction opposite to that indicated by the arrow 58. During such rearward movement of the plunger 11, compression springs 25 acting upon the frame 23 and the cover die 8 thereon, first permit the latter to follow so as to retain the two parts of the die 8 and 9 still in a closed position and in contact with each other. Since during this time the plunger 33 is still under pressure and acting in the direction indicated by the arrow 59, the plunger 6 simultaneously follows the rearward movement of the cover die 8 and pushes the metal slug 26 out of the shot sleeve 5. By providing a suitable stop in the hydraulic cylinder 34, the forward movement of plunger 33 is stopped as soon as the forward end of plunger 6 has emerged from the mouth of the shot sleeve 5, as shown in Fig. 2.

Since the slug 26 is connected by the cooling metal to the plug 41, filling the gates 18 and 19, the cover die 8 and the insert 17 with the plate 14 thereon are likewise connected. Plate 14 thus follows the retracting movement of the cover die 8 caused by the action of springs 25 in the direction shown by the arrow 59 until the heads 16 of the rods 15 stop any further movement of plate 14 and the insert 17. Springs 25, however, continue to act upon the frame 23 and continue to take along the cover die 8 including the metal plug 41, since the latter, due to the conical shape of the gate 19 is unable to slide therein. The slug 26 is thus held in place by the insert 17 while the cover die 8 with the plug 41 in gate 19 continues its movement to tear off the plug 41 from the slug 26, the point of severance naturally being that of the least resistance, namely at the smallest cross sectional area of the metal residue, i. e. at the junction of plug 41 with the slug 26. Thus, slug 26 remains in the shape of a flat disk, and, as there is no other metal residue to hold it, it will drop off the face of the insert 17 automatically. In the meantime frame 23 and cover die 8 continue to move a short distance in the direction of arrow 59 until frame 23 hits upon the stops 22 on the tie bars 3. Cover die 8 is thus stopped, whereas ejector die 9 continues its movement in the direction opposite to arrow 58. Consequently, the two parts of the die separate and move apart, and the plug 41, formed by gates 18 and 19, which by contraction of the cooling metal remains on the distributing core 21, is taken along by the latter and withdrawn from the gate 19 of cover die 8. When the die is in a completely open position, as shown in Fig. 2, pinion 29 is turned by any suitable means, either manual or hydraulic, to actuate the rack 30 including ejector plate 12 thereon with the result that the ejector pins 13 eject the casting from the ejector die 9 and the die cavity 20 therein, and also withdraw the plug 41 formed by the

5

distributing channels 28 from the core 21. In the event that the slug 26, after the plug 41 formed by the gates 18 and 19 has been torn off, should stick to the insert 17, it may be easily removed therefrom by a slight tap with a suitable tool and will then drop off. The control lever 57 is then actuated so as to charge the hydraulic cylinder 34 with pressure from the auxiliary cylinder 51 through the pipe 48, whereupon the plunger 6 returns to its initial position to start a new cycle of operation.

The diagrammatic illustration of the invention according to Figs. 1 and 2 is merely intended to show the basic idea thereof. Various details thereof may be modified to comply with the specific requirements. For example, for the compression springs 25, hydraulic pistons may be substituted. Also, in place of the hydraulic plunger 11 any other suitable mechanism may be provided for opening and closing the die. The frame 23 which carries the cover die 8 may also be of a different design from that illustrated, and it may be guided in a different manner. The frame 23 need also not be mounted on the tire bars of the apparatus, as shown, but any other suitable manner of mounting may be applied.

In the actual operation of die-casting foundries the demand often occurs for dies made especially for die-casting apparatus with a vertical pressure chamber and a lateral gate, which can also be used for such apparatus with a horizontal pressure chamber or shot sleeve. Since, in almost every case, the dies are tempered, it is not possible simply to convert the gates and channels. On the other hand, for vertical pressure chambers, it is usually prohibitive to build the pressure chamber so as to extend through one half of the die up to the parting face, as it is generally done in apparatus with a horizontal pressure chamber, inasmuch as the apertures or cavities of the die are much more closely adjacent each other in accordance with the smaller diameter of the filling opening, so that there is no space between them for the pressure chamber. This difficulty is also overcome by the present invention and it is therefore only necessary to modify the construction as shown in Figs. 1 and 2 in accordance with Fig. 3. In such a case, adapter plate 14 is no longer provided with a conical seat 27 to be fitted into the cover die 8, but it abuts against the face of the cover die 8 with its entire surface. The insert 17 is then designed so that one side thereof acts as a closure of the pressure chamber or shot sleeve, and that it extends completely through the adapted plate 14 and at the opposite side fits into the gate opening 60 of the die already existing. Thus, it may be said that the insert 17 takes over the function of the gate as it is provided in die-casting apparatus with a vertical pressure chamber. Otherwise, the operation of the modified embodiment as shown in Fig. 3 is similar to that shown in Figs. 1 and 2. The gate also has its smallest cross sectional size at the point where it merges with the pressure chamber or shot sleeve 5, and this size is preferably made less than one-third of the cross sectional size of the pressure chamber.

While the foregoing description sets forth in detail what I regard as the preferred embodiments of my invention, it is to be understood that numerous changes may be made therein without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim as new is:

1. Die-casting apparatus having a two-part die, means for opening and closing said die, and a shot sleeve extending transverse to the parting face of said die, a plunger in said shot sleeve, the die part adjacent said shot sleeve having a gate therein, said gate communicating with said shot sleeve when said die is in a closed position, a separate gate element intermediate said die part and said shot sleeve and independently movable in axial

6

direction of said shot sleeve, said gate element having a gate therein communicating with the gate in said die part and adapted to be pressed against the mouth of said shot sleeve when said die is in the closed position for carrying out the casting operation, said die part and said gate element being adapted to be interconnected by the metallic residue formed in said gates during said casting operation, so that said gate element separates from said mouth when said die retracts to start its opening movement, thereby taking along said gate element through the interconnecting metal residue in said gates, and means for restricting the retracting movement of said gate element while said die part continues its retracting movement so as to tear off said residue from the metal slug formed intermediate said plunger and said gate element.

2. Die-casting apparatus having a two-part die, means for opening and closing said die, and a shot sleeve extending transverse to the parting face of said die, a plunger in said shot sleeve, the die part adjacent said shot sleeve having a gate therein, said gate communicating with said shot sleeve when said die is in a closed position, a separate gate element intermediate said die part and said shot sleeve and independently movable in axial direction of said shot sleeve, said gate element having a gate therein communicating with the gate in said die part and adapted to be pressed against the mouth of said shot sleeve when said die is in the closed position for carrying out the casting operation, said die part and said gate element being adapted to be interconnected by the metallic residue formed in said gates during said casting operation, so that said gate element separates from said mouth when said die retracts to start its opening movement, thereby taking along said gate element through the interconnecting metal residue in said gates, and means for restricting the retracting movement of said gate element while said die part continues its retracting movement so as to tear off said residue from the metal slug formed intermediate said plunger and said gate element, said gates having their smallest cross sectional size immediately adjacent the outer surface of said gate element facing said shot sleeve, so that said residue is torn off said slug so as to leave said slug substantially in the form of a metal disk on the face of said gate element.

3. Die-casting apparatus having a two-part die, means for opening and closing said die, and a shot sleeve extending transverse to the parting face of said die, a plunger in said shot sleeve, the die part adjacent said shot sleeve having a gate therein, said gate communicating with said shot sleeve when said die is in a closed position, a separate gate element intermediate said die part and said shot sleeve and independently movable in axial direction of said shot sleeve, said gate element having a gate therein communicating with the gate in said die part and adapted to be pressed against the mouth of said shot sleeve when said die is in the closed position for carrying out the casting operation, said die part and said gate element being adapted to be interconnected by the metallic residue formed in said gates during said casting operation, so that said gate element separates from said mouth when said die retracts to start its opening movement, thereby taking along said gate element through the interconnecting metal residue in said gates, and means for restricting the retracting movement of said gate element, while said die part continues its retracting movement so as to tear off said residue from the metal slug formed intermediate said plunger and said gate element, said gates having their smallest cross sectional size immediately adjacent the outer surface of said gate element facing the mouth of said shot sleeve, the diameter of said smallest cross sectional size of said gates being less than one-third of the cross sectional inner diameter of said shot sleeve.

4. Die-casting apparatus having a two-part die, means for opening and closing said die, and a shot sleeve extending transverse to the parting face of said die, a plunger

in said shot sleeve, the die part adjacent said shot sleeve having a gate therein, said gate communicating with said shot sleeve when said die is in a closed position, a separate gate element intermediate said die part and said shot sleeve and independently movable in axial direction of said shot sleeve, said gate element having a gate therein communicating with the gate in said die part and adapted to be pressed against the mouth of said shot sleeve when said die is in the closed position for carrying out the casting operation, said die part and said gate element separating from said mouth when said die retracts to start its opening movement, said die part being adapted for taking along said gate element through the interconnecting metal residue in said gates, means for restricting the retracting movement of said gate element, while said die part continues its retracting movement so as to tear off said residue from the metal slug formed intermediate said plunger and said gate element, the cross sectional size of said gate in said die part at the point facing the adjacent end of the gate of said gate member being larger than the cross sectional size of said gate end of said gate member, said gates having their smallest cross sectional size immediately adjacent the outer surface of said gate element facing said shot sleeve, so that said residue is torn off said slug so as to leave said slug substantially in the form of a metal disk on the face of said gate element.

5. Die-casting apparatus having a two-part die, means for opening and closing said die, and a shot sleeve extending transverse to the parting face of said die, a plunger in said shot sleeve, the die part adjacent said shot sleeve having a gate therein, said gate communicating with said shot sleeve when said die is in a closed position, a separate gate element intermediate said die part and said shot sleeve and independently movable in axial direction of said shot sleeve, said gate element having a gate therein communicating with the gate in said die part and adapted to be pressed against the mouth of said shot sleeve when said die is in the closed position for carrying out the casting operation, said die part and said gate element being adapted to be interconnected by the metallic residue formed in said gates during said casting operation, so that said gate element separates from said mouth when said die retracts to start its opening movement, thereby taking along said gate element through the interconnecting metal residue in said gates, and means for restricting the retracting movement of said gate element while said die part continues its retracting movement so as to tear off said residue from the metal slug formed intermediate said plunger and said gate element, and means for restricting the further retracting movement of said die part when said metal slug has been torn off, the distance of said gate element from said shot sleeve when restricted by said restricting means associated therewith being sufficient to permit the removal of said slug from said gate element.

6. Die-casting apparatus having a two-part die, comprising a base and a cover, means for opening and closing said die, and a shot sleeve extending transverse to the parting face of said die, a plunger in said shot sleeve, said cover adjacent said shot sleeve having a gate therein, said gate communicating with said shot sleeve when said die is in a closed position, a separate gate element intermediate said die cover and said shot sleeve, and independently movable in axial direction of said shot sleeve, said gate element having a gate therein communicating with the gate in said cover and adapted to be pressed against the mouth of said shot sleeve when said die is in the closed position for carrying out the casting operation, said cover and said gate element being adapted to be interconnected by the metallic residue formed in said gates during said casting operation, so that said gate element separates from said mouth when said die retracts to start its opening movement, thereby taking along said gate element through the interconnecting metal residue in said gates, means for restricting the retracting movement of said gate element while said cover continues

its retracting movement so as to tear off said residue from the metal slug formed intermediate said plunger and said gate element, and means in said die base for ejecting the casting from said die cavity near the end of said retracting movement thereof.

7. Die-casting apparatus comprising a stationary shot sleeve, said sleeve having a filling opening adapted to receive a quantity of molten metal, a piston movable in said sleeve, a die comprising a base and a cover adapted to fit with its rear side tightly upon said base, a separate gate element fitting tightly upon the front side of said cover, means for reciprocating said base relative to said stationary shot sleeve so that, when advancing from its rearward position toward said shot sleeve, said base first contacts the rear side of said cover so as to close the die, and then proceeds with said cover and the separate element thereon until said element abuts against the mouth of said shot sleeve, said die having a die cavity therein intermediate said base and said cover, a gate being formed in said cover and said gate element and in communication with said shot sleeve when said die is in its closed position, means for slidably mounting said gate element for movement relative to said shot sleeve, means for blocking such movement at a certain distance from said shot sleeve when said die opens, means for slidably mounting said cover for movement relative to said shot sleeve, means for blocking movement of said cover at a certain distance from said shot sleeve when said die opens, the distance of movement of said cover from said shot sleeve being slightly larger than that of said gate element, and means tending to separate said cover from said gate element when said base is retracted, so that when said base is in its forward position pressing said cover and gate element against the end of said shot sleeve and molten metal is poured into said shot sleeve, said plunger will force said metal through said gates into said die cavity and, after filling said cavity and said gate, will leave a metal slug intermediate said plunger and the face of said gate element, whereupon when said base is retracted and the metal residue in said gate interconnects said cover, gate, and slug, said separating means on said cover urging said cover and gate element to follow said base away from said shot sleeve until the blocking means of said gate element stop further movement thereof, while said separating means further urge said cover to follow said base, thereby tearing off the metal residue within the gates from said slug on the face of said gate element to drop off from said gate element, whereupon the blocking means of said cover stop further movement thereof while said base with the casting thereon is withdrawn from said cover.

8. Die-casting apparatus comprising a stationary shot sleeve, said sleeve having a filling opening adapted to receive a quantity of molten metal, a piston movable in said sleeve, a die comprising a base and a cover adapted to fit with its rear side tightly upon said base, a separate gate element fitting tightly upon the front side of said cover, means for reciprocating said base relative to said stationary shot sleeve so that, when advancing from its rearward position toward said shot sleeve, said base first contacts the rear side of said cover so as to close the die, and then proceeds with said cover and the separate element thereon until said element abuts against the mouth of said shot sleeve, said die having a die cavity therein intermediate said base and said cover, a gate being formed in said cover and said gate element and in communication with said shot sleeve when said die is in its closed position, means for slidably mounting said gate element for movement relative to said shot sleeve, means for blocking such movement at a certain distance from said shot sleeve when said die opens, means for slidably mounting said cover for movement relative to said shot sleeve, means for blocking movement of said cover at a certain distance from said shot sleeve when said die opens, the distance of movement of said cover from said shot

sleeve being slightly larger than that of said gate element, means tending to separate said cover from said gate element when said base is retracted, so that when said base is in its forward position pressing said cover and gate element against the end of said shot sleeve and molten metal is poured into said shot sleeve, said plunger will force said metal through said gates into said die cavity and, after filling said cavity and said gate, will leave a metal slug intermediate said plunger and the face of said gate element, whereupon when said base is retracted and the metal residue in said gate interconnects said cover, gate, and slug, said separating means on said cover urge said cover and gate element to follow said base away from said shot sleeve until the blocking means of said gate element stop further movement thereof, while said separating means further urge said cover to follow said base, thereby tearing off the metal residue within the gates from said slug on the face of said gate element to drop off from said gate element, whereupon the blocking means of said cover stop further movement thereof while said base with the casting thereon is withdrawn from said cover, and means in said die base for ejecting the casting from said die cavity near the end of said retracting movement thereof.

9. Die casting apparatus comprising, in combination, a pressure chamber means having an outlet opening; a gate element formed with a gate passage therethrough registering with said outlet opening, said gate passage having a cross section substantially smaller than the cross section of said outlet opening, said gate element being movable between an advanced position abutting at one side thereof on said pressure chamber means and a second position spaced from said pressure chamber means; die means located adjacent the other side of said gate element and formed with a molding chamber and with an inlet passage registering with said gate passage, said die means being movable toward said pressure chamber means to an advanced casting position abutting against said gate element and pressing the same against said pressure chamber means so that upon casting a residue is formed having a wider portion in said outlet opening and a constricted portion in said gate passage, said die means being movable away from said pressure chamber means to a retracted position spaced from said pressure chamber means a predetermined distance; and stop means restricting movement of said gate element away from said pressure chamber means in said second position spaced from said pressure chamber means a distance smaller than said predetermined distance so that said gate element is first taken along by said die means during movement of the same from said casting position to said retracted position due to the connection formed by the residue, whereupon said residue is torn off at said constricted portion when said stop means stop said gate element in said second position.

10. Die casting apparatus comprising, in combination, a pressure chamber means having an outlet opening; a gate element formed with a gate passage therethrough registering with said outlet opening, said gate passage having a cross section substantially smaller than the cross section of said outlet opening and narrowing toward said outlet opening, said gate element being movable between an advanced position abutting at one side thereof on said pressure chamber means and a second position spaced from said pressure chamber means; die means located adjacent the other side of said gate element and formed with a molding chamber and with an inlet passage registering with said gate passage, said die means being movable toward said pressure chamber means to an advanced casting position abutting against said gate element and pressing the same against said pressure

chamber means so that upon casting a residue is formed having a wider portion in said outlet opening and a constricted portion in said gate passage, said die means being movable away from said pressure chamber means to a retracted position spaced from said pressure chamber means a predetermined distance; and stop means restricting movement of said gate element away from said pressure chamber means in said second position spaced from said pressure chamber means a distance smaller than said predetermined distance so that said gate element is first taken along by said die means during movement of the same from said casting position to said retracted position due to the connection formed by the residue, whereupon said residue is torn off at said constricted portion when said stop means stop said gate element in said second position.

11. Die casting apparatus comprising, in combination, a pressure chamber means having an outlet opening; a gate element formed with a gate passage therethrough registering with said outlet opening, said gate passage having a cross section substantially smaller than the cross section of said outlet opening, said gate element being movable between an advanced position abutting at one side thereof on said pressure chamber means and a second position spaced from said pressure chamber means; die means including two die parts, one of said die parts being located adjacent the other side of said gate element and formed with an inlet passage registering with said gate passage, said two die parts together forming a molding chamber communicating with said inlet passage, said die means being movable toward said pressure chamber means to an advanced casting position in which said one die part abuts against said gate element and presses the same against said pressure chamber means so that upon casting a residue is formed having a wider portion in said outlet opening and a constricted portion in said gate passage, said die means being movable away from said pressure chamber means; means for moving said other die part; first stop means restricting further movement of said one die part away from said pressure chamber means in a retracted position of said die means so that the other die part separates from said one die part during further movement thereof, said one die part in said retracted position being spaced from said pressure chamber means a predetermined distance; second stop means restricting movement of said gate element away from said pressure chamber means in said second position spaced from said pressure chamber means a distance smaller than said predetermined distance so that said gate element is first taken along by said die means during movement of the same from said casting position to said retracted position due to the connection formed by the residue whereupon said residue is torn off at said constricted portion when said second stop means stop said gate element in said second position.

References Cited in the file of this patent

UNITED STATES PATENTS

1,916,495	Shaw	July 4, 1933
1,943,680	Lester	Jan. 16, 1934
2,065,213	Dolan et al.	Dec. 22, 1936
2,368,818	Freenor	Feb. 6, 1945
2,494,777	Patterson et al.	Jan. 17, 1950
2,568,771	Smith	Sept. 25, 1951
2,570,613	Vinal	Oct. 9, 1951
2,587,070	Spillman	Feb. 26, 1952
2,612,666	McGarigal	Oct. 7, 1952

FOREIGN PATENTS

908,322	France	Sept. 3, 1945
50,004	Denmark	Mar. 11, 1935