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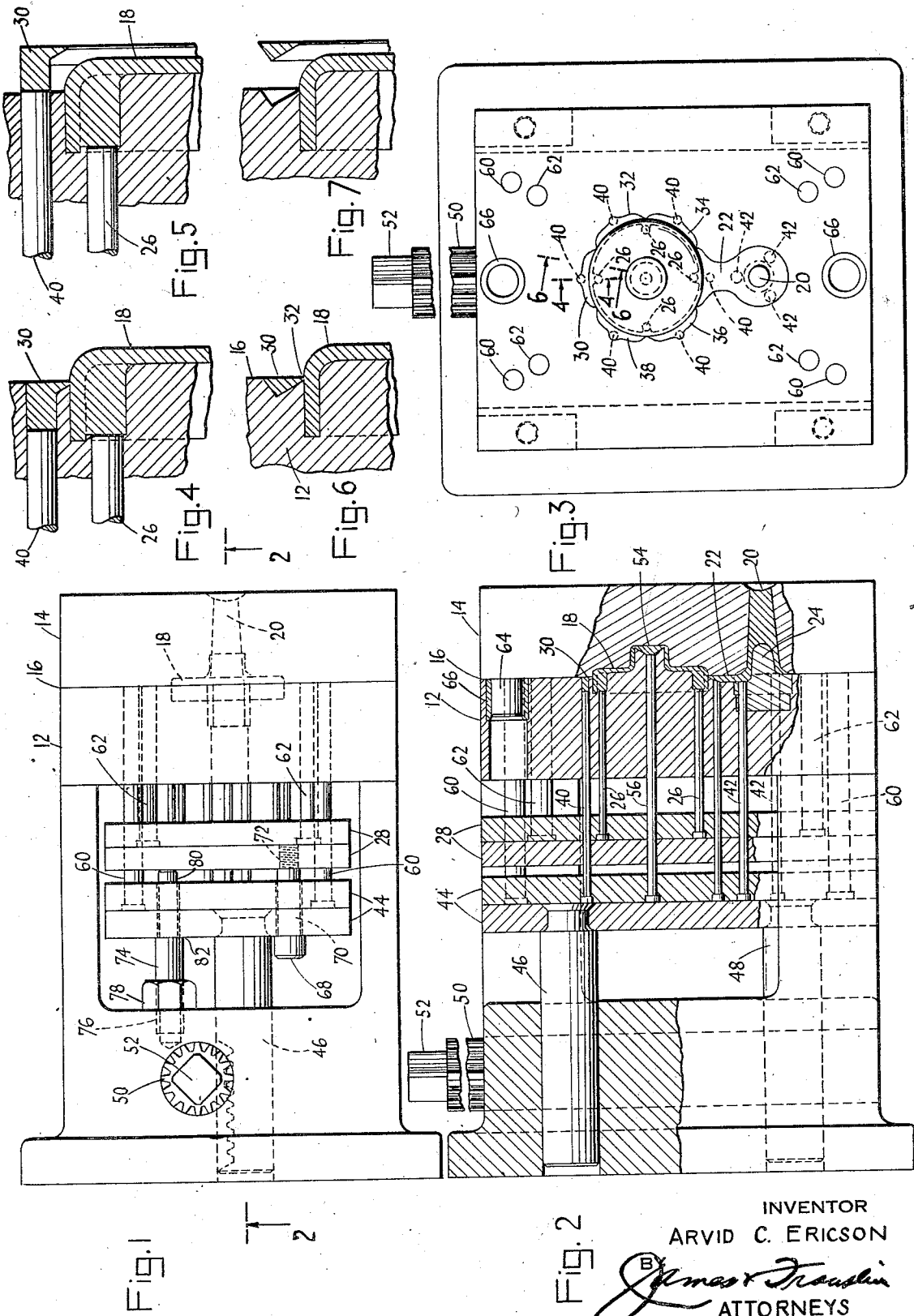
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COMBINED CASTING AND TRIMMING DIE

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 8

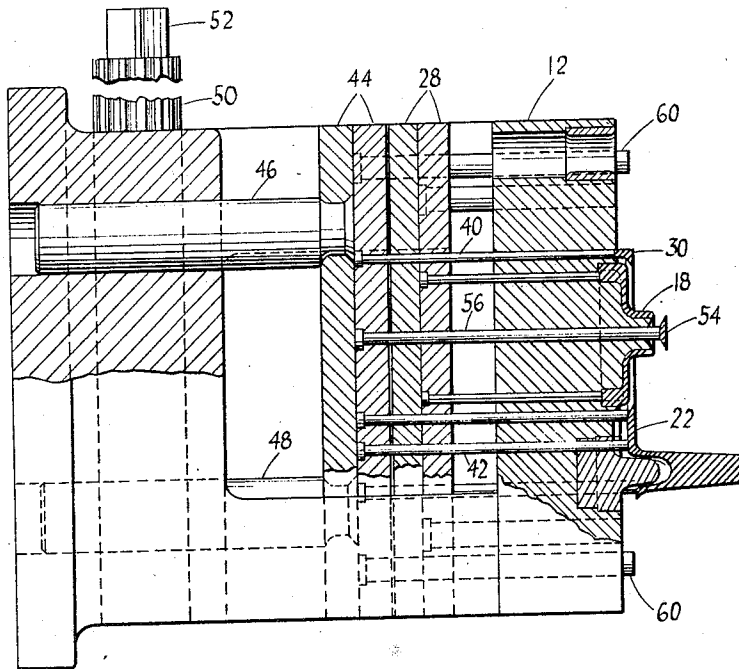
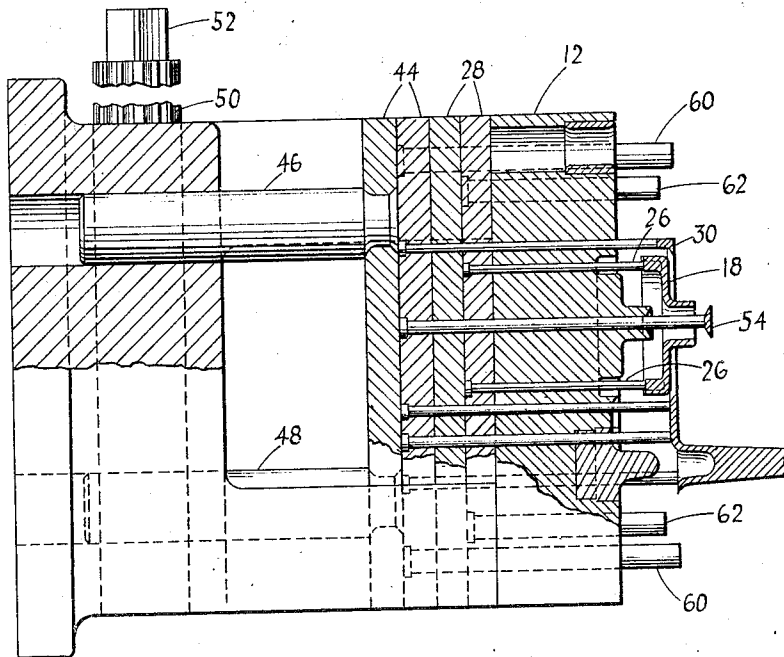


Fig. 9



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COMBINED CASTING AND TRIMMING DIE

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10 Claims. (Cl. 22—94)

This invention relates to dies, particularly for pressure casting.

The object of my invention is to generally improve dies, especially dies used for die casting metals.

In die casting some of the molten metal tends to escape between the parting faces of the die, producing a so-called fin or flash. The cleaning of the casting to remove this fin or flash requires considerable handling and labor and at times costs more than the initial cost of the casting. Sometimes so-called trimming dies are used, in an effort to reduce the cleaning cost, but the trimming die is itself very costly, and the use of such a die is feasible only where a vast number of identical pieces are to be cast. Also there is considerable handling or labor cost even when using a trimming die.

The primary object of my invention is to overcome the foregoing difficulties and to provide a single molding die which will function to trim or clean the casting as a part of the complete molding operation, so that the molding and cleaning operations are all accomplished in a single die.

To the accomplishment of the foregoing general object, and such other more specific objects as will hereinafter appear, my invention consists in the self-cleaning die elements and their relation one to the other as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawings, in which:

Fig. 1 is a plan view of a die embodying features of my invention;

Fig. 2 is a partially sectioned elevation, the section being taken approximately in the plane of the line 2—2 of Fig. 1;

Fig. 3 shows the parting face of the ejector die, the cover die being removed;

Fig. 4 is a fragmentary section taken in the plane of the line 4—4 of Fig. 3, but drawn to enlarged scale;

Fig. 5 is a similar section showing an intermediate stage in the operation of the die;

Fig. 6 is a fragmentary section taken in the plane of the line 6—6 of Fig. 3, but drawn to enlarged scale;

Fig. 7 is a similar section showing an intermediate stage in the operation of the die;

Fig. 8 is a section similar to Fig. 2, but showing an intermediate stage in the operation of the die; and

Fig. 9 is a section similar to Fig. 2, but showing a final stage in the operation of the die.

Referring to the drawings, and more particularly to Figs. 1 and 2, the die there shown comprises an ejector portion 12 and a cover portion 14 separable on a parting face 16. The die has a main cavity at 18 which is supplied with molten metal under pressure through gate passages 20 and 22. The ejector die portion 12 may include a conventional gate post 24 to help insure retraction of the gate or sprue from cover die 14 when the die is opened.

After the die is opened the casting in cavity 18 is ejected to discharge the same, and for this purpose a suitable number of appropriately distributed ejector pins 26 may be provided. These pins are secured with their heads between the laminations of a suitable ejector plate 28.

Because of the pressure under which the metal is injected into the die a thin fin of metal tends to seep from the main cavity 18 at the parting face of the die. Continued operation of the die may lead to gradual erosion of the die metal and consequent increase in the extent of fin. To clean this fin is troublesome and expensive. The cleaning operation is facilitated by anticipating the existence of the fin and forming overflow cavities adjoining the periphery of the main cavity at the parting face so as to form a relatively thick substantial body of metal, instead of a thin fin, this body of metal being joined to the main casting by an extremely thin leakage connection which is readily severed. The idea is clearly shown in Fig. 6, in which the ejector die 12 is provided with an overflow cavity 30 at the parting face 16 immediately adjacent the periphery of the main cavity or casting 18. The overflow metal forms a so-called safety edge which is connected to the main casting 18 by an exceedingly thin or necked connection 32. This may theoretically have zero thickness, that is, the point of joinder may lie in the original parting face 16 of the die, so that it is only a leakage quantity of metal that overflows into the auxiliary cavity 30. The resulting safety edge is readily broken away from the main casting 18.

Referring now to Figs. 2 and 3 the ejector portion 12 of the die is provided with a series of adjoining overflow cavities 30, 32, 34, 36, and 38. The gate 22 may also be treated as an overflow cavity for purposes of the present invention, it too being connected to the main casting by a very thin and readily-severed connection.

In accordance with the present invention a special set of ejector pins is provided for bearing against the overflow metal or safety edge. These ejector pins are arranged for differential

movement relative to the regular ejector pins 26 previously referred to, and may thus be used to sever the safety edge or, in other words, to trim the casting; all as a part of the ejecting operation. This will be clear from inspection of Figs. 4 and 5 in which the main casting 18 is operated upon by ejector pin 26, while the safety edge 30 is operated upon by pin 40, which may conveniently be termed a trimmer pin. In Fig. 5 the trimmer pin 40 has been moved a short distance to the right, prior to any movement of the ejector pin 26, and thereby trims the safety edge 30 from the casting 18. Subsequent movement of ejector pin 26 will eject the casting 18. The reverse sequence may also be employed, that is to say, in some cases it may be more convenient to separate the casting from the safety edge by moving the casting away from the safety edge. Whether the ejector pins or the trimmer pins should be moved first will depend upon the configuration of the particular casting being made.

Reverting now to Fig. 3, trimmer pins are provided at the points 40, and the usual ejector pins for the sprue or gate are preferably replaced by trimmer pins 42.

Referring now to Figs. 1 and 2 the trimmer pins 40 and 42 are connected to a laminated plate 44 which may be made up exactly like an ejector plate, but which may for convenience be called a trimmer plate. It will be noted that the trimmer plate 44 is spaced from the ejector plate 28, thus affording room for initial movement of the trimmer plate.

In the present case the ejector and trimmer plates are operated by racks 46 and 48 operated on by a long pinion 50. This pinion and rack arrangement is conventional for use on an ordinary ejector plate. In the present case the trimmer pins are moved ahead of the ejector pins and it is therefore convenient to connect the racks 46 and 48 to the trimmer plate 44, as shown. It will be evident that rotation of the pinion, as by means of a handle having a socket at one end adapted to fit over the squared end 52 of the pinion, will move the trimmer plate 44 until the latter contacts the ejector plate, following which both plates will be moved together.

This operation will be clear from a comparison of Figs. 2, 8, and 9 of the drawings. In Fig. 8, the racks 46 and 48 have moved trimmer plate 44 to the right until it contacts ejector plate 28. At this time the trimmer pins 40 and 42 have trimmed the safety edge 30 and gate 22 from the casting 18. An additional safety edge taking the form of a disc 54 is preferably provided at the center of casting 18, and this disc has been severed from the casting by the central trimmer pin 56. Pin 56, like the other trimmer pins, is secured to trimmer plate 44.

Referring now to Fig. 9, continued movement of racks 46 and 48 toward the right has now caused movement of the ejector plate 28, as well as the trimmer plate 44, thus causing the ejector pins 26 to eject the casting 18 from the ejector die 12. While shown adhering to the pins, the casting and safety edge will either drop free or may be readily picked therefrom. The operator may toss the casting into a suitable receptacle, while the overflow metal and gate are tossed into another receptacle, or may even be placed directly back into the bath of molten metal for immediate remelting. In some cases where the machine is to be operated at high speed, it is better to simply let all of the metal fall into a

single receptacle for separation later by a helper or other attendant.

The ejector plate 28 and also the trimmer plate 44 are preferably provided with so-called surface pins to guard against possibility of the operator not restoring the plates to initial position preparatory to the next casting operation. The surface pins of the trimmer plate are shown projecting through the parting face of the die 60 in Fig. 8, and the surface pins 62 of the ejector die are clearly shown in Fig. 9. In the present case there are eight such pins, the location of which is clearly shown in Fig. 3. The length of the pins is such that their ends are flush with the parting face 16 of the die when the ejector and trimmer plates are in proper position. Thus the closing of the die will insure proper position because otherwise the parting face of the cover die 14 will bear against the ends of the surface pins and force the same back as the die is closed, to the position shown in Figs. 1 and 2.

The cover die may be provided with pilot pins 64 (Fig. 2) which are received in bushings 66 (Fig. 3) in the ejector die.

Ordinarily the ejector and trimmer plates will be restored to initial position by the operating pinion 50, rather than by the surface pins. For this purpose the ejector plate 28 is preferably connected to the trimmer plate 44 by means of a lost-motion connection or pull-back pin 68 (Fig. 1). The body 70 of this pin passes freely through the trimmer plate 44, and is screwed into the ejector plate at 72. It will be evident that when trimmer plate 44 is pulled toward the left by the rack 46, it will pull the ejector plate 28 toward the left, with some lost motion therebetween.

To insure separation of the plate 28 and 44, a stop pin 74 may be provided, this being fixedly secured in the ejector die at 76. It is preferably adjustable by means of its threaded connection, and its adjustment may be locked by means of a lock nut 78. The end 80 of the stop pin arrests movement of ejector plate 28, while permitting continued movement of trimmer plate 44. This may also be stopped, if desired, as by means of a shoulder 82 on stop pin 74.

It is believed that the construction and operation, as well as the many advantages of my improved die will be apparent from the foregoing detailed description thereof. The operator closes the die and causes ejection of the molten metal into the die. This may be by means of a pump, air chamber, plunger, or other known mechanisms. The die is thereupon opened and the ejector mechanism operated. As the ejector mechanism operates it automatically separates the overflow metal and gate from the casting. Little or no additional finishing of the casting is needed. The casting may be buffed but only in cases where it would anyway have to be buffed because a better grade finish is desired.

The large cost for designing, machining, and material in making up a special trimmer die is saved, as well as the labor in handling and trimming the cast pieces in the trimmer die. There is an even greater saving in labor cost if no trimmer die is made and, of course, it is not feasible to employ a trimmer die unless huge quantities of the casting are to be made. The die cost is only slightly greater than it would be for an ordinary die for producing the same molded piece. The only additions to the die are the trimmer plate with its trimmer pins and surface pins. In many cases the trimmer pins are not entirely extra because they replace additional

ejector pins which would have been provided even in an ordinary die.

The ejection mechanism itself may be conventional. The rack and pinion arrangement here disclosed is common, but other arrangements may equally well be used. For example, stop pins may be provided on the frame of the machine which will encounter and arrest the movement of the trimmer plate as the ejector die is being bodily moved away from the cover die to open the die. Thus toward the end of the opening movement of the die, but while the die is still moving, the plates will be stopped for purposes of ejection. In the present case the trimmer plate would be stopped first, thus separating the overflow metal before beginning the ejection of the casting. Other known hydraulic, mechanical linkage, and gear arrangements may also be employed.

In any case where the casting, due to its shape, has little adhesion to the die, the casting may be ejected ahead of the overflow metal, and in the latter case the overflow cavities should be so shaped as to hold the overflow metal as the casting is ejected. Merely shortening the trimmer pins will help produce the desired adhesion. In general it is desirable to move the safety edge toward the casting rather than away from the casting. In the present case the outside safety edge is at the middle of a wall instead of at a corner, and therefore there is little or no difference between trimming movement in either direction. However, to explain what is meant by movement "toward" the casting, it may be stated that the central overflow metal 54 is here moved away from the casting, or in the less desirable direction, that is, it would perhaps be slightly better if the overflow metal 54 could be moved in a direction opposite to that in which it is moved in the present case.

It is apparent that while I have shown and described my invention in a preferred form, many changes and modifications may be made in the structures disclosed without departing from the spirit of the invention as sought to be defined in the following claims.

In the claims the expression "constrictedly connected" is intended to apply to a connection constricted in one direction, but not necessarily in the other, because in the latter direction, that is, along the parting face, the dimension is usually extensive. For example, the gate passage is constrictedly connected to the main cavity, but the connection is flared or broad in the plane of the parting face, in order to provide for adequate flow of the molten metal. The connection is constricted in a direction transverse to the parting face, in order to produce a thin connection which is readily severed by the differential movement of the ejector pins.

I claim:

1. A die comprising ejector and cover portions separable on a parting face, said die having a main cavity, and overflow cavities adjoining the main cavity at the parting face to produce a safety edge, said overflow cavities being constrictedly connected to the main cavity at the parting face so that the safety edge is connected to the main body of material by a thin connection, ejector pins for bearing against material in the main cavity, trimmer pins for bearing against the safety edge, and means to differentially move said ejector and trimmer pins in order to separate the molded product and the safety edge during discharge of the molded material from the die.

2. A die comprising ejector and cover portions separable on a parting face, a main cavity in said die, overflow cavities adjoining the main cavity at the parting face to produce a safety edge, said overflow cavities being constrictedly connected to the main cavity at the parting face so that the safety edge is connected to the main body of material by a thin connection, a gate passage also adjoining said main cavity and constrictedly connected thereto, ejector pins for bearing against material in the main cavity, trimmer pins for bearing against the safety edge and the gate, and means to differentially move said ejector and trimmer pins in order to separate the molded product and the safety edge and gate during discharge of the molded material from the die.

3. A die comprising ejector and cover portions separable on a parting face, a main cavity in said die, overflow cavities adjoining the main cavity at the parting face to produce a safety edge, said overflow cavities being constrictedly connected to the main cavity at the parting face so that the safety edge is connected to the casting by a thin connection, ejector pins for bearing against the casting in the main cavity, an ejector plate carrying said ejector pins, trimmer pins for bearing against the safety edge, a trimmer plate carrying said trimmer pins, said plates being normally spaced to permit movement of one ahead of the other, the movement of one of said plates prior to movement of the other functioning to separate the casting and the safety edge, and the subsequent continued movement of both plates functioning to discharge both the casting and the safety edge from the mold.

4. A die comprising ejector and cover portions separable on a parting face, a main cavity in said die, overflow cavities adjoining the main cavity at the parting face to produce a safety edge, a gate passage also adjoining the main cavity, ejector pins for bearing against a casting in the main cavity, an ejector plate carrying said ejector pins, trimmer pins for bearing against the safety edge, trimmer pins for bearing against the gate, a trimmer plate carrying said trimmer pins, said plates being normally spaced to permit movement of one ahead of the other, the movement of one of said plates prior to movement of the other functioning to separate the casting and the gate and safety edge, and the subsequent continued movement of both plates functioning to discharge the casting and the gate and safety edge from the mold.

5. A die comprising ejector and cover portions separable on a parting face, a main cavity in said die, overflow cavities adjoining the main cavity at the parting face to produce a safety edge, ejector pins for bearing against a casting in the main cavity, an ejector plate carrying surface pins and said ejector pins, trimmer pins for bearing against the safety edge, a trimmer plate carrying surface pins and said trimmer pins, said plates being normally spaced to permit movement of one ahead of the other, the movement of one of said plates prior to movement of the other functioning to separate the casting and the safety edge, and the subsequent continued movement of both plates functioning to discharge both the casting and the safety edge from the mold.

6. A die comprising ejector and cover portions separable on a parting face, a main cavity in said die, overflow cavities adjoining the main cavity at the parting face to produce a safety

edge, ejector pins for bearing against a casting in the main cavity; an ejector plate carrying said ejector pins, trimmer pins for bearing against the safety edge, a trimmer plate carrying said trimmer pins, said plates being normally spaced to permit movement of one ahead of the other, rack and pinion means for moving one of said plates, stop means for stopping the other plate to insure separation of the plates, and pull back means interconnecting the plates, the movement of one of said plates prior to movement of the other functioning to separate the casting and the safety edge, and the subsequent continued movement of both plates functioning to discharge both the casting and the safety edge from the mold.

7. In the operation of a molding die having a main cavity, a gate passage leading thereto, overflow cavities therearound, said gate and overflow passages being constrictedly connected to said main cavity, and ejector pins for material in said main cavity, in said gate passage, and in said overflow cavities, the method of automatically cleaning the molded product while ejecting the same from the die which includes operating the ejector pins for the main cavity at a time somewhat different from the time of operation of the ejector pins for the gate passage and overflow cavities, and thereby separating the main body of material and the overflow material and the gate at the thin connections therebetween.

8. In the operation of a molding die having constrictedly connected first and second cavities, and ejector pins for material in said cavities, the method of automatically severing the molded materials while ejecting the same from the die which includes operating the ejector pins for one of the cavities at a time somewhat different from the time of operation of the ejector pins for the other cavity, and thereby separating the

molded bodies of material at the thin connection therebetween.

9. A die having a plurality of constrictedly connected cavities for producing a plurality of bodies of material integrally connected by a thin connection, a first set of ejector pins for bearing against one body of material molded by one cavity, a first ejector plate carrying said first set of ejector pins, a second set of ejector pins for bearing against another body of material molded by another cavity, a second ejector plate carrying said second set of ejector pins, said plates being normally spaced to permit movement of one ahead of the other, the movement of one of said plates prior to movement of the other functioning to separate said molded bodies of material, and the subsequent continued movement of both plates functioning to discharge all of the molded bodies of material from the mold.

10. A die comprising ejector and cover portions separable on a parting face, said die having first and second cavities constrictedly connected at the parting face for producing first and second bodies of material integrally connected by a thin connection at the parting face, a first set of ejector pins for bearing against the first body of material in the first cavity, a second set of ejector pins for bearing against the second body of material in the second cavity, said second cavity being so shaped as to hold the second body of material with a grip exceeding the force needed to break the first body of material away from the second body of material, and means to differentially move said first set of ejector pins ahead of said second set of ejector pins in order to separate the first molded body of material from the second molded body of material at the aforesaid thin connection during discharge of the bodies from the die.

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