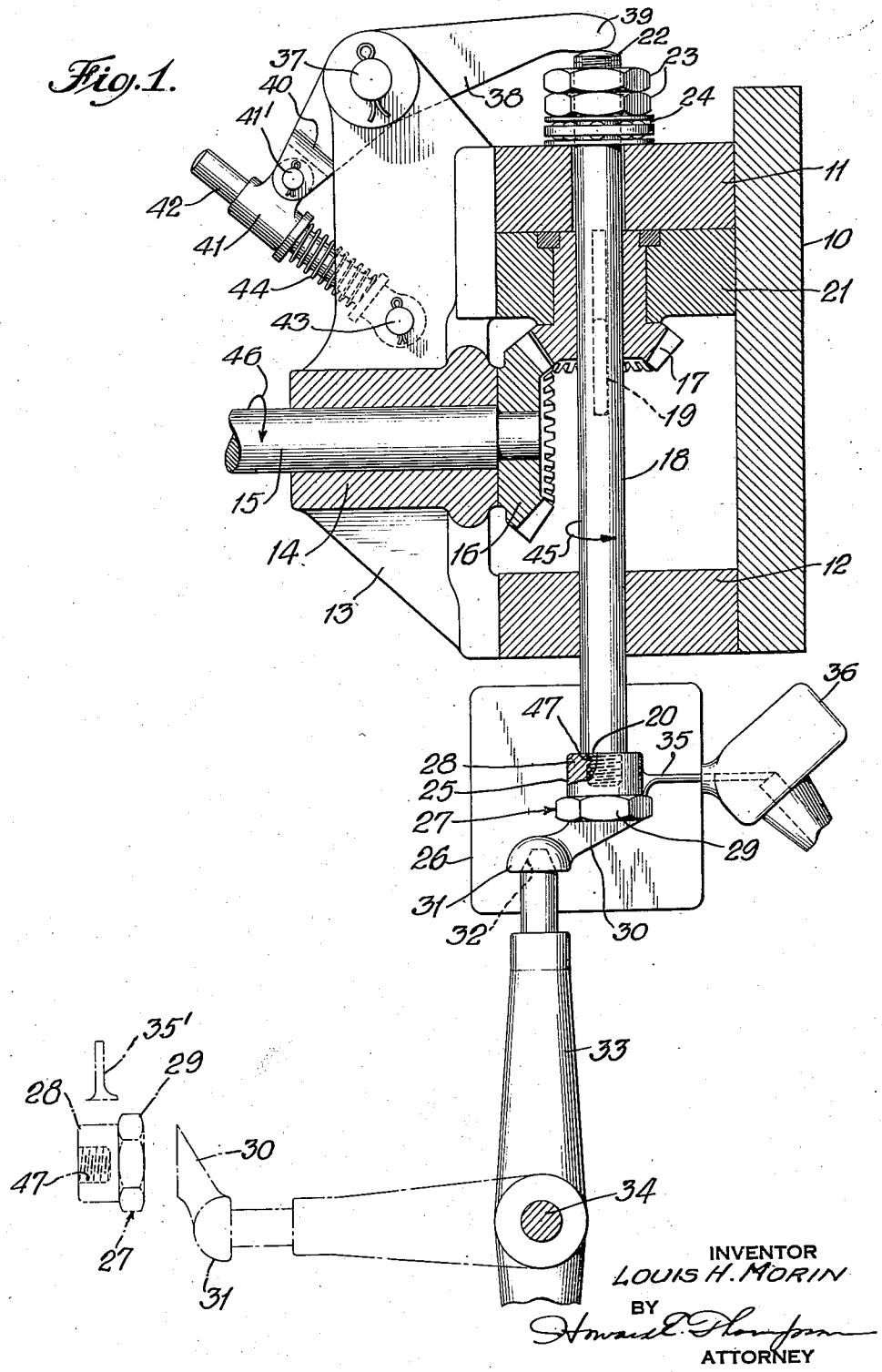
Dec. 25, 1951 L. H. MORIN 2,579,952

METHOD OF FORMING THREADED DIE CASTINGS

Filed June 16, 1950 3 Sheets-Sheet 1

Fig. 1.



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Fig. 1a.

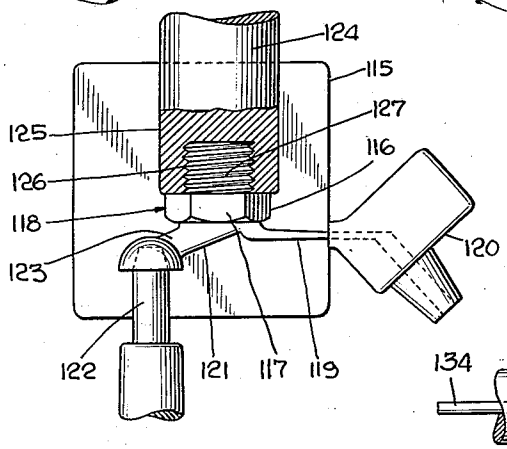


Fig. 2.

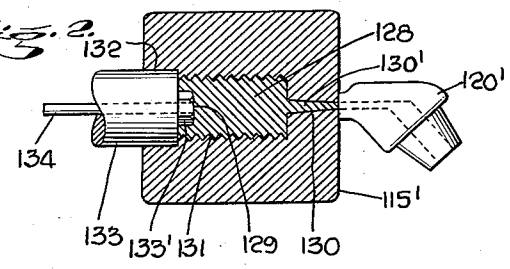


Fig. 3.

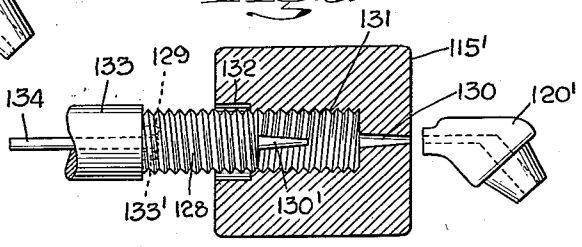


Fig. 4.

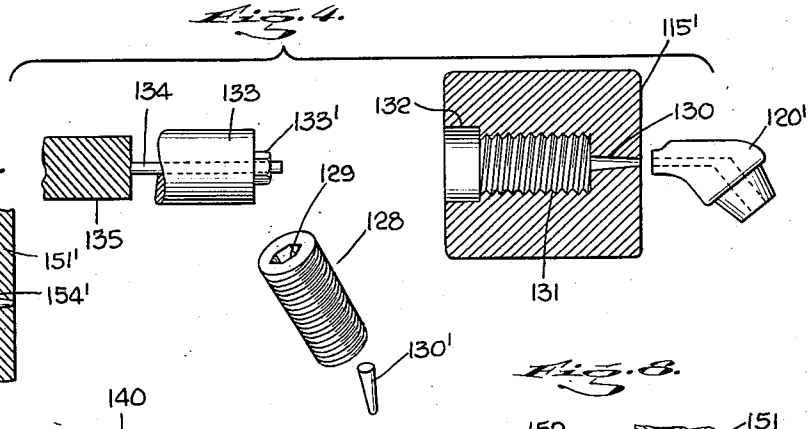


Fig. 8a.

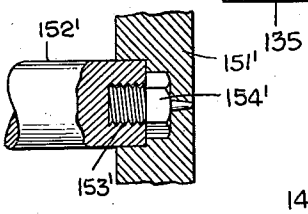


Fig. 8.

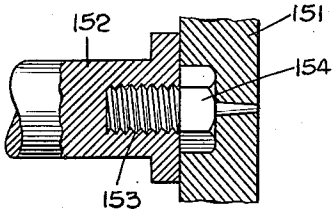
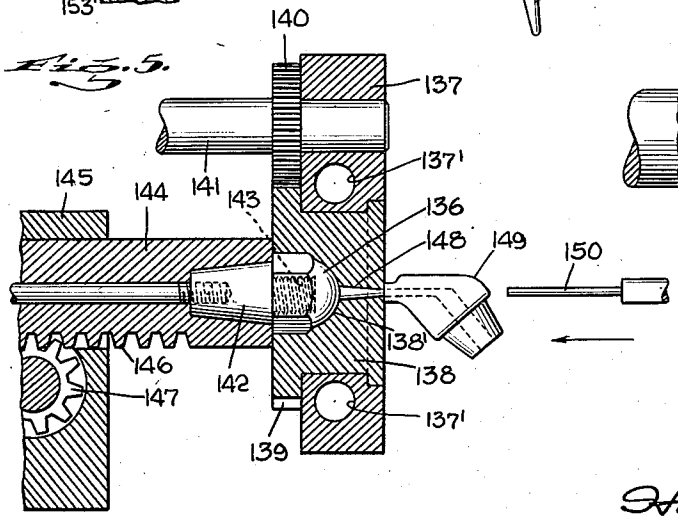


Fig. 5.



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Fig. 6.

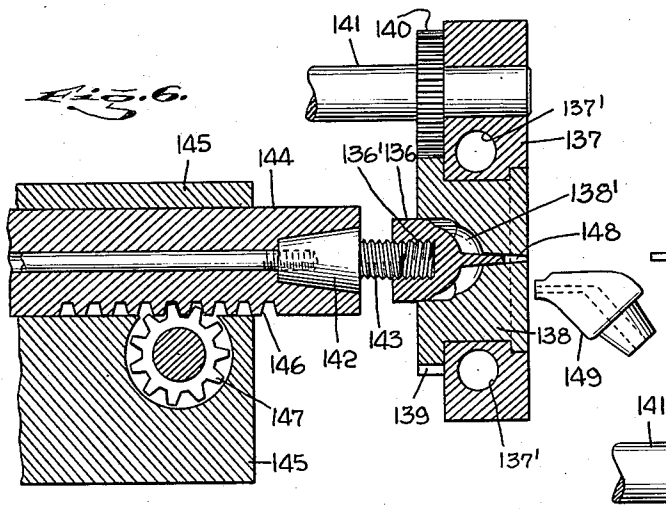


Fig. 7.

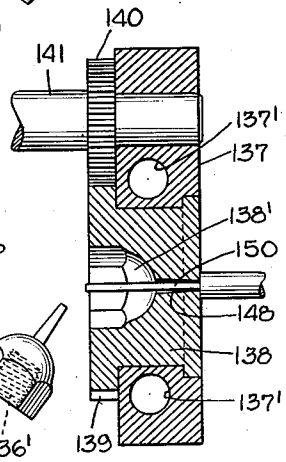
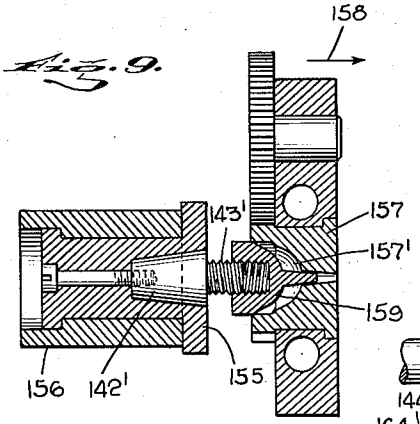


Fig. 9.



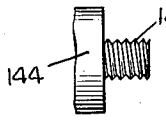


Fig. 10.

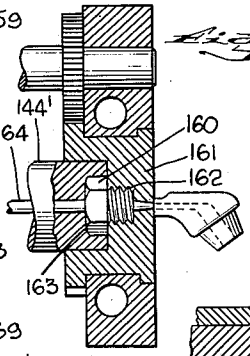
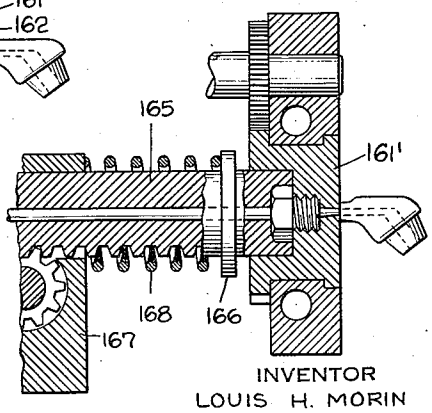


Fig. 11.



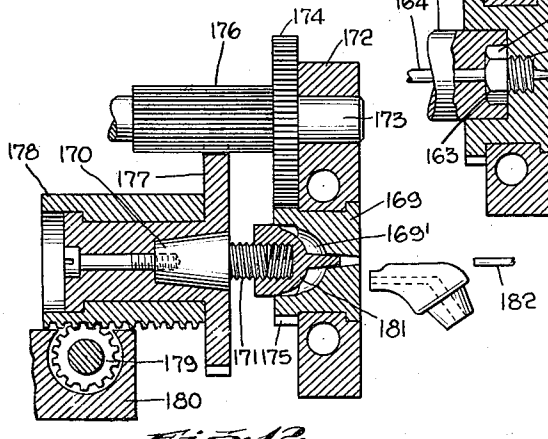


Fig. 12.

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UNITED STATES PATENT OFFICE

2,579,952

METHOD OF FORMING THREADED DIE CASTINGS

Louis H. Morin, Bronx, N. Y.

Application June 16, 1950, Serial No. 168,616

25 Claims. (Cl. 18—55)

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This invention relates to the formation of die castings, and more particularly, to a method of producing a threaded portion on the casting at the time the casting is formed. It relates further to the removal of the formed casting from the dies to be delivered to a trimming station where the casting is trimmed to produce a finished product. Still more particularly, the invention deals with a method of producing die castings which comprises supporting a forming member in die casting position relatively to the cavity of a die member to give a predetermined shape to a casting to be formed in the cavity, supporting the die member relatively to the forming member so that the cavity is closed, moving one of the said members relatively to the other while pressure injecting casting material into the cavity to form a casting, and then freeing the casting from at least one of the members by virtue of the movement imparted to the moving member.

The novel features of the invention will be best understood from the following description when taken together with the accompanying drawings, in which selected embodiments of the invention are disclosed, and in which:

Fig. 1 comprises a schematic sectional view illustrating one method of carrying my invention into effect and indicating parts in different positions by dot and dash lines.

Figure 1*a* is a view partly in section, illustrating a modification of the method of Fig. 1.

Figs. 2 to 4, inclusive, are diagrammatic views illustrating steps in another modification, Fig. 4 being an exploded view showing the ejected and trimmed casting.

Figs. 5 to 7 are sectional views diagrammatically illustrating successive steps in another modification.

Figs. 8 and 8*a* are diagrammatic sectional views illustrating a method similar to that illustrated in Figs. 5 to 7.

Fig. 9 is a view illustrating another method similar to that shown in Figs. 5 to 7.

Fig. 10 is a sectional view diagrammatically illustrating another modification of the method of Figs. 5 to 7.

Fig. 11 is a view similar to Fig. 10 showing another modified method, and

Fig. 12 is a view illustrating a further modification.

In Fig. 1 I have diagrammatically illustrated at 10, a plate of a casting machine having outwardly extending bearings 11 and 12 joined by a bracket 13 having a bearing portion 14. In the bearing 14 is arranged a continuously driven shaft 15 carrying on its inner end a bevel gear 16. This gear meshes with another bevel gear 17 keyed to a rod 18 slidable longitudinally in the hub of said gear, as is indicated by the key 19.

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The rod 18 forms what might be termed a core, or more generally classified as a thread forming member or element having at its lower end a reduced threaded portion, as indicated at 20. The gear 17 is mounted to rotate in a supplemental bearing 21. The rod or member 18 has an upper threaded end 22 on which is mounted adjustment and lock nuts, as at 23, between which, and the top of the bearing 11, is disposed a ball bearing 24. The purpose of this construction is to properly fix and position the threaded portion 20 within the cavity 25 of a pair of dies, one of which is shown at 26 in the drawing.

In illustrating one adaptation of my invention, the cavity 25 is so formed as to produce what might be termed a nut or cap 27 having an internal threaded sleeve portion 28 and an enlarged hexagon head 29. The cavity 25 also is shaped to form a portion 30, enlarged as seen at 31 to receive the upper conical end 32 of a transfer finger 33. The finger 33 is pivoted, as seen at 34, and when the dies are opened and the member 18 freed from the casting, as later described, the finger will transfer the complete casting to a trimming station. The cavity 25 also includes a gate forming portion 35 through which the casting material is injected into the cavity from a suitable nozzle diagrammatically illustrated at 36. When at the trimming station, the gate part 35', as well as the part 30 are trimmed from the casting, by suitable tools, not shown, as diagrammatically illustrated in dot and dash lines in the drawing.

Pivoted to the upper part of the bracket 13, as seen at 37, is a lever 38. The lever has a long end 39 operating directly upon the upper end of the member 18, as clearly seen, and the other forked end 40 of the lever has a block 41 pivoted thereto, as seen at 41'. The block 31 is slidably mounted on a rod 42 pivoted to the bracket, as seen at 43. On the rod 42 is arranged a coil spring 44, which operates upon the block 41 to normally support the lever end 39 upon the end of the member 18, while at the same time, allowing the member 18 to move upwardly against the action of the spring 44 in the operation of unthreading the member 18 from the casting 27.

As previously stated, when the casting machine is in operation for intermittently producing castings, such as 27, the member 18 is constantly rotated in the direction of the arrow 45, the shaft

15 being driven in the direction of the arrow 46. Assuming that the member 18 has been adjusted so as to properly position the thread forming end 20 of said member within, or with respect to the cavity 25, the machine is now in position to form successive castings. The dies are first brought into abutting engagement with each other around the lower end of the member 18 and around the pin 33, then casting material is pressure injected into the cavity through the gate 35 to form the casting 27 and the internal thread 47 in the sleeve portion 28. Instantaneously upon the formation of the casting and said thread, the constant rotation of the member 18 will cause said member to feed upwardly, detaching the member 18 from the casting and simultaneously the dies are opened and the finger 33 moves the casting to the trimming station where the casting is trimmed. The part 30 including the enlargement 31 is stripped from the finger 33, the finger then returns to the full line position shown in the drawing and the member 18 is returned by the spring 44 to its normal position, as shown in the drawing, and the next successive casting is formed upon a completion of the above operation.

In producing castings of the type and kind under consideration, and particularly when a core like thread forming member or element is employed, if this element was kept stationary in the formation of the cast body therearound, the cast body in setting and chilling would freeze upon the core and this freezing, caused by shrinkage in the continued chilling of the cast body, would make it difficult to remove the core from the casting.

With my improved method, by employing the constantly rotating core, the instant that solidification of the casting material takes place in the impression, the core, being rotated in a direction to unscrew itself from the threads of the casting, will thread out of the casting until the latter is free, at which time the dies are opened and the casting removed therefrom by the ejector finger, or in any other way. This method of procedure will produce clean threads in the casting and will adapt itself for producing threads on castings having relatively small diameters and where the castings as a whole may be relatively small.

In a more general sense, my invention may be said to comprise a method of forming a casting directly upon, or in association with a member which is in motion during the injection of the casting material into the cavity of the mold for any purpose whatever and where motion applied to the member is advantageous.

In Fig. 1*a* of the drawing, I have diagrammatically shown a modification of the above described method to the end of producing an externally threaded product such as a bolt, rather than an internally threaded product like the cap 27.

In Fig. 1*a*, 115 represents one of a pair of dies that are movable toward and from each other, each die having a cavity 116 for forming a head 117 of hexagonal or other shape on the resulting casting or product 118, the die 115 having a gate passage 119 for admission of casting material into the cavity 116 from an injection nozzle, diagrammatically seen at 120. In addition to the gate 119, a further cavity 121 is provided in the die, into which extends a transfer finger 122 for transferring the cast product 118 to a trimming station for removal of the portion 123 of the casting from the product proper 118.

At 124 is shown a rotating rod or forming member constituting part of the die elements for producing the product 118. The forming member is constantly rotated, as in the case of the member 18 in Fig. 1, and fits in a recess or socket 125 in the dies. It has a threaded socket 126 which forms part of the complete die cavity 116 to produce the threaded part 127 of the resulting bolt.

The member 124 is constantly rotated as the casting material is injected into the complete die cavity so that when the casting material solidifies, the member 124 automatically moves vertically upward to free itself from the threaded portion 127. As in the method described in Fig. 1, when the dies 115 are separated, the cast product 118, including the cast portion 123, is moved by the transfer pin 122 to a trimming station, not shown, where the casting is trimmed.

From the foregoing description, it will appear that the two die parts 115, plus the die member 124, together constitute die elements or cavity forming elements, and that one of these elements is constantly rotated during the injection of casting material into the cavity.

In Figs. 2 to 4, inclusive, I have diagrammatically shown another method of forming an externally threaded cast product. In this case the product is in the form of a set screw 128 having a socket 129 of hexagonal or other shape at one end thereof. Here, 115' may be a single die member having a threaded cavity 131; 130 represents the gate passage, 120' the nozzle for injection of casting material. The threaded cavity 131 has at one end an enlarged bore 132 for reception of a constantly rotating rod member 133, within which is disposed an ejector pin 134. It will be understood that the member 133 may be rotated by any suitable means, including means similar to that shown in Fig. 1. As will appear from a consideration of Figs. 2 to 4, when the casting or product 128 is formed, the constant rotation of the member 133 will cause the casting 128 to be unthreaded out of the cavity 131, in the manner partially seen in Fig. 3. When the casting has been completely unthreaded, the rotating member 133 may be moved outwardly by means not shown until the ejector pin 134 strikes a suitable abutment 135 which will cause the cast product 128 to be displaced from the hexagonal portion 133' of the member 133, which forms the hexagonal socket 129. On release or timely in the release of the product 128, the gate portion 130' of the casting can be trimmed from the product 128. If desired, the casting can be transferred to a trimming station for the trimming step.

In Figs. 5, 6 and 7, I have diagrammatically shown another method of procedure in the formation of a domed hexagon nut product 136, sometimes termed an acorn nut. In said figures, 137 represents a die supporting block, in which a circular die 138 is rotatably mounted. The die includes an annular gear portion 139 which meshes with a pinion 140 on a suitable drive shaft 141 so that the die 138 can be constantly rotated. Channels 137' in the block 137 serve to conduct a cooling medium in heat exchange relation with the die 138.

At 142 is shown another cavity forming element comprising primarily a threaded core pin 143 for forming the threaded socket 136' of the product 136, the element 142 being mounted in a rack bar 144 slidably mounted in a suitable support 145. The teeth 146 of the rack bar 144 are engaged by an intermittently rotated gear 147 also ar-

ranged in the support 145. Gear 147, which oscillates the rack bar, is power driven by means not shown.

At 138' is shown the cavity of the die 138 which is characterized to form the product 136. Opening into the cavity 138' is a gate passage 148, into and through which casting material is adapted to be injected from a suitable nozzle 149. At 150 is seen an ejector pin utilized for final displacement of the cast product 136 from the cavity 138'.

With the method disclosed in Figs. 5 to 7, inclusive, it will be apparent that when the casting is formed, the constant rotation of the die 138 will cause the threaded core 143 to be displaced from the threaded bore 136' of the product 136. To provide for this displacement, the rack 144 is moved outwardly, and this movement is synchronized with the displacement of the core 143 from the bore 136', as by means of a cam and lever arrangement, not shown. The combination of these operations causes the product 136 to be partially removed from the cavity 138' in the manner illustrated in Fig. 6. However, the core 143 becomes displaced from the socket 136' before the cast product 136 is fully removed from the cavity 138', and then in timely relationship the nozzle 149 is moved out of the path of the gate passage 148 and the ejector pin 150 then passes into this passage and serves to finally eject the casting in the manner illustrated in Fig. 7 of the drawing.

It will be understood that in the particular method just described the nut 136 need not necessarily have a hexagonal shape, but may be square, etc., or may be provided with other keying means to enable it to rotate with the die 138.

In Fig. 8 of the drawing, I have shown a slight modification of the method as illustrated in Figs. 5 to 7, inclusive, wherein 151 represents a circular, rotatable die generally of the kind disclosed at 138, except as to the shape and contour of the cavity, and 152 represents a forming element, similar to the element 143—144, but differing therefrom in that it has a threaded cavity 153 rather than a threaded core pin 143. Thus, with the method as illustrated in Fig. 8, a bolt-like product 154 is produced in the final casting rather than the nut-like product 136. Aside from the changes noted, the method of procedure in producing the product 154 of Fig. 8 will be the same as that illustrated in Figs. 5 to 7, inclusive.

In Fig. 8a, the method is the same as in Fig. 8. The only differences are that in Fig. 8a the cavity in die 151' and the end of element 152' projecting into said cavity have different shapes than the corresponding items in Fig. 8.

In Fig. 9, I have shown another method of producing a nut-like product, similar to the product 136, of the method of Figs. 5 to 7, the only difference in the two methods being that, in Fig. 9, there is no rack and gear for moving the element 142'. The latter is fixed in a member 155 arranged in a suitable stationary support 156. In this method, the die 157, including its associated die block and driving pinion, are suitably mounted by means not shown so as to move relatively to the forming member or element 142' in the direction of the arrow 158, as partially illustrated in Fig. 9, in order to free the casting from the threaded portion 143'. If the axial movement in the direction of the arrow 158 is greater than the speed of unthreading, the casting 159 will move out of the die cavity 157' in the manner illustrated and can be finally ejected by a pin, as for example, the pin 150 of Figs. 6 and 7. On the other hand, if the speed of axial movement parallels the unthreading speed, the casting will remain in the cavity 157' and can be ejected by the ejector pin, as mentioned.

In Fig. 10 of the drawing, I have shown another method of procedure which is like the method disclosed in Figs. 5 to 7, inclusive, but differs primarily in the formation of a bolt-like cast product 160 rather than the nut product 136. In other words, the die 161 will have a thread forming cavity 162 and the rack member 144' will have a socket 163 of hexagon or other shape for formation of the head of the bolt 160. With this method, an ejector pin 164 is employed in the rack 144' to eject the casting 160 in accordance with the teachings in Fig. 4 of the drawing.

In Fig. 11 of the drawing is shown a modification of the method of Fig. 10, wherein a rack member 165, generally similar to the rack 144', is employed, except that a collar 166 is provided thereon, and between this collar and a support and guide 167 for the rack there is arranged a coil spring 168 to tensionally maintain the forming rack element 165 in engagement with the die 161'. Also, the rack member 165 is not power driven, as in the methods of Figs. 5, 6, 7, and 10. The rack member is moved axially away from the die 161' by virtue of the unthreading action between the die and the casting, this axial movement taking place against the action of spring 168.

In Fig. 12 of the drawing, I have shown another method of procedure which employs the principle of rotation of both cavity forming members or elements, that is to say, the die member or element 169 and the core member or element 170. The latter includes a threaded core portion 171, which is positioned within the cavity 169' of the die 169, as in the teachings in Figs. 5, 6, 7, and 9. The die holder 172 has a shaft 173 extending through it, similar to the shaft 141, and on this shaft is disposed a large gear 174 which meshes with a smaller gear 175 on the die 169. On the shaft 173 is a pinion 176 which meshes with a large gear 177 to which the member or element 170 is attached. With this construction, it will be apparent that the die member 169 will be rotated at a greater speed than the speed of rotation of the core member 170.

In addition to providing dual rotation of the forming members employed, means is provided to move one of the members axially of the other. In this case, the member 170 is axially moved through the medium of a sleeve rack 178 actuated by a power driven fine tooth pinion 179 arranged in the support 180 on which the rack 178 is mounted for sliding movement. In other words, two rotary movements are provided for the forming members 169 and 170, and one of these members is movable axially of the other. Although both members are rotatable in the same direction, by rotating the die member at a faster speed and by synchronizing therewith the axial movement of the core member away from the die member, the casting 181 will be freed from both members and may be finally ejected from the die member by means of the ejector 182, after first lowering the casting nozzle. By suitable gearing, as by interposing a gear between gears 174 and 175, or between pinion 17 and gear 177, the members 169 and 170 may also be rotated in opposite directions.

From the several methods described, it will appear that in all instances at least two forming members cooperate with each other to character-

ize the cavity formed between them, which cavity defines the shape and characteristics of the resulting casting. At least one of the cavity forming members is constantly rotated, and at the instant that solidification of the casting material takes place in the cavity, the rotating member will cause the casting to be separated from at least one of the forming members.

Castings having internal and external threads may be produced. In some instances, castings having no threads may be formed by employing unthreaded forming members. The advantage of producing such castings by the present methods over methods using stationary unthreaded forming members is that the castings will not freeze or shrink onto the forming members. The rotation, and the axial movement, of the unthreaded forming members will take place as described above in the methods using threaded forming members.

The present illustrations are simple forms to demonstrate the general principles of the invention. Other products besides nuts, bolts, or Allen set screws may, of course, be formed, depending upon the shape or contour of the forming members which are employed. It will further be apparent that threads of different kinds can be formed and that any suitable kind of casting material can be employed.

This application is a continuation-in-part of copending application Serial Number 714,187; filed December 5, 1946, now abandoned.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The method of forming die castings including internal threaded portions, which comprises supporting a thread forming member in part of the mold cavity of a pair of relatively movable dies with the dies held in closed position around said member, rotating said member in the cavity, injecting casting material into said cavity while said member is rotating to form a casting with an internal thread shaped by the thread forming member, and removing said member from the casting by virtue of said rotation of said member, thereby screwing the same out of the thread formed in the casting.

2. The method of forming die castings including internal threaded portions, which comprises supporting a thread forming member in part of the mold cavity of a pair of relatively movable dies with the dies held in closed position around said member, rotating said member in the die cavity, injecting casting material into said cavity while said member is rotating to form a casting with an internal thread shaped by the thread forming member, immediately removing said member from the casting by continuously rotating said member, thereby screwing the same out of the thread formed in the casting, forming the casting on a transfer finger supported between said dies, and then opening the dies and removing the casting therefrom by said finger.

3. The method of forming die castings including internal threaded portions, which comprises supporting a thread forming member in part of the mold cavity of a pair of relatively movable dies with the dies held in closed position around said member, rotating said member in the die cavity, injecting casting material into said cavity while said member is rotating to form a casting with an internal thread shaped by the thread forming member, immediately removing said member from the casting by continuously rotating said member, thereby screwing the same out of the thread formed in the casting, forming the casting on a transfer finger supported between said dies, then opening the dies and removing the casting therefrom by said finger to a trimming station, and trimming the casting at said station.

4. The method of forming die castings having threaded portions, which comprises supporting a thread forming member within the cavity of a pair of dies when in closed position, rotating said member within the dies, injecting casting material into the die cavity to form therein and on said rotating member a casting having threads shaped by said member, and removing the member from the casting by unscrewing the same therefrom by virtue of said rotation of said member.

5. The method of producing a threaded die casting, which comprises adjustably supporting a thread forming member with respect to the cavity of a pair of dies to predeterminedly position the member in said cavity, pressure injecting casting material into said cavity with the dies in closed position while constantly rotating said thread forming member in a direction to unscrew the member from the thread formed thereby, immediately unthreading the member from the resulting casting upon solidification of the same, and then separating the dies and removing the casting with the formed thread thereon from the position between the dies.

6. The method of forming die castings, which comprises supporting a member in the cavity of a pair of relatively movable dies to give predetermined shape to a casting to be formed in said cavity, supporting the dies in closed position around said member, constantly moving the member within the die cavity while pressure injecting casting material into the cavity to form a casting on said member, and freeing said casting with respect to the member by the constant movement imparted thereto.

7. In the art of forming die castings upon a core contributing predetermined structural characteristics to the resulting casting, the method which comprises yieldably and adjustably supporting a core in predetermined position within the cavity of a pair of dies, constantly rotating the core between the dies in closed position while injecting casting material into the die cavity to form a casting on that part of the core supported therein, freeing the core instantaneously from the casting by continuously rotating said core, and feeding the core out of the casting to free the casting for ejection from the cavities during movement of the dies into open position.

8. The method of forming die castings, which comprises supporting a member in the cavity of a pair of relatively movable dies to give predetermined shape to a casting to be formed in said cavity, closing the dies around said member, constantly rotating the member within the die cavity while pressure injecting casting material into the cavity to form a casting on said member, and constantly rotating said member to free it from the casting formed thereon.

9. The method of forming die castings, which comprises supporting a core member and an ejector member in the cavity of a pair of relatively movable dies to give predetermined shape to a casting to be formed in said cavity, supporting the dies in closed position around said members, constantly moving the core member between the dies and within the die cavity while

pressure injecting casting material into the cavity to form a casting on said members, constantly moving said core member to free it from the casting formed thereon and to withdraw the core member from the die cavity.

10. The method of forming die castings, which comprises supporting a member in the cavity of a pair of relatively movable dies to give predetermined shape to a casting to be formed in said cavity, supporting the dies in closed position around said member, moving the member within the die cavity while pressure injecting casting material into the cavity to form a casting on said member, and freeing said casting with respect to the member by said movement imparted thereto.

11. The method of forming die castings which comprises continuously moving a core between a pair of relatively movable dies having mating cavities, closing the dies about said moving core so that at least a portion thereof moves within the die cavities, injecting molten casting material into said cavities and in contact with the moving core, continuing to move the core as the casting material solidifies, thereby freeing the core from the resulting casting, opening the dies and ejecting the casting therefrom.

12. The method of forming die castings which comprises positioning a core and an ejector within the die cavities of a pair of relatively movable dies having mating cavities, injecting molten casting material into said cavities and in contact with said core and ejector to form a casting attached to the core and to the ejector, freeing the core from the casting by moving the core relatively thereto, opening the dies and ejecting the casting therefrom by moving said ejector having the casting attached thereto, trimming the casting on the ejector, and then stripping the casting from the ejector.

13. The method of forming die castings, which comprises supporting a member in the cavity of in the cavity of a die member to give predetermined shape to a casting to be formed in said cavity, closing the dies around said member, constantly rotating the member within the die cavity while pressure injecting casting material into the cavity to form a casting on said member, and constantly rotating said member to free the casting formed thereon from the dies.

14. The method of forming die castings, which comprises supporting a member in the cavity of a pair of relatively movable dies to give predetermined shape to a casting to be formed in said cavity, supporting the dies in closed position around said member, moving the member within the die cavity while pressure injecting casting material into the cavity to form a casting on said member, and freeing said casting with respect to the dies by said movement imparted to the member.

15. The method of producing die castings which comprises supporting a forming member in the cavity of a die member to give a predetermined shape to a casting to be formed in said cavity, supporting the die member relatively to the forming member so that the cavity is closed, moving one of said members relatively to the other while pressure injecting casting material into the cavity to form a casting, and freeing said casting from at least one of said members by said movement imparted to the moving member.

16. The method of producing die castings which comprises supporting a forming member in die casting position relatively to the cavity of a die member to give predetermined shape to a casting to be formed in said cavity, supporting the die member relatively to the forming member so that the cavity is closed, moving one of said members relatively to the other while pressure injecting casting material into the cavity to form a casting, and freeing said casting from at least one of said members by said movement imparted to the moving member.

17. The method of forming an externally threaded die casting, which comprises supporting a forming member in die casting position relatively to a die member to collectively form between said members a cavity in which said casting is to be formed, one of said members being threaded so that the surfaces of the cavity are threaded at least in part, supporting said members in engagement with each other, rotating one of said members in said engagement while simultaneously pressure injecting casting material into the cavity to form a casting, and freeing said casting from at least one of said members by virtue of the rotary movement imparted to the said rotating member.

18. The method of forming castings having threaded portions comprising supporting a core member in the cavity of a die member to give a predetermined contour to a casting to be formed in said cavity, one of said members being threaded, pressure injecting casting material into the cavity while constantly rotating said die member to form said casting, and utilizing the rotary motion of the die member as a means for freeing the casting by unthreading the latter from one of said members.

19. The method of forming castings having threaded portions comprising supporting a core member in the cavity of a die member to give a predetermined contour to a casting to be formed in said cavity, one of said members being threaded, pressure injecting casting material into the cavity while constantly rotating said die member to form said casting, utilizing the rotary motion of the die member as a means for freeing the casting by unthreading the latter from one of said members, and during said unthreading step moving the core member axially with respect to said die member.

20. The method of forming castings having threaded portions comprising supporting a core member in the cavity of a die member to give a predetermined contour to a casting to be formed in said cavity, one of said members being threaded, pressure injecting casting material into the cavity while constantly rotating both of said members, and utilizing the rotary motion of said members as a means for freeing the formed casting by unthreading the latter from one of said members.

21. The method of forming die castings which comprises supporting a forming member in die casting position relatively to the cavity of a die member to form by the die member and forming member a cavity characterizing the product to be cast, moving both of said members while pressure injecting casting material into the cavity to form a casting, and freeing the casting relatively to both members by virtue of the movement imparted to said members.

22. The method of forming die castings which comprises supporting a forming member in die casting position relatively to the cavity of a die member to form by the die member and forming member a cavity characterizing the product to be cast, rotating both of said members while pres-

sure injecting casting material into the cavity to form a casting, freeing the casting from one of said members by virtue of the rotary movement imparted to said members, and imparting an axial movement to one of said members to eject the casting from the other member.

23. The method of forming an externally threaded die casting which comprises supporting a forming member in die casting position relatively to a threaded die member to collectively form between said members a threaded cavity in which said casting is to be formed, supporting said members in engagement with each other, continuously rotating the forming member while it is in engagement with the die member, pressure injecting casting material into said cavity while said forming member is beng continuously rotated, thereby forming a threaded casting in the cavity, forming keying means in the casting corresponding to cooperative keying means on the forming member, and unthreading said casting from the die member by virtue of the rotary movement imparted to the forming member.

24. The method of forming a threaded die casting which comprises supporting a forming member in die casting position relatively to a die member, one of said members being threaded to collectively form between said members a threaded cavity in which said casting is to be formed, supporting said members in engagement with each other, continuously rotating the die

member while it is in engagement with the forming member, pressure injecting casting material into the cavity while said die member is being continuously rotated, thereby forming a threaded casting in the cavity, unthreading the casting from the forming member by virtue of the rotary movement imparted to the die member, and simultaneously with said unthreading step moving the forming member axially with respect to the rotating die member.

25. The method of forming a threaded die casting which comprises supporting a forming member in die casting position relatively to a die member, one of said members being threaded to collectively form between said members a threaded cavity in which said casting is to be formed, supporting said members in engagement with each other, continuously rotating the die member while it is in engagement with the forming member, pressure injecting casting material into the cavity while said die member is being continuously rotated, thereby forming a threaded casting in the cavity, unthreading the casting from the forming member by virtue of the rotary movement imparted to the die member, and simultaneously with said unthreading step moving the die member axially away from the forming member.

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No references cited.