June 5, 1951 L. H. MORIN 2,555,754

METHOD OF FORMING MOVABLY COUPLED MEMBERS

Original Filed Dec. 28, 1943 2 Sheets-Sheet 1

Fig. 1.

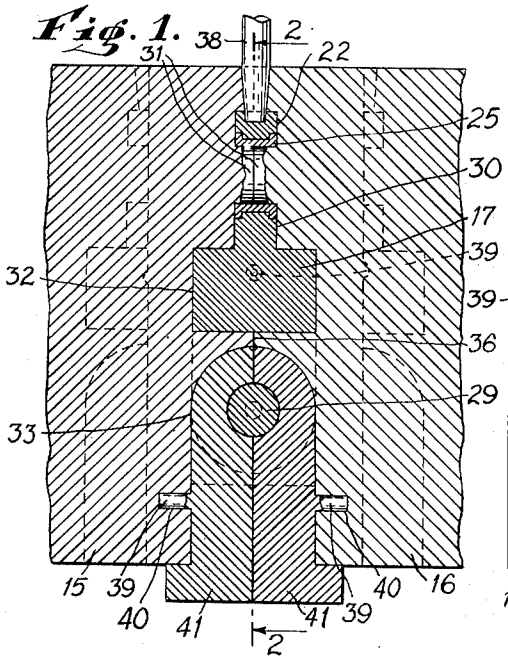


Fig. 2.

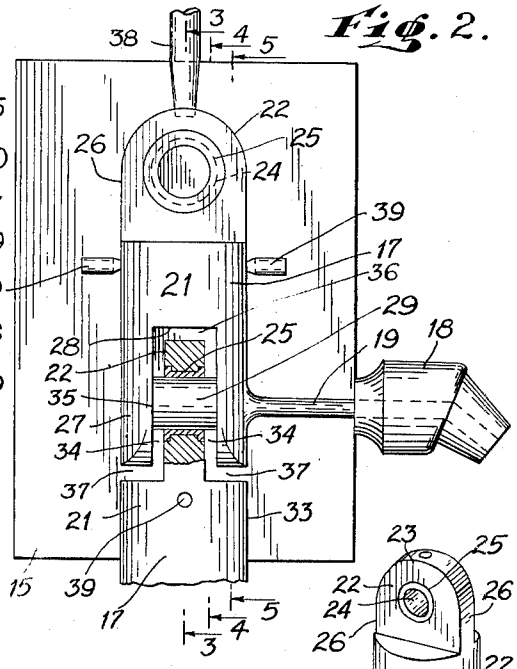


Fig. 3.

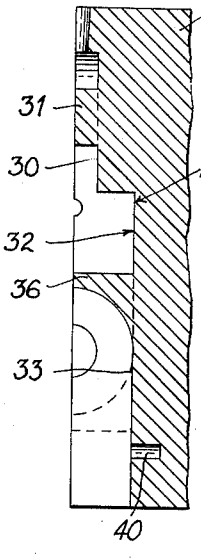


Fig. 4.

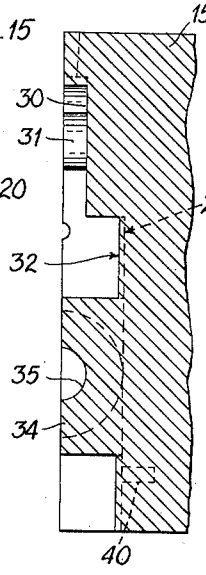


Fig. 5.

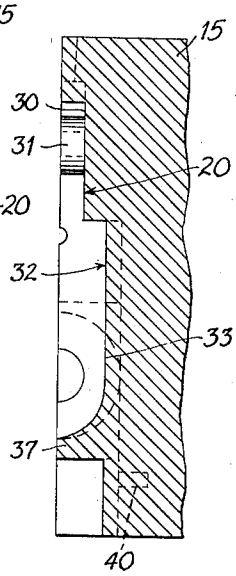
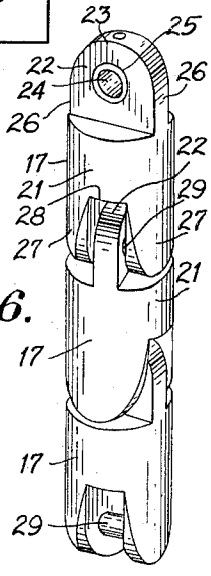


Fig. 6.



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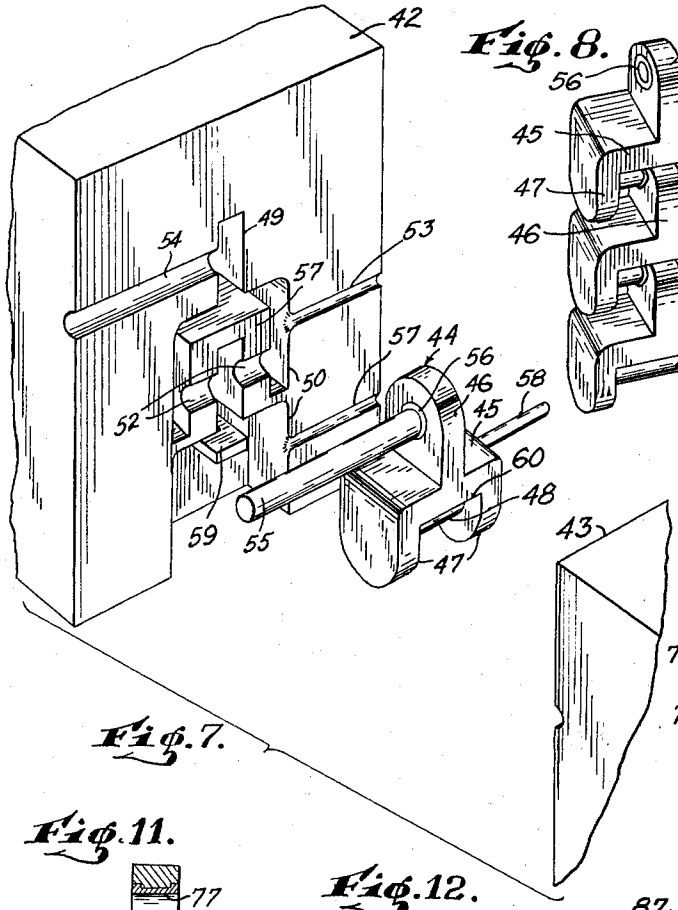


Fig. 7.

Fig. 8.

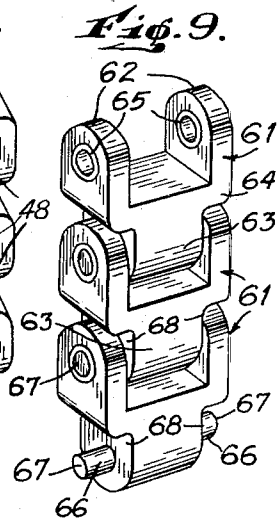


Fig. 9.

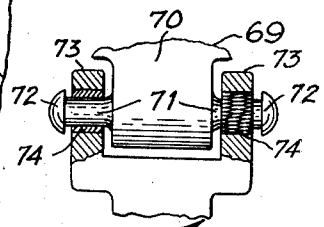


Fig. 10.

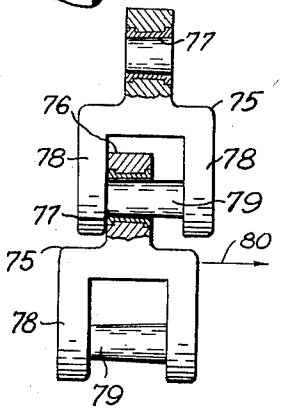


Fig. 11.

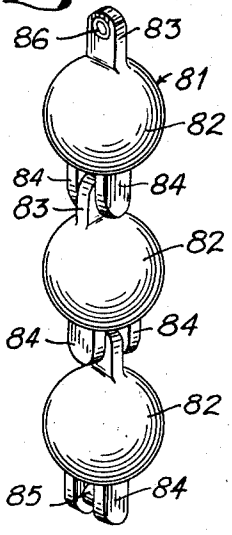


Fig. 12.

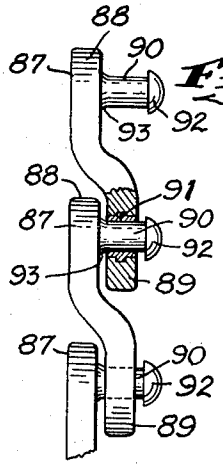


Fig. 13.

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METHOD OF FORMING MOVABLY COUPLED MEMBERS

Louis H. Morin, Bronx, N. Y.

Original application December 28, 1943, Serial No. 515,883. Divided and this application June 15, 1945, Serial No. 599,686

6 Claims. (Cl. 22—203)

1

This invention relates to the formation of die cast bodies including integral pintle or pin portions. More particularly, the invention relates to the production of such bodies in united relationship to each other and, for example, in the production of such articles of manufacture as link chains, and, further, to the novel method of producing articles of manufacture of the class described. The novel features of the invention will be best understood from the following description, when taken together with the accompanying drawing, in which certain embodiments of the invention are disclosed and, in which, the separate parts are designated by suitable reference characters in each of the views and in which:

Fig. 1 is a longitudinal sectional view through a die diagrammatically illustrating the method of forming successive castings and indicating the die parts in open position in dotted lines.

Fig. 2 is a section on the line 2—2 of Fig. 1, showing parts of the castings in elevation and other parts in section and omitting parts shown in Fig. 1.

Fig. 3 is a partial section on the line 3—3 of Fig. 2, showing only one of the die parts.

Figs. 4 and 5 are views similar to Fig. 3, the sections being on the lines 4—4 and 5—5 of Fig. 2.

Fig. 6 is a perspective view of a short length of chain made in accordance with the method and by the dies illustrated in Figs. 1 to 5 inclusive.

Fig. 7 is a diagrammatic exploded view, showing a modified form of die structure with the casting disposed therebetween.

Fig. 8 is a perspective view of a few links of chain formed in accordance with the teachings of Fig. 7 and on the same general principles as taught in Figs. 1 and 2.

Fig. 9 is a perspective view of another form of links made according to the method generally outlined in Figs. 1, 2 and 7.

Fig. 10 is a side and sectional detailed view of a linkage substantially the same as that shown in Fig. 9, but showing a further modification.

Fig. 11 is a view similar to Fig. 10 showing another form of link.

Fig. 12 is a view similar to Fig. 6 showing another form of link; and

Fig. 13 is a view similar to Figs. 10 and 11 showing another type of link construction.

This application constitutes a division of my prior application Ser. No. 515,883; filed December 28, 1943, now matured into Patent No. 2,460,524.

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In the construction of pivotally or swingably coupled bodies of various kinds and classes, it has been the practice to join the pivot or hinge portions of the bodies by pins or similar elements commonly referred to as pivots, pintles and the like. In such cases, the pins or pivots have been in the form of separate members secured to or coupled with the parts to be pivoted together or hingedly coupled.

It is the purpose of my invention to simplify the construction of coupled members or bodies of the kind under consideration and, particularly, where it is desirable to permanently couple the members or bodies, to die cast at least one of the bodies with a pivot or pintle portion arranged within a companion body, so that the resulting bodies are united in the casting operation. This method of procedure, in addition to forming simply two bodies which are swingably or pivotally united, also makes it possible to produce multiple link bodies, for example, in the production of link chains.

For purposes of illustrating one adaptation of the invention, I have shown in the accompanying drawings a few types of linkages in the construction of link chains. These illustration are given simply to convey the general adaptability of the invention to the production of articles of manufacture of the kind under consideration, wherein the chain links are not only formed, but automatically produced in assembled relationship to each other in the successive casting operations of the machine.

In Figs. 1 and 2 of the drawing is diagrammatically shown two die parts 15—16 for the formation of die cast link bodies 17 in the injection of casting material from a nozzle 18, note Fig. 2, through a gate 19 on the parting line of the dies into the impression or cavity 20 formed on adjacent surfaces of the dies. At this time, it will be well to point out that in forming the several castings, the castings may be formed from metal or metal alloys, or may be formed from plastic materials.

Before proceeding to define the die structure, it will be well to describe the structure of each cast member or body 17, which in the construction shown, constitutes a link of a chain. Each body has a central solid cylindrical portion 21, at one end of which is a projecting tongue 22, having a rounded outer surface, as seen at 23, and an aperture 24, passing through the central portion of the tongue and in which is arranged a flanged bushing 25. The tongue 22 is arranged centrally of the cylindrical portion 21 and the

side walls 26 thereof are continuous with the side walls of the body portion 21. Thickness of the tongue 22 is approximately one-third of the diameter of the cylindrical portion 21.

The other end of the cylindrical body 21 is yoke-shaped or fork-shaped in form, as a result of parallel outer arms 27 formed as continuations of the cylindrical portion 21. Between the arms 27 is a recess 28 greater in width than the thickness of the tongue 22, as will be clearly seen upon a consideration of Fig. 2 of the drawing. The two arms 27 are joined by an integral pin or pintle portion 29 arranged within the recess 28 substantially centrally thereof and so as to support the tongue 22 of a companion link body 17 freely within the recess 28, it being understood that the pin or pintle 29 is arranged within the bushing 25 of the tongue 22 of said companion link.

In Figs. 3, 4 and 5 of the drawings are shown the contours of die 15 and, as die 16 is of the same construction, the brief description of one will apply to both. At 30 is shown the cavity portion, in which the tongue 22 is formed. This cavity portion has a pin or stud member 31, upon which the bushing 25 is arranged in any desired manner, prior to the casting operation. In other words, the bushing amounts to an insert in the die cavity 20 and is preferably in the form of a bushing member having properties which will be desirable from a standpoint of wear. In a metallic casting, the bushing will be of a harder bearing metal or, in some instances, might be a fiber, whereas in the plastic castings, fiber or metallic bushings of any suitable type and kind can be employed. As a matter of fact, a bushing of a plastic material, which would be harder or present a better wearing surface than the plastic employed in the casting, also may be used.

At 32 is shown the cavity in which the cylindrical portion 21 is formed and at 33 is shown the cavity for forming the arms 27. In this latter cavity is an inwardly protruding portion 34, note Fig. 4, apertured as seen at 35 to form the pin or pintle 29. The projection 34 has a web or fin portion 36. The parts 34—36 collectively form the recess 28 between the arms 27 and around the tongue portion 22 of the companion pre-cast body 17, as will clearly appear from a consideration of Fig. 2 of the drawing.

Arranged and movably supported between the adjacent surfaces of the dies 15—16 and extending into the cavity 30 is a pin or shaft 38, upon which each casting is formed. This pin or shaft performs three distinct operations. First, it supports the casting in the operation of separating the dies or moving them into the dotted line position indicated in Fig. 1 of the drawing and, in this sense, becomes an ejector. Secondly, it is utilized to move the casting relatively to the dies to position the same in the cavity 33 and, thirdly, to rotate the casting so as to bring the tongue 22 in a position at right angles to the casting position and, thus, to facilitate formation of the pin or pintle portion 29 within the aperture 24 or the bushing arranged in said aperture, as will clearly appear from a consideration of Fig. 2 of the drawing. In this position, the pre-formed casting has its tongue 22 arranged at right angles to the tongue of the upper casting shown as being formed in and between the dies.

The dies have recesses to form projecting hanger pins 39 on the tongue 22 adapted to enter the recesses 40 in the dies. This supports the pre-cast body 17 against displacement from the cavity 33, after the rod or shaft 38 has been stripped from the casting. This latter operation is performed by partially closing the dies and in returning the rod or shaft 38 to its normal position preparatory to receiving the next successive casting. The pins 39 are trimmed from the castings in the operation of trimming the gates 19.

The result of the above operation will produce a chain of any desired length with the link body 17 permanently united in the manner partially illustrated in Fig. 6 of the drawing. I have found from experience that, in casting the pin or pintle portion 29 within the aperture 24 or the bushing 25 in said aperture, in cooling there is a shrinkage of the pin or pintle 29 sufficiently to provide a very snug but yet free coupling between the link bodies. At this time, it is also well to point out that the use of bushings is not absolutely essential and, in many articles of manufacture, the bushings can be dispensed with and the pin or pintle portions cast directly within and to fit snugly within the apertures of the companion member or body.

In Fig. 1 of the drawing, I have shown at 41 what might be regarded as a dummy used in the initial casting operation or, in other words, in forming the first member or body 17. This dummy or filler-piece 41 has the general contour of the upper portion of one of the castings, that is to say, the tongue 22 including the bushing 25 therein and the cylindrical body 21. It will be preferably composed of two parts split along the axis of the pintle 29 so as to facilitate quick detachment from the first link formed.

In Fig. 7 of the drawing is diagrammatically illustrated parts of two dies 42 and 43 used in the formation of modified forms of link members or bodies 44. The members or bodies 44, instead of being cylindrical in form, are generally in the form of a rectangular plate 45, which forms the central body portion similar to the body 21 and on one side of which is an apertured and bushed tongue 46 and, at the other side, a pair of projecting and spaced arms 47 joined by a pin or pintle portion 48. In Fig. 7, the parting line surface of die 42 is shown in perspective and, as the surface of dies 42 and 43 are the same, the brief description of one will apply to both.

The mold cavity or impression has a cavity 49 for forming the tongue 46, a cavity 50 for forming the body 45 and arms 47, a projecting portion 51 in cavity 50 for forming the recess around pintle 48 and having in it recesses 52, wherein the pintle of the next successive link is formed. On the surface of the die is a gate passage 53 for admitting casting material to the die cavity and a core pin passage 54 for receiving a horizontal core pin 55 on which the insert bushing 56 is arranged, prior to the casting operation. With this construction, the core forming stud members 31 of the construction shown in Figs. 1–6 are dispensed with, as is also the rod or shaft 38. The core 55 is used to shift the castings and, in this construction, rotation of the castings is not necessary, in that all of the tongue members 46 remain in alinement, as will appear from a consideration of Fig. 8 of the drawing.

The dies 42—43 have a gate recess 57 for receiving the gate 58 of a pre-formed casting when the same is shifted into the lower position (Fig. 7) in the die cavity preparatory to the casting of the next successive link. In the impression 50 is arranged a supporting plate 59 which is adapted to engage the lower surface 60 of the body 45 between the arms 47, to hold the pre-formed

casting in the lower portion of the die cavity, when the dies are partially closed, as they are in stripping the core pin **55** from the casting and moving the same into alinement with the recess **54** preparatory to receiving another bushing insert **56** and the next successive casting to be formed.

In Fig. 9 of the drawing is shown another modification in the formation of the link body. All reference to the dies are omitted, in that it will be apparent from a consideration of Figs. 1, 2 and 7 just what type of die structure would be necessary in forming these link bodies **61**. The method of making the link bodies **61** differs from that used in making the bodies **44** primarily because the former are cast in an inverted position relative to the latter, that is to say, with the parallel spaced arms **62** arranged upwardly instead of downwardly and with a thicker tongue **63** arranged downwardly instead of upwardly. The central rectangular plate portion **64** is otherwise substantially the same as the plate portion **45**. In this construction, the apertures having the bushings **65** therein are formed in the arms **62** by a core pin similar to the core pin **55**, but extending entirely across the dies to enter both cavities employed for forming the arm **62** or, if desired, independent core pins can be used on each side of the dies, thus minimizing the stroke in stripping the core pins from the castings, as will be apparent. With this construction, instead of forming a pin or pintle between the arms **62**, projecting pin or pintle members **66** are formed at opposite sides of the tongue member **63** and of sufficient length so as to bring the outer surfaces **67** of the pin members **66** flush with, or substantially flush with the outer surfaces of the arms **62** or the bushings **65** therein. With the link bodies **61**, the arms **62** of one body fit and operate in recesses **68** formed at opposite sides of the tongue **63** and beneath the plate **64** and are disposed within said recesses.

In Fig. 10 of the drawing is shown a slight modification of the construction shown in Fig. 9. The only difference is that, in Fig. 10, the separate link bodies **69** or the tongue portions **70** thereof have projecting pintle pins **71** which include integral heads **72** at their outer ends and disposed outwardly of the spaced arms **73**, as will clearly appear. In the apertures of the arm **73** are arranged bushings **74**. In this construction knurled bushings are employed, the knurling being used to retain the bushings against displacement.

In Figs. 1, 2 and 6, flange bushings are shown, but it will be understood that any means may be employed to key or retain the bushings against displacement or movement within the casting bodies except as and when it would be desirable to allow these bushings to move within the castings.

In Fig. 11 of the drawing is shown a slight modification of the construction illustrated in Fig. 8. Here the link bodies **75** have tongue portions **76** with tapered bushings **77** therein, or a tapered hole formed in the tongue portions. The spaced arms **78** are joined by a tapered pin **79**, thus providing a limited movement of the tongue portion **76** of each body on the pin or pintle **79**, particularly in the direction of the arrow **80** of said figure. This embodiment of the invention shows the use of tapered pintles, or pintles with tapered portions thereon.

In Fig. 12 is shown a modification of the construction shown in Fig. 6 and differs therefrom

primarily in providing links **81** having a central ball or sphere-like body **82** instead of the cylindrical body **21**, the ball or sphere having the projecting tongue **83** at one end similar to the tongue **22** and the spaced arms **84** at the other end similar to the arms **27**. The arms **84** have the integral pintle **85**, which passes through the bushed aperture **86** of the tongue **83**.

In Fig. 13 of the drawing is shown a modification which might be regarded as one-half of the shown in Fig. 10 of the drawing, or in other words, a half-like construction. Here each link body **87** comprises simply offset end portions **88** and **89**, the end portion **88** having at one side a projecting headed pin **90**, similar to the pin **71**. Whereas the end portion **89** has a bushed aperture **91** for receiving the pin **90**. With this construction, the heads **92** of the pins **90** serve to maintain the links against separation. These heads might be of any desired contour.

In all of the constructions disclosed, it will be understood that chain links of predetermined dimensions, or comprising a predetermined number of link members or bodies can be made in a successive number or series of casting operations. Aside from trimming operations, for removal of the gate portions and plating or other finishing operations which might be desirable, substantially finished products are produced in one series of operations of the machine employed.

In some instances, only two of the members are united in forming a single product. In other cases, short lengths are produced in manufacturing such things as bracelets. In the chain uses of the invention, the product may be made as other chains are made, in long pieces and, when sold, cut off to required lengths. However, when large quantities of chains of a given length are desired, the cycle of operations can be so controlled and timed as to produce these given lengths by automatically controlling the number of successive castings formed and the periodic insertion of the dummy or filler-pieces, as for example, the filler-piece **41**. Similar dummies or filler-pieces would be used in the construction of the several types of link bodies shown in Figs. 8 to 13 inclusive.

In forming the several castings and, in moving the casting from its casting station to the station for receiving the next successive casting, a suitable lubricant may be sprayed into the aperture or socket portion prior to casting the pin or pintle therein. Where this aperture or socket is formed by the core pin, as with the structures shown in Figs. 7, 8 and 9, the spraying of the lubricant will take place after the core pin has been removed and while the dies are still in a partially closed position. A suitable spray nozzle or jet will be moved into and out of the path of the dies in accomplishing this result.

The various links disclosed, with the exception of that illustrated in Fig. 13, may be said to have tongue portions at one end and socket portions at the other end for receiving the tongue portions of adjacent links. The sockets are formed by the U-shaped ends of the links. In this sense, the interfitting tongue and groove or socket portions are coupled together by pins or pintles which are integral with one of said portions. For example, in Figs. 1 and 2, the pintles are integral with the socket portions, whereas in Figs. 9 and 10, the pintles are integral with the tongue portions.

In all of the constructions disclosed, a pin or pintle portion is cast within an aperture or

socket or within a bushing that may be supported in this aperture or socket to form a wearing surface therein. The shrinkage of the pin or pintle in chilling will form the necessary clearance for providing free swinging or pivotal movement of the parts one with respect to the other. In some instances, the pin or pintle portion, which might otherwise be termed a shaft, can have specific contour fitting a pre-formed contour in the socket portion, or in adding other functions or uses to the pin or shaft portion. From a contour standpoint, the tapered pin of Fig. 11 is one illustration. Further illustrations of contour are found in Figs. 10 and 13, in which figures the ends include heads and, furthermore, the pins 90, where they join the end 88 of the link are flared or filtered, as at 93, to give added strength to said pins.

I claim:

1. The herein described method of forming chains from a series of similar die cast links coupled against displacement and movable relatively to each other, which comprises first casting one link between relatively movable dies with a pin-receiving portion therein, then separating the dies and moving said link into a different position between said dies, then closing the dies and casting the next adjacent link with a pin-receiving portion and an integral pintle cast in the pin-receiving portion of the first link, repeating this operation to produce a required number of links of a chain in a successive series of die casting operations, and rotatably shifting the position of the link during movement thereof into said different position between the dies.

2. The herein described method of forming chains from a series of similar die cast links coupled against displacement and movable relatively to each other, which comprises first casting one link between relatively movable dies with an apertured portion therein, then separating the dies and moving said link into a different position between said dies, rotating the link to a position 90° with respect to the cast position thereof, then closing the dies and casting the next adjacent link with an apertured portion and an integral pintle portion cast in the aperture of the first link, and repeating this operation to produce a required number of links of a chain in a successive series of die casting operations.

3. The herein described method of forming permanently coupled and relatively movable die cast members, which comprises the steps of first die casting one member between a pair of relatively movable dies and forming on said member an apertured portion and a pin portion, then separating the dies and moving said member into a different position between the same dies with the apertured portion of said member arranged at right angles to the cast position thereof, closing the dies on said re-positioned member and casting a second member with the pin portion thereof cast within the apertured portion of the first member to provide between said intercast members a movable coupling.

4. A continuous method of forming permanently coupled and relatively movable die cast members by means of a pair of relatively movable dies which comprises die casting in one casting step a member with an upper apertured tongue portion and a lower pin-connected fork portion, freeing the member for movement by separating the dies, lowering the member in the space between the dies, rotating said member in said space to a position substantially 90 degrees removed from its first position, closing the dies around the member preparatory to coupling another member thereto, casting a second and identical member above said first member with the fork portion of the second member over the tongue portion of the first member and connected thereto by virtue of said pin being cast within and through said aperture, freeing said first and second members for movement by separating the dies, lowering said last-mentioned members in the space between the dies, rotating said members in said space substantially 90 degrees, closing the dies around said second member, and casting a third and identical member on said second member in the same manner as the second member was cast on the first member.

5. A continuous method of forming permanently coupled and relatively movable die cast members which comprises die casting in one casting step a member with an apertured tongue portion and a pin-connected fork portion, freeing the member for movement by separating the dies, moving the member in the space between the dies to a position substantially 90 degrees removed from its first position, closing the dies around the member preparatory to coupling another member thereto, and casting a second and identical member adjacent said first member with the fork portion of the second member engaging the tongue portion of the first member and connected thereto by virtue of said pin being cast within and through said aperture.

6. A continuous method of forming permanently coupled and relatively movable die cast members which comprises die casting in a single casting step a member with an apertured portion and a pin portion, freeing the member for movement by separating the dies, moving the member in the space between the dies to a position substantially removed from its first position, closing the dies around the member preparatory to coupling another member thereto, and casting a second and identical member adjacent said first member and connected thereto by virtue of said pin portion of the second member being cast within and through said apertured portion of the first member, and continuing to free said members for movement, to move them in the space between the dies, to close the dies about them in order to couple succeeding members thereto, and to cast succeeding members thereon in the manner above described.

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