Oct. 2, 1956 J. S. NELSON 2,764,790

PERMANENT MOLD FOR MAKING CAST LINK CHAIN

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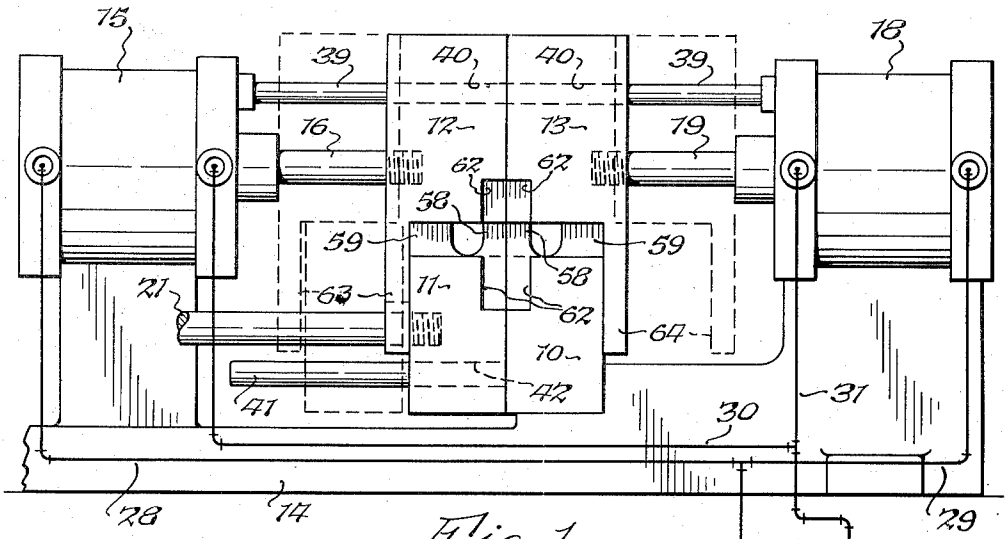
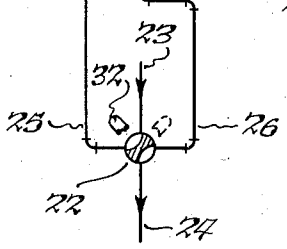


Fig. 1.



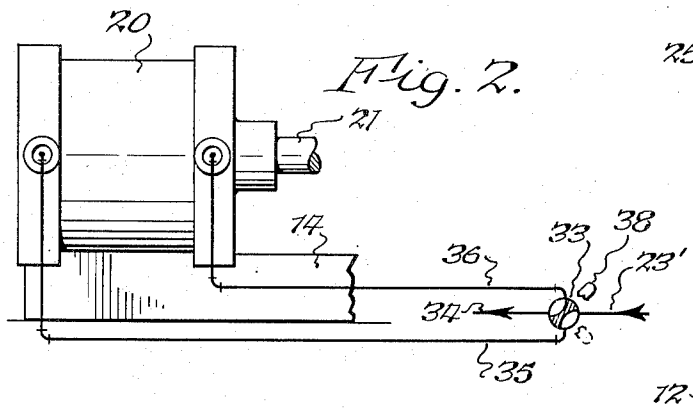


Fig. 2.

Fig. 3.

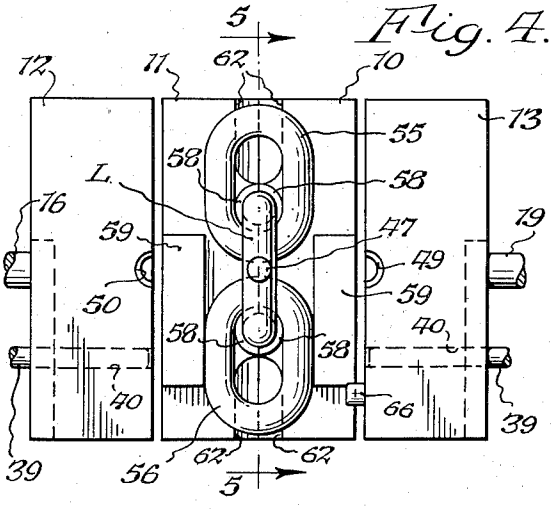
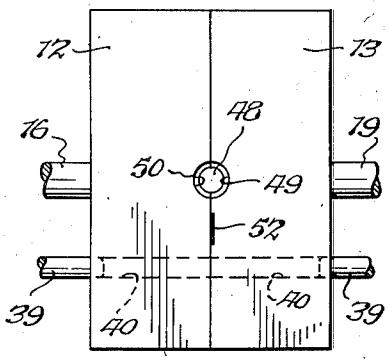


Fig. 4.



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Fig. 5.

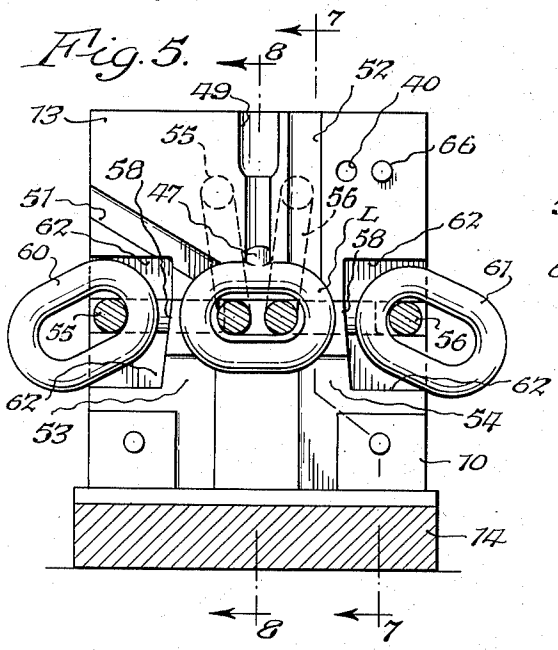


Fig. 6.

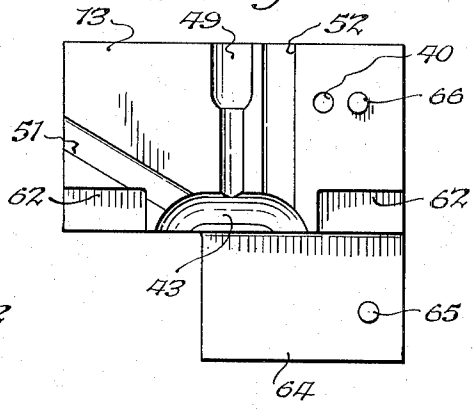
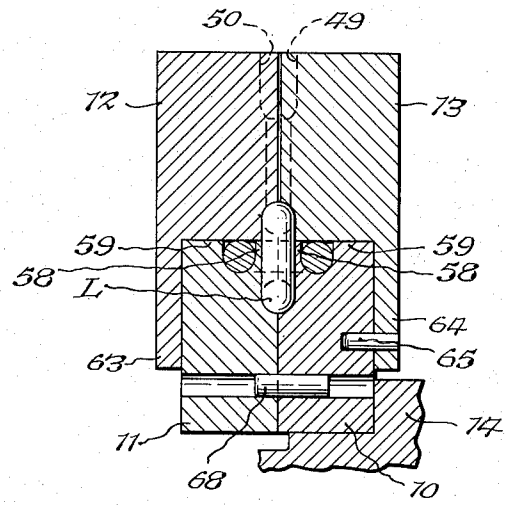


Fig. 7.



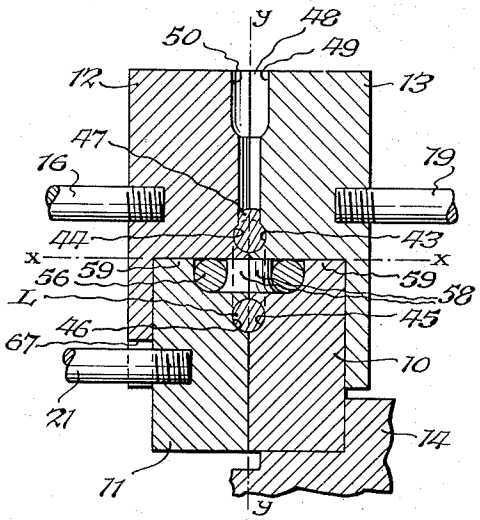


Fig. 8.

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PERMANENT MOLD FOR MAKING CAST LINK CHAIN

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3 Claims. (Cl. 22—137)

This invention relates to a permanent mold for making cast link chain of aluminum or bronze.

Heretofore it has been customary to form the links for a chain from lengths of bar stock each of which is bent into a ring and then welding the opposing ends of the ring together. The use of such a method to form aluminum chain is not commercially feasible because of the difficulty and prohibitive cost of welding aluminum.

It is also known to cast links which are used in chains but this is usually done by forming the molds of sand which of course are destroyed in order to free the molded link. Such a method is also economically unfeasible and too slow for mass production.

While prior attempts have been made to employ permanent molds for casting chain links, these attempts have been singularly unsuccessful from a commercial standpoint so that cast aluminum or bronze chain is unavailable on the market today and unheard of although there is a great need therefor.

Aluminum or bronze chain is desirable for use where the conventional iron or steel chain rapidly corrodes and requires frequent maintenance. Further because of its lighter weight aluminum or bronze chain is highly suited for ornamental purposes where the heavier iron chain is now being used. Also, by using the proper aluminum or bronze alloys link chain having the desired strength properties can be produced.

It is therefore the principal object of the present invention to provide a permanent mold for making a cast aluminum or bronze chain link interconnected with previously cast links.

Another object is to provide such a mold which can be used to produce commercial quantities of aluminum or bronze chain in a practical and economically feasible manner.

Another object is to provide a multiple part mold which can be both rapidly assembled preparatory to the casting operation and also quickly disassembled to free the link after it has been cast, the whole procedure taking only a matter of seconds.

Another object is to provide such a mold which forms a chain link which requires little dressing up after being cast to make it commercially acceptable.

Other objects and advantages will be apparent from the following description and accompanying drawings in which:

Fig. 1 is an elevational view of one end of a permanent mold embodying my invention and shown as associated with apparatus, partially illustrated, for operating the mold.

Fig. 2 is a supplemental view showing additional apparatus, not illustrated in Fig. 1, for operating the mold.

Fig. 3 is a top plan view of the mold shown in Fig. 1 with certain of the associated parts being illustrated fragmentarily.

Fig. 4 is a top plan view similar to Fig. 3 with the upper parts of the mold separated and showing the manner in which the central link cast in the mold is disposed with respect to adjacent chain links on either side.

Fig. 5 is a vertical central sectional view through the mold, this view being taken on line 5—5 of Fig. 4, and showing the disposition of the various links, additional links to those shown in Fig. 4 being illustrated.

Fig. 6 is a view similar to Fig. 5 and showing only the inner face of one of the upper mold parts with the chain removed.

Fig. 7 is a vertical cross sectional view of the mold in its fully closed position, this view being taken on line 7—7 of Fig. 5.

Fig. 8 is a similar cross sectional view taken on line 8—8 of Fig. 5.

The permanent mold embodying my invention is shown as having four parts 10, 11, 12 and 13. Referring to Fig. 1, the parts 10 and 11 are the lower right and left sections, respectively, and the parts 12 and 13 are the upper left and right sections respectively. The mold part 10 is shown as being mounted in a stationary position and for this purpose is suitably rigidly mounted on a base 14 which may be supported in any suitable manner. The other mold parts 11, 12 and 13 are shown as arranged for movement in a horizontal direction, this for the purpose of opening and closing the mold as hereinafter described.

The means for moving the movable mold parts 11, 12 and 13 may be of any suitable type, those shown being pneumatic piston and cylinder devices which are preferred. Thus, in Fig. 1, a cylinder 15 is shown as rigidly mounted on the base 14 and has its piston rod 16 connected to the upper left mold part 12; and a similar cylinder 18 is rigidly mounted on the base 14 to the right of the mold and has its piston rod 19 suitably connected to the upper right mold part 13. Referring to Fig. 2 which is an extension of the left end of the frame 14, there is shown a third cylinder 20 rigidly mounted thereon and having its piston rod 21 suitably connected to the lower left mold part 11. The piston and cylinder devices are of the double acting type.

The pistons (not shown) slidably arranged in the various cylinders 15, 18 and 20 and connected to their respective piston rods 16, 19 and 21 are caused to reciprocate by air lines and valves which will now be described. The numeral 22 represents diagrammatically a four-way valve connected on diametrically opposite sides to a compressed air line 23 leading to any suitable source (not shown) of compressed air such as an air compressor, and to an exhaust line 24 communicating with the atmosphere. Also connected to diametrically opposite sides of the valve 22 are lines 25 and 26. The line 25 has two branches 28 and 29, the branch line 28 leading to the end of the cylinder 15 remote from the mold and the branch line 29 leading to the end of the cylinder 18 remote from the mold. The line 26 also has two branches 30 and 31, the branch line 30 leading to that end of the cylinder 15 which is adjacent the mold and the other branch line 31 leads to that end of the cylinder which is adjacent the mold. The valve 22 is operated by a control lever 32.

With this control lever 32 in the full line position shown and with the valve as illustrated, it will be seen that compressed air is admitted from line 23, through the upper left passage of the valve into line 25, from whence the compressed air passes through branch lines 28 and 29 into their respective cylinders 15 and 18 at the ends thereof remote from the mold so as to urge the pistons toward each other and thereby bring the upper mold parts 12 and 13 together and so maintain them. The opposite ends of these cylinders 15 and 18 are connected to the atmosphere through the branch lines 30 and 31,

line 26, lower right passage of the valve 22 and exhaust line 24. When the control lever 32 is swung to the right to the dotted line position the valve 22 is rotated so as to establish communication between the lines 23 and 26 on the one hand and the lines 24 and 25 on the other hand. This operates to reverse the pressures on the pistons in the various cylinders and cause the upper mold parts 12 and 13 to separate or open.

Turning now to a consideration of the operation of the cylinder 20 which controls the movement of the lower left mold part 11, the numeral 33 represents a valve similar to the valve 22. Line 23' is the compressed air line and may be considered a branch of line 23. Line 34 is an exhaust line to the atmosphere and is diametrically opposite to line 23'. The other pair of lines connected to diametrically opposite sides of the valve 33 are the lines 35 and 36. The line 35 leads to that end of the cylinder 20 which is remote from the mold and the line 36 leads to the opposite end of this cylinder. The valve 33 is shown as movable by a control lever 38. With this lever 38 in the full line position shown, compressed air is admitted from line 23', through the lower right passage of the valve 33, thence through the line 35 to the remote end of the cylinder 20. This urges the piston and rod 21 to move to the right to close the lower left movable mold part 11 against the stationary mold part 10 and to maintain it so closed. When the control lever is swung downwardly to the lower position represented by the dotted lines, the valve 33 is rotated to establish communication between the compressed air line 23' and the line 36 on the one hand and the exhaust line 34 and the line 35 on the other hand and thereby reverse the pressures on the piston in the cylinder 20 so as to retract the piston rod 21 and separate the lower mold parts 11 and 10.

During opening and closing of the mold, the movable mold parts are guided so as to assure proper registry of the various parts when the mold is closed. To this end, each of the cylinders 15 and 18 carries a guide rod 39 which slides in a hole 40 provided in the upper mold parts 12 and 13. As shown, the corresponding guide rods 39 and holes 40 are in alinement with one another. Movement of the lower movable mold part 11 is guided on a rod 41 fast to the stationary mold part 10 and projecting through a hole 42 in the movable mold part 11.

The mold parts 10, 11, 12 and 13 are shown as being in the form of metal blocks having their opposing vertical faces suitably recessed to provide jointly a mold cavity for the link to be cast therein. Such a link is shown at L in Figs. 4, 5, 7 and 8. All the mold parts meet along a common vertical plane represented by the line *y*—*y* in Fig. 8 and along a common horizontal plane represented by the line *x*—*x* in Fig. 8. It will be noted that the plane *y*—*y* or vertical parting line of the mold parts passes through the center of the link L whereas the plane *x*—*x* or horizontal parting line of the mold parts is arranged above the midpoint of the spacing between the horizontal and parallel side stretches of the link L.

The inner vertical face of the upper mold part 13 is shown in Fig. 6 in which the groove 43 has its ends turned downwardly to open to the lower face of the mold block 13. This groove 43 is semi-circular in cross-section. A similar groove 44 is formed in the inner vertical face of the other upper mold part 12 (see Fig. 8) and these two grooves 43 and 44 jointly form a channel circular in cross-section for the upper section of the link L. Referring to Figs. 5, 6 and 7, the opposing vertical faces of the lower mold blocks 10 and 11 are formed respectively with grooves 45 and 46 semi-circular in cross section, each turned up at its ends to form continuations of the grooves 43 and 44 respectively.

When the mold is closed as shown in Figs. 3 and 8, molten metal is poured into the mold cavity through a gate 48 formed by semi-circular grooves 49 and 50 provided respectively in the opposing vertical faces of the upper mold blocks 13 and 12. The grooves 49 and 50 forming the gate 48 lead to the mold cavity and, of course, will leave a sprue 47 on the link L which can be later removed as by grinding off the same.

An important feature of the invention is the means which I provide for venting the mold cavity when the molten metal is poured into the cavity. Heretofore it has been general practice to provide circular vent holes but to provide adequate cross sectional area for the passage of air being displaced, in order to prevent defective castings, the circular vent holes were so large that metal would flow into them leaving risers or projections on the cast article which sometimes rendered it difficult to open the mold and always required additional time for removing the risers or projections. I have avoided all these difficulties by providing very shallow but broad vents. Referring to Fig. 5, two such vents 51 and 52 are shown as provided by grooves formed in the inner vertical face of the upper mold part 13, and also two similar grooves 53 and 54 in the inner vertical face of the lower mold part 10. The groves 51, 52, 53 and 54 are only several thousandths of an inch deep and it has been found that the molten metal will not flow into these grooves. While I have shown these grooves as provided only in the inner vertical faces of the mold parts 10 and 13 it will be understood that they can be provided instead in the inner vertical faces of the other mold parts 11 and 12, or registered grooves can be provided in both faces as long as the thickness of the vent hole formed jointly by them is not more than a few thousandths of an inch. Also, of course, the direction of the grooves and their number can be varied from that shown in the drawings as long as provision is made for a liberal venting of the mold cavity. With such a venting arrangement I have found that good sound links can be cast with a very low percentage of rejects because of blow holes and the like.

It is a further important feature of my invention to make provision for casting the link L to connect two links which have already been formed. This is illustrated in Figs. 4 and 5 where the links 55 and 56 are to be connected by the link L. These links 55 and 56 have previously been formed singly as in a simple two part mold which forms no part of the present invention and hence is not illustrated. Accommodation for the links 55 and 56 in a horizontal plane is provided by recessing the upper faces of the lower mold parts 10 and 11. Referring to Fig. 4, the upper surfaces of the mold parts 10 and 11 are recessed the thickness of the links 55 and 56 everywhere except for leaving a pair of raised tubular necks 58—58 which surround the curved portions of the link L at opposite ends thereof and a pair of raised abutments 59—59 which engage the lower surfaces of the upper mold blocks 12 and 13, as shown in Figs. 7 and 8.

Since additional links 60 and 61 may be connected to the links 55 and 56 respectively when the link L is cast, recesses 62 are provided at the adjacent corners of the various mold parts 10, 11, 12 and 13 to provide jointly recesses to accommodate the links 60 and 61 when the mold is fully closed.

To interconnect the mold parts 10, 11, 12 and 13 when the mold is fully closed, the upper mold parts 12 and 13 are shown as having depending skirt portions 63 and 64 respectively which extend along and lie against the lateral outer faces of the lower mold blocks 11 and 10 respectively. The skirt portion 63 is cut out at 67 (Fig. 8) to avoid interference with the piston rod 21. As shown in Fig. 6, the skirt portion 64 for the upper mold part 13 has at least one dowel pin 65 which is received in a registered hole in the lower mold block 10. Although not shown, the skirt 63 for the other upper mold part 12 has a similar dowel pin and recess connection with the lower mold block 11. These dowel pins 65 prevent vertical separation of the mold blocks along the horizontal parting line *x*—*x* shown. The upper pair of mold blocks 12 and 13 are prevented from vertical displacement relative to each other along the line *y*—*y* by one or more dowel pins 66 on

one of these blocks received in registered recesses in the other of these blocks. Similarly the lower mold blocks **10** and **11** are prevented from displacement by dowel pins **68—68** on one of these blocks and received in registered recesses in the other of these blocks.

Assuming the apparatus to be in the condition shown in Fig. 1 in which the mold is shown fully closed with no chain links arranged in any of its recesses, the control lever **32** for the valve **22** is turned to the dotted line position which will open the upper half of the mold by separating the upper mold blocks **12** and **13** to the position of these blocks shown in Fig. 4. The already formed links **55** and **56** will then be placed flat or horizontally on the exposed upper surfaces of the lower mold parts **10** and **11** with the curved inner ends of these links embracing the upstanding necks **58—58**. If additional links such as the links **60** and **61** shown in Fig. 5 are on the links **55** and **56** respectively, the links **60** and **61** are set on end or vertically in the recesses **62** in the lower mold blocks **10** and **11**.

The upper mold parts are then brought together again by returning the control lever **32** to its original full line position. This closes the mold fully and molten aluminum or bronze may thereupon be poured into the mold cavity through the gate **48** to form the link L with the sprue **47** thereon. As previously explained, molten metal will not flow into the shallow broad vents. After the metal cools sufficiently which is practically simultaneous with the pouring operation, the control lever **32** is again swung to the right to cause the upper mold parts to separate to the position shown in Fig. 4. The links **55** and **56** are then turned upwardly about their inner ends to the dotted line position shown in Fig. 5. This unlocks the split halves of the necks **58** which were projecting into the eyes or openings in the links **55** and **56** and permits the lower mold parts **10** and **11** to be separated which is thereupon accomplished by turning the control lever **38** for the valve **33** downwardly to its dotted line position. With the mold now fully open the cast link L is free to be removed from the lower part of the mold cavity. The control lever **38** is then returned to its full line position which operates to close the lower mold parts **10** and **11** so that the mold again assumes the condition shown in Fig. 4, preparatory to receiving additional preformed links corresponding to the links **55, 56, 60** and **61**.

In this manner cast aluminum or bronze chain can be produced in suitable quantity and with sufficient facility and rapidity to make the manufacture of such chain commercially practical. It will be understood that the sprues on the cast links L can be hammered off or ground off to improve the appearance of the chain.

I claim:

1. A permanent mold for making cast chain links of aluminum or bronze comprising a pair of separable lower mold blocks, one of which is movable relative to the other, a pair of separable upper mold blocks slidably arranged on said lower mold blocks, the opposed faces of said lower mold blocks forming vertically disposed end cavities and a communicating horizontally disposed side stretch cavity for casting the lower portion of said chain link, said upper mold blocks being provided with a complementary cavity leading from said end cavities and defining the remaining mold cavity of said chain link, a communicating gate for the pouring of molten metal into said mold cavities, said lower mold blocks having recessed surfaces to accommodate preformed chain links between said upper and lower mold blocks to which the cast link is interlinked, a plurality of shallow gas vent openings between the vertically opposed faces of said upper and lower mold blocks and leading outwardly from said mold cavity, and means for opening and closing said mold blocks by relatively moving said blocks away from each other in a direction normal to the mold cavity face of said mold.

2. A permanent mold for making cast chain links of aluminum or bronze comprising a pair of separable lower mold blocks, one of which is movable relative to the other, a pair of separable upper mold blocks slidably arranged on said lower mold blocks, the opposed faces of said lower mold blocks forming vertically disposed end cavities and a communicating horizontally disposed side stretch cavity for casting the lower portion of said chain link, said upper mold blocks being provided with a complementary cavity leading from said end cavities and defining the remaining mold cavity of said chain link, a communicating gate for the pouring of molten metal into said mold cavities, said lower mold blocks having recessed surfaces to accommodate preformed chain links between said upper and lower mold blocks to which the cast link is interlinked, and means for opening and closing said mold blocks by relatively moving said blocks away from each other in a direction normal to the mold cavity face of said mold.

3. A permanent mold for making cast chain links of aluminum or bronze comprising a pair of separable lower mold blocks, one of which is movable relative to the other, a pair of separable upper mold blocks slidably arranged on said lower mold blocks forming vertically disposed end cavities and a communicating horizontally disposed side stretch cavity for casting the lower portion of said chain link, said upper mold blocks being provided with a complementary cavity leading from said end cavities and defining the remaining mold cavity of said chain link, a communicating gate for the pouring of molten metal into said mold cavities, said lower mold blocks having recessed surfaces to accommodate preformed chain links between said upper and lower mold blocks to which the cast link is interlined, dowel pins on said mold blocks which are received in registered recesses in the adjacent opposed mold blocks for retaining said mold blocks in accurate registration upon closure of said mold, a plurality of shallow gas vent openings between the vertically opposed faces of said upper and lower mold blocks and leading outwardly from said mold cavity, and means for opening and closing said mold blocks by relatively moving said blocks away from each other in a direction normal to the mold cavity face of said mold.

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