Feb. 14, 1950 G. E. SCHMID 2,497,098

APPARATUS FOR CASTING MOLTEN METAL

Filed July 3, 1946 3 Sheets-Sheet 1

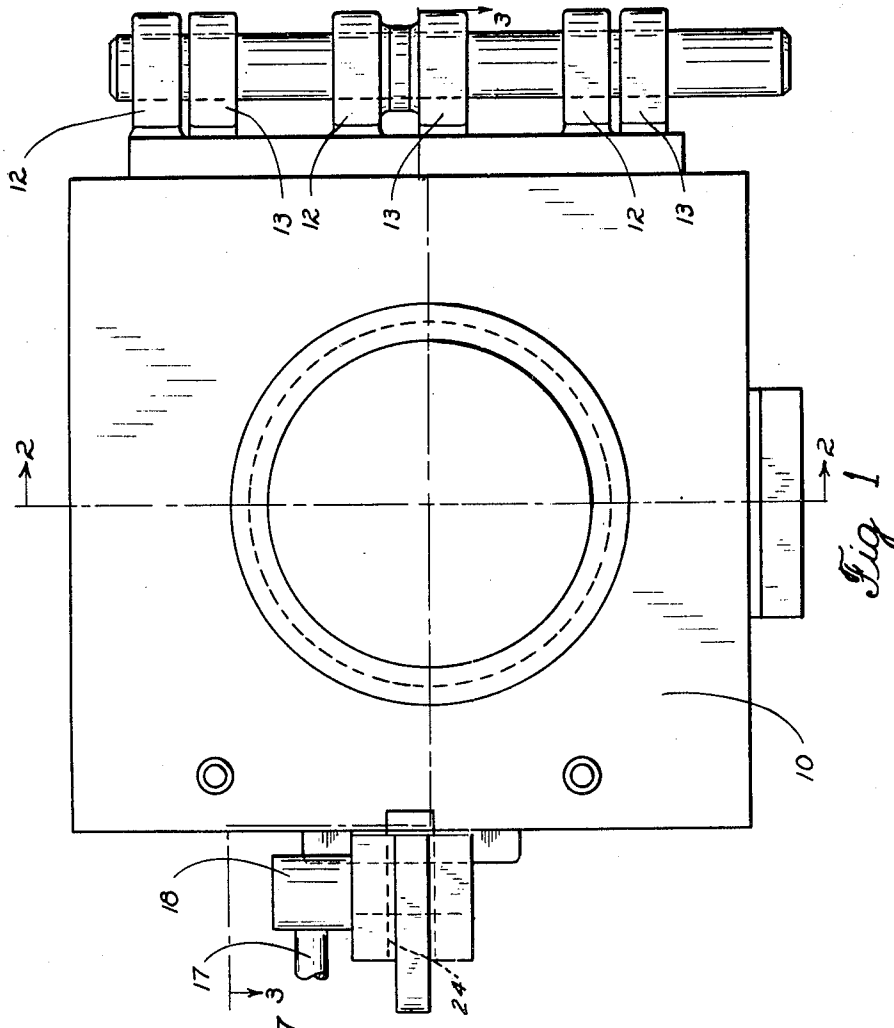


Fig. 1

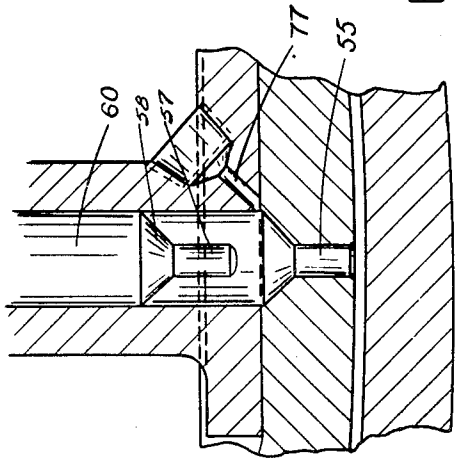


Fig. 4

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Feb. 14, 1950 G. E. SCHMID 2,497,098

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Filed July 3, 1946 3 Sheets-Sheet 2

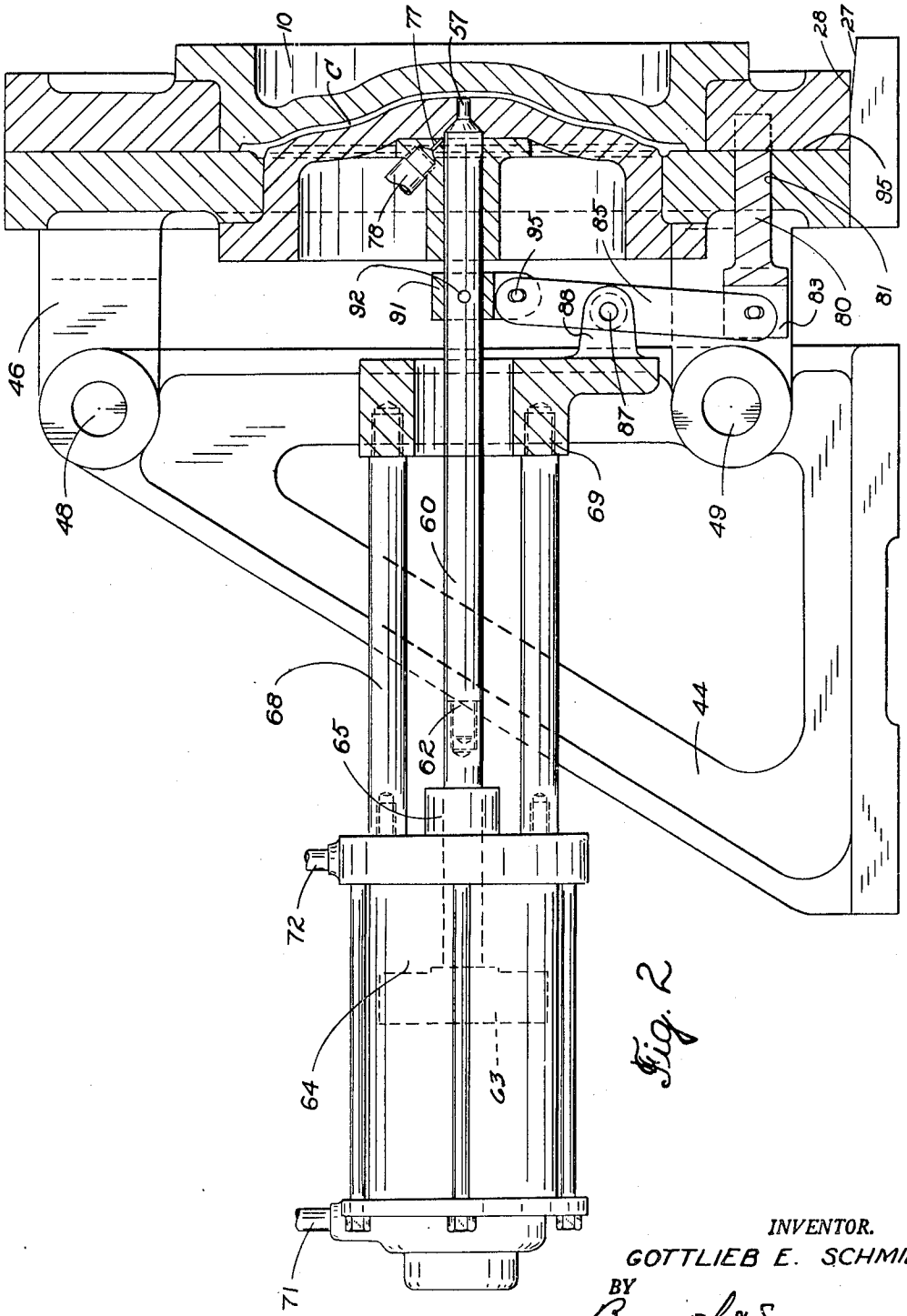


Fig. 2

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Filed July 3, 1946 3 Sheets-Sheet 3

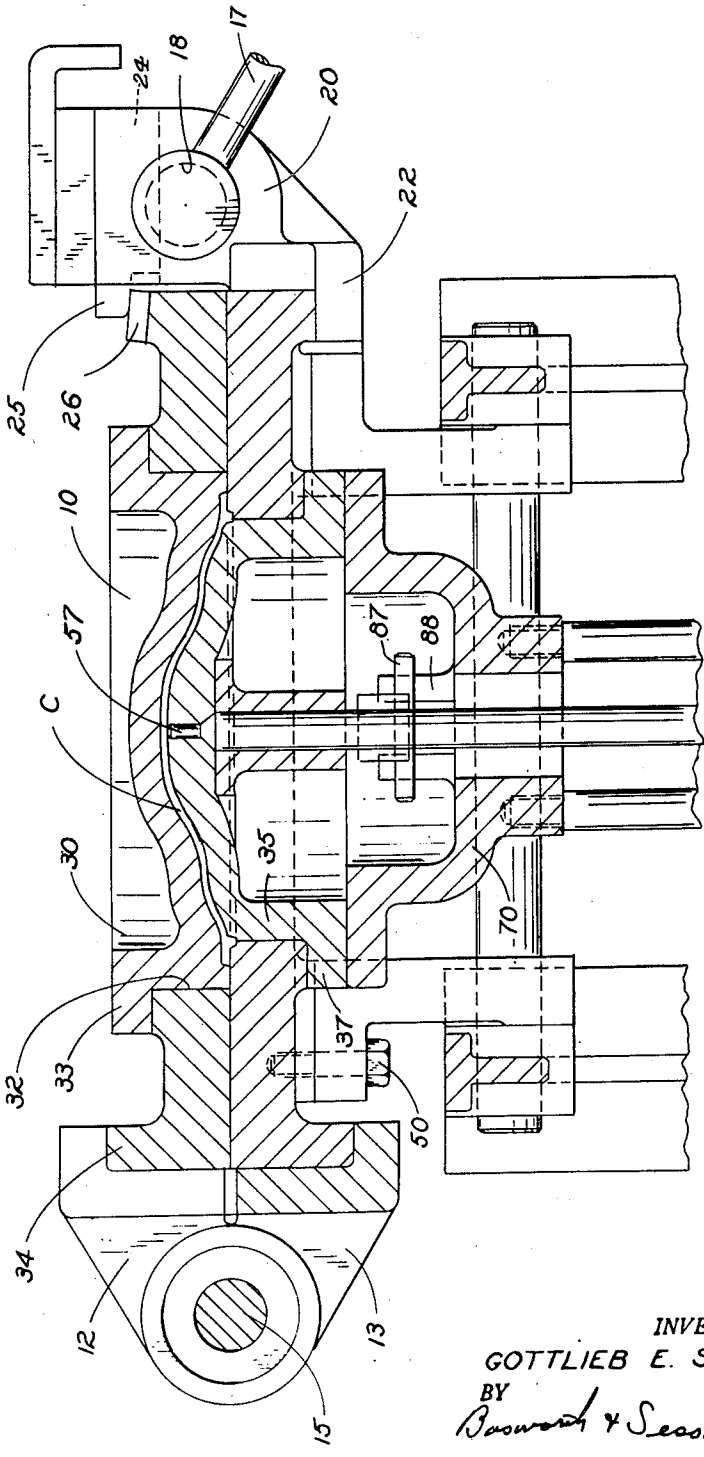


Fig. 3

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UNITED STATES PATENT OFFICE

2,497,098

APPARATUS FOR CASTING MOLTEN METAL

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Application July 3, 1946, Serial No. 681,302

4 Claims. (Cl. 22—94)

1

This invention relates to the art of casting material in molds or dies that are used repeatedly as distinguished from sand molds and the like that are used only once. More particularly it relates to a method and apparatus by which to remove there from castings, such as aluminum castings from a ferrous permanent mold, that tend to cling to a surface of the mold cavity after they have hardened.

Permanent molds for castings have been widely used and are so constructed that two or more mating mold or die sections may be closed to form a mold cavity corresponding to the shape of the article to be cast. The mold is so constructed that it may be opened readily to permit removal of the hardened casting and thereafter closed to receive the material from which a succeeding casting is to be made. To preserve the surface of the mold cavity and avoid damage to the hardened casting it is essential that the latter be easily removable from the mold in spite of any tendency of the casting to adhere to the mold surface, this even in cases where the configuration of the cast surface does not lend itself readily to disengagement from the mold. Knock out pins have commonly been employed to push the casting away from the mold in which case the pressure exerted by the pin sometimes deformed that part of the surface with which the pin made contact and occasionally chipped or fractured the casting, particularly if it was relatively thin.

It is a general object of the present invention to provide a method and apparatus by which readily to remove castings from a mold without damage either to the casting or to the mold. Another object of the invention is to provide a method and apparatus by which fluid under pressure, preferably compressed air, is directed against the casting to spread out between it and the mold and break the former free from the latter. Still another object of the invention is to provide means for insuring that the mechanism for applying the compressed air to the mold cannot become clogged with the molten material from which the casting is made. Still an additional object is to condition the fluid pressure ejection mechanism for use and prevent closure of the mold while the mechanism is so conditioned. A still further object of the invention is to provide a method for simultaneously setting the mold so it cannot be closed and directing fluid under pressure against the casting that is to be ejected.

Other objects of the invention will become apparent from the following description and from

2

the drawings in which a preferred embodiment is described and shown.

In the drawings, Figure 1 is a front elevation of a mold embodying the invention; Figure 2 is a vertical section through the mold of Figure 1 as indicated by the lines 2—2 thereon; Figure 3 is a horizontal section through the mold of Figure 1 as indicated by the lines 3—3 thereon; and Figure 4 is a detail section showing the ejection mechanism where the compressed air passage enters the mold cavity.

Generally the invention contemplates the provision of at least one passage, although more may be used, leading from a source of fluid under pressure, as compressed air, and communicating directly with the mold cavity. A removable plug or plunger is provided by which to close and seal this passage during the time a casting is being poured and hardened thereby to prevent the molten material from clogging and hardening in it. At the time the mold is opened to remove the casting the plunger may be withdrawn, a valve opened and fluid under the desired pressure admitted between the casting and that wall of the mold cavity to which it clings.

It is possible to determine at the time the mold is designed what portions of the surface the casting is likely to cling to and locate the fluid passage or passages accordingly. When the plunger is withdrawn to expose the passage a locking dog or safety pin is advanced from one of the mold walls to an extended position where it will abut the other wall if it is swung into position to close the mold and prevent the mold from being used to receive molten material. The dog remains in an extended position as long as the passage is exposed to the mold cavity.

The construction illustrated and described herein is for purposes of illustrating the method and apparatus of the invention: numerous modifications within the scope of the claims will be apparent to those skilled in the art.

The mechanism herein illustrated in front elevation in Figure 1 comprises a two part mold that may be closed to leave a mold cavity C and opened to remove a casting. It includes a front or door portion 10 provided with ears 12 that lie in vertical alignment with ears 13 on a stationary part of the casting machine to form a hinge held by a pintle or pin about which the cover may be swung between the open and closed positions. At the side of the mold opposite the hinge is a lever 17 (Figure 3) pivotally supported at 18 in a bracket 20 secured to the stationary frame of the mold indicated generally at 22. The lever

carries a gear tooth segment that engages a rack-toothed lock bar 24 slidable horizontally to move a tapered tooth 25 across a correspondingly tapered surface 26 of the cover 10 to cam and lock the mold door in closed position.

Accurate registration of the two parts of the mold is attained by provision of the slightly inclined cam surface 27 (Figure 2) carried by the main frame of the mold and adapted to support and guide into position the lower portion 28 of the cover 10.

The main mold portion and the door or cover portion 10 provide between them mold cavity C into which the molten casting material is poured. In the illustrated embodiment of the invention this cavity is seen to have the form of an aluminum lid for a cooking utensil. Such a lid is only one of many objects that may be cast in a mold as described with the aid of the present invention and while the invention is primarily intended for use in removing aluminum castings it will be apparent that it may also be used in operations where other materials are cast or molded.

The mold cavity C is bounded by a concave surface formed in a ring 30 positioned in a circular bore 32 of the cover 10, and having an annular shoulder 33 that abuts a shoulder 34 of the cover. A convex mold surface complementary to the concave surface is formed on a member 35 flanged at 37 to provide a shoulder that bears against the fixed main frame 22. The ring members 30 and 35 are permanently secured to the cover 10 and frame 22 respectively. The frame 22 is supported on two cast triangular brackets 44 (Figure 2) by lugs 46 that are secured to the brackets by pins 48 and 49, and are bolted at 50 (Figure 3) to the main frame 22.

With the assembly just described it is possible to close the cover 10 about the hinge pin 15 and lock it by the lever 17 to form the closed mold cavity C. Molten material is poured into the cavity through a suitable opening (not shown) at the top to fill the same and force out through another opening the air that otherwise would be entrapped therein. After the casting has solidified the lock at 25 may be withdrawn by the lever 17 and the cover 10 swung around the pin 15 to open the mold and separate the convex and concave faces that form the mold cavity. When this has been done it frequently will be found that the casting will cling to the convex mold surface on the member 35. It is necessary to apply a separating force to remove the casting from this surface.

According to the present invention, an extraneous fluid, preferably compressed air, at an elevated pressure is admitted between the casting and the convex mold surface to spread out between the two and free the casting. This compressed air is admitted through a passage or opening 55 communicating with the center point of the mold cavity, because this permits equal distribution of fluid pressure over the surfaces and also because any slight irregularity in the casting due to deposit of material adjacent the opening is concealed when a knob or handle is later secured to the lid.

The passage or opening 55 is normally closed by the plug or plunger 57 that conforms to the interior passage surface as best shown in Figure 4. To insure that the plunger will seat properly as nearly flush as may be with the convex mold surface of the cavity a conical shoulder 58 is provided on it to engage a corresponding conical surface just behind the opening 55. The plunger 57 is provided with an elongate rod portion 60 that is secured at 62 to the piston rod of a piston 63 mounted in a cylinder 64. A packing gland 65 prevents undue leakage between the piston rod and the cylinder end wall. The cylinder 64 is of conventional air cylinder construction and is secured to supporting bars 68 that in turn are received at 69 in a bell shaped casting 70 secured to the portion 37 of the member 35 and thus to the main frame 22.

Compressed air may be admitted through lines 71 or 72 to one or the other side of the piston 63 in the cylinder 64 by any suitable means, such as a four way rotary control valve, to move the piston back and forth and shift the plunger 57 to open or close the passage 55 communicating with the mold cavity. So long as plunger 57 is in place, air cannot enter the mold cavity; but after the plunger has been withdrawn, air under pressure may be admitted through an opening 77 from a line 78, also controlled by the rotary control valve, into the passage 55 and then into the mold cavity itself between the casting and the convex surface of the member 35.

As the compressed air leaves the opening 55 it forces its way over the entire region in which the casting clings to the mold to separate it from the mold without damage and particularly without any imperfections or marks such as result from the use of ejector pins and the like. It is believed that in addition to the separating effect due to the application of pressure to separate the casting from the mold there is a cooling effect on the parts that causes their relative contraction, and due to the uneven shape of the surfaces, a resultant separation between the casting and mold.

After a casting has been removed compressed air is admitted through line 71 to cylinder 64 to move the piston to the right (Figure 2) and return the plunger 57 to close the passage 55 with the plunger end lying flush with the adjacent convex mold surface.

To prevent the mold from being closed and locked while the plunger 57 is withdrawn and the passage 55 filled with molten metal mechanism is provided automatically to insure that the cover 10 may not be tightly closed until the passage 55 is sealed by the plunger. For this purpose a safety pin or dog 80 is slidably mounted at 81 (Figure 2) in the lower central portion of the main mold frame 22. In the position shown in this figure it is withdrawn flush with the parting line of the mold and permits the cover 10 to be closed. When the pin 80 is moved toward the right to the dotted line position shown it provides an outstanding abutment that prevents the cover 10 from being closed flush and locked and thus indicates to the operator that the mold is not in condition to be filled. The pin 80 is moved back and forth consequent upon movement of the member 60 and its associated mechanism through the medium of the piston 63 and cylinder 64. The pin 80 is slotted at its inner end at 83 to receive a link 85 pinned at 87 adjacent its midportion to ears 88 on the bell shaped casting 70. The other end of the link 85 is pinned at 95 to ears of a collar 91 secured at 92 to the member 60.

Due to the foregoing construction it will be apparent that as the plunger 57 is shifted to close the opening 55 the pin 80 will be withdrawn toward the left (Figure 2) to permit the cover 10 to be closed and locked by the lever 17. On the

other hand when the plunger 57 is withdrawn to open the passage 55 to admit compressed air from the line 78 into the mold cavity the link 85 will be rocked about its pivot 87 to shift the pin 80 toward the right (Figure 2). At this time the pin will stand beyond (to the right of) the parting line surface 95 and thus prevent the cover 10 from being closed while the casting ejection mechanism is in condition for operation.

From the foregoing description it will be seen that the invention provides a novel method and apparatus effectively, simply and safely to remove castings from mold surfaces to which they may cling. The casting is not marred or otherwise marked by use of the present invention. Apparatus embodying the invention is simple of construction and operation and is positive in its action to warn against pouring into the mold at such a time as to harm the ejector mechanism.

It is intended that the patent shall cover, by suitable expression in the appended claims, whatever features of patentable novelty reside in the invention.

I claim:

1. In apparatus of the class described, a mold comprising at least two parts that may be separated to open the mold and permit removal of a casting from a mold cavity, means forming a passage communicating with the mold cavity to introduce an extraneous pressure fluid between the casting and a surface of the mold to which it may cling to separate the same, a shiftable plunger adapted to open and close said passage, fluid piston and cylinder means to actuate said plunger, a safety member adapted to engage one of said mold parts to prevent the premature closing of said mold, and means mechanically interconnecting said safety member and said plunger.

2. In apparatus of the class described, a mold comprising at least two parts that may be separated to open the mold and permit removal of a casting from a mold cavity, means forming a passage communicating with the mold cavity to introduce an extraneous pressure fluid between the casting and a surface of the mold to which it may cling to separate the same, a shiftable plunger adapted to open and close said passage, fluid piston and cylinder means to actuate said plunger, a safety member adapted to engage one of said mold parts to prevent the premature closing of said mold, and a link mechanically interconnecting said safety member and said plunger to shift said safety member in a predetermined manner consequent upon movement of said plunger.

3. In apparatus of the class described, a mold comprising at least two parts that may be separated to open the mold and permit removal of a casting from a mold cavity, means forming a passage communicating with the mold cavity to introduce an extraneous fluid pressure between the casting and a surface of the mold to which it may cling to separate the same, a cylinder aligned with said passage, a piston in said cylinder, a piston rod terminating in a shiftable plunger adapted to slide within said passage to open and close said passage to said mold cavity, a safety member slidably supported in one of said mold parts and adapted to engage the other to prevent the premature closing of said mold, and a link interconnecting said safety member and said piston rod to shift said safety member in a predetermined manner consequent upon movement of said piston rod.

4. In apparatus of the class described, a frame, a mold comprising at least two parts with one part carried rigidly by said frame and the other part pivotally mounted with respect to said frame to permit the mold to be opened and a mold cavity therein exposed, piston and cylinder elements, one rigidly carried by said frame and the other slidable with respect thereto, means forming a passage in said frame-carried mold part in alignment with said slidable element and communicating with said mold cavity, means to admit compressed air to said passage to pass into said mold cavity, a plunger adapted to be actuated by said slidable element to open and close said passage, a pin slidably supported in said frame-carried mold part on an axis parallel to the axis of said slidable element, and a link pivotally mounted at its mid portion on said frame and at its ends engaging said slidable element and said pin respectively to shift said pin outwardly and prevent said mold from being closed when said passage is opened by said slidable element.

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