

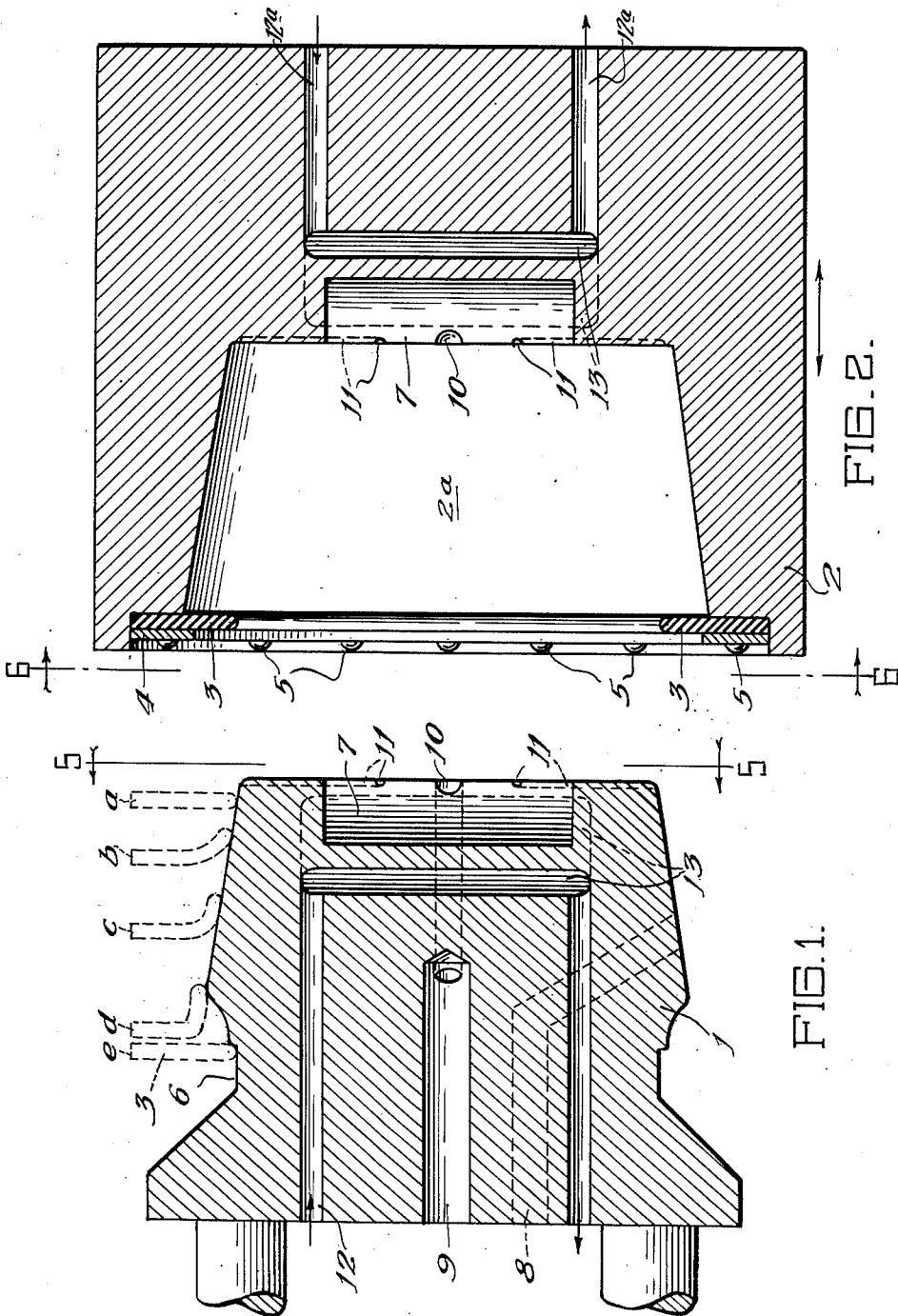
May 12, 1953

R. F. PLOTT
VACUUM DIE-CASTING

2,637,882

Filed Feb. 17, 1944

3 Sheets-Sheet 1



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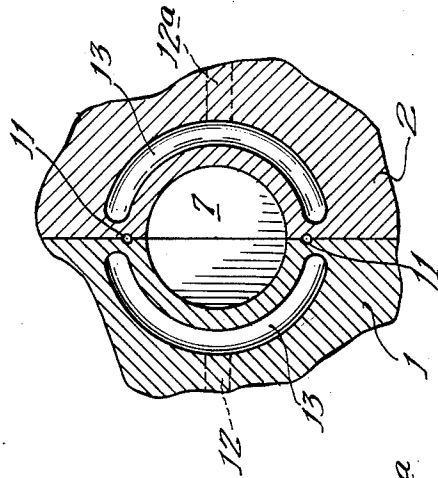
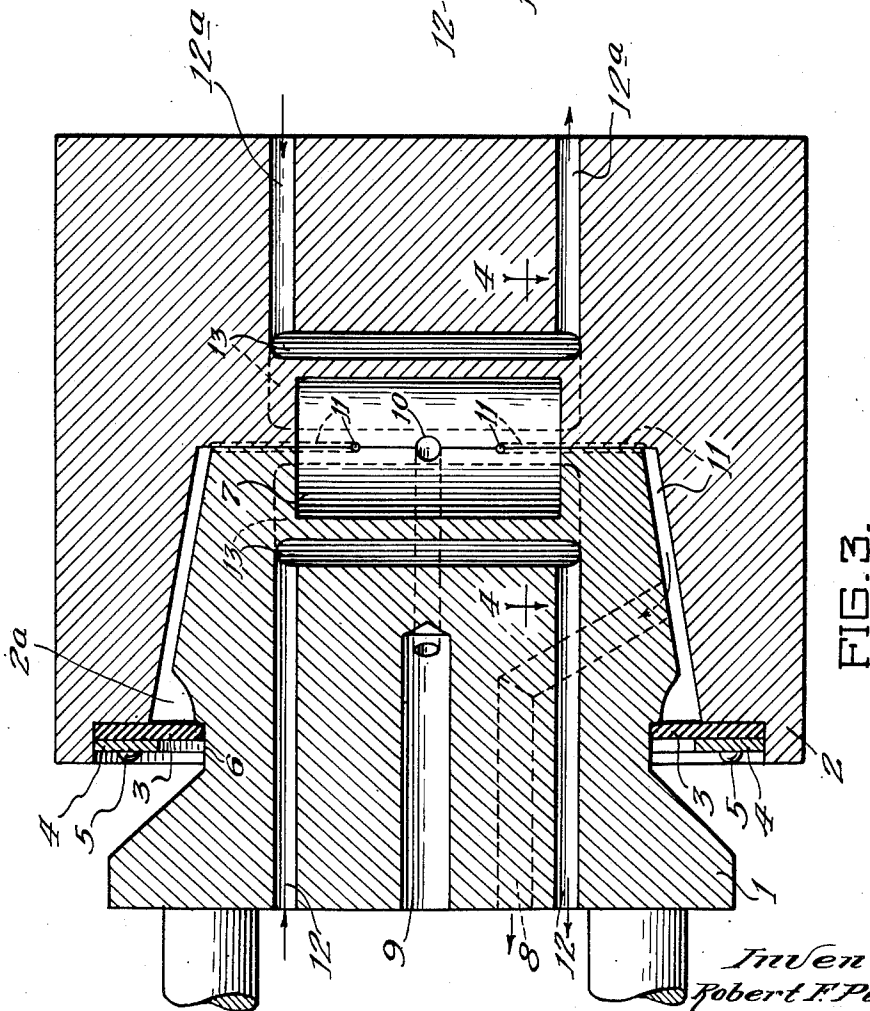
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3 Sheets-Sheet 3

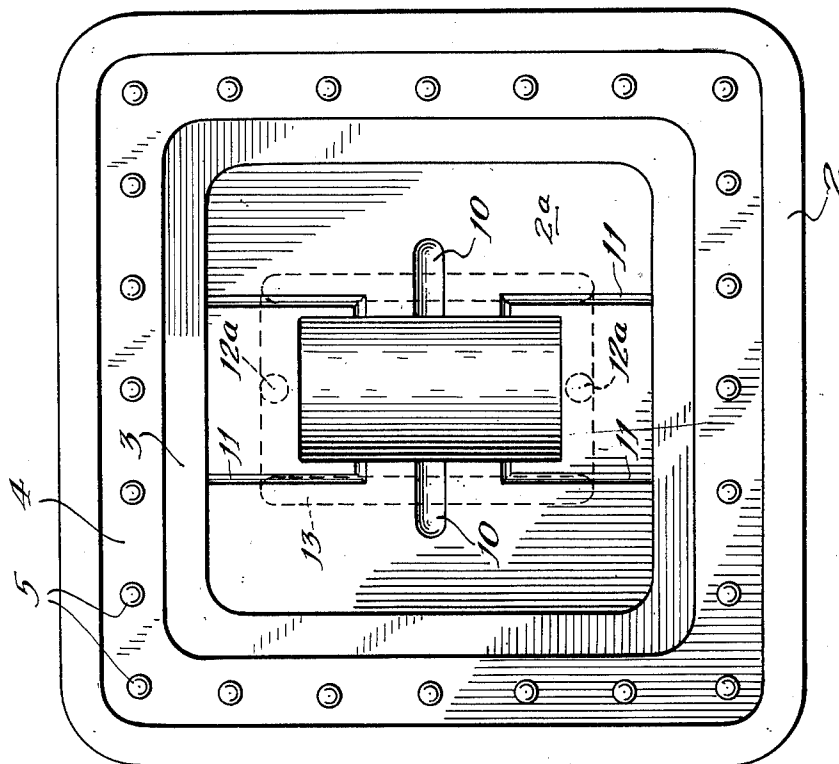


FIG. 6.

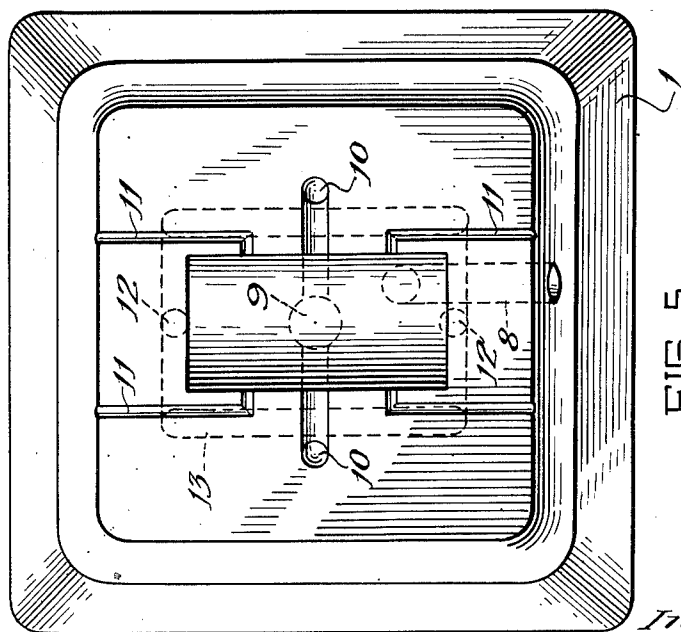


FIG. 5.

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VACUUM DIE-CASTING

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8 Claims. (Cl. 22-73)

1

My invention relates to a die casting machine and more particularly to a die casting machine of the type wherein the die cavity is evacuated prior to each casting operation.

In the past it has been customary to provide an airtight seal between the movable and stationary die sections (or members), also referred to as dies, of a die casting machine, by placing a rubber gasket on the peripheral face of one of the die sections and clamping the rubber gasket between the confronting face portions of the two die sections. However, as the result of excessive compressive force applied to such rubber gasket by the two die sections when clamped together, squeezing the rubber gasket between them, and furthermore, as the result of excessive heat developed during the casting operation, such gasket soon becomes permanently deformed and burned thereby destroying the effectiveness of the seal.

An object of my invention is to provide a practical and efficient evacuable die casting apparatus that operates successfully to eliminate porosity in die castings caused by entrapped air that is not entirely removed by ordinary venting technique.

Another object of my invention is to provide in a die casting machine of the type wherein the die cavity is evacuated prior to casting, an airtight sealing member that will maintain an effective vacuum tight seal without the necessity of applying any pressure thereto by either die section.

Another object of my invention is to provide in a die casting machine of the evacuable type, a vacuum tight seal that is maintained relatively cool and thereby substantially free from the deleterious effects caused by heat normally produced during the casting operation.

Other objects, features, and advantages of my invention will become more apparent from the following detailed description when read in conjunction with the accompanying drawings in which:

Fig. 1 is a longitudinal cross-sectional view of a stationary die of a die casting machine.

Fig. 2 is a longitudinal cross-sectional view of a movable die that cooperates with the stationary die shown in Fig. 1.

Fig. 3 is a longitudinal cross-sectional view of the assembled stationary and movable dies in the closed position.

Fig. 4 is a cross-sectional view taken along line 4-4 of Fig. 3.

Fig. 5 is an end view taken along line 5-5 of Fig. 1.

2

Fig. 6 is an interior view taken along line 6-6 of Fig. 2.

For purposes of illustration, the invention is shown in conjunction with a suitable pair of co-operable dies, and referring more particularly to the drawings, numeral 1 denotes a fixed or stationary die that cooperates with a movable die 2 for use in a die casting machine. The movable die 2 has an opening 2a therein, to telescopically receive the fixed die 1, and moves in the directions indicated by the arrows. Attached to the movable die 2 is a gasket or sealing member 3, hereinafter referred to as seal 3, of rubber or other suitable flexible, plastic material. The seal 3 is mounted at the outer perimeter of the opening 2a in the die 2, and entirely surrounds the opening extending radially inward thereof. The seal 3 is clamped and held in place by a plurality of screw-threaded bolts or other suitable fastening means 5.

As stated, the rubber seal or gasket 3 entirely surrounds the opening 2a in the movable die 2 and is arranged to hermetically seal the space closed by the movable and fixed dies when in co-operative association. To this end, the fixed die 1 tapers from rear to front in the form of a wedge with the forward perimeter being small enough to pass through the opening defined by the seal 3. The seal 3 normally remains in the desired position perpendicular to the direction of movement of the die 2 because the outer perimeter of the seal is held under uniform tension by the gasket 4. The edges of the seal 3 that contact the fixed die 1 are rounded and curved in such a manner as to permit passage of the movable die 2 through the seal, and this passage particularly is aided by the use of a lubricant of low vapor pressure such as, for example, "lubriseal," that is coated on the tapered surface of the die 1. By virtue of this construction, it will be observed that as the movable die 2 advances into closing relation with the die 1, the rubber seal 3 is flexed or bent inwardly of the opening 2a in progressively increasing amounts as it slides over the tapered surface of the fixed die 1, as shown in positions a to d (shown dotted) in Fig. 1, until finally the seal clears the base of the tapered surface portion and snaps into a groove 6 that provides a flat surface or face portion against which the gasket laps and seals, as shown in position e (also shown dotted) and in Fig. 3.

When the dies 1 and 2 are fully closed, and with the seal 3 in the lapped, sealing engagement shown in Fig. 3, mold cavity 7 may be exhausted through ducts 11 and a vacuum port 8 that is con-

3

nected to a suitable vacuum pump (not shown). The partial vacuum created causes the seal 3 to be drawn tightly against the front surface of the groove 6 thus sealing the two parts of the die together in a vacuum tight manner. The seal is aided by the presence of the lubricant on the surface of the edge of groove 6 that effectively seals any small openings or cracks between the gasket 3 and the flat face of the groove 6, and permits the further evacuation of the die cavity. The molten metal to be cast is then sucked into the mold cavity 7 through a metal intake port 9, from which the metal enters the mold cavity 7 through gates 10. The mold cavity 7 is vented by the ducts 11.

The dies 1 and 2 are cooled by water or other suitable fluid flowing through pipes 12—12a into substantially semi-cylindrical cooling jackets 13, one in each die (see Fig. 4). The position of the seal 3 at some distance from the molten metal, and the water cooling of the fixed die, provide the necessary protection for the seal material from the heat present during the casting process.

If it is desired to raise the pressure at which the liquid metal is forced into the die cavity 7 above that of the surrounding atmosphere, the movable die 2 must be held in place by a hydraulic press (not shown), or other suitable means. The small vent ducts 11 insure the earliest solidification of the metal in this vicinity and protect the vacuum required to hold the plastic seal 3 tightly in place.

It will appear, therefore, in accordance with my invention, that a seal (or gasket) is provided that is subjected only to atmospheric pressure and that is not clamped between the two confronting face portions of the dies and that, solely by the difference of pressure between the surrounding atmosphere and the vacuum in the cavity, exerts sufficient force on the seal 3 against a flat peripheral surface portion of the fixed die 1 to provide an effective vacuum tight seal. Such seal is aided by the lubricant present on the flat surface portion. The position of the seal 3 at some distance from the hot metal, and the water cooling of the fixed die 1, serve to protect the seal from the deleterious effects of the heat during the casting process.

While I have described one embodiment of the invention, it will be apparent that other embodiments are readily suggested by the above teachings. For example, the seal or gasket could be fastened on the fixed die and the tapered surface formed on the movable die. It should be understood, therefore, that the invention is not limited to the particular embodiment herein illustrated and described, except insofar as it is defined by the appended claims.

I claim:

1. In a die casting machine, complementary die members cooperating to provide a die cavity, one of said die members being movable to open and close said cavity, and a gasket secured to a perimeter of one of said die members and extending inwardly thereof, the other of said die members having a wedge shaped surface cooperable with the free edge portion of said gasket to tension and flex the gasket by progressively increasing amounts as the die members are brought closer together, the base portion of the wedge shaped surface having adjacent thereto a surface portion arranged to form a lapped sealing joint with said gasket after the latter has cleared the base portion of said wedge shaped surface as the dies are brought into the closed position.

4

2. In a die casting machine, complementary die members cooperating to provide a die cavity, one of said die members being movable to open and close said cavity, a gasket secured to a perimeter of one of said die members and extending inwardly thereof, the other of said die members having a wedge shaped surface cooperable with the free edge portion of said gasket to tension and flex the gasket by progressively increasing amounts as the die members are brought closer together, the base portion of the wedge shaped surface having adjacent thereto a surface portion arranged to form a lapped sealing joint with said gasket after the latter has cleared the base portion of said wedge shaped surface as the dies are brought into the closed position, and a lubricant of low vapor pressure on said wedge shaped surface and on said adjacent surface portion to aid in forming a gas tight seal between said gasket and said adjacent surface portion.

3. In a die casting machine, complementary die members cooperating to provide a die cavity, one of said die members being movable to open and close said cavity, a gasket secured to a perimeter of one of said die members and extending inwardly thereof, the other of said die members having a wedge shaped surface cooperable with the free edge portion of said gasket to tension and flex the gasket by progressively increasing amounts as the die members are brought closer together, the base portion of the wedge shaped surface having adjacent thereto a surface portion arranged to form a lapped sealing joint with said gasket after the latter has cleared the base portion of said wedge shaped surface as the dies are brought into the closed position, and water cooling means in one of said die members adjacent said lapped sealing joint for keeping said lapped sealing joint relatively cool during the casting operation.

4. In a die casting machine, complementary die members cooperating to provide a die cavity, one of said die members being movable to open and close said cavity, a projecting flexible gasket extending along a perimeter of one of said die members, the other of said die members having a wedge surface arranged to cooperate with and flex the gasket by progressively greater amounts as the dies are brought closer together, and a flat surface portion on said other die beyond and immediately adjacent the base portion of said wedge surface operable to allow said gasket to unflex to its original position when the dies are completely closed together, said flat surface portion forming a gas tight lapped joint with said gasket when the dies are completely closed together, said gasket being held against said radially extending surface by pressure resulting from vacuum created interiorly of said dies.

5. In a die casting machine, complementary die members cooperating to provide a die cavity, one of said die members being movable to open and close said cavity, a flexible gasket secured to a perimeter of said movable die member, the other of said die members having a surface arranged to slidably engage the edge of said flexible gasket, said surface being shaped to progressively flex said gasket by increasing amounts as the dies are brought together and finally to allow the gasket to unflex to its normal position as the dies are completely closed together, and said surface having immediately adjacent thereto a surface forming a lap joint with the gasket when the dies are in the closed position.

6. In a die casting machine, complementary die

5

members cooperating to provide a die cavity, one of said die members being movable to open and close said cavity, a flexible gasket secured to a perimeter of said movable die member, the other of said die members having a surface arranged to slidably engage the edge of said flexible gasket, said surface being shaped to progressively flex said gasket by increasing amounts as the dies are brought together and finally to allow the gasket to unflex to its normal position as the dies are completely closed together, said surface having immediately adjacent thereto a surface forming a lap joint with the gasket when the dies are in the closed position, and liquid cooling means in one of said die members for keeping the gasket relatively cool during the casting operation.

7. In a die casting machine, complementary die members cooperating to provide a die cavity, one of said die members being movable to open and close said cavity, a flexible gasket secured to a perimeter of said movable die member, the other of said die members having a surface arranged to slidably engage the edge of said flexible gasket, said surface being shaped to progressively flex said gasket by increasing amounts as the dies are brought together and finally to allow the gasket to unflex to its normal position as the dies are completely closed together, said surface having immediately adjacent thereto a

6

surface forming a lap joint with the gasket when the dies are in the closed position, and a lubricant of low vapor pressure coated on both of said surfaces of said other die.

8. In a die casting machine, complementary die members cooperating to provide a die cavity, one of said die members being movable to open and close said cavity, a flexible gasket secured to a perimeter of one of said die members, the other of said die members having a surface arranged to slidably engage the edge of said flexible gasket, said surface being shaped to progressively flex said gasket by increasing amounts as the dies are brought together and finally to allow the gasket to unflex to its normal position as the dies are completely closed together, and said surface having immediately adjacent thereto a surface forming a lap joint with the gasket when the dies are in the closed position.

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