Sept. 3, 1957 L. SAIVES 2,804,666

PRESSURE CASTING PISTON MACHINES

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Fig.1

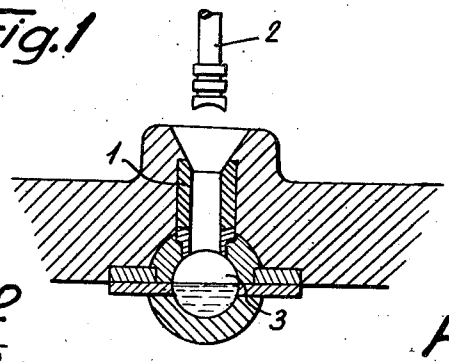


Fig.2

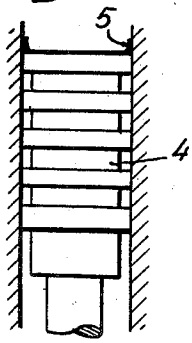


Fig.3

Fig.4

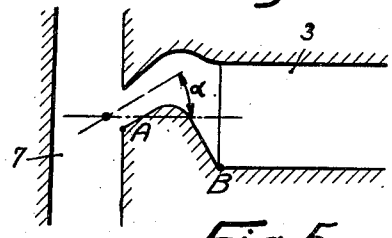


Fig.5

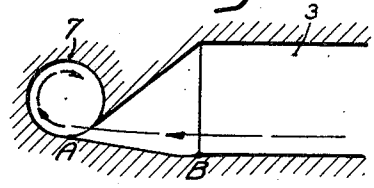


Fig.6

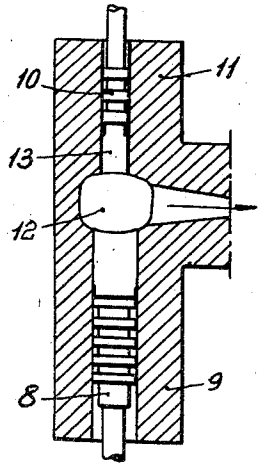
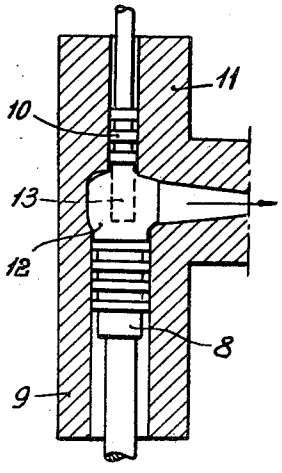


Fig.7



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PRESSURE CASTING PISTON MACHINES

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2 Sheets-Sheet 2

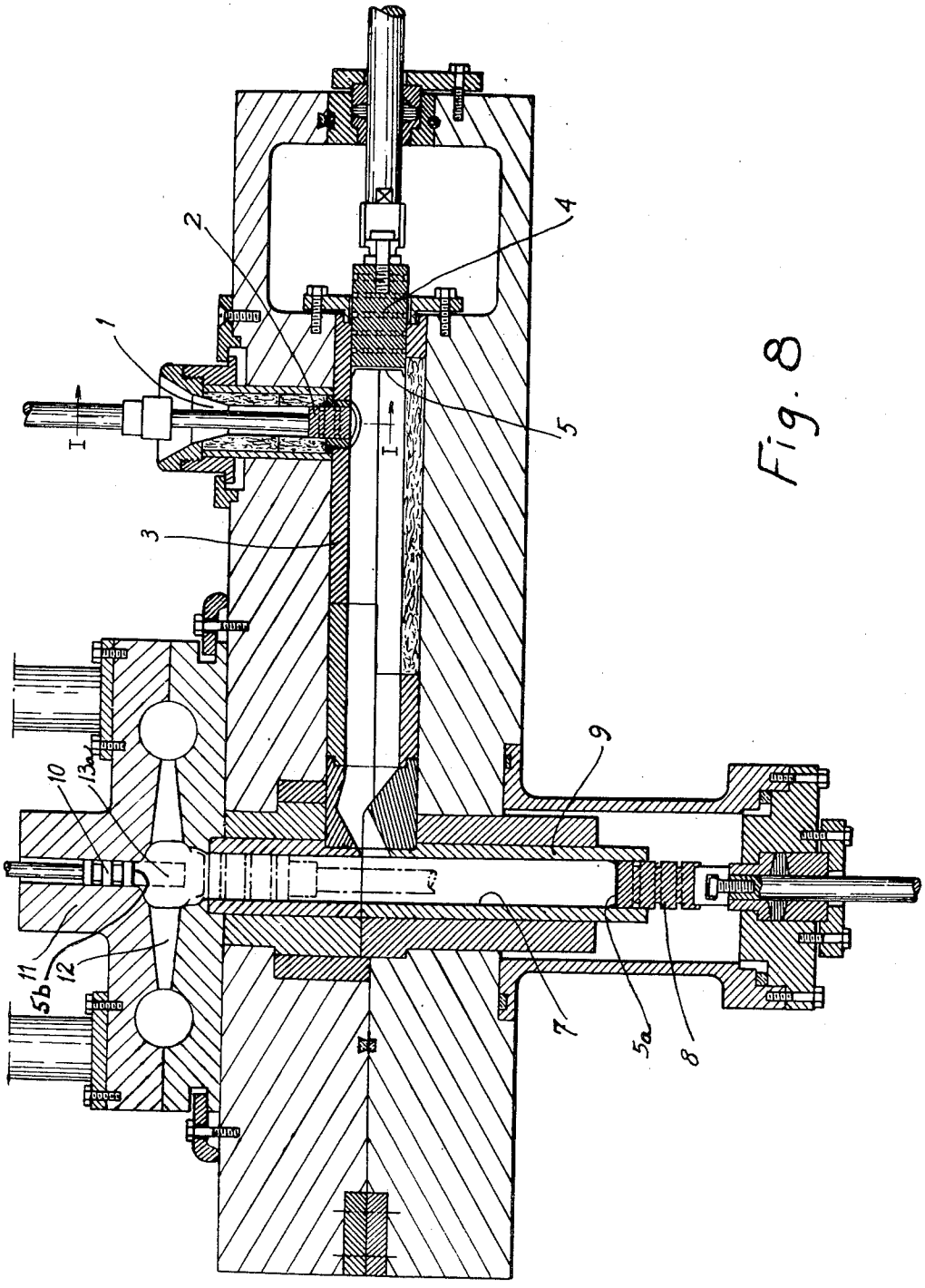

Fig. 8

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PRESSURE CASTING PISTON MACHINES

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2 Claims. (Cl. 22—68)

The invention has for its object various improvements applied to machines for casting ferrous metals under pressure and particularly to the pistons and to the ladle cylinder.

Machines adapted for casting articles under pressure are known in which the liquid metal, first of all poured into a ladling on ladle cylinder of special steel communicating with the mould, is displaced into the mould by a hydraulic piston.

A number of disadvantages inherent in these machines are summarised below:

1. The walls of the pouring hole are progressively choked and the movement of the ladle piston is thus obstructed.

2. The sealing between pistons and cylinders is obtained by wads of steel wool and graphite fixed on the head of the pistons. The assembly of this packing deteriorates rapidly and ceases to serve its purpose.

3. In certain of these machines, the passage connecting the ladle cylinder to the injection cylinder is disposed axially of the ladle cylinder. This arrangement favours the production of splashes of metal which solidify more quickly than the mass of the metal and these small fragments obstruct the casting passage towards the mould.

4. The action of the injection piston on the column of liquid or viscous steel moving towards the mould does not ensure that the compression is equally distributed at all points of the mass in this column. The result is an imperfect filling of the mould and cavities in the final casting.

As regards this latter point, this unequal distribution of the pressure is explained by the fact that the moving column of metal is solidified in its external portion in contact with the cylinder and forms a solid tube, only the interior of which remains viscous. The solidified portions of this tube and particularly its base offer resistance to the action of the piston and screen the viscous metal from the necessary pressure. A technique is known which consists in subjecting the viscous zone to a supplementary compressive stress by the action of a force piston disposed in the injection piston and coming into action at the end of the travel of the piston. However, difficulties are presented in obtaining the sealing between the two pistons and in detaching the forcing piston from the metal after the operation.

The following arrangements obviate the aforementioned disadvantages and constitute considerable improvements.

In the accompanying diagrammatic drawings, the figures illustrate examples of application of the arrangements referred to and are not of any limitative nature.

Figure 1 is a sectional view taken on line 8 of Fig. 8 showing a scraper piston for the pouring hole.

Figure 2 shows a sealing arrangement applied to an injector piston.

Figure 3 is a sectional view of the sealing cup.

Figures 4 and 5 respectively show a sectional elevation of the end of the ladle cylinder and a plan view of the end of this cylinder.

Figures 6 and 7 respectively show by way of example an embodiment of a forcing piston at the commencement and end of the injection.

Fig. 8 is a vertical sectional view of the complete assembly of the machine in accordance with the invention.

The improvements in question are:

1.—*Scraper piston*

Figure 1 is a transverse section showing a part of a pressure casting machine modified in accordance with the invention.

The wall of the pouring hole has a lining 1 of refractory material. A piston 2 operated by a jack (not shown) may slide in the lining as far as the external level of the ladle cylinder 3. The surface and the path of the piston are arranged in such manner that at the end of its travel, the piston may form the wall of the ladle cylinder in order to avoid the rising of the metal at the commencement of the action of the ladle piston.

The operation of the apparatus is as follows:

Molten metal from a casting ladle is emptied into the ladle cylinder 3, the scraper piston 2 is lowered and this scrapes off the solidified parts adhering to the pouring hole 1. At the end of its travel, the scraper piston 2 completely closes the pouring hole 1 as indicated above and the ladle piston is then set in operation.

Figure 1 shows the invention applied to a pressure casting machine in which the ladle cylinder is horizontal. The invention is obviously applicable to any machine for casting under pressure.

2.—*Sealing of the pistons*

The invention has for an object a sealing system applicable to pistons of all kinds and obviating the disadvantages of the known arrangements.

The piston 4 carries a dished plate or cup 5 of the shape shown in Figures 2 and 3.

The pressure flattens the edges of the cup on the cylinder and thus ensures the sealing during injection of a metal at high temperature under high pressure and at high speed. The thickness of this plate, its constitution (refractory steel) and the height of its raised edges are combined as a function of the particular conditions of each manufacturing operation.

3.—*Shape of the end of the ladle cylinder*

The shape indicated in Figures 4 and 5 has for its object to obviate the aforementioned disadvantages.

The jet of metal coming from the ladle cylinder 6 is directed in accordance with an inclined helix with an angle towards the base which may be of the order of 20°. In order to obtain this result, the communication passage is constricted in the last portion A of the ladle cylinder and opens tangentially to the walls of injection cylinder 7. The liquid metal arriving tangentially is twisted helically towards the base of the injection cylinder 7 and thus does not cause any splashes.

4.—*Forcing piston*

The arrangement of forcing piston which has been proposed obviates the defects which have been referred to.

Figure 6 shows by way of example one embodiment of this forcing system which is applied to a casting machine in which the joint plane of the mould is horizontal, the ladle cylinder is horizontal and is disposed below the mould, the latter being supplied at the bottom by a vertical injection cylinder.

In Figure 6, the pistons are shown in the position at the commencement of injection.

Figure 7 shows the arrangement of the pistons on completion of injection.

The piston 8 is disposed in the injection cylinder 9 and

has on its inner end a cup 5*a* like cup 5 of Figs. 2 and 3.

The forcing piston 10 is located in the forcing cylinder 11 and has on its inner end a cup 5*b* like cup 5 of Figs. 2 and 3. Its diameter is approximately two-thirds of the diameter of the injection cylinder and when at rest it leaves a free space 13 between its face and the chamber 12 which communicates with the mold (not shown) through a passageway 15.

The operation of the apparatus is as follows:

After the lading cylinder piston 4 (Fig. 8) has filled the injection cylinder 9 with liquid steel, the piston 8 is set in motion in an upward direction and commences to fill the chamber 12 and the mould (not shown). The steel being solidified on the walls of the injection cylinder 9 forms a tube. This tube offers a resistance sufficient to stop completely the rising movement of the injection piston before the filling of the mould is completed. At this moment, the metal which has filled the free space 13 between the chamber 12 and the forcing piston 10 has solidified and there is then initiated the movement of compression of the forcing piston 10. It is the solidified metal slug 13*a* in front of the forcing piston which directly exerts the compressive stress on the metal. Losses of metal are avoided owing to the good adjustment of the slug in the cylinder and since the forcing piston does not penetrate into the viscous metal, there is no difficulty in extracting the piston. The slug 13*a* is removed when the cast article is trimmed.

The arrangement of the forcing piston has been given by way of example axially of the injection piston.

I claim:

1. In a pressure casting piston machine in combination, means defining a chamber, a passageway leading from said chamber to a mold, a forcing cylinder opening into said chamber, an injection cylinder opening into said chamber, a ladling cylinder communicating with said injection cylinder, the communication between said ladling cylinder and injection cylinder comprising a converging passageway extending from an end of said ladling cylinder and opens tangentially into the injection cylinder in a downwardly inclined helical direction, a pouring passage opening laterally from said ladling cylinder for charging a molten metal into said ladling cylinder, said passage having a cylindrical lining of refractory material, a scraping piston movable into said passage, said piston having a cylindrically curved inner end and being movable to an inner position in which it closes said passage and said inner end is substantially flush with the wall of said ladling

cylinder, a piston movable in said ladling cylinder to force metal from said ladling cylinder helically into the injection cylinder, a piston movable in said injection cylinder to force molten metal into said chamber and said forcing cylinder, said forcing cylinder being of substantially smaller cross section than the injection cylinder so that molten metal forced into said forcing chamber solidifies to form a slug, a piston movable in said forcing cylinder to force said slug into said chamber and thereby apply pressure to molten metal in said chamber and in said mold, and a dished plate of a heat-conducting refractory metal being provided on the inner end of at least one of said pistons other than the piston in the pouring passage, said plate having cupped edges projecting away from the piston and having the characteristic of becoming pliable at a predetermined temperature and pressure, whereby a seal is effected between the piston and its corresponding cylinder when molten metal is moved by the piston and none of the metal is permitted between the piston and the cylinder nor to be cooled therein and bind the piston.

2. In a pressure casting piston machine in combination, an injection cylinder, a piston reciprocable in said cylinder, a ladling cylinder disposed at substantially right angles to said injection cylinder and communicating at one end with said injection cylinder, said end of the ladling cylinder converging progressively to provide a connecting passageway of reduced cross section that opens tangentially into the injection cylinder in a downwardly inclined helical direction, means for charging a molten metal into said ladling cylinder and a piston movable in said ladling cylinder to force molten metal through said converging passageway helically into said injection cylinder.

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