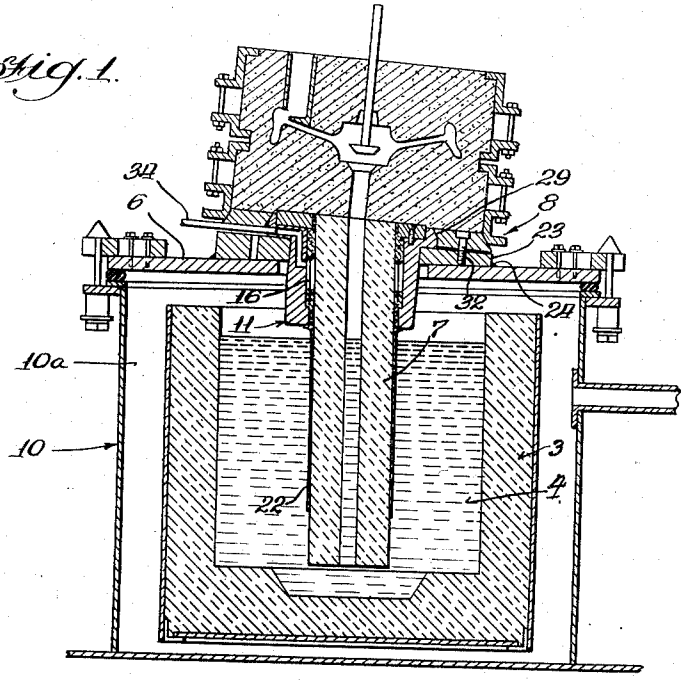
Sept. 23, 1958 C. F. STROM 2,852,822

VACUUM SEAL FOR PRESSURE POURING APPARATUS

Filed Aug. 12, 1955

Fig. 1.



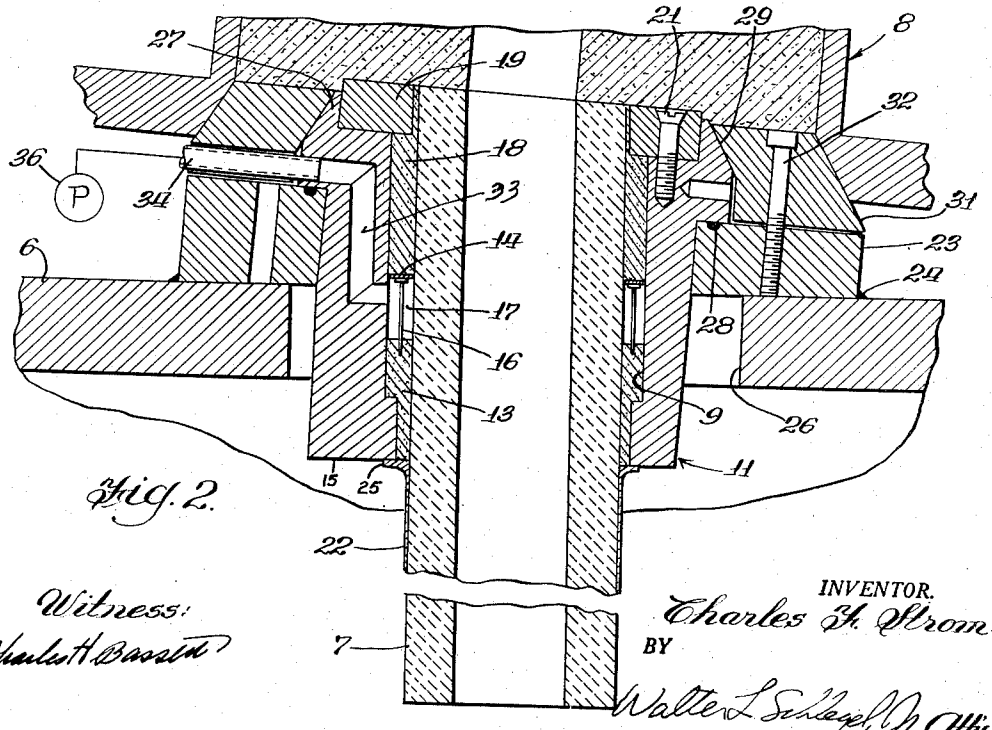


Fig. 2.

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VACUUM SEAL FOR PRESSURE POURING APPARATUS

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Application August 12, 1955, Serial No. 527,921

9 Claims. (Cl. 22—69)

This invention relates to a method and means for pouring castings and more particularly to the casting of steel by forcing molten steel under pressure upwardly into a mold.

In the pressure casting of molten metal, the metal is forced from a ladle upwardly through a tubular ceramic pouring spout into a mold responsive to a rise in air pressure within a pressure chamber containing the ladle. Due to the porous wall structure of the pouring spout, air is sometimes forced through the wall of the spout into the metal passing upwardly through the spout, thereby causing the production of faulty or defective castings.

It is, therefore, an object of the invention to provide a pressure pouring apparatus and method of operating same embodying means effective to prevent or materially reduce an escape of air through the wall of a pouring spout into a body of molten steel flowing therethrough.

Another object of the invention resides in the provision of a pressure casting apparatus in which the upper end of the tubular pouring spout is cemented within a metallic head and defines therewith an annular vacuum chamber communicating with an air passageway leading to a vacuum pump, whereby any air leaking through the cement between the spout and head is drawn therefrom into said chamber instead of passing inwardly through the wall of the spout into the molten steel.

The invention embodies other novel features, details of construction and arrangement of parts which are hereinafter set forth in the specification and claims and illustrated in the accompanying drawing, wherein:

Figure 1 is a central vertical sectional view of the apparatus utilizing the preferred embodiment of the invention; and

Figure 2 is an enlarged view of a portion of the apparatus illustrated in Figure 1.

Referring now to the drawings for a better understanding of the invention, the pressure pouring apparatus is shown as comprising a cover **6** adapted to be detachably secured to a housing **10** to form therewith a sealed chamber **10***a*, the housing being provided with an air conduit leading to a suitable source of air under pressure. The housing is adapted to enclose a ladle **3** filled with molten steel 4 which is forced upwardly through a tubular pouring spout or tube **7** into the cavity of a mold generally designated **8** responsive to an increase in air pressure within the housing.

The pouring spout or tube **7** is formed of a porous gas permeable ceramic material and is secured at its upper end within a bore **9** in a metallic head **11** by means of a suitable wet type air setting refractory mix comprising, for example:

	Percent
SiO_2	46
Fe_2O_3	1
Al_2O_3	44
TiO_2	1
Na_2O	3
	95

5% combined water.

As illustrated in Figure 2, the mix is adapted to be worked to a putty consistency and inserted downwardly between the bore **9** of the head **11** and the pouring spout 7 to form first a lower refractory section **13**, the mix being retained against downward movement out of the head by means of a sealer ring (not shown) snugly encircling the spout and in flush engagement against the bottom of the head. A retainer ring **14** is then supported within the bore **9** in vertically spaced relation to the lower section **13** by means of circumferentially spaced rods **16** to define an annular vacuum chamber **17** surrounding the spout.

Another body of porous gas permeable refractory mix is then inserted into the bore **9** to form an upper refractory section **18** between the head and the spout; after which the mix may be dried and set by heating the head by means of a flame. The upper section **18** preferably extends upwardly between the spout **7** and the inner peripheral surface of a graphite ring **19** secured to the upper side of the head **11** by means of cap screws **21**.

After the pouring spout **7** has been cemented to the head **11**, a non-porous gas impermeable glaze coating **22** is applied to the outer surface of the spout and radially across the lower end of the lower refractory section **13** onto the lower face of the head to prevent a leakage of air through the wall of the spout into molten steel passing therethrough. The glaze coating may extend downwardly to within 18 or 20 inches from the lower end of the spout and at least down to the level of the molten metal in the ladle as shown in Figure 1. A suitable glaze coating may comprise, for example, the following mix:

	Percent
SiO_2	57
R_2O_3	12
PbO	6
Na_2O	7
K_2O	7
B_2O_3	11
	100

The head **11** is journaled for rotational adjustment in a wedge-shaped ring **23** continuously welded at **24** to the cover **6** formed with an aperture **26** to receive the lower end of the head. An annular flange **27** is formed on the upper end of the head for annular abutting engagement against the upper face of the ring **23**, and an annular sealing ring **28** is interposed between the flange **27** and ring **23** to prevent leakage of air under pressure from the interior of the housing to the atmosphere.

The upper end of the head **11** is formed with a frustoconical surface **29** engaged by a retainer ring **31** which is secured to the wedge-shaped ring **23** by means of cap screws **32**. By first loosening the screws **32**, the head may be rotated to move the spout from a vertical posi-

tion to an inclined position to prevent entrapment of air within the mold cavity as the latter is being filled with molten metal, as disclosed in the patent applications heretofore referred to.

An air passageway **33** is provided in the head **11** leading from the vacuum chamber **17** to a pipe **34** which is connected to a conventional vacuum pump **36** employed to exhaust air from said chamber. As the pouring spout **7**, upper and lower refractory sections **18** and **13**, glaze coating **22**, head **11**, and graphite ring **19** have different coefficients of expansion, it is difficult to maintain an air-tight seal between the pouring spout and the head during operation of the pouring apparatus. This is because as these three elements expand and contract at different rates, there develops between the glaze coating **22** and the lower surface **15** of head **11** a minute orifice **25** which permits pressure to pass from housing chamber **10***a* between the housing and tube and thence through the porous wall of the tube at a place on the tube above the glaze coating where the tube is gas permeable. By providing an annular vacuum chamber **17** between the pouring spout and the head, it is apparent that any air leaking thereinto through orifice **25** from the interior of the housing past the lower refractory section **13** will be withdrawn therefrom by the vacuum pump **36**. It will also be noted that the vacuum pump **36** could be omitted from the structure, if desired, whereby air under pressure leaking from the interior of the housing into the vacuum chamber would be exhausted to the atmosphere. It has been found, however, that the pump **36** affords positive protection against leakage of air into the tube through refractory section **13**.

While the invention has been shown in but one form, it is obvious to those skilled in the art that it is not so limited but is susceptible of various changes and modifications without departing from the spirit and scope of the claimed invention.

I claim:

1. In a pressure pouring apparatus of the type wherein liquid material is forced by the exertion of superatmospheric gas pressure thereagainst from a gas-tight container to a mold disposed without the container, the combination of: means for introducing pressure gas into the container, a porous gas permeable pouring tube having one end disposed to extend through an aperture in the container and into the material to be poured and having the other end in communication with the mold, a gas impermeable coating on the tube extending from the material to the container aperture, and means to maintain in the aperture of the container externally of the tube a pressure value no greater than atmospheric pressure to prevent the pressure gas from permeating the tube.

2. In a pressure pouring apparatus of the type wherein liquid material is forced by the exertion of superatmospheric gas pressure thereagainst from a gas-tight container structure to a mold disposed without the container structure, the combination of: means for introducing pressure gas into the container structure, a porous gas permeable pouring tube having one end disposed to extend through an aperture in the container structure and into the material to be poured and having the other end in communication with the mold, a non-porous gas impermeable coating on the tube extending from the material to be poured to the container structure at said aperture and defining therewith an orifice through which pressure gas in the container structure can pass to the tube, said tube and container structure defining therebetween in said aperture an annular air chamber surrounding the outer surface of the tube, and in said chamber being at atmospheric pressure or less, to prevent pressure gas from permeating the tube.

3. A pressure pouring apparatus according to claim 2, wherein said container structure presents a passageway therein communicating with said chamber, and wherein said apparatus includes pump means communicating with said passageway and operable to exhaust gas from said chamber.

4. A pressure pouring apparatus according to claim 2, wherein said chamber is disposed between and defined by a pair of axially spaced annular sections of a composition which serves to support the tube within the aperture of said container structure.

5. In a pressure pouring apparatus of the type wherein molten steel is forced by the exertion of gas pressure thereagainst from a gas-tight container to a mold disposed without the container, the combination of: means for introducing pressure gas into the container, a mounting member disposed within an aperture of the container and having a bore extending therethrough, a gas-tight seal between the container and the member, a porous gas permeable pouring tube having one end communicating with the mold and having the other end disposed to extend through the bore of the member and into the material to be poured, a non-porous gas impermeable coating on the tube extending from the material to be poured to the member, and means to maintain within the bore of the member externally of the tube above said coating a pressure value no greater than atmospheric pressure to prevent the pressure gas from permeating the tube.

6. In a pressure pouring apparatus of the type wherein molten steel is forced by the application of pressure thereagainst from a gas-tight container to a mold disposed without the container, the combination of: means for introducing pressure gas into the container, a mounting member disposed within an aperture of the container and having a bore extending therethrough from top to bottom, a gas-tight seal between the member and the container, a porous gas permeable pouring tube having one end communicating with the mold and the other end disposed to extend through the bore of the member and into the container, a non-porous gas impermeable coating on the tube extending from the material to be poured onto the container, said member and said tube presenting therebetween in said bore an annular chamber surrounding the outer surface of the tube, and means to maintain in said chamber a pressure value no greater than atmospheric pressure to prevent the pressure gas from permeating the tube.

7. A pressure pouring apparatus according to claim 6, wherein the chamber in the bore of the member is disposed between and defined by a pair of axially spaced annular sections of a composition which serve to support the tube within said bore.

8. A pressure pouring apparatus according to claim 6, wherein said member presents a passageway therein communicating with said chamber, and wherein said apparatus includes pump means communicating with said passageway and operable to exhaust gas from said chamber.

9. In a pressure pouring apparatus of the tube wherein molten steel is forced by the exertion of gas pressure thereagainst from a gas-tight container to a mold disposed without the container, the combination of: means for introducing pressure gas into the container, a mounting member mounted within an aperture of the container and having a bore extending therethrough from top to bottom, a gas-tight seal between the member and the container, a porous gas permeable pouring tube having one end in communication with the mold and the other end disposed to extend through the bore of the member and into the container, axially spaced annular sections of a refractory mix supporting the tube in the bore of the member and defining between the outer surface of the tube and the inner surface of the member an annular chamber, a non-porous gas impermeable coating on the tube extending from the material to be poured onto the member and defining with the member an orifice through which pressure gas can pass from the container to the tube, and means for maintaining a pressure value in the

chamber which is no greater than atmospheric pressure to prevent pressure gas from permeating said means including a passageway in said member and means to exhaust gas from said chamber through said passageway.

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CERTIFICATE OF CORRECTION

Patent No. 2,852,822 September 23, 1958

Charles F. Strom

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 2, after "permeating" insert -- the tube, --.

Signed and sealed this 10th day of February 1959.

(SEAL)

Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON
Commissioner of Patents