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APPARATUS FOR TESTING THE GAS PERMEABILITY OF A MOLDED SPECIMEN

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FIG.1.

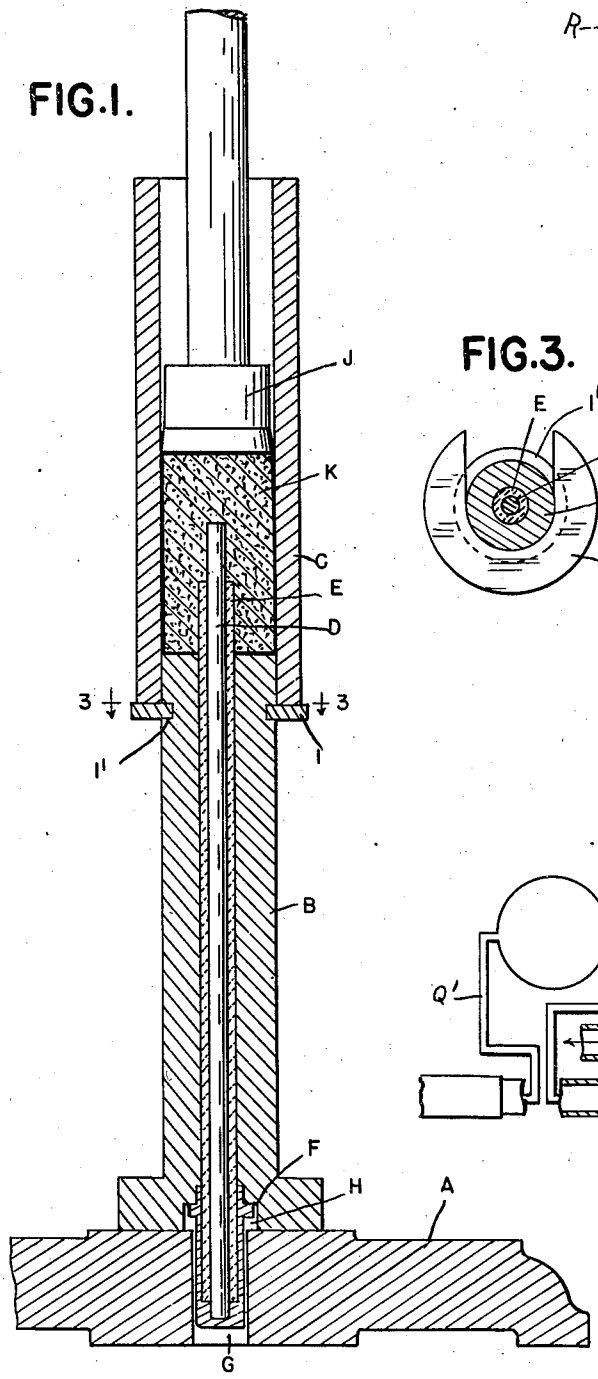
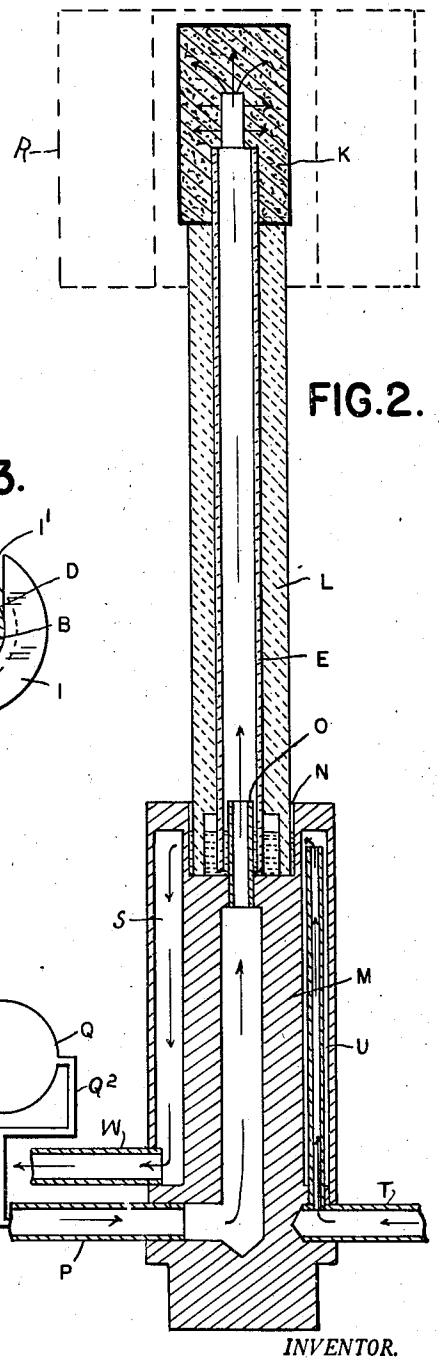


FIG.3.

FIG.2.



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APPARATUS FOR TESTING THE GAS PERMEABILITY OF MOLDED SPECIMENS

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13 Claims. (Cl. 73—38)

The invention relates to apparatus for testing molding materials such as molding sands.

It is the object of the invention to test the gas permeability of such materials and more particularly under conditions similar to those existing during the casting of metal in the mold. To this end the invention comprises the apparatus, as hereinafter set forth.

In the drawing:

Figure 1 is a vertical central section through an apparatus for forming a mold of the material to be tested with a sample therein, and attaching the same to a refractory tube;

Figure 2 is a similar view showing the mold and tube mounted in the testing apparatus,

Figure 3 is a section taken on line 3—3 of Figure 1.

Molding sands and other molding materials must be sufficiently permeable to gases and vapors to permit escape of the same from the molding chamber during the casting process. It is, therefore, important to test the permeability of the material to determine its suitability for forming molds. Such tests can be made in a cold specimen of the material but this is not conclusive as to behaviour under heated conditions such as when molten metal is cast therein. I have, therefore, devised an apparatus through which the sample to be tested is heated to a temperature corresponding to that which it attains when the molten metal is cast in contact therewith. I have also provided means for accurately measuring the rate of flow of the gases which escape through the material.

Figure 1 illustrates the apparatus for forming a sample of the material into a mold to be tested. This apparatus comprises a suitable base A, a post B supported thereon and which in turn supports a cylinder C in which the mold is to be formed. The post B is hollow and contains a rod D and a surrounding refractory tube E such as a tube of quartz. These members are supported in a bushing member F engaging an aperture G in the base A and also extending into a recess H in the bottom of the post B. The proportions are such that the tube E extends upward into the space within the cylinder C while the rod D extends beyond the upper end of the tube. The tube C is sleeved about the upper end of the post B and is temporarily supported thereon by a removable collar I which, as shown, is of U-shaped form engaging a groove I' in the post B. Thus, when the collar I is removed, the tube may be telescoped onto the post, as will be hereinafter explained.

In forming a mold or specimen of the material to be tested, a measured quantity of such material is placed within the cylinder C and is then tamped by a plunger J so as to compact it to the same degree as in forming a casting mold. The plunger is then removed, the collar I disengaged from the groove I', and the cylinder is stripped from the mold K by drawing it down on the post B. This will leave the mold K attached to the tube E after which the core D is drawn downward out of the tube E forming a chamber or concavity within the mold. To form a gas-tight seal between the tube E and the mold, the upper end of the tube E is coated with a sealing material such as sodium silicate which will cement with the sand. The tube E is then disengaged from the post B and a refractory tube L is sleeved thereon to form a bottom support for the mold K.

The construction is then transferred to the apparatus shown in Figure 2 which comprises a hollow post M having a cylindrical recess N at its upper end, with a tube O extending upward through the recess and communicating with the space within the post. Mercury is placed in the annular channel surrounding the tube O. At the lower end of the post is a tube P leading from a source of air under pressure and having connected thereto a metering device Q for indicating or recording the quantity of air passing through the tube. The metering device may be any suitable construction and has inlet and outlet tubes Q' and Q^2 respectively in communication with the interior of the tube P.

In making the test, the lower end portions of the tubes E and L are inserted within the recess N and the mercury in said recess will form a gas-tight seal so that any air or gas passing through the tube P into the post M will be directed upward into the chamber within the mold K. However, before the air is passed through the tube, the mold K is heated to a temperature substantially the same as that which it would acquire in contact with molten metal. This may be accomplished by lowering an annular electric heating furnace R (such as shown in my former Patent 2,279,368 issued April 14, 1943) so as to surround the mold K and heat it to the proper temperature. The furnace is then removed and air is blown through the tube P, metering device Q, post M, tube E, into the chamber within the mold K from which it passes outward through the voids between the sand particles. The rate of flow is registered by the metering device Q and will thus indicate the gas permeability of the material tested.

The tests may be applied either to green sand

specimens or to baked specimens. With the former it is necessary to treat the sodium silicate to absorb the water content thereof, which may be accomplished by treating with alcohol. On the other hand, if the specimen is first baked at a low temperature, this treatment will remove the water from the sealing material.

To avoid heating of the post M it is preferably provided with an annular liquid circulating passage S therein which is connected with any source of cooling medium. Preferably water is employed as the cooling medium and is conducted from a suitable source (not shown) through a tube T to a restricted tube U within the passage S. Any suitable means such as a tube W may be employed for receiving the water from the passage S and conducting it to a suitable drainage or discharge means (not shown).

What I claim as my invention is:

1. In an apparatus for testing the gas permeability of a molded specimen having a chamber, a hollow post having a cylindrical recess at its upper end, a tube extending upward through the base of the recess and in communication with the interior of said hollow post, a second tube encircling the first tube and having its lower end resting upon the base of said recess, the upper end of the second tube being sealed within the chamber of said specimen, a tube sleeved on the second tube, said last mentioned tube having its lower end resting upon the base of said recess and having its upper end forming a supporting seat for said specimen, means connected to the hollow post for supplying a gas under pressure through the interior of said post and first and second tubes to the chamber of said specimen to be discharged through the voids of said specimen, and means connected to the last mentioned means for measuring the gas supplied.

2. An apparatus for testing the gas permeability of a molded specimen having an axially extending chamber, comprising a post having a cylindrical recess at its upper end and provided below said upper end with a gas passage, a tube extending upwardly through the base of the recess from said gas passage, a second tube encircling the first tube and having its lower end within said recess, the upper end of the second tube being sealed within the chamber of said specimen, a refractory tube sleeved on the second tube, said refractory tube having its lower end within said recess and having its upper end forming a supporting seat for said specimen, and means for supplying a gas under pressure through the gas passage in said post and said first and second tubes to the chamber of said specimen to be discharged through the voids of said specimen.

3. An apparatus for testing the gas permeability of a molded specimen having a central chamber, comprising a post having a recess at its upper end and provided below said recess with a gas passage, a tube extending upwardly through the base of the recess from said gas passage, a second tube encircling the first tube and having its lower end within said recess, the upper end of the second tube extending into the chamber of said specimen, means for supplying a gas under pressure through the gas passage in said post and said first and second tubes to the chamber of said specimen to be discharged through the voids of said specimen, and means connected to the last mentioned means for measuring the gas supplied.

4. An apparatus for testing the gas permeability of a molded specimen having an axially extending chamber, comprising a post having a recess at its upper end and provided below said recess with a gas passage, a tube extending upwardly through the base of said recess from said gas passage, a second tube encircling the first tube and having its lower end within said recess, mercury in the recess forming a seal between the post and first mentioned tube, the upper end of the second tube extending into the chamber of said specimen, a support for said specimen sleeved on the second tube, means for supplying a gas under pressure through the gas passage in said post and said first and second tubes to the chamber of said specimen to be discharged through the voids of said specimen, and means connected to the last mentioned means for measuring the gas supplied.

5. An apparatus for testing the gas permeability of a molded specimen having a central chamber, comprising a post having a recess at its upper end and provided below said recess with a gas passage, a tube extending upwardly through the base of the recess from said gas passage, a second tube encircling the first tube and having its lower end within said recess, the upper end of the second tube extending into the chamber of said specimen, a support for said specimen on the second tube, means for supplying a gas under pressure through the gas passage in said post and said first and second tubes to the chamber in said specimen to be discharged through the voids of said specimen, and means for cooling the post including an annular passage for a cooling medium within said post about the gas passage aforesaid, said annular passage being provided at substantially diametrically opposite sides thereof with inlet and outlet means for the cooling medium.

6. An apparatus for testing the gas permeability of a molded specimen having a central chamber, comprising a post having a recess at its upper end and provided below said recess with a gas passage, a tube extending upwardly through the base of the recess from said gas passage, a second tube encircling the first tube and having its lower end within said recess, the upper end of the second tube extending into the chamber of said specimen, a support for said specimen on the second tube, means for supplying a gas under pressure through the gas passage in said post and said first and second tubes to the chamber in said specimen to be discharged through the voids of said specimen, means for cooling the post including an annular passage for a cooling medium within said post about the gas passage aforesaid, said annular passage being provided with inlet and outlet means for the cooling medium, and a restricted tube for said cooling medium located within said annular passage and connected to said inlet means.

7. An apparatus for testing the gas permeability of a molded specimen having an axially extending chamber, comprising a post having a recess at its upper end and provided below said recess with a gas passage, a tube extending upwardly through the base of the recess from said gas passage, a second tube encircling the first tube and having its lower end within said recess, mercury in said recess forming a seal between the post and first mentioned tube, the upper end of the second tube extending into the chamber of said specimen, a support for said specimen on said second tube, means for supplying a gas under pressure through the gas passage in said

post and said first and second tubes to the chamber of said specimen to be discharged through the voids of said specimen, and means for cooling the post and mercury seal including an annular passage for a cooling medium within said post about the gas passage and mercury seal aforesaid.

8. In an apparatus for testing the gas permeability of a molded specimen having a central chamber, a tube extending into the central chamber of the specimen, a refractory tube sleeved on the first mentioned tube, said refractory tube terminating short of an end of the first mentioned tube and forming a supporting seat for the specimen, means for supplying a gas under pressure through the first mentioned tube into the chamber of the specimen and out through the voids in the latter, and means for measuring the flow of gas supplied to the chamber of the specimen.

9. In an apparatus for testing the gas permeability of a molded specimen having a central chamber, a tube having an end portion adapted to be sealed within said chamber, said tube constituting a means by which a gas under pressure may be introduced into the chamber of said specimen, and a refractory support for said specimen sleeved on said tube.

10. An apparatus for testing the gas permeability of a molded specimen having a central chamber, comprising a post having a recess at its upper end and provided below said recess with a gas passage, a tube extending upwardly through the base of the recess from said gas passage, a second tube encircling the first tube and having its lower end within said recess, the upper end of the second tube extending into the chamber of said specimen, and means for supplying a gas under pressure through the gas passage in said post and said first and second tubes to the chamber of said specimen to be discharged through the voids of said specimen.

11. An apparatus for testing the gas permeability of a molded specimen having an axially extending chamber, comprising a post having a recess at its upper end and provided below said recess with a gas passage, a tube extending upwardly through the base of said recess from said gas passage, a second tube encircling the first tube and having its lower end within said recess, mercury in the recess forming a seal between the post and first mentioned tube, the upper end of the second tube extending into the chamber of said specimen, and means for supplying a gas under pressure through the gas passage in said post and said first and second tubes to the chamber of said specimen to be discharged through the voids of said specimen.

12. An apparatus for testing the gas permeability of a molded specimen having a central chamber, comprising a post having a recess at its upper end and provided below said recess with a gas passage, a tube extending upwardly through the base of the recess from said gas passage, a second tube encircling the first tube and having its lower end within said recess, the upper end of the second tube extending into the chamber of said specimen, means for supplying a gas under pressure through the gas passage in said post and said first and second tubes to the chamber in said specimen to be discharged through the voids of said specimen, and means for cooling the post including an annular passage for a cooling medium within said post about the gas passage aforesaid, said annular passage being provided with inlet and outlet means for the cooling medium.

13. An apparatus for testing the gas permeability of a molded specimen having an axially extending chamber, comprising a post having a recess at its upper end and provided below said recess with a gas passage, a tube extending upwardly through the base of the recess from said gas passage, a second tube encircling the first tube and having its lower end within said recess, mercury in said recess forming a seal between the post and first mentioned tube, the upper end of the second tube extending into the chamber of said specimen, means for supplying a gas under pressure through the gas passage in said post and said first and second tubes to the chamber of said specimen to be discharged through the voids of said specimen, and means for cooling the post and mercury seal.

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