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DILATOMETER STRUCTURE

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FIG. 1.

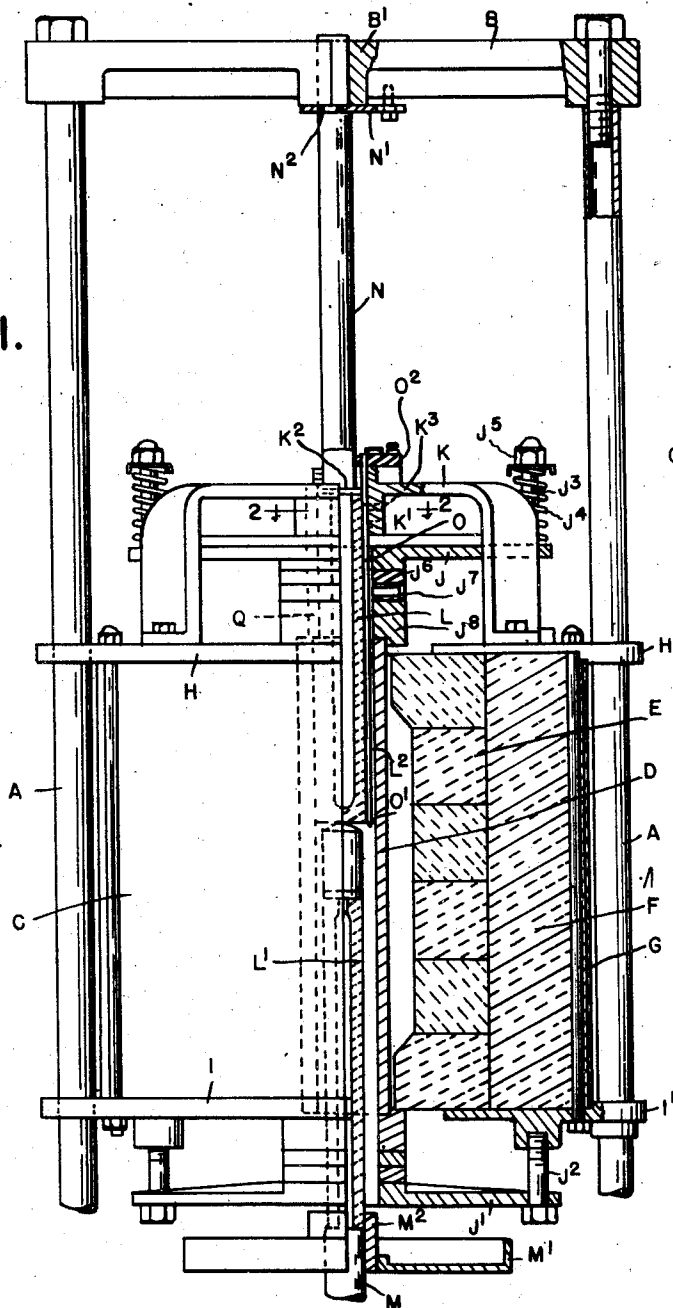
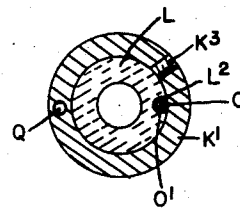


FIG. 2.



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DILATOMETER STRUCTURE

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9 Claims. (Cl. 219—36)

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The invention relates to apparatus designed for use in testing molded sand and of the general character forming the subject matter of my former Patent 2,279,368, of April 14, 1942. In common with this earlier construction the apparatus forming the subject matter of the instant application comprises a frame and an electric furnace movably mounted thereon, said furnace being provided with a tubular resistor having a vertical axis and forming within the same the heating chamber in which the sample is tested. Extending into this heating chamber from opposite ends of the resistor are rods formed of refractory material, such as quartz, one being secured to the upper end of the frame and the other being attached to the piston of a hydraulic cylinder mounted on the base of the frame. There is also mounted on the base means for developing hydraulic pressure within the cylinder which is transmitted through the lower rod to the sample and the amount of pressure thus transmitted is indicated on the gauge. The construction is such that to perform a test the furnace is first raised on the frame so as to expose the ends of the two rods. The sample is placed between these ends after which the furnace is lowered to heat the sample to a temperature corresponding to that to which it would be subject in contact with molten metal. Hydraulic pressure is then applied to the piston and the strength of the sample determined by the reading on the gauge.

It is the object of the instant invention to improve the construction shown in the patent and to overcome certain defects therein. One improvement is to leave the upper refractory rod at all times within the heated chamber instead of moving it alternately in and out of said chamber as in the patent. Such change avoids the loss of heat by dissipation from the highly heated rod when removed from the furnace.

Another improvement is to effectively seal the upper end of the furnace so that the highly heated gases cannot escape therefrom. With these and other improved features in mind, the invention consists in the construction as hereinafter set forth.

In the drawing:

Fig. 1 is a front elevation, one-half in vertical central section of my improved apparatus; and

Fig. 2 is a section taken on the line 2—2, Fig. 1.

As the general structure of the apparatus is the same as that shown in my former Patent 2,279,368, I have omitted showing some portions thereof such as the base and hydraulic apparatus

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mounted thereon. The portion of the frame above the base comprises the vertical rods A connected to each other at their upper ends by the cross head B. Slidably mounted upon these rods is the electric furnace C which includes a tubular resistor D, a refractory wall E surrounding the same and heat insulation F surrounding said wall and held within an outer cylindrical casing G. Heads H and I form respectively the top and bottom of the furnace and these heads have apertured ears H', I' extending therefrom and sleeved upon the rods A. The tubular resistor is held between upper and lower heads J and J', the latter being secured to the head I by bolts J². The upper head J is slidable on rods J³ rising from the head H and springs J⁴ sleeved on these rods bear against the head and are tensioned by adjustable nuts J⁵ on the rods. This produces a yielding resilient pressure by the head J against the resistor which compensates for expansion and contraction due to temperature changes.

To avoid loss of heat by convection and also to maintain a static atmosphere within the heating chamber, the upper end of the resistor D must be sealed. Also, the upper refractory rod which makes contact with the sample must be supported centrally within the resistor. As shown, this is accomplished by a yoke or strap member K secured to the head H and extending thereabove. K' is a hub at the center of the member K which is recessed to receive the upper end of a refractory rod L preferably formed of quartz. Insulating material K² is packed around the rod within the recess in the hub K' and a set screw K³ in the hub serves to clamp the rod in said recess. The rod L passes through the head J and intermediate members between this head and the resistor D, these including an insulator member J⁶ and conductor members J⁷ and J⁸ which latter connect the resistor to the external electric circuit (not shown). The rod closely fits these members to form a substantially gas tight seal. Thus, the portion of the rod L which extends within the tubular resistor D is fixedly positioned by the portion extending upward and into the hub K' so as to form at its lower end an abutment against which the sample may be pressed.

To support the sample within the heated chamber and to apply pressure thereto, there is a lower refractory rod L' which extends upward through the lower end of the resistor tube. This rod is connected at its lower end to a rod M which extends downward to hydraulic apparatus (not shown) but which is the same in construction as shown and described in my former patent. A tray

or pan M' secured to the rod M and having a central apertured hub M² forms the connecting means between the rods M and L. Thus, with the apparatus as so far described, the refractory rod L' will be normally stationary with respect to the frame while the refractory rod L is movable with the furnace. Thus, if the furnace is raised by sliding it upward on the rods A, the rod L' will be completely withdrawn therefrom so that a sample to be tested may be placed on its upper end after which the furnace may be again lowered to bring the sample into contact with the lower end of the rod L. In the latter position the rod L must be held stationary to form an abutment against which the sample is pressed by the operation of the hydraulic mechanism and the rods M and L'. To provide for this a rod N attached to the hub K' extends upward therefrom and through a bearing B' in the cross head B. When the furnace is raised and lowered, the rod N will be slideable through the bearing B' but, when in its lower position, it may be locked preferably by a member N' pivotally attached to the head B and engaging a groove N² in the rod N. This will hold the furnace and also the depending refractory rod L stationary, while the testing of the sample is performed.

It is desirable that the operator should know the exact temperature within the heated chamber during the testing operation. This may be indicated by the operation of an electrical thermocouple. However, a thermocouple is a delicate piece of apparatus and to protect the same from injury, I have devised the following construction. The refractory rod L is formed with a channel L² extending longitudinally thereof of sufficient area to receive a refractory tube O. This tube contains the conductor wires of the thermocouple O' which latter is located at the lower end of the rod L in the chamber immediately surrounding the sample to be tested. The upper end portion of the tube O extends through the hub K' and is connected to an insulator block O² from which electrical connection may be made to the indicator (not shown).

For making certain tests it is desirable to have an atmosphere within the heated testing chamber corresponding to that which is present in the actual use of the molds. Thus, this atmosphere may be either oxidizing or reducing according to particular conditions. I have, therefore, provided means for introducing gas into the chamber within the tubular resistor, this comprising a passage Q extending through the hub K' and other members between the same and the resistor D. Gas from any suitable source and of the desired quality may thus be introduced through this passage and will fill the chamber within the resistor from which the sample is tested.

What I claim as my invention is:

1. A furnace including a tube extending vertically therethrough and forming the heating chamber, a refractory rod extending into said tube from the upper end thereof, means without the tube for rigidly holding said rod in fixed relation thereto, and for sealing the upper end of said tube, a second refractory rod extending upward into said tube through the lower end thereof and adapted to support the work and press the same against the upper rod, and means for relatively moving said furnace and second rod to separate the same for the insertion of the work.

2. An electric furnace including a tubular resistor extending vertically, a refractory rod extending axially downward into said tubular re-

sistor, means above said resistor for rigidly supporting said rod in fixed relation thereto and for sealing the upper end of the tube, a second refractory rod extending upward into said tubular resistor through the lower end thereof and adapted to support the work and press the same against said upper rod, and means for relatively moving said furnace and lower rod to separate the same for the introduction of the work.

3. An electric furnace including a vertically extending tube forming a heating resistor, refractory rods extending into said tube from opposite ends thereof and adapted to apply pressure to the work therebetween, means at the upper end of the furnace for rigidly supporting the upper refractory rod in its position within the tube, means for sealing the upper end of the tube surrounding said rod, and means for introducing a gas through said seal to form an atmosphere of predetermined character within the tube.

4. An electric furnace including a vertically extending tube forming a heating resistor, refractory rods extending into said tube from opposite ends thereof and adapted to apply pressure to the work therebetween, means for rigidly holding the upper rod in its position within the tube and for sealing the upper end of the tube around said rod, said upper rod having a channel extending longitudinally thereof, and a thermocouple located at the lower end of said upper rod and having its conductors extending out from the furnace through said channel.

5. An electric furnace including a vertically extending tube forming a heating resistor, refractory rods extending into said tube from opposite ends thereof and adapted to apply pressure to the work therebetween, means for rigidly holding the upper rod in its position within the tube and for sealing the upper end of the tube around said rod, said upper rod having a channel extending longitudinally thereof, and a thermocouple provided with a tube for the electrical conductors, said conductor tube being located in said channel to position the thermocouple at the lower end of the rod and to carry the conductors therefrom out of the furnace.

6. The combination with a frame, of an electrical furnace vertically movable upon said frame, said furnace including a vertical tube forming a heating resistor, refractory rods extending into said tube from opposite ends thereof and adapted to press the work therebetween, means connected to the upper end of the furnace for rigidly supporting said upper refractory rod within said tube, means for sealing the upper end of said tube above said refractory rod, a guide rod extending upward from said upper refractory rod in alignment therewith and connected to said furnace, a bearing on said frame through which said guide rod slides to raise the furnace on said frame and to separate the same from said lower refractory rod, and means on said bearing for interlocking with said guide rod in the lowered position of said furnace to hold the latter in such position.

7. Testing apparatus comprising a frame having a plurality of vertically extending spaced rods and a horizontal member interconnecting the tops of said rods, an electric furnace having a vertical opening therethrough mounted for vertical movement on said rods, an upper abutment rod rigidly secured in the opening in said furnace and extending downwardly from the top of said furnace to a point substantially midway between its ends, means closing the space between the upper end of said upper abutment rod and the opening in

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said furnace to prevent convection, and a lower abutment rod extending upwardly through the lower end of the opening in said furnace to a point adjacent the lower end of said upper abutment rod when said furnace is in lowermost position.

8. Testing apparatus comprising a frame having a plurality of vertical rods and a centrally apertured crosshead connecting the tops of said rods, an electric furnace vertically movable on said rods and having a vertically elongated, upwardly closed, downwardly open chamber therein, an upper abutment rod extending downwardly from the top of said chamber and being movable with said furnace, a lower abutment rod extending upwardly to a point adjacent the lower end of said upper abutment rod, and a rigid rod extending upwardly from said furnace in alignment with said upper abutment rod and passing through the aperture in said crosshead, and means on said crosshead for rigidly locking said rigid rod to said crosshead when said furnace is in lowermost position for directly sustaining the

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thrust imparted to said upper abutment rod through a test specimen pressed between the ends of said abutment rods.

9. Test apparatus for subjecting a specimen to pressure in an environment controlled as to temperature comprising a vertically movable furnace having a vertically elongated, downwardly open, upwardly closed chamber therein, a lower elongated abutment rod extending upwardly into said chamber, an upper elongated abutment rod extending downwardly in said chamber to a point close to the upper end of said lower abutment rod, and being vertically movable with said furnace, means extending laterally from said furnace for guiding said furnace in its vertical movement, a rigid rod movable with said furnace and extending upwardly therefrom in alignment with said upper abutment rod, and means for rigidly supporting said rigid rod for directly sustaining upward thrust imparted to said upper abutment rod through a test specimen pressed between the ends of said abutment rods.

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