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STRUCTURE FOR METHOD OF DRYING GRANULAR MATERIAL

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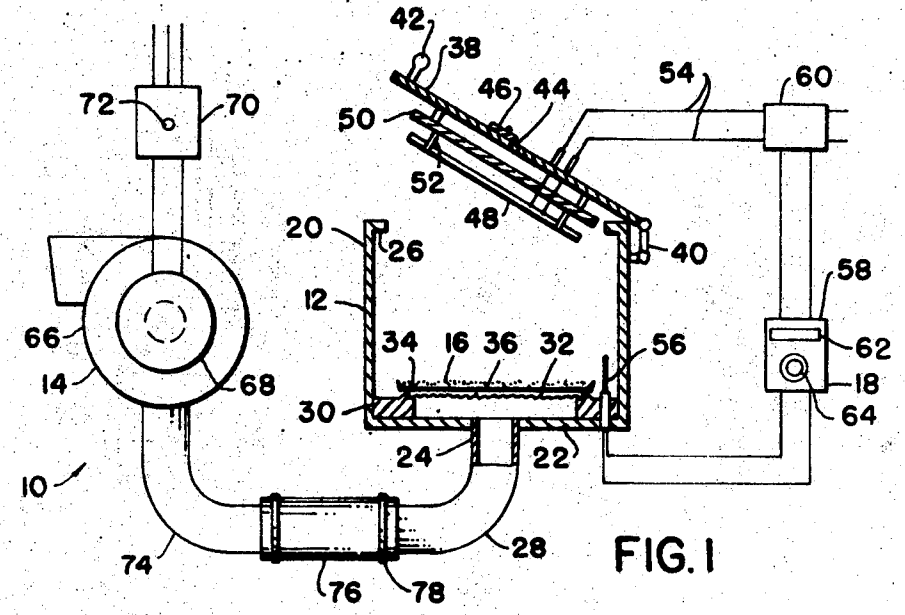


FIG. 1

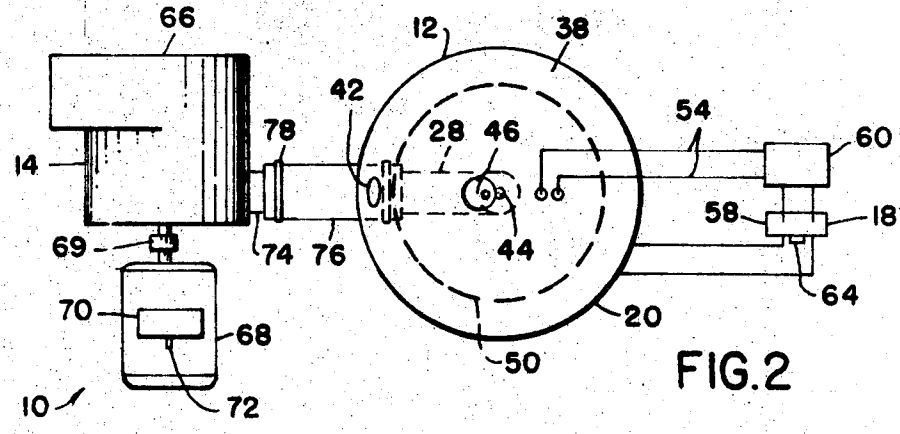


FIG. 2

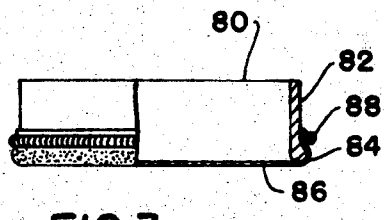


FIG. 3

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STRUCTURE FOR AND METHOD OF DRYING GRANULAR MATERIAL

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ABSTRACT OF THE DISCLOSURE

The structure for drying granular material disclosed comprises an oven including means for supporting a sample of granular material on a filter paper or in a specially constructed pan over an opening through which a vacuum is drawn in the oven, means for sealing the sample of granular material over the vacuum forming opening and for sealing the oven except for a controlled air intake opening in response to drawing a vacuum in the oven, and means for maintaining the oven at a predetermined temperature. The vacuum is drawn in the oven through a conduit connected to a motor driven vacuum pump of large capacity. Temperature is maintained at a predetermined level in the oven by means of thermostatically controlled temperature regulating and indicating heating structure.

In accordance with the method of the invention, the granular material to be dried is placed in the oven, a vacuum is drawn in the oven through the granular material whereby steam from the granular material is withdrawn from the oven, and the oven is heated. The oven is sealed in response to drawing a vacuum therethrough except for controlled air flow. The temperature of the oven is automatically regulated and indicated.

BACKGROUND OF THE INVENTION

Field of the invention

The invention relates to structure for and a method of drying granular material or the like and refers more specifically to an oven including means for withdrawing steam from the oven and creating a vacuum therein while maintaining a predetermined temperature in the oven and the method of drying granular material including heating granular material in a vacuum at a predetermined temperature while drawing steam therefrom and drawing air thereacross. The invention also includes a particular pan for holding granular material to be dried in the oven of the invention by the method of the invention.

Description of the prior art

In the past, foundry sand to be dried to, for example, determine its moisture content for consideration in tempering thereof, has been heated in an oven to dry the granular material after first being weighed. The original moisture content thereof may then be determined after a subsequent weighing of the dry granular material. In general, the drying ovens of the past have not been provided with structure for drawing a vacuum in the ovens to remove steam from the material dried or for sealing the ovens in response to drawing the vacuum except for a predetermined air flow over the granular material. Furthermore, it has often been the case that even the temperature has not been automatically regulated in the past to maintain a predetermined temperature during the drying of a granular material sample. Consequently, moisture tests have required a considerably longer time than necessary in the past due to inefficient drying of granular material samples in prior ovens by prior methods.

SUMMARY OF THE INVENTION

It is therefore one of the purposes of the invention to provide scientific structure for drying a sample of granular material or the like including an oven, means for automatically regulating the temperature in the oven and for drawing a vacuum in the oven across the sample of granular material placed therein. Also, in accordance with the structure of the invention the granular material is positioned across an opening in the oven through which the vacuum is drawn to facilitate drawing air through the sample and drawing steam away from the sample during the drying process and the oven is sealed by the vacuum drawing structure except for a controlled air flow therethrough. The granular material may be positioned in the oven in a special pan to permit drawing of air through and steam from the granular material.

As indicated above, the invention further includes the method of drying granular material comprising maintaining a predetermined temperature around the granular material in a vacuum and drawing steam away from the granular material being dried while drawing air through the granular material being dried.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic representation partly in section of structure for drying granular material constructed in accordance with the invention.

FIG. 2 is a top view of the structure for drying granular material illustrated in FIG. 1 showing the oven door closed.

FIG. 3 is an enlarged side elevation view partly broken away of a modified pan for holding granular material to be dried in the structure for drying granular material illustrated in FIGS. 1 and 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown best in FIG. 1, the structure **10** for drying granular material includes an oven **12**, structure **14** for drawing a vacuum in the oven **12** and for drawing air through and steam away from granular material **16** within the oven **12** in operation. The apparatus **18** is provided to maintain a regulated temperature within the oven **12** and to indicate the regulated temperature.

More specifically, the oven **12** includes a cylindrical body **20** having a bottom **22** with an opening therethrough. A radially inwardly extending sealing flange **26** is provided at the upper end of the oven body **20**. An elbow **28** through which a vacuum may be drawn is secured in the opening **24** in the bottom **22** of the oven **12** by convenient means not shown.

A granular material sample mounting ring **30** is positioned in the bottom of the oven **12**. Metal mesh **32** is positioned over the inner diameter of the ring **30** as shown best in FIG. 1 to prevent objects from falling into the elbow **28**. The ring **30** is further provided with a sealing ridge **34** about the inner periphery thereof whereby on drawing a vacuum in the oven **12** through the elbow **28**, a filter paper **36** on which a sample of granular material **16** is positioned for drying will be drawn against the ring **30** about its periphery.

The oven **12** is provided with a cover **38** pivotally mounted by links **40** to the body **20** of the oven **12**. The cover **38** is adapted to be in metal to metal sealing engagement with the sealing flange **26** of the oven **12** in a closed position. Opening **44** is provided in the cover **46** through which air is metered into the oven in conjunction with the eccentrically pivotally mounted closure **46** associated therewith.

A heating element **48** is secured to the reflecting disc **50** suspended from the cover **38** by insulating members

52. The heating element 48 is of the exposed high intensity type to increase the ultraviolet heat applied to the granular material 16 in the oven 12. Electrical energy is passed to the heating element 48 through the conductors 54 from a source of electrical energy not shown.

The temperature in the oven 12 is controlled by the apparatus 18 through the thermostat 56 which senses the temperature of the oven 12 and the commercial temperature control unit 58 operable to open and close the conductors 54 through the switch structure 60 in accordance with the temperature sensed in the oven 12 by the thermostat 56 and to indicate the temperature on the indicator 62. A temperature setting control 64 is also provided on the unit 58 to regulate the temperature at which the oven is maintained. Units 58 are commercially available and may contain, for example, an amplifier having the control knob 64 in the input circuit thereof, the input to which is from the thermocouple 56 and the output of which is a relay coil operable to open and close the circuit through the conductors 54 on a predetermined electrical signal through the amplifier in response to the signal from the thermocouple 56.

The structure for drawing a vacuum in the oven 12 includes a vacuum pump 66 having a high capacity driven by an electric motor 68 through a coupling 69. The electric motor 68 is energized through the starter box 70 from a source of three phase electrical energy not shown on closing of the start stop switch 72. The vacuum pump 66 is connected to an elbow 74. Both of the elbows 28 and 74 are connected through a flexible tube 76 having a wire reinforcement therein to prevent collapsing thereof. Clamps 78 are used to secure the flexible tube to the elbows 28 and 74 at the opposite ends thereof as will be understood by those in the art.

While as shown in FIG. 1, the sample of granular material 16 may be placed in the oven 12 on a filter paper 36, if a larger sample of granular material is to be dried in the oven 12, a pan 80 is provided. The pan 80 includes the cylindrical member 82 having the radially outwardly extending flange 84 at the bottom thereof. A filter paper 86 is stretched across the bottom of the cylindrical member 82 and extends upwardly along the sides thereof as shown in FIG. 3. The filter paper 86 is maintained in position on the cylindrical member 82 by the annular coil spring 88.

In overall operation of the structure for drying granular material 10 in accordance with the method of the invention, a sample of granular material to be dried is positioned within the oven 12 on filter paper 36. The oven 12 has previously been brought up to a predetermined selected heat as determined by the thermocouple 56 and the setting of the dial 64. The oven door 38 is then closed and the switch 72 closed whereby the motor 68 drives the pump 66 to draw a vacuum within the oven 12.

The vacuum being drawn within the oven 12 through the elbow 28 holds the granular material to be dried and the filter paper tightly against the screen 32 and the sealing ridges 34 and at the same time draws air through the opening 44 in the cover 38 and aids in the sealing of the cover 38 whereby air is drawn over the granular material 16 and steam is drawn away from the granular material 16. Thus the granular material 16 is heated at a predetermined temperture in a vacuum while steam is being removed therefrom and air is being passed therethrough whereby the granular material 16 is dried in a particularly short time as, for example, in forty-five seconds rather than the usual 3½ minutes for a twenty-five gram sample of foundry sand.

While one embodiment of the present invention has been considered in detail, it will be understood that other

embodiments and modifications thereof are contemplated by the inventor. It is therefore the intention to include all embodiments and modifications as are defined by the appended claims within the scope of the invention.

What I claim as my invention is:

1. Structure for drying granular material comprising an oven having a first and a second portion, means through which air is drawn into a first portion of the oven, means operably associated with the first portion of the oven for heating the air drawn into the first portion of the oven, means for drawing air into the first portion of the oven and for withdrawing sufficient air from the second portion of the oven to maintain a vacuum within the oven and filter means positioned between the first and second portions of the oven for supporting granular material to be dried within the oven whereby air drawn into the first portion of the oven and heated is drawn through the granular material to turn the moisture in the granular material into steam and the heated air and steam is drawn through the second portion of the oven and out of the oven so that the granular material is dried rapidly.

2. Structure as set forth in claim 1 wherein the filter means comprises a hollow cylinder, filter material positioned over one end of the cylinder and an annular resilient member securing the filter means to the one end of the cylinder.

3. Structure as set forth in claim 1 wherein the means through which air is drawn into the one portion of the oven comprises an opening in the one portion of the oven and further including means for varying the size of the opening to vary the flow of air into the oven.

4. Structure as set forth in claim 1 and further including thermocouple structure operably associated with the oven for sensing the temperature in the oven and regulating the means for heating the air drawn into the oven in response to the sensed oven temperature.

5. The method of drying granular material comprising passing air into one portion of an oven, heating the air in the one portion of the oven, drawing a vacuum in the oven from a second portion of the oven and positioning the granular material on filter means between the first and second portions of the oven whereby the heated air from the first portion of the oven is drawn through the granular material to turn the moisture therein into steam and the steam and heated air is further drawn through the filter means and the second portion of the oven and out of the oven.

6. The method as set forth in claim 5 and further including the step of varying the quantity of air drawn into the first portion of the oven.

7. The method as set forth in claim 5 and further including sensing the temperature in the oven and automatically regulating the heating of the air drawn into the oven in accordance with the sensed temperature of the oven to maintain a predetermined oven temperature.

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