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MICROSCOPE FURNACE STAGE

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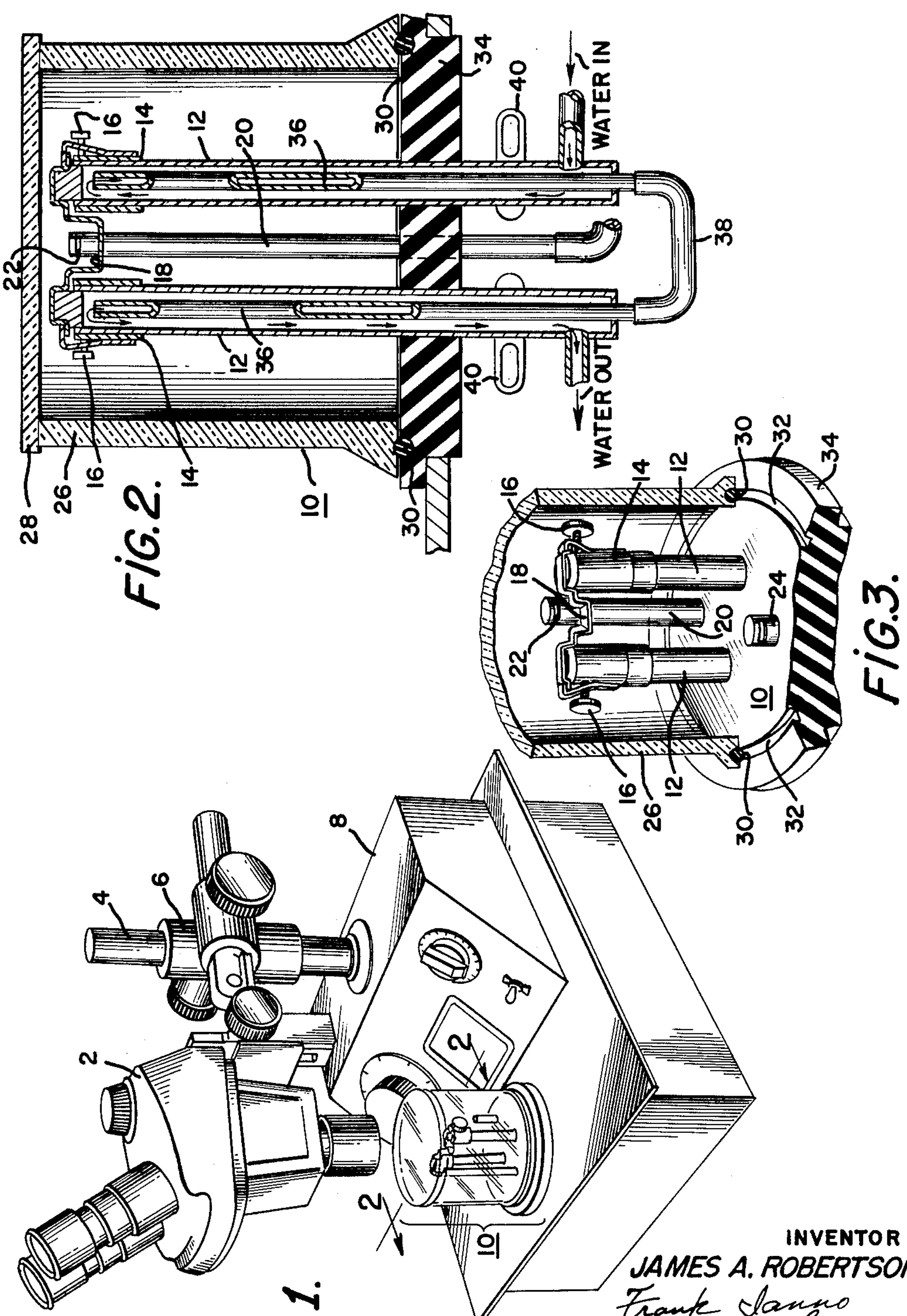

FIG.1.

FIG.2.

FIG.3.

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MICROSCOPE FURNACE STAGE

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This invention relates to a microscope stage and more particularly to a strip micro furnace adapted for use as a stage for a microscope.

The use of micro furnaces as stages in microscopes is known. These stage furnaces are normally small heated chambers in which the heat is supplied by either radiation, convection or both from the wall of the chamber. The specimen is normally placed within a chamber and the oven heated to the desired temperature. Typical stages are reported in U.S. Patent 1,609,129 issued to H. S. Roberts on November 30, 1926, and U. S. Patent 2,969,712 issued to D. M. Olson, January 31, 1961.

One of the problems presented by this type of stage micro furnace is the relatively slow rate at which they heat the specimen. Thus, when temperatures above 1,000° C. are required, these types of apparatus require a good deal of time to reach these temperatures. Additionally temperatures cannot rapidly be fluctuated through temperature gradations at the higher temperatures, so that observation of transition temperatures, crystal growth and melting are impaired. Another difficulty with micro furnace stages is that the furnace chamber which is heated gives off a great deal of heat, and is difficult to work with at high temperatures (above 1,000° C.) without causing local heating of the microscope.

It is an object of this invention to present a micro furnace stage which permits heating to high temperatures, at a high rate of heating and under conditions which keep the microscope cool.

It is a further feature of the present invention to disclose a micro furnace stage wherein a temperature level can be predetermined and can be regulated through a temperature range over an extended period of time.

These and other objects of the invention will be apparent from the following detailed description and the appended drawings.

In the drawings, FIG. 1 is a perspective view of the furnace with a microscope mounted in swingable relationship.

FIG. 2 is a sectional view of the micro furnace stage illustrating the inner details of the stage.

FIG. 3 is a perspective close up view of the micro furnace stage with the cover broken away.

In FIG. 1 of the drawing, 2 represents the microscope mounted on vertical shaft 4, in a movable relationship about shaft 4, by a collar 6. The microscope assembly is mounted on support 8 which houses the electrical controls used in regulating of the strip micro furnace.

The strip micro furnace stage 10 is shown in detail in FIGURES 2 and 3. The strip micro furnace stage 10 is mounted on a solid support 34 having therein a circular grooved indentation 32 in which rests circular gasket 30. A high temperature glass envelope 26 encloses the entire micro strip furnace and is fitted on top with an optical window 28 e.g. quartz. The envelope is maintained in a gas tight relationship with 34 by means of gasket 30. The gas tight seal is effective by virtue of the weight of the envelope 26 on the gasket 30 affixed in base support 34. Thus envelope 26 can be removed by simply lighting it off the entire furnace.

The micro furnace elements are made up of two conductive electrodes 12, having terminal supports 14, which hold the heating strip 18 in fixed relationship between the supports by clamping means 16 located on terminal supports 14. Stand pipe 20 has an opening 22 for passing a gaseous stream over the surface of the heating strip 18. The gas which enters the micro furnace is removed via exit pipe 24. The function of stand pipe 20 is to remove vapors or other fumes which would obscure visual observation of the specimen while it is being heated on the heating strip 18. Further, the atmosphere within the micro furnace can be controlled by selecting the gas that is introduced through stand pipe 20.

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The electrodes 12 are adapted to carry the current through the heating strip 18. This strip may be a high temperature resistant metal such as platinum, molybdenum or other heating elements such as a graphite cloth, etc. A metallic heating element is preferred where molten specimens are being studied, because it supports the sample regardless of wetting characteristics. The electrodes, 12, contain inner tubes 36 concentrically placed within the electrodes. The upper portions of the inner tubes 36 are in a space relationship with respect to the outer electrodes 12, while the base of these tubes are in a sealed relationship with the outer electrodes. The electrodes are water cooled by passing water through the concentric space between the inner tubes 36 and the outer walls of electrode 12. For convenience sake, FIG. 2 shows a method of joining the inner tubes 36 by a tubular connection 38, so that only one water inlet and outlet need be used for cooling both electrodes at the usual low operating voltages.

When an electric potential is applied to the two electrodes, by means of conductors 40, electricity flows through the heating strip 18. Because of the resistance to the passage of the current through the heating strip 18, the temperature of the strip will rise to temperatures on the order of 1,800° C. in about 3 seconds. The exact temperature of the strip can be closely regulated by varying the amount of current which is passed through the strip.

In using the present apparatus the specimen is placed on the micro strip 18, the glass envelope 26 is placed over the furnace, and current is applied to the electrodes 12. A supply of water is passed through the electrodes 12 in order to maintain them cool relative to the micro strip 18. The microscope 2 is then rotated about shaft 4 into position over the optical window 28 of micro strip furnace stage 10 and the specimen observed as the temperature is either increased or decreased as desired. In order to assure a clear view of the specimen, a stream of gas is passed through stand pipe 20 out through aperture 22 and above the surface of the specimen and heating strip 18. By this means any fumes or gases which are evolved will be swept away and will permit an unobstructed view of the specimen. In the event the specimen must be heated in a controlled atmosphere the entire furnace can be swept out with an inert gas prior to the commencement of heating and a stream of this gas can be maintained above the surface of the specimen throughout the heating period.

The temperature of the specimen is determined with a contact thermocouple, an optical pyrometer, or by voltage control after calibrating the micro strip furnace. This is done by placing standard solid compounds having known melting points on the heated strip and determining the applied potential necessary to melt these compounds. By employing standards having a wide range of melting temperatures, an accurate calibration of temperature versus applied potential can be obtained. The calibration, once made, enables direct translation of applied potential into temperatures.

Illumination of the stage can be achieved in any one of three ways. If the sample is a thick section where only the outer surface of the specimen is being observed, indirect lighting can be used to illuminate the stage via oblique or vertical application. On the other hand, if a thin specimen is being studied and observation through the specimen is desired, the light required for observation can come from the heated micro strip or from light emitted by the heated specimen per se. At temperatures above about 800° C. illumination by the micro strip is often sufficient as the source of light for viewing the specimen. The utilization of light emitted by the specimen itself is normally solely used where refractories and other high temperature melting specimens are heated to temperatures on the order of about 1,500° C. to observe their crystal growth and transition temperatures.

The present micro strip furnace stage is advantageous over prior micro furnace stages in that temperatures as high as 3,000° C. can be reached in a few seconds without excessively heating either the electrodes or the stage. Thus, reactions too slow to observe by ordinary heating means can readily be carried out in a short time. Further the temperature can be preset for these high temperature ranges within narrow limits so that critical high temperature regions can readily be reached, maintained, and observed over an extended period of time.

While the present embodiment of the invention shows the envelope in a gravity held gas-sealed relationship with respect to the base, it is obvious that other gas-sealed relationships such as ground glass fittings, screw fittings, etc., can also be employed, and that the envelope can be constructed of other equivalent materials i.e. quartz, metal etc., without departing from the scope of the invention.

Pursuant to the requirements of the patent statutes, the principle of this invention has been explained and exemplified in a manner so that it can be readily practiced by those skilled in the art, such exemplification including what is considered to represent the best embodiment of the invention. However, it should be clearly understood that, within the scope of the appended claims, the invention may be practiced by those skilled in the art, and having the benefit of this disclosure, otherwise than as specifically described and exemplified herein.

What is claimed is:

1. A heated strip microscope furnace stage comprising a base, an envelope covering said base, said envelope containing an optical window, electrode means mounted in said base, said electrodes comprising upright hollow members having a closed upper end and containing inner tubes

concentrically placed within said hollow electrodes for passing a cooling fluid through the concentric annular space between the electrodes and the inner tubes, an electrically conductive strip bridging said electrodes adapted to receive a specimen thereon, hollow conducting means having an aperture therein and mounted in said base for conducting a stream of gas in close proximity to said conductive strip, and a hollow removal means mounted in said base for withdrawing said gas from said furnace stage.

2. A heated strip microscope furnace stage comprising a base, an envelope covering said base, said envelope containing an optical window, a pair of tubular electrodes mounted in said base, said tubular electrodes being closed at their upper ends and containing inner tubes concentrically placed within said tubular electrodes and adaptable for passing a cooling fluid through the concentric annular space between the electrodes and said inner tubes, said electrodes containing clamping means at the closed upper ends, an electrically conductive strip bridging said electrodes adapted to receive a specimen thereon, said ends of said strip held by the clamping means of said electrodes, a tubular stand pipe mounted in said base and having an aperture at its upper end for passing a stream of gas in close proximity to said conductive strip, a second tubular stand pipe mounted in said base for removal of said gas from said furnace stage, said optical window being positioned so that said conductive strip is readily viewable through said optical window of said envelope.

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