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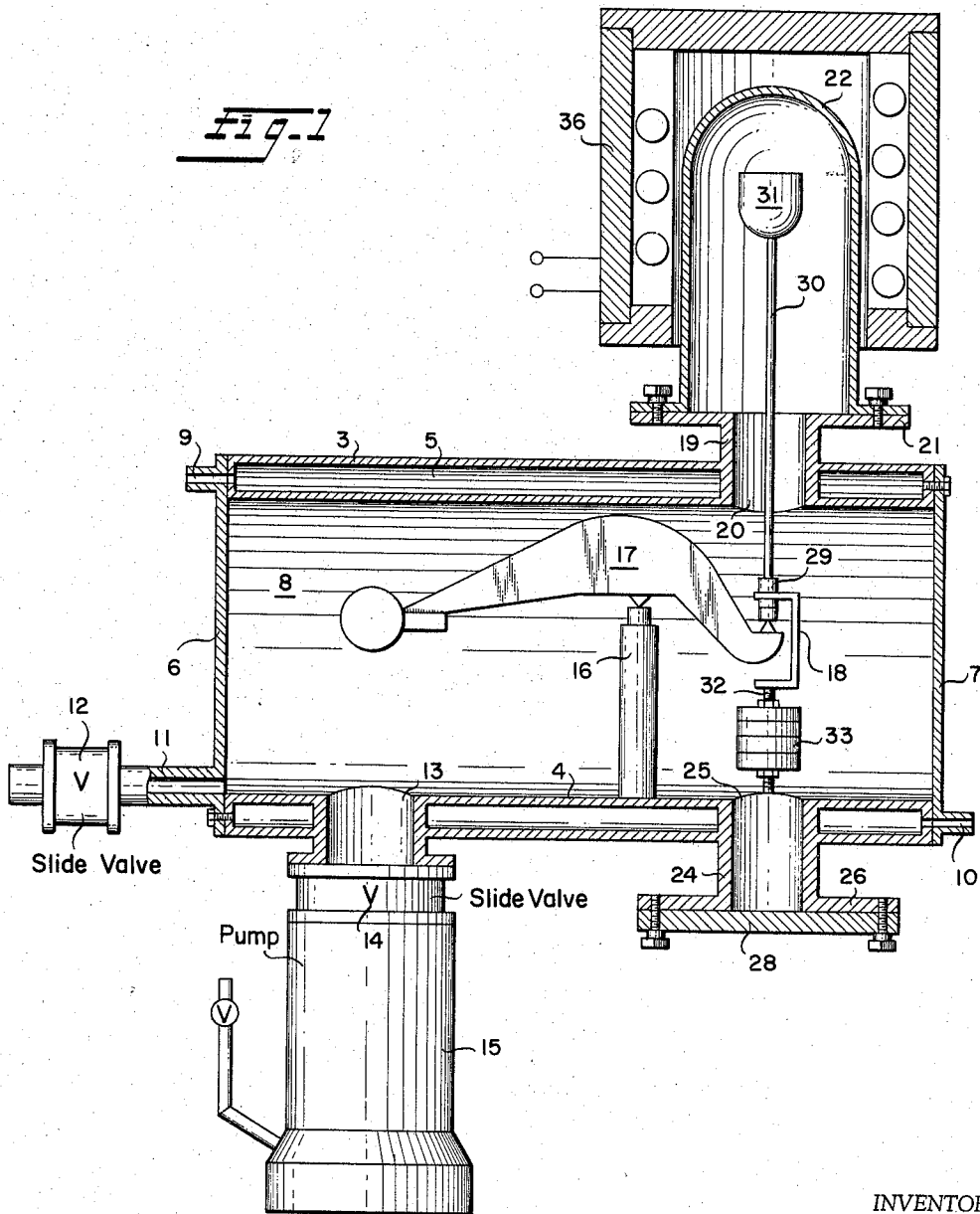
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BALANCE

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2 Sheets-Sheet 1



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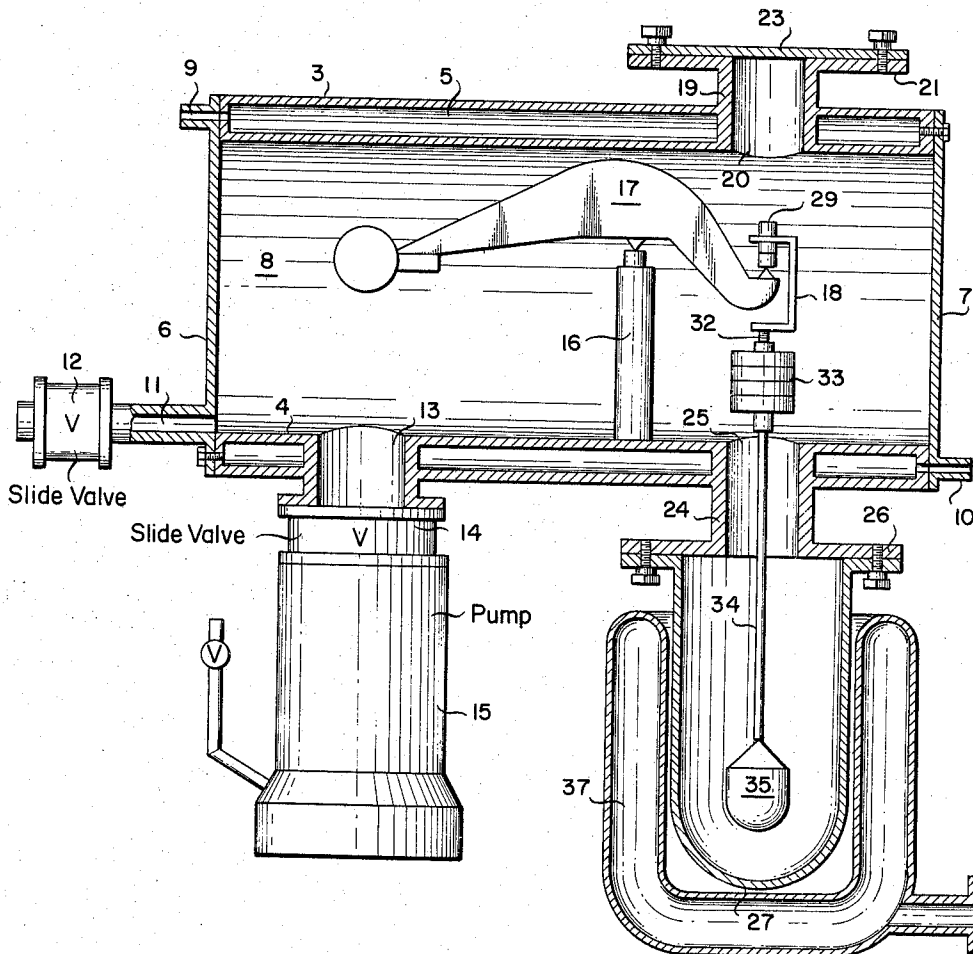
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Fig. 2



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BALANCE

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4 Claims. (Cl. 177-180)

This invention relates to a balance and more particularly to a balance having a gas-tight casing. Balances with gas-tight casing are provided to ascertain weights in a vacuum, at lower than atmospheric pressure, at a high pressure, in a special gaseous atmosphere, or at temperatures far different from the normal room temperature.

For many investigations, however, it is desirable to weigh the specimen under test conditions which are quite different from the conditions under which the various parts of the balance can still operate reliably. This applies particularly if the specimen has to be weighed at very high or very low temperatures. In order to meet these and similar requirements the balance according to the invention comprises a gas-tight casing, a balance beam fulcrumed inside said casing, an outer knife edge on one arm of said balance beam, said casing having two apertures located respectively above and below said outer knife edge of the balance beam, a specimen carrier pivoted on said outer knife edge of the balance beam and projecting through one of said apertures in the space outside of said gas-tight casing, a bowl-shaped cover releasably and hermetically secured to said gas-tight casing to enclose the projecting part of said specimen carrier, and sealing means releasably and hermetically secured to said gas-tight casing to close the other of said apertures. Said gas-tight casing preferably is double-walled at least in the region of said two apertures and connections are provided for introducing and withdrawing a coolant or heating medium to and from the cavity between said walls. In order to improve the versatility of the balance said gas-tight casing has flanges designed as a support either for a bowl-shaped cover or for sealing means in the form of a plate and is provided with appropriate fastening means such as screws or clamps. Finally, the balance outlined above may have one or more additional weights which are insertable through the lower aperture and attachable to the hanger attachment provided with the specimen carrier.

These and other objects of the invention will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawing in which:

FIG. 1 shows a beam balance with a bowl or bell member fitted above the gas-tight casing, and

FIG. 2 shows the same balance with the bowl or bell member fitted below the gas-tight casing.

The casing of the balance comprises a cylindrical outer wall 3 and spaced coaxial cylindrical inner wall 4, which together define a cavity 5 at least in the region of two openings or apertures 20 and 25. Circular walls 6 and 7 are detachably fastened to the ends of the cylindrical double walls 3, 4 so as to form a casing containing a chamber 8 sealed off in a gas-tight manner from the outside. The fastening means for the end walls 6 and 7 are not shown in detail. Tubular nipples 9 and 10 are inserted in the end walls 6 and 7 and both open into the cavity 5 to provide inlet and outlet means for a cooling or heating medium that can flow through the cavity 5 so that the chamber 8 of the casing can be kept at a predetermined temperature. One end wall 6 also has an inlet 11 which opens into the interior 8 and which can be closed by means of a stop-cock or slide valve 12. In

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the cylindrical walls 3, 4 of the casing there is a connection 13 of large cross-section opening into the chamber 8 and connected to a pump 15 by a further stop-cock or slide valve 14. The inlet 11 and the pump connection 13 are used to keep a filling gas of suitable composition at a predetermined pressure in the chamber 8 of the casing or in certain cases to evacuate the casing.

A column or stand 16 on which the balance beam 17 is fulcrumed is fixed at the inner wall 4 of the casing. It is desirable for the beam 17 to be asymmetrical, and the conventional hanger attachment 18 which is usually yoke-shaped is pivoted on the outer knife edge of the shorter arm of the beam. Other parts of the balance, such as the arresting means for locking the beam 17 and the hanger attachment 18 and the usually optical or electrical means for reading the inclination of the beam, are also wholly or partly located within the inner wall 4 of the casing; for reasons of clarity, however, such parts have not been shown in the drawing.

A short pipe 19 is fitted in the casing substantially vertically above the hanger attachment 18; it passes through the walls 3 and 4, and the openings or aperture 20 defined thereby opens into the chamber 8 of the casing. A flat flange 21 juts out laterally from the top of the pipe 19. The flange 21 is designed as a support either for a bowl-shaped cover 22 (FIG. 1) or for sealing means in the form of a plate 23 (FIG. 2) and is provided with appropriate fastening means such as screws or clamps. Similarly, substantially vertically below the hanger attachment 18 there is provided a short pipe 24 defining an opening or aperture 25 and having a flange 26 so that either a depending bowl-shaped cover 27 (FIG. 2) or a lower sealing plate 28 (FIG. 1) can be attached in a gas-tight manner.

The top of the hanger attachment 18 comprises a sleeve 29 which can be screw-threaded or conical internally to receive a specimen carrier 30 (FIG. 1), the carrier 30 being inserted from above through the aperture 20 and terminating at its top in a crucible 31 to receive a specimen. In order that the hanger attachment 18 may be in stable equilibrium when the specimen carrier 30 extends upwardly (FIG. 1), a screw-threaded rod 32 attached to the bottom of the hanger attachment 18 can have additional weights 33 screw threaded thereon and possibly locked thereto. The external dimensions of the weights 33 are such that they can be inserted from below through the aperture 25. The screw-threaded rod 32 also makes it possible to suspend a specimen carrier 34 extending through the lower aperture 25 and terminating in a crucible 35 to receive the specimen, as illustrated in FIG. 2. The additional weights 33 are then not strictly necessary, and in this case some or all of them may be removed, for example for the purpose of effecting a rough tarring.

The balance as described is versatile without requiring bulky or expensive additional equipment. If, for example, weighings are to be carried out with the specimen at a high temperature, as is the case when investigating the thermal decomposition of chemical compounds, or when measuring vapour pressure, or when measuring formation enthalpies or when determining activating energies, then, as shown in FIG. 1, the cover 22 is fixed to the flange 21 and the lower aperture 25 is closed in a gas-tight manner by means of the sealing plate 28. The required additional weights 33 should be mounted on the hanger attachment 18 in the manner shown. In order to bring the specimen in the crucible 31 to the desired temperature an electric furnace 36 is placed over the outside of the top of the cover 22 as shown in FIG. 1. Some of the heat generated by the furnace 36 is dissipated upwardly without any special steps being required and thus is not applied to the casing. Any heat produced purely by radiation can be prevented from reaching the

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chamber 8 of the casing by circulating a coolant medium through the cavity 5. In this way the conditions in the chamber 8 of the casing for operating the critical parts of the balance can be kept substantially constant even over long periods.

It may be advantageous to use a cover 22 above the casing in the manner of FIG. 1 even if the specimen is to be weighed at ambient temperature but in that case the furnace 36 can be omitted. This may be so, for example, if vaporization rates are to be determined by weighing the specimen continuously.

When weighing is to be carried out with the specimen at a low temperature as is the case, for example, for magnetic measurements and for measurements relating to freeze drying or low temperature distillation then, as shown in FIG. 2, the cover 27 is attached to the lower flange 26 of the casing and the upper aperture 20 is closed by means of the sealing plate 23. The cover 27 may be partially immersed in a coolant or be partially surrounded by a double-walled tank 37 containing the coolant. Any air refrigerated by the coolant flows downwardly and will have little or no harmful effect on the casing. If necessary, however, a heating medium may be circulated through the cavity 5 in order to keep the temperature in the chamber 8 of the casing constant.

It is recommended to use the cover 27 as in FIG. 2 even if weighings are to be carried out at normal temperature for sedimentation measurements, density measurements in melts, measurements of surface tension and the like. For investigations of this type the tank 37 shown in FIG. 2 can be dispensed with.

I claim:

1. A balance, comprising
 - a gas-tight casing containing a chamber;
 - a balance beam fulcrumed in said casing chamber for pivotal movement about a horizontal axis;
 - an outer knife carried by one arm of said balance beam, said knife including a horizontal knife edge;
 - a hanger attachment pivotally supported on said knife edge, said hanger attachment being contained solely in said chamber, said casing containing a pair of opposed through openings directly above and below said hanger attachment, respectively;
 - a vertical specimen carrier connected with said hanger attachment and extending vertically therefrom through a first one of said openings, said specimen carrier terminating at its free end externally of said casing;
 - a bowl-shaped cover enclosing the free end of said specimen carrier and removably connected with said casing to define a hermetic seal about said first opening;
 - and means removably connected with the casing to hermetically seal the other of said casing openings.
2. A balance, comprising
 - a gas-tight casing containing a chamber;
 - a balance beam fulcrumed in said chamber for pivotal movement about a horizontal axis;
 - an outer knife carried by one arm of said balance beam, said knife including a horizontal knife edge;
 - a hanger attachment pivotally supported on said knife edge, said hanger attachment being contained solely in said chamber;
 - said casing containing a pair of opposed through chamber openings directly above and below said hanger at-

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tachment, respectively, said casing including also a double-walled portion defining a cavity adjacent said openings, and inlet and outlet cavity openings communicating with said cavity for introducing and removing a heat exchanging medium into and from said cavity, respectively;

- a vertical specimen carrier connected with said hanger attachment and extending vertically therefrom through a first one of said chamber openings, said specimen carrier terminating at its free end externally of said casing;
 - a bowl-shaped cover enclosing the free end of said specimen carrier and removably connected with said casing to define a hermetic seal about said first chamber opening;
 - and means removably connected with the casing to hermetically seal the other of said chamber openings.
3. A balance, comprising
 - a gas-tight casing containing a chamber;
 - a balance beam fulcrumed in said casing chamber for pivotal movement about a horizontal axis;
 - an outer knife carried by one arm of said balance beam and including a horizontal knife edge;
 - a hanger attachment pivotally supported on said knife edge, said hanger attachment being contained solely in said chamber, said casing containing a pair of opposed through openings directly above and below said hanger attachment, respectively, and a pair of rigid conduits extending outwardly from said openings and terminating at their free ends in flanged portions, respectively;
 - a vertical specimen carrier connected with said hanger attachment and extending vertically therefrom through a first one of said openings and the conduit associated therewith, said specimen carrier terminating at its free end externally of said casing and beyond the flange portion of the conduit;
 - a bowl-shaped cover enclosing the free end of said specimen carrier and removably connected with the associated conduit flange portion to define a hermetic seal about said first opening;
 - and means removably connected with the flange portion of the other conduit to hermetically seal the other of said chamber openings.
 4. Apparatus as defined in claim 1, and further including at least one weight member supported by said hanger attachment, said weight member having dimensions smaller than the corresponding dimensions of the lower one of said casing openings, whereby said weight member may be introduced into and removed from said chamber via said lower opening.

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