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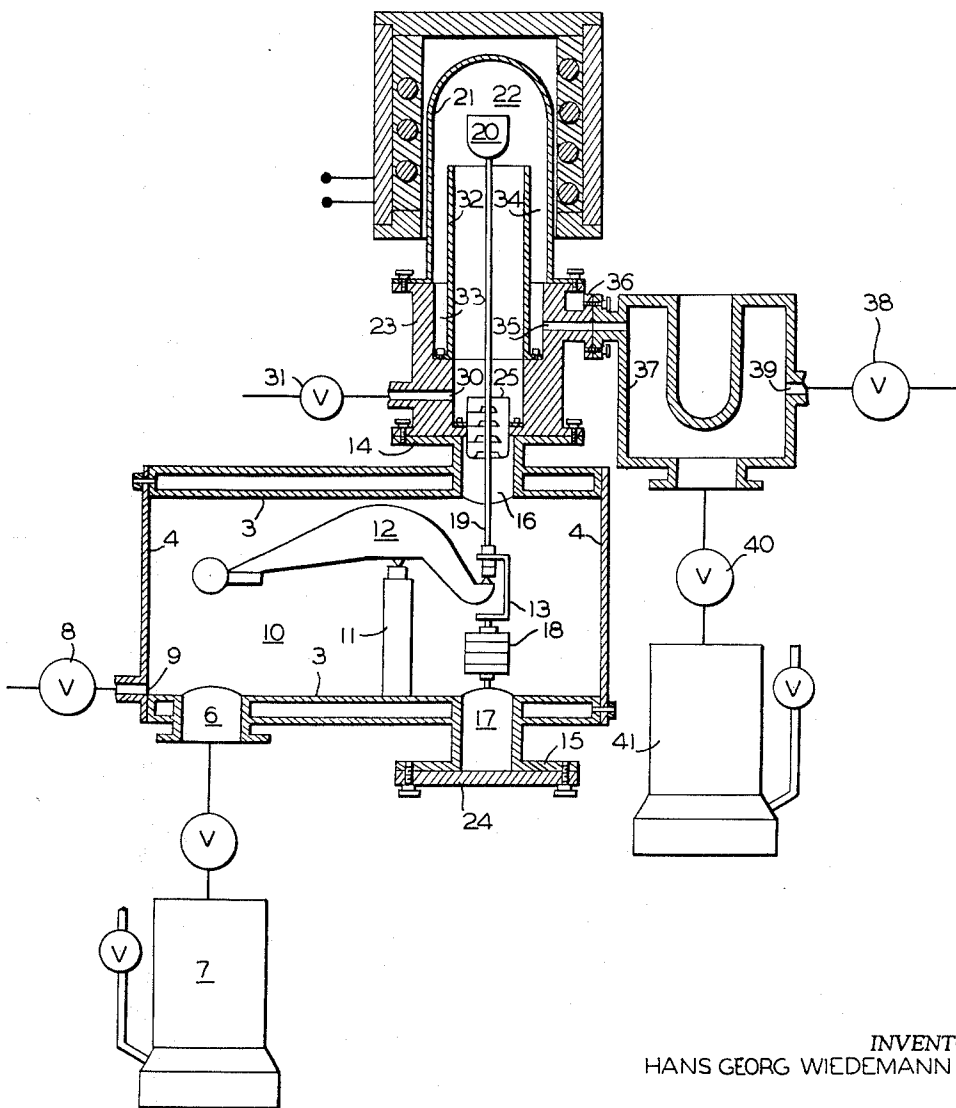
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BALANCE WITH GAS-TIGHT HOUSING

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FIG. 1.



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FIG. 2.



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BALANCE WITH GAS-TIGHT HOUSING

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5 Claims. (Cl. 177-241)

This invention relates to a balance, and more particularly to a balance having a gas-tight housing. The gas-tight housing encloses at least the beam of the balance and, suspended from one arm of the balance beam, the hanger attachment provided with the specimen bowl. In order to weigh the specimen under experimental conditions which differ considerably from the working conditions under which the various parts of the balance enclosed by the gas-tight housing can operate reliably, an elongated bell is usually provided on the gas-tight housing into which the specimen bowl and the adjacent part of the hanger attachment project. In order to weigh the specimen at temperatures differing greatly from the normal room temperature, that end of the bell which is directed away from the balance housing and which encloses the specimen bowl is immersed a correspondingly dimensioned cooling or heating means.

This type of the balance, with a gas-tight housing, having a bell-shaped member attached thereon, is frequently referred to as a "thermo-balance." Such balances have various deficiencies, as experience has shown, which render a wider practical application difficult. This is particularly true if the specimen to be weighed gives off corrosive gases. Even if these gases are pumped out of the balance housing continuously, it is inevitable that a part of the gases will come in contact with the knife edges of the balance beam and, in time, will cause the destruction thereof. Even more unfavourable in this respect are experimental conditions in which the specimens are weighed in a corrosive gaseous atmosphere having a high temperature. But even when a non-corrosive gaseous atmosphere is used, the hitherto conventional thermo-balances still exhibit deficiencies if the sample has to be weighed in a flow of gas which, in the region of the bell, is subjected to considerably different temperatures than prevail inside the housing of the balance. Due to the flow of gas, heat conveyance occurs which is a function of the velocity of the gas flow, and the said heat makes it virtually impossible to maintain an adequately constant temperature inside the housing of the balance.

The present invention aims to provide a thermo-balance which does not exhibit the drawbacks briefly mentioned above. Accordingly, this invention relates to a balance comprising a gas-tight housing, a balance beam fulcrumed inside said housing, a bell-shaped member detachably connected to said gas-tight housing, a tube protruding into said bell-shaped member and providing communication between the interior of said bell-shaped member and the interior of said gas-tight housing, a gas outlet leading out from the annular space formed by said tube and said bell-shaped member, a hanger attachment pivoted on one arm of said balance beam and protruding through said tube into said bell-shaped member, and a specimen bowl located inside said bell-shaped member and fastened to one end of said hanger attachment. A still further object of the invention is to provide, in a thermo-balance of the kind outlined, an annular flange

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detachably inserted between said gas-tight housing and said bell-shaped member, which flange carries said tube and includes said gas outlet and a gas inlet discharging into said tube.

5 These and other modifications and the advantages 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 is a cross-section through the balance housing with the bell-shaped member in place, and

10 FIG. 2 is a cross-section through the protective baffle shown in FIG. 1, on a much larger scale than that of FIG. 1.

The gas-tight balance housing is formed by a cylindrical double jacket 3 and side walls 4 which may be detachably fastened to the jacket 3. In order to evacuate the housing, there is provided a gas outlet 6, closable by a valve or gate 5, for connection with a suction pump 7. A gas inlet 9, closable by a valve or gate 8, is also provided to fill the housing with a gas of suitable composition when required. Inside the hollow space 10 bounded by the parts 3 and 4 of the housing, the balance beam 12 is fulcrumed on a support member 11 inside the housing of the balance. On the shorter arm of the beam 12, provided with a terminal knife-edge, is pivoted a hanger attachment. This hanger attachment has a stirrup member 13 and in the region vertically above and below the member 13 the balance housing has two connecting flanges 14 and 15 each of which incorporates an aperture 16, 17, respectively, both of which are in communication with the hollow space 10. Apart from the stirrup member 13 the hanger attachment comprises, if required, additional weights 18 and, further, a rod 19 projecting upwardly through the aperture 16 or downwardly through the aperture 17. In FIG. 1 a rod 19 protruding upwardly through the aperture 16 is shown. On the end of the rod 19 which is directed away from the stirrup member 13, a specimen bowl 20 is fastened. The rod 19 and the bowl 20 generally consist of a ceramic material which is sufficiently resistant to the gases likely to be encountered.

A bell-shaped member 21, which generally consists of glass or ceramic, into the inside 22 of which the specimen bowl 20 protrudes, is now detachably fixed to an annular flange 23 which in turn is connectable to the upper connection flange 14 or to the lower connection flange 15 of the balance housing. The flange of the balance housing which is not used to fasten the bell-shaped member 21 is provided with a cover 24 as shown in FIG. 1 where said cover 24 is fitted to the lower connection flange 15. A multi-section baffle 25 is secured in the bore of the annular flange 23 at the end which is near the housing, the preferred embodiment of said baffle 25 being shown in FIG. 2. The rod 19 of the hanger attachment passes with adequate lateral play freely through this baffle 25. The outer jacket 26 of the baffle, made from thin metal plate, is bent back inwardly at one end to form an annular groove 27. A number of screen plates 28, in the form of shallow truncated cones, are coaxially mounted inside of the outer jacket 26. At least the screen plate nearest the groove 27 overhangs, at a distance therefrom, the returned inner edge of the outer jacket 26. The screen plates 28 are attached to the outer jacket 26 by means of one or more thin webs 29.

According to FIG. 1, the annular flange 23 furthermore has a gas inlet 30, which is provided with a valve or gate 31 and which discharges into the bore of the annular flange 23, said bore widening outwardly from the

baffle 25. Looking in the direction towards the bell-shaped member 21, the bore in the annular flange 23 is again widened until its diameter is virtually the same as the inside diameter of the bell-shaped member 21. This widest portion of the bore is penetrated by a tube 32 of substantially smaller diameter, so that an annular space 33 is formed which is in communication with an annular space 34 bounded by the tube 32 and the bell-shaped member 21. The base portion of the tube 32 is attached to the annular flange 23 at the base of the widest portion of its bore. The tube protrudes into the bell-shaped member 21 sufficiently to discharge adjacent the specimen bowl 20. The rod 19 carrying the specimen bowl 20 passes through the tube 32. A gas outlet 35 is provided approximately halfway along the annular space 33 in the annular flange 23, and a cooling trap 37 is usually fitted to the connecting flange 36 of the gas outlet 35. The cooling trap 37 can in turn be provided with a gas outlet 39 closable by a valve or gate 38 and, if necessary, can be connected, through a further valve or gate 40, to a suction pump 41. Finally, in order to be able to use the balance to weigh a specimen markedly different in temperature from normal room temperature, a cooling or heating means 42 is placed over that portion of the bell-shaped member 21 which encloses the specimen bowl 20, the heating or cooling means being only shown diagrammatically in FIG. 1. Further components of the balance, such as the supports or consoles for the housing and for the suction pumps 7 and 41 are not shown in FIG. 1 for reasons of clarity.

The most discriminating demands on the balance described arises if, for example, the specimen is to be weighed in a flow of corrosive gas at high temperature. For this purpose, the preferable procedure is as follows. With the heating means 42 and the bell-shaped member 21 removed, the specimen to be weighed is placed in the bowl 20. The baffle 25 prevents any portions of the specimen which are split by negligence from penetrating the inner space 10 of the balance housing. After the bell-shaped member 21 has been mounted on the annular flange 23 and the heating means 42 fitted over the bell-shaped member 21, both pumps 7 and 41 are set in motion with the valves or gates 8, 31, 38 closed and with the valves or gates 5 and 40 open, in order to evacuate the housing of the balance and also the bell-shaped member 21. The heating means 42 may now be operated so that the bowl 20 and the specimen contained therein, are brought to the desired temperature. When this has been done, the valve or gate 5 may be closed, the pump 7 switched off and, by a slight opening of the valve or gate 8, a noble or other inert gas can be let in through the gas inlet 9. This protective gas flows through the housing of the balance, then through the aperture 16 and the baffle 25, and (via the tube 32, it reaches the interior of the bell-shaped member 21. From thence it is sucked through the annular spaces 34 and 33 to the gas outlet 35, to be cooled by the trap 37 and sucked away by means of the pump 41. The corrosive gas which is to flush around the specimen is fed through the valve or gate 31 to the gas inlet 30. From there, together with the protective gas, it flows through the tube 32 into the hollow space 22 of the bell-shaped member 21. Extraction occurs in the manner already explained, through the annular spaces 34 and 33, through the gas outlet 35 and cooling device 37, by means of the pump 41. By appropriately regulating the two valves or gates 8 and 31, it is possible to maintain a gas pressure inside the balance housing, which is slightly higher than the gas pressure inside the tube 32 and the bell-shaped member 21, thus preventing the corrosive gas from entering the balance housing, so that the vital parts of the balance are effectively safeguarded against any attack by corrosive gases. This can also be achieved in a corresponding manner if high gas pressures are to be maintained inside the balance housing and the bell-shaped member 21. In this case,

the valve or gate 40 is closed, the pump 41 stopped and the valve or gates 8, 31 and 38 accordingly opened and regulated.

If the temperature inside the bell-shaped member 21 is much higher than inside the balance housing the baffle 25 will reflect a considerable part of the radiated heat and so safeguard the hanger attachment and the shorter arm of the balance beam 12 against excessive heating. Furthermore, along the tube 32, there will be a considerable temperature drop which may lead to the formation of condensate on the colder parts of the tube. The condensate formed on the outside of the tube 32 can only drip into the annular space 33, in which it is collected. The condensate formed on the inside of the tube 32 will, however, collect in the annular space bounded by the cylindrical jacket of the baffle 25 and the inside of the bore in the annular flange 23. If condensate should form on the inside of the jacket 26 or on the screen plates 28 of the baffle 25 (FIG. 2), the same will be trapped in the groove 27. In this way, even during prolonged use of the balance, condensate which is frequently highly active chemically is prevented from penetrating the balance housing, and from destruction of balance components therein. By virtue of the detachable connection of the annular flange 23 on the balance housing all components which are subject to dirt or wear can readily be removed, and, if necessary, cleaned or replaced, whilst the balance parts inside the balance housing are protected and only require normal maintenance.

I claim:

1. A balance with a gas-tight housing comprising a balance beam fulcrumed inside said housing, a bell-shaped member detachably connected to said housing, a tube protruding into said bell-shaped member and providing a communication between the interior of said gas-tight housing and the interior of said bell-shaped member, a gas outlet leading out from the annular space formed by said tube and said bell-shaped member, a hanger attachment pivoted on one arm of said balance beam and protruding through said tube into said bell-shaped member, and a specimen bowl located inside said bell-shaped member but outside said tube and fastened to a protruding part of said hanger attachment.

2. The invention as recited in claim 1, wherein a first gas inlet is provided which discharges into said gas-tight housing and wherein a second gas inlet is provided which discharges into said tube.

3. The invention as recited in claim 2, wherein a multi-section baffle is inserted between said second gas inlet and the interior of said gas-tight housing, which baffle encloses the projecting part of said hanger attachment with lateral clearance.

4. A balance with a gas-tight housing comprising a balance beam fulcrumed inside said gas-tight housing, an annular flange detachably fastened to said gas-tight housing, the bore of said annular flange communicating with the interior of said gas-tight housing, a bell-shaped member detachably connected to said annular flange, a tube mounted on said annular flange, said tube protruding into said bell-shaped member and providing a communication between the bore of said annular flange and the interior of said bell-shaped member, a gas outlet leading out from the annular space formed by the outside of said tube and the inside of said annular flange, said annular space being in communication with the annular space formed by the protruding part of said tube and said bell-shaped member, a hanger attachment pivoted on one arm of said balance beam, said hanger attachment having a rod protruding through said annular flange and said tube into said bell-shaped member, and a specimen bowl fastened to said rod in the region inside said bell-shaped member but outside said tube.

5. The invention as recited in claim 4, wherein said flange has a gas inlet discharging into its bore and wherein in the region between said gas inlet and the interior of said gas-tight housing a multi-section baffle is inserted

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in said bore of the flange, which baffle encloses said rod with lateral play.

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