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Cheng

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[54] **DILATOMETER**

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[52] **U.S. Cl.** **73/16**

[51] **Int. Cl.** **G01n 25/16**

[58] **Field of Search** ..... 73/16; 33/147 D, 148 D

[56] **References Cited**

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Primary Examiner—Herbert Goldstein

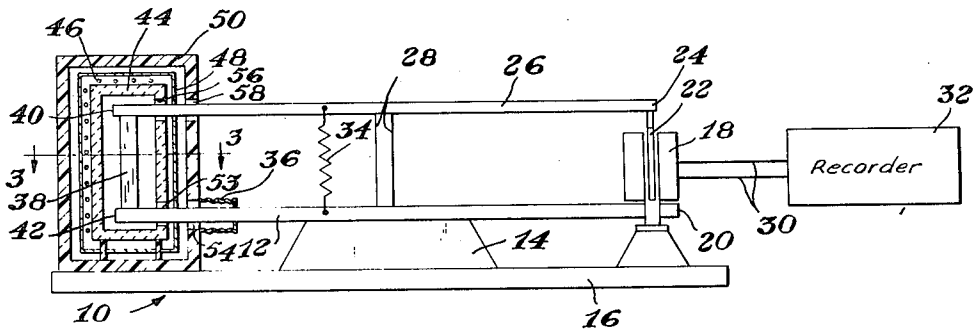
Attorney, Agent, or Firm—Earl D. Ayers

[57] **ABSTRACT**

A dilatometer comprising a fixed beam and a movable beam which is pivotally mounted with respect to the fixed beam. The sample to be measured fits between one set of beam ends. The other end of the movable beam is coupled to the movable core of a differential transformer which provides an output signal which is a function of beam movement.

The sample holding beam ends are enclosed in an insulated housing. The beams are disposed horizontally.

4 Claims, 3 Drawing Figures



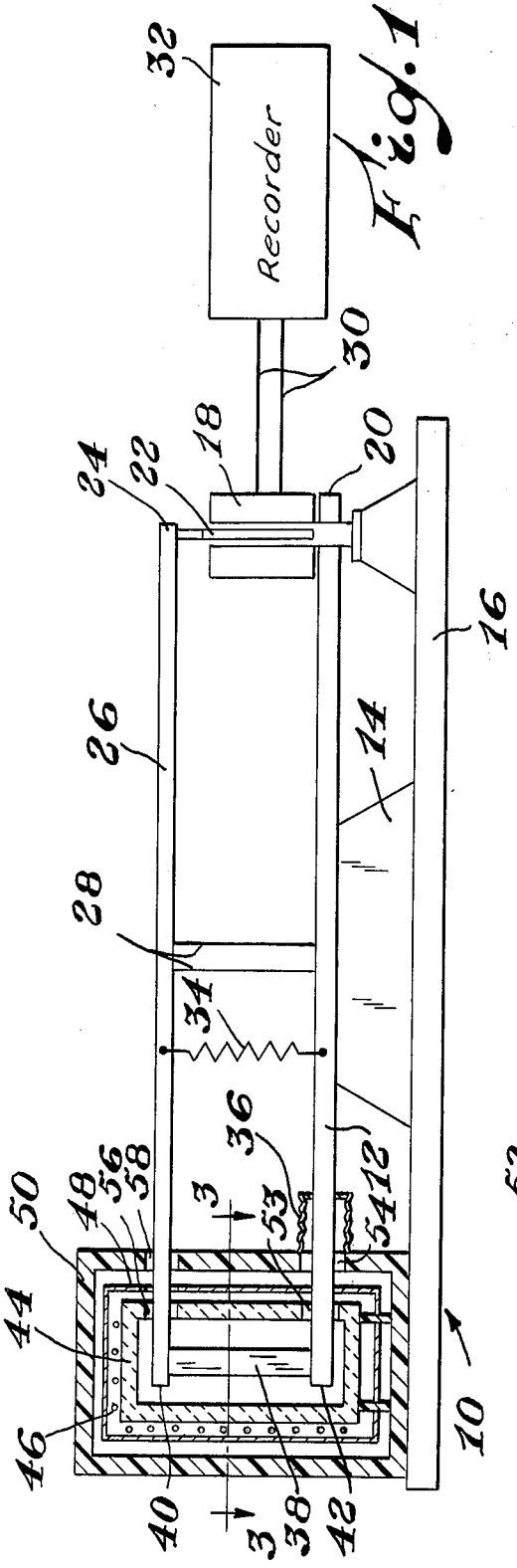


Fig. 1

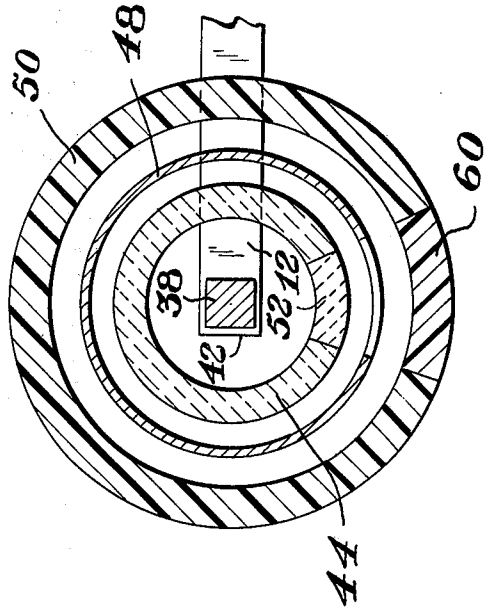


Fig. 3

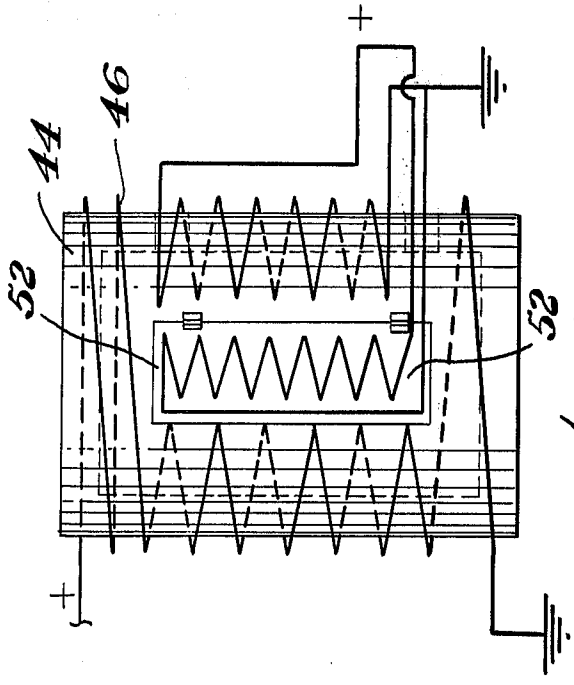


Fig. 2

DILATOMETER

BACKGROUND OF THE INVENTION

This invention relates to dilatometers and particularly to dilatometers in which the sample is disposed normal to the sensing arm.

Conventional dilatometers usually require compensation for direct reading and recording. Tube sensing rod differential expansion can be a problem.

Also, conventional dilatometers are rather bulky and difficult to operate under vacuum conditions.

Another disadvantage of conventional dilatometers is the relatively slow rate of heating or cooling the sample.

OBJECTS OF THE INVENTION

Accordingly, a principal object of this invention is to provide an improved dilatometer.

Another object of this invention is to provide an improved, simpler to use, dilatometer.

A further object of this invention is to provide an improved, more compact, dilatometer.

An additional object of this invention is to provide an improved, faster operating dilatometer apparatus.

STATEMENT OF INVENTION

In accordance with this invention, there is provided dilatometer apparatus comprising a fixed elongated beam and a movable elongated beam which is pivotally mounted with respect to the fixed beam. The beams are disposed with the movable beam above the fixed beam, the sample to be tested being disposed between one pair of beam ends. A differential transformer body is fixed disposed with the fixed beam and its movable iron core is coupled to the movable beam whereby a change in sample length moves the iron core, resulting in an output signal from the transformer which is coupled to a readout device.

The end of the beams to which the sample is covered is housed in a thermally insulated housing containing heating or cooling means.

BRIEF DESCRIPTION OF THE DRAWING

The invention, as well as additional objects and advantages thereof, will best be understood when the following detailed description is read in connection with the accompanying drawing, in which:

FIG. 1 is a simplified diagrammatical side elevational view, partly in section, of apparatus in accordance with this invention;

FIG. 2 is a simplified side elevational view of the heating part of the housing shown in FIG. 1, and

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 1.

DETAILED DESCRIPTION OF THE DRAWING

Referring to the drawing, and particularly to FIG. 1, there is shown dilatometer apparatus, indicated generally by the numeral 10.

An elongated fixed beam 12 is supported by a base 14 from a solid, fixed surface 16. A linear variable differential transformer 18 is supported by the surface 16 at or near the end 20 of the fixed beam 12. The movable iron core 22 of the transformer 18 is secured to the end part 24 of a movable beam 26 which is pivotally supported, usually mid way along its length, by pivot

28. The pivot 28 is in fixed position relationship with respect to the fixed beam 12.

The output of the transformer 18 is coupled by means of leads 30 to a recorder 32 or other suitable readout device.

The other ends 40, 42 of the movable and fixed beams 26, 12, respectively, hold a test sample 38 between them by compressive force. A spring 34 coupled between the beams holds the beam ends against the sample 38 by supplying the requisite compressive force. A chain of the type used on balances may be substituted for the spring 34.

The ends of the beams which hold the test sample 38 are enclosed in a suitable inner housing 44 made of ceramic or a high temperature alloy such as Inconel. The inner housing 44 contains a door 52 in its side wall so that the sample 38 conveniently may be inserted or removed from the apparatus.

Heating means, indicated by the resistance elements 46, are provided to heat the sample 38. Alternatively, for low temperature work, cooling coils may replace the resistance elements.

A reflective foil layer 48 usually surrounds the inner housing 44.

An outer housing 50, supported on the fixed surface 16, surrounds and supports the inner housing 44. The outer housing is made of a good thermal insulation material. The inner and outer housing each have ports 53, 54, and 56, 58 through which the beams 12, 26 extend. A bellows 36, usually made of stainless steel, surrounds the port 54 and seals against the beam 12.

The outer housing 50, like the inner housing 44, has a door 60 through which the sample 38 may be inserted and removed. The foil 48 has an opening between the doors 52, 60.

In this simplified apparatus, the heat energization or control means is not shown.

The beams 12, 26 may conveniently be made of Alundum or Cordierite. The specific type of differential transformer to be used will be well-known to those skilled in the art.

OPERATION

The operation of the apparatus of this invention is generally similar to the operation of conventional dilatometers. The sample is loaded between the beam ends 40, 42, and, usually, the micrometer adjustment screw of the transformer is manipulated to "zero adjust" the transformer output or to calibrate the signal.

The heating (or cooling) of the sample then takes place, causing a change in dimension of the sample which results in movement of the transformer core.

Because little pressure is placed on the sample, samples of very low strength may be tested.

Also, because of the compactness of the apparatus, it may be placed under a bell jar for operation under vacuum or other controlled atmospheric conditions.

What is claimed is:

1. Dilatometer apparatus comprising an elongated horizontally disposed fixed beam and an elongated horizontally disposed movable beam, said movable beam being pivotally mounted between its ends with respect to said fixed beam, a differential transformer having a body part and a movable core part, said body part being fixed positionally with respect to said fixed beam and said movable core part being coupled to an end of said movable beam, means for retaining by compres-

sive force a sample to be tested between the adjacent ends of said beams which are remote from said transformer, said ends which are remote from said transformer being enclosed in a temperature controllable housing.

2. Apparatus in accordance with claim 1, wherein said beams are made of Alundum.

3. Apparatus in accordance with claim 1, wherein said movable beam is pivotally mounted on a fix positioned element extending between said beams.

4. Apparatus in accordance with claim 1, wherein said housing is a multisection housing having temperature control means coupled thereto.

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