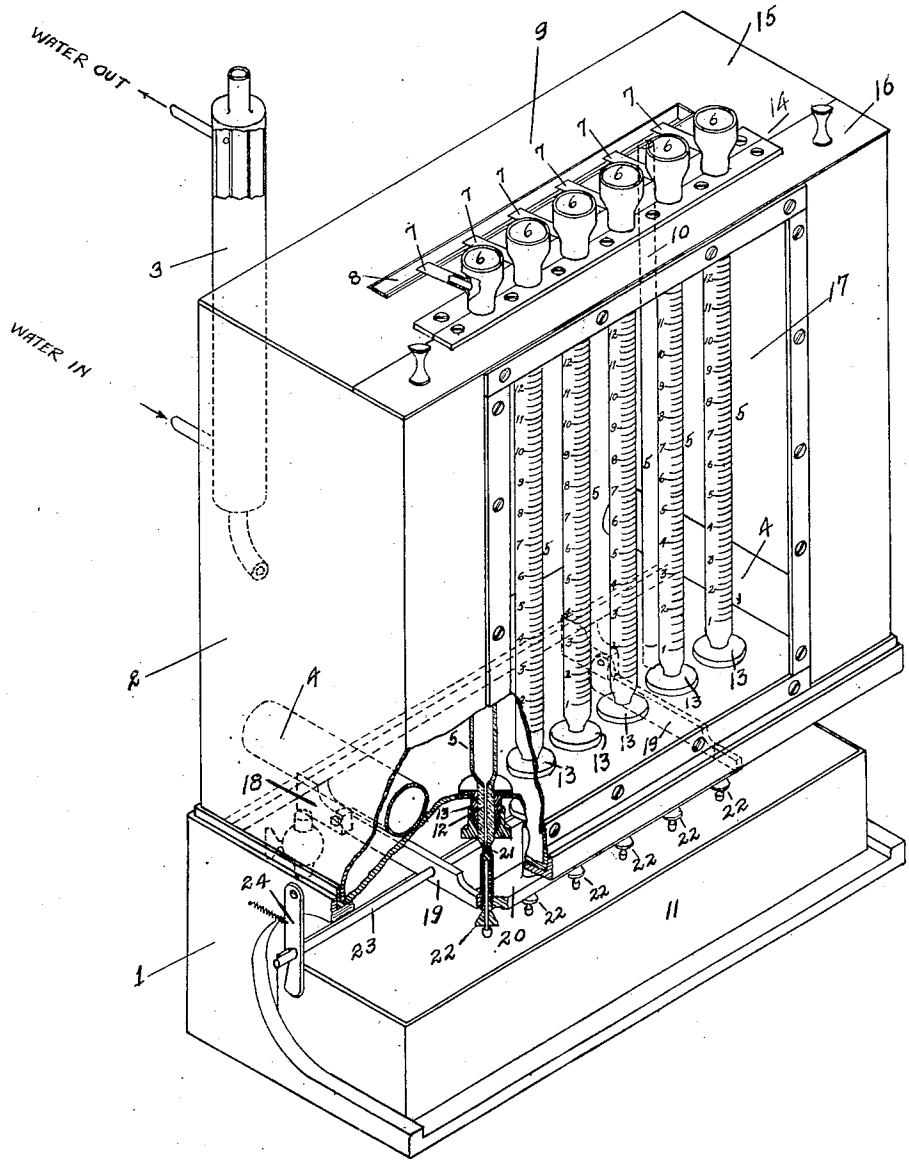
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METHOD OF AND MEANS FOR MEASURING THE VISCOSITIES OF LIQUIDS

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METHOD OF AND MEANS FOR MEASURING THE VISCOSITIES OF LIQUIDS

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This invention relates to the method of and means for determining the viscosities of liquids, and has for its object the rendering of the determination of viscosities more simple, rapid, and accurate than is possible by other methods and means hitherto known. The features of my invention which aid in the accomplishment of the above object are:

1. A low degree of sensitivity to temperature changes.

2. Elimination of a timing device external to the instrument, such as a stop-watch.

3. Elimination of the necessity of stirring the liquid while heating it to the proper temperature.

4. The provision of an overflow device to automatically secure the proper initial level of the liquid.

5. The provision of a scale for direct reading of viscosity.

6. Ability to determine viscosities of a plurality of liquids simultaneously.

In the accompanying drawing I have illustrated the preferred embodiment of my invention. In the drawing the numeral 1 indicates the base of the instrument upon which is supported the bath reservoir 2, which is of metal or other suitable material. 3 is a reflux condenser to condense the vapors from the bath reservoir and to return them to the bath reservoir. The cylindrical tubes 4 extend horizontally into the bath from the rear, are closed at their forward ends and open at their rear ends to permit the insertion of immersion heaters for heating and boiling the bath liquid. The tubes 5 extend through the bath reservoir, and project at the top and bottom, being enlarged at their tops, as indicated at 6, to facilitate filling. Each tube is supplied with a side-arm tube 7, sloping downward and to the rear, and discharging into the trough 8, formed in the top 9 of the bath reservoir 2. The vertical tube 10 extends through the bath reservoir 2 and drains the trough 8 into the removable waste pan 11. The lower ends of the tubes 5 are formed as capillary tubes as indicated at 12. The packing glands 13 are of conventional design. A snug fitting joint between the tubes 5 and the top 9 is secured by means of gaskets and clamping strips 14. Associated with each tube 5 is a scale which is graduated so as to read viscosities in terms of any units which are a function of kinematic viscosity. The top 9 is formed in two parts, 15 and 16, to facilitate access to the interior of the bath reservoir 2. The bath reservoir is supplied with front and rear windows 17 to permit observation of the tubes 5. Formed in the base 1 are the brackets 18, to which are pivoted the arms 19, which are joined at their forward ends by the bar 20. The pads 21, of leather, cork, or other suitable material, are resiliently and adjustably mounted on the bar 20, by means of the devices 22, and are adapted to close the lower ends of the tubes 5 simultaneously when the arms 19 are in their upper position, as shown in the drawing. The devices 22 consist of spring pressed pistons sliding in tubes mounted on the bar 20. The piston rods slide freely thru axial holes in the adjusting screws which close the lower ends of the tubes. Said piston rods carry stops on their lower ends which limit their upward movement. The rod 23 extends through the arms 19, and projects at each end beyond the end faces of the base 1, to form handles for moving the pivoted stopping mechanism 19, 20, 21, 22. The stopping mechanism is held in its upper position by means of the pivoted latch-member 24, and a similar member pivoted at the opposite end, but not shown. By drawing the lower end of the latch-members 24 forward, and pressing downward on the ends of the rod 23, the latter is released, thus simultaneously opening the lower ends of the tubes 5, and permitting the efflux of the liquids therefrom.

To use the instrument for measuring the viscosities of liquids, a liquid whose boiling point is the temperature at which it is desired to measure the viscosities is placed in the bath reservoir, and the bath is then caused to boil by mean of immersion heaters which are fitted snugly into the hollow cylinders 4. A liquid of known viscosity is poured in one of the tubes 5, and liquids whose viscosities are to be determined are poured into the others. After allowing sufficient time for the liquids to

reach substantially the temperature of the bath liquid and to overflow to constant level through the side arms 7, the efflux of the liquids from the tubes 5 is started by lowering the stopping mechanism, and is continued until the liquid of known viscosity reaches the mark corresponding to its viscosity when the flow from all the tubes is stopped simultaneously. The meniscus of each liquid will then be at the point corresponding to its viscosity.

Since the liquids whose viscosities are to be determined are compared simultaneously with a liquid of the same type, changes in temperature will have approximately the same effect on each, making its unnecessary to control the temperature with the degree of accuracy necessary with non-comparative instruments. As the liquids are practically surrounded by the bath, and have a large surface per unit volume, the necessity of stirring is eliminated.

Throughout these specifications, and the accompanying claims, the term "liquid" is meant to include true liquids such as water solutions, petroleum oils, animal and vegetable oils, etc., and also plastic materials such as liquid greases, emulsions, solutions of rubber in benzene, etc. Likewise where the term "viscosity" is used, it is meant to include true viscosity, and also consistency or plasticity.

What I claim as my invention is:

1. In a viscosity measuring device, the combination with a plurality of tubes for containing liquids of unknown viscosities and a similar tube for containing a liquid of known viscosity, said tubes being adapted to allow the liquids to flow therefrom; of means for starting and stopping the flows of all the liquids from their respective tubes simultaneously, said means influencing said flows only when starting and stopping them.

2. In a device for measuring the viscosities of liquids, the combination with a tube for containing a liquid of unknown viscosity and a similar tube for containing a liquid of known viscosity, said tubes being provided with outlets to allow the liquids to flow therefrom; of means for opening and closing said outlets whereby the flows of the liquids from their respective tubes may be started and stopped simultaneously, said means influencing said flows only when starting and stopping them.

3. In a device for measuring the viscosities of liquids, the combination of a plurality of tubes for containing liquids of unknown viscosities and a similar tube for containing a liquid of known viscosity, said tubes being provided with outlets to allow the liquids to flow therefrom; with means for opening and closing said outlets whereby the flows of the liquids from their respective tubes may be started and stopped simultaneously, said means influencing said flows only when starting and stopping them.

4. In a device for measuring the viscosities of liquids, the combination with a plurality of tubes for containing liquids of unknown viscosities and a similar tube for containing a liquid of known viscosity, said tubes being provided with outlets to allow the liquids to flow therefrom; of a set of pads mounted upon a common member, said member being adapted to be moved from and to a position where the pads will close the outlets to all the tubes, whereby the flows of the liquids from their respective tubes will be started and stopped simultaneously.

5. The method of measuring the viscosities of a plurality of liquids by placing the several liquids and a liquid of known viscosity in tubes joined at their lower extremities to tubes of small internal diameter, and provided near their upper extremities, with side-arm tubes to secure definite initial level, each tube being provided with a scale reading directly in viscosity units, said method consisting in bringing all of said liquids to the same definite predetermined temperature; simultaneously starting the flows of said liquids from all the tubes; simultaneously stopping said flows when the meniscus of the liquid of known viscosity reaches the mark on the scale on its tube corresponding to its viscosity, and reading the scale of each tube opposite the meniscus of the liquid in the tube.

6. A device for simultaneously measuring the viscosities of a plurality of liquids, said device consisting of a plurality of vertical tubes for containing said liquids and a vertical tube for containing a liquid of known viscosity, each tube joined at the lower extremity by a tube of small internal diameter, and provided near the top with a means for automatically securing reproducible, predetermined initial level of the liquid; means for maintaining the tubes substantially at constant temperature; means for starting and stopping the flow of said liquids simultaneously; means for maintaining said starting and stopping device in open or closed position; there being means associated with each tube containing a liquid of unknown viscosity for determining the viscosity of the liquid in that tube from the position of the meniscus of the liquid in said tube when the meniscus of the liquid of known viscosity reaches a predetermined position in its tube.

7. A device for simultaneously measuring the viscosities of a plurality of liquids, composed of a plurality of tubes for containing said liquids and a tube for containing a liquid of known viscosity; and means for starting and stopping the flow of said liquids from said tubes simultaneously; there being means associated with each tube containing a liquid of unknown viscosity for determining the viscosity of the liquid in that tube from the position of the meniscus of the liquid in that

tube when the meniscus of the liquid of known viscosity reaches a predetermined position in its tube.

8. A device for simultaneously measuring the viscosities of a plurality of liquids, composed of a plurality of replaceable tubes for containing said liquids and a replaceable tube for containing a liquid of known viscosity; means associated with each tube for automatically securing a predetermined initial level for the liquid contained in that tube; means for starting and stopping the flow of said liquids from said tubes simultaneously; and means for maintaining said starting and stopping means in open or closed position; there being means associated with each tube containing a liquid of unknown viscosity for determining the viscosity of the liquid in that tube from the position of the meniscus of the liquid when the meniscus of the liquid of known viscosity reaches a predetermined position in its tube.

9. A device for simultaneously measuring the viscosities of a plurality of liquids, comprising a plurality of replaceable tubes for containing said liquids and a replaceable tube for containing a liquid of known viscosity, said tubes being enlarged at their upper ends and being joined at their lower ends by tubes of small internal diameter; means for automatically securing a predetermined initial level of each liquid; means for starting and stopping the flow of said liquids from said tubes simultaneously; means for maintaining said last named means in open or closed position; there being means associated with each tube containing a liquid of unknown viscosity for determining the viscosity of the liquid in that tube from the position of the meniscus of the liquid when the meniscus of the liquid of known viscosity reaches a predetermined position in its tube.

10. An instrument for simultaneously measuring the viscosities of a plurality of liquids, comprising a base; a bath reservoir mounted on said base; a plurality of vertical tubes extending through said reservoir, said tubes being provided near their upper extremities with sidearm tubes and being formed at their lower extremities with relatively small internal diameters; a pair of arms pivotally mounted on said base below said reservoir, said arms being joined at their outer ends by a transverse member; and a plurality of pads resiliently mounted on said transverse member, said pads being adapted to close the lower ends of said vertical tubes when said pivotally mounted arms are swung upward and to open said lower ends of said vertical tubes when said pivotally mounted arms are swung downward; there being a scale associated with each tube from which the viscosity of the liquid in that tube as indicated by the position of the meniscus of the liquid, may be read when the meniscus of a liquid of known viscosity contained in one of said vertical tubes coincides with the point on the scale associated with its tube corresponding to its viscosity.

11. In a device for measuring the viscosities of liquids, a tube containing a liquid of known viscosity, a second tube for containing a liquid whose viscosity is to be measured, means for opening said tubes simultaneously, to provide for the exit of the liquids from both tubes; said means also being adapted for closing said tubes simultaneously to stop said exits and influencing the exit of the liquids only when starting and stopping it; there being means associated with the second tube whereby the undetermined viscosity is determined from the position of the meniscus of the liquid when the meniscus of the liquid of known viscosity reaches a predetermined position in its tube.

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