May 13, 1930. W. D. SMITH 1,758,677

VISCOSIMETER AND DISPLAY DEVICE

Filed June 15, 1925

Fig. 1.

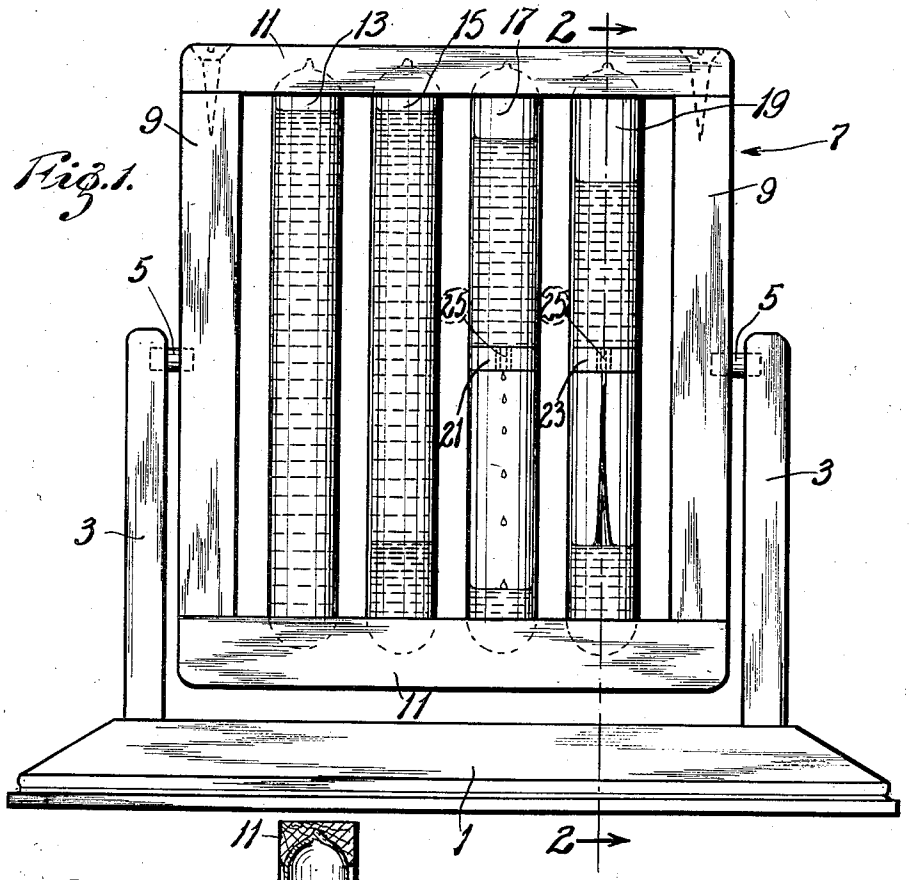
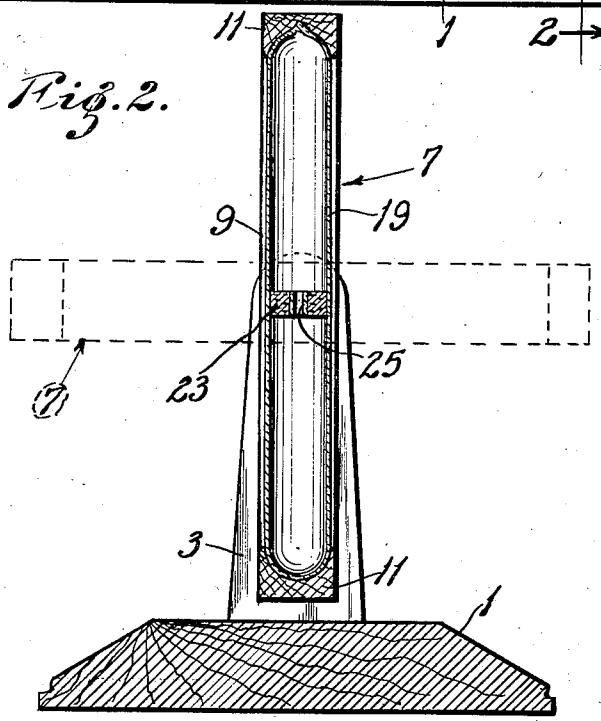


Fig. 2.



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UNITED STATES PATENT OFFICE

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VISCOSIMETER AND DISPLAY DEVICE

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This invention relates to viscosimeters, and with regard to certain more specific features, to a display device for showing the relative or absolute viscosities of various oils and other liquids.

Among the several objects of the invention may be noted the provision of an effective display device for demonstrating some of the relative merits and demerits of several liquids, preferably oils; the provision of such a device as will measure and demonstrate the viscosities of these several liquids while displaying their said merits or demerits; the provision of a device of the type described which requires no refilling operation for a repetition of demonstrating or display events; and the provision of an improved viscosimeter for obtaining viscosities of liquids. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the features of construction, combinations of elements and arrangements of parts, which are exemplified in the description hereinafter in connection with the accompanying drawings, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is shown one of various possible embodiments of the invention,

Fig. 1 is a front elevation of the device; and

Fig. 2 is a vertical section taken on the line 2—2 of Fig. 1.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Referring now more particularly to Fig. 1, there is illustrated at 1 a base on which is mounted a pair of standards or uprights 3.

The standards 3 carry two longitudinally aligned, horizontally formed gudgeon pins 5. The pins 5 rotatably bear a frame 7 at approximately its horizontal gravity line. They may bear the frame at any two points. The pins 5 may be fastened to the frame 7 and extend into suitable bearings on the standards 3, if so desired. In any event the frame 7 is rotatable between the standards.

The frame comprises side members 9 and lateral members 11. Between the lateral members 11, and parallel to the side members 9 are held a series of four air evacuated closed tubes 13, 15, 17 and 19. The tubes are made of glass or other transparent material and are preferably of one size and bore. The degree of air evacuation is such as to accomplish the results hereinafter set forth.

Two of the tubes 13 and 15 are substantially, though perhaps not completely, filled with liquids which are to be compared. Assuming, for example, that oils are to be compared, the tube 13 may be substantially filled with clean unused oil and the tube 15 may be substantially filled with used oil of the same kind containing grit and sediment due to use. In a given vertical position of the frame 9 and the tubes, the sediment in tube 15 will precipitate to the bottom of the tube, thereby dynamically demonstrating the presence of said sediment. Inasmuch as there is practically no air in either of the tubes, no bubbles can be formed to pass upwardly through the respective liquids and thereby falsify sight readings as would be the case were there a substantial amount of air or other gas present in the space not occupied by the oil, which air or gas would ordinarily tend to travel upwardly, upon the inversion of the tubes in the manner to be set forth hereinafter.

Carried by said frame 7 and placed in line with said tubes 13 and 15 are the air evacuated closed tubes 17 and 19. These tubes 17 and 19 are provided with lateral partitions 21 and 23 respectively, forced tightly into the tubes and placed at an approximate mid-position within said tubes. Lacquer or the like may be used to seal the edges of the partitions to the glass tubes 17 and 19.

The partitions 21 and 23 each comprise a disc of relatively soft material such as cork. The disc is bored centrally thereof and a short lining tube 25 is forced into the bore. Lacquer or the like may be used to fasten the tube 25 within said bore.

The partitions 21 and 23 substantially separate each of the tubes into two like sized chambers or compartments. Liquid may flow from one chamber of a tube to the other chamber thereof by way of the lining tube 25. This tube is made of glass or other hard ma-

terial such that the character of the passage between chambers is constant. The bores of the two tubes 25 of the two partitions 21 and 23 are of the same magnitudes in length and diameter. Hence all factors affecting the flow of liquid between the two chambers of one of the tubes 17 or 19 are constant, and the viscosity of a liquid flowing through the lining tube 25 is all that will affect its rate of flow. Therefore the rate of flow is an inverse measure of the viscosity.

By half filling the tubes 17 and 19 with samples of the said fresh oil and said used oil respectively, one of each of their chambers will be filled up to its partition.

Inversion of the tubes 17 and 19 will permit the liquids to flow from one chamber to the other, of each tube respectively. No air is forced to pass upwardly through the liner 25 inasmuch as the tubes are air evacuated. Hence, a smooth flow of oil is had, undisturbed by any upward passage of bubbles. This is because there is no air present to form bubbles which would tend to flow upwardly upon inversion of the tubes.

The rate of flow from the upper to the lower chamber will be approximately inversely proportional to the viscosity of the oils. Hence the oil with least viscosity namely, the used oil, will fill its lower chamber more quickly.

An observer knowing by colors or otherwise that the oil in tube 19 is the same as that in tube 15 will readily deduce that the used oil, full of dirt and sediment, has had its viscosity lowered, inasmuch as it is mobile and relatively quickly flows downwardly to fill its lower chamber.

On the other hand, the fresh oil which he views in tubes 13 and 17 has visibly different characteristics than said used oil. The sample thereof in tube 13 appears unlike the sample of used oil in tube 15. Furthermore, the sample of the fresh oil in tube 17 flows downwardly more slowly than the sample of used oil in tube 19. Hence he deduces that it may be poor policy to use oil too long, because it becomes gritty and loses its viscosity. The effectiveness of the display is obvious.

After all the oil available in the tubes 17 and 19 has flowed to the lower chambers, and the sediment has settled down in tube 15, the display becomes static and loses value.

In order to repeat the dynamic actions it is only necessary to turn the frame 7 over, that is through an angle of 180 degrees, and the flow from chamber to chamber is reversed, as well as is the settling action in the tube 15. All events are completely repeated.

The dotted position of the frame 7 in Fig. 2 suggests the turning action which may be performed on the frame, and not a different display position.

The device is a demonstration, to the layman, of the difference between the appearance of clean unused oil and dirty used oil, and the difference between their viscosities. It may demonstrate, in a like manner, the differences between colors and viscosities of different grades of unused and clean oil. The effect of adulterations would also be clearly visible.

It is to be understood that the partitions 21 and 23 may be replaced by a narrowed neck in the glass itself of the tube 17 or 19. Other types of partitions may also be used. The one shown here is illustrative and is the preferred form.

It is evident that the principle of using air evacuated chambers on each side of the flow nozzle of a viscosimeter, could be used on instruments for obtaining absolute viscosities. The oil would then be out of contact with the air and check determinations could easily and quickly be made by inversion of the device.

The display device may be intermittently driven by an automatic mover for unattended display purposes.

In view of the above it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A viscosimeter for liquid comprising a pair of air evacuated compartments separated by a partition having at least one restricted opening, said liquid partially filling the said compartments and said liquid being adapted to flow from one compartment to the other.

2. A viscosimeter comprising a pair of transparent air evacuated compartments separated by a partition having a restricted opening and means for revolving either compartment above the other.

3. A display device for liquids comprising an air evacuated chamber adapted to contain a liquid, an air evacuated chamber mounted with said first named chamber and adapted to contain a liquid, a partition having a restricted opening in said second named chamber adapted to divide it into two compartments.

4. A display device for liquids comprising an air evacuated vertical chamber adapted to contain a liquid, an air evacuated chamber mounted with said first named chamber and adapted to contain liquid, a partition having a restricted opening in said second named chamber adapted to divide it into upper and lower compartments and means for simultaneously inverting said chambers.

5. A display device for liquids comprising a plurality of air evacuated vertical cham-

bers adapted to contain a liquid, a plurality of air evacuated chambers mounted with said first named chambers and adapted to contain liquids, partitions having restricted openings in said second named chambers adapted to divide them into upper and lower compartments and means for simultaneously inverting all of said chambers.

6. A viscosimeter comprising an air evacuated chamber, a partition having a constricted opening therein adapted to separate the chamber into compartments, one compartment being adapted to contain liquid which is adapted to flow into the other compartment through the opening and back again by inverting the chamber, the operation being repeatable indefinitely.

7. A comparative viscosity and constituency display device for liquids comprising a stand, a rotatable frame thereon, a plurality of air evacuated tubes mounted in said frame normal to its axis and adapted to each receive a liquid to be compared, a plurality of air evacuated tubes mounted similarly and containing partitions having constricted openings substantially midway thereof said last named tubes being partially filled with samples of the liquids in said first named tubes, all of the tubes being invertable an indefinite number of times by rotating the frame.

8. A comparative viscosity and constituency display device for liquids comprising a stand, a rotatable frame thereon, a plurality of air evacuated tubes mounted in said frame normal to its axis and adapted to each receive a liquid to be compared, a plurality of air evacuated tubes mounted similarly and containing partitions having constricted openings substantially midway thereof said last named tubes being partially filled with samples of the liquids in said first named tubes, all of the tubes being invertable an indefinite number of times by rotating the frame, said first named tubes being adapted to make the liquid therein turbid when inverted, if the liquid will permit, and said last named tubes being adapted, when inverted, to pass their liquid through said openings to show the viscosity thereof.

9. The display viscosimeter for liquid comprising a pair of compartments separated by a partition having at least one restricted opening, said liquid partially filling said compartments, said opening permitting flow of said liquid from one compartment to the other, the compartments being adapted to expedite said flow.

10. The display viscosimeter for liquid comprising a pair of compartments separated by a partition having a restricted opening through which liquid is adapted to flow, said liquid partially filling said compartments, said opening permitting flow of said liquid from one compartment to the other, the compartments being adapted to expedite said flow.

11. The display viscosimeter for liquid comprising a pair of invertible compartments separated by the partition having a restricted opening through which liquid is adapted to pass from one compartment to the other, said liquid partially filling said compartments, said opening permitting flow of said liquid from one compartment to the other, the compartments being adapted to expedite said flow.

In testimony whereof, I have signed my name to this specification this 13th day of June, 1925.

WILLARD D. SMITH.