Jan. 9, 1923.

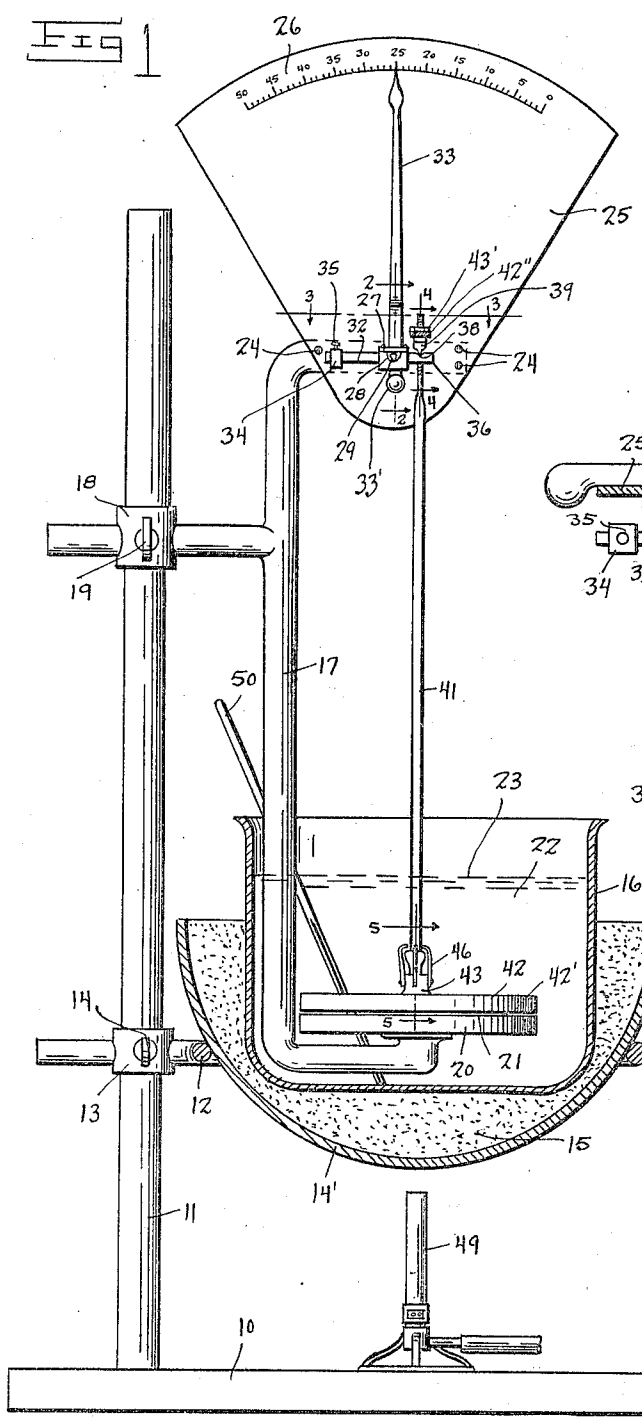
1,441,564.

A. D. EBERLY.

FLUID TESTING DEVICE.

FILED JUNE 1, 1920.

Fig 1



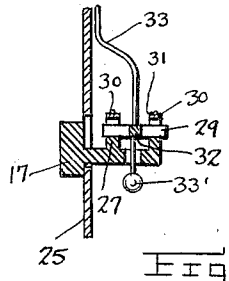


Fig 2

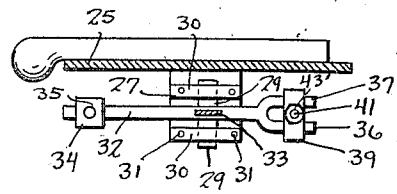


Fig 3

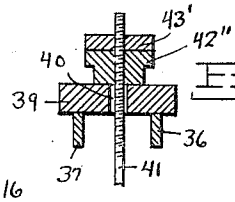


Fig 4

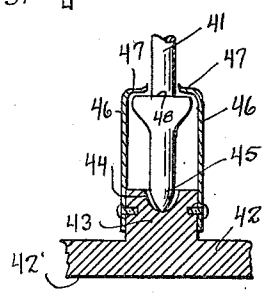


Fig 5

Inventor

Austin D. Eberly

H. E. Scantlebury

Attorney

Patented Jan. 9, 1923. 1,441,564

UNITED STATES PATENT OFFICE.

AUSTIN D. EBERLY, OF SPOKANE, WASHINGTON.

FLUID-TESTING DEVICE.

Application filed June 1, 1920. Serial No. 385,583.

To all whom it may concern:

Be it known that I, AUSTIN D. EBERLY, a citizen of the United States, and a resident of Spokane, in the county of Spokane and State of Washington, have invented certain new and useful Improvements in Fluid-Testing Devices, of which the following is a specification.

My invention relates to improvements in fluid testing devices and has for one of its objects to provide a means for determining and indicating the relative adhesive and cohesive properties of fluids, by which the lubricating value of the fluids may be judged.

A further object is to provide a device of the class described which shall indicate the degree of resistance different fluids offer to forces tending to drive them out from between two surfaces separated by such fluid.

A still further object is to provide a device of the class described, wherein the adhesive and cohesive quality and hence the lubricating value of fluids may be determined by the thickness of a film of the fluid placed between a fixed base and a movable head after a certain pressure has been brought to bring said base and said head into contact, and means for varying the temperature of the fluid to determine the effect of heat on the adhesive and cohesive properties of the fluid.

A still further object is to provide a device of the class described wherein, in addition to the novel means for determining and comparing the cohesive and adhesive properties of the fluid, the usual flash and fire point tests may be made.

Other objects and features of novelty will be described in connection with the accompanying drawings and specification and will be more fully pointed out in and by the appended claims.

In the drawings;

Figure 1 is a side elevation of my device, shown partly in section.

Figure 2 is an enlarged section on line 2—2 of Figure 1.

Figure 3 is an enlarged section on line 3—3 of Figure 1.

Figure 4 is an enlarged section on line 4—4 of Figure 1.

Figure 5 is an enlarged section on line 5—5 of Figure 1.

Like numerals of reference designate the same part throughout the various figures of the drawing.

Upon the vertical standard 11, which is supported by the base 10, is slidably mounted the sleeve or collar 13 to which is secured the cup supporting ring 12. Ring 12 may be held in fixed position on the standard 11 by thumb screw 14. Supported by ring 12 is the cup 14′ which may contain sand, or the like, 15, within which is set the fluid container 16.

A post 17 carries in offset relation thereto, a sleeve 18 slidably mounted on standard 11. It will be seen that post 17 and all elements carried thereby may be raised or lowered in substantially parallel relation to standard 11 by loosening thumb screw 19. Post 17 may be held in fixed relation to standard 11 and fluid container 16 by tightening thumb screw 19. Carried by the lower extremity of post 17 is the fixed base 20, arranged in a substantially horizontal plane. Base 20 is preferably in the form of a round disk of a suitable diameter and is fashioned with the smooth, substantially plane upper surface 21.

The level of the fluid 22, to be tested, is indicated at 23 and it will be noted that by loosening screw 19 and raising or lowering post 17, the base 20 may be withdrawn from or reimmersed in the fluid 22.

Secured to the upper extremity of post 17 by screws 24 is the dial plate 25, provided with a suitably graduated scale 26. Carried by post 17 and projecting through dial plate 25 is the bearing 27 (Fig. 2) provided with the V grooves 28, within which bears the knife edge balance bar 29. Caps 30, secured to bearing 27 by screws 31, serve as keepers to prevent accidental removal of bar 29 from bearing 27. Bar 29 is carried by lever 32, bearing 27 forming the fulcrum for said lever, which lever 32 also supports the dial hand or pointer 33. Pointer 33 is adapted to register with scale 26 and is counterbalanced at 33′.

Slidably mounted on one end of lever 32 is the weight 34 which may be set in fixed position by set screw 35. The opposite end of lever 32 is forked to form arms 36 and 37 (Fig. 3) which arms are provided with V grooves 38 to form bearing for the knife edge block 39 which bridges the arms 36 and 37. Block 39 is centrally apertured as at 40 to allow the free passage of the rod or wire 41 which is threaded at its upper extremity for threaded engagement with the bore of the knurled nut 42″ and lock nut

43′, the lower face of nut 42″ resting on the upper face of block 39.

A movable head 42 is provided with the centrally disposed lug 43 which is centrally recessed at 44 to receive the end 45 of rod 41. Fingers 46 extend upwardly from lug 43 and are bent inwardly at 47 to engage the shoulder 48 on rod 41 when said rod is drawn upwardly. The combined weight of rod 41, block 39, and nuts 42″ and 43′ is sufficient to overcome the leverage exerted on lever 32 by weight 34 and consequently, as long as rod 41 is suspended from lever 32 the pointer 33 will be swung in a clockwise direction until head 42 contacts with base 20 or a film of fluid between said head and said base. When head 42 comes to rest on base 20 or a fluid film thereon, the weight of rod 41 will carry said rod downwardly until end 45 bears on the bottom of recess 44, at which time shoulder 48 will be slightly out of contact with the bent portions 47 of fingers 46, thereby allowing head 42 a freedom of movement to accommodate the level of its lower surface 42′ to the level of the surface 21, the bearing of recess 44 and end 45 centering head 42 with respect to base 20 but allowing for a slight rocking movement of head 42 in all directions. The provision of the joint just described will render the device operable even though base 20 and surface 21 be slightly out of level.

The lower substantially plane face 42′ of head 42 superposes face 21 and is fashioned smooth and true and is complementary to face 21.

Means such as Bunsen burner 49 may be provided to raise the temperature of fluid 22, while thermometer 50 may be immersed in fluid 22 to indicate the temperature thereof.

As is common knowledge, the office of a lubricating fluid is to interpose a film between opposed surfaces to separate and lessen the friction between them. Therefore, the comparative value of lubricants lies in the comparative amount of cohesion among its own particles and their comparative powers of adhesion to surfaces, as it is these properties which determine how well they will retain a film between opposed surfaces under certain conditions. An ideal lubricant is one which lacks any considerable amount of cohesion among its particles (thus allowing its particles to freely separate so the lubricant will readily flow to all desired points) and one which has great adhesive power (which gives it the quality of adhering to surfaces even under great pressure and thereby keep such surfaces from contacting).

When heated, the body of a lubricant is more or less broken up, according to its quality, and this breaking up, while making the lubricant more freely flowing by lessening its cohesive property, causes it to lose to a greater or less extent its most important quality of adhesion to surfaces. Thus, when heated, lubricants lose somewhat of their lubricating value. Since, for most purposes, a lubricant as actually used is raised to a considerable temperature either by friction or externally applied heat, it is important that the lubricant to be tested should be raised to such a temperature as will approximate actual conditions under which the lubricant is expected to work.

In a lubricant or fluid the relative powers of adhesion and amount of cohesion may be determined by the degree of resistance the lubricant or fluid offers to a force tending to drive it out from between two surfaces separated by such lubricant or fluid. As will be seen, my device registers this degree of resistance at different temperatures of the lubricant or fluid and thereby enables one to compare the relative adhesive and cohesive properties of different lubricants and fluids,

In setting up the apparatus for use, container 16 is first emptied and the surfaces 21 and 42′ are wiped thoroughly dry and clean. Rod 41 and all members secured thereto may be separated from the rest of the apparatus by lifting block 39 upwardly and drawing it clear of fork arms 36 and 37. Shoulder 48 will contact with fingers 46 so that head 42 may be drawn upwardly with rod 41. By adjusting nut 19 and sliding post 17 upwardly or downwardly, base 20 may be positioned within container 16 as in Figure 1. Head 42 is then lowered into the container 16 until it rests on base 20, whereupon block 39 is placed in the position of Figure 1 so that its knife edge bears on the bottom of groove 38. By then properly adjusting nuts 42″ and 43′, lever 32 will be swung in a clockwise or counterclockwise direction (caused by pressure brought to bear on block 39 downwardly with respect to lever 32, or by the downward action of weight 34, respectively) until pointer 33 exactly registers with the zero mark or any other point on scale 26 which the operator desires to use as a starting point for the pointer in the test to be made.

Head 42 is then removed from container 16 and fluid 22 is poured therein. Head 42 is then immersed in fluid 22 and allowed to sink through such fluid as far as gravity will carry it. The size and weight of head 42 and rod 41 being constant, gravity will cause a constant pressure to be exerted by such head on any fluid which may lie between it and the base 20. The fluid which covers face 21 will prevent head 42 from contacting with face 21. The distance faces 21 and 42′ are held apart by the film of fluid is indicative of the fluids power to resist the

force or pressure (gravity, in this case) tending to drive it from between two surfaces (21 and 42′) and the degree of cohesion and adhesion possessed by the fluid. It follows that head 42 being raised with respect to its initial position of rest on base 20, rod 41 will also be raised with respect to its position when head 42 is contacting with base 20, and that by this raised position weight 34 is allowed to swing lever 32 and pointer 33 in a counter clockwise direction. Due to the comparative distance of bearing 38 and the end of pointer 33 from the common fulcrum 29, a very slight movement of rod 41 will cause a greatly magnified movement of the end of pointer 33, thereby enabling the operator to observe, by watching the movement of pointer 33 over scale 26, very slight movements of rod 41. It will be seen that the change in position of pointer 33 from its position when head 42 was contacting with base 20 is a means of indicating the thickness of the fluid film separating surfaces 21 and 42′.

Burner 49 may then be lighted to apply heat to cup 14 which heat will be distributed evenly to container 16 through sand 15. In turn, the fluid 22 will be heated. As fluid 22 is heated, its body is more or less broken up, and it thereby loses a certain degree of its cohesive and adhesive qualities, allowing the head 42 to drive out a portion of the fluid film from between faces 21 and 42′ with a consequent lowering of head 42, which lowering and the amount thereof will be registered by a corresponding movement of pointer 33 towards its initial position.

Therefore, by applying the same degree of heat to different lubricating fluids, the operator may observe the comparative power of resistance such fluids offer to the same force exerted to drive them from between two surfaces. The operator may either watch the movement of pointer 33 over scale 26 through the heating of fluid 22, or he may observe the relative position thereof only at certain predetermined temperatures or at the flash and fire point, it being especially desirable to ascertain the cohesive and adhesive qualities of lubricants at the flash point, the well known tests for flash and fire points being readily made without disturbing the apparatus.

By calibrating scale 26 in any convenient unit of measure or with reference to units applied to other known qualities of fluids, I have provided a means for indicating the comparative cohesive and adhesive qualities of different fluids at the same or different temperatures.

I claim:

1. In a fluid testing device a post, a base fixed on said post, a movable head, means adapted to suspend said head above said base, said suspension means comprising a balance bar supported by said post, a lever attached to said balance bar, and a rod operatively connected to said head at one extremity and having an adjustable connection with said lever at its other extremity.

2. A testing device comprising a fluid container, a base immersed in said fluid, means for raising and lowering said base with respect to the level of said fluid, a movable head immersed in said fluid, and superposed with respect to said base, said movable head being held apart from said base by said fluid, and indicating means operatively connected to said movable head to indicate the thickness of the fluid between said base and said head.

3. In a testing device, a fluid container, a base within said container, a lever pivotally supported above said base, means for swinging said lever in one direction of rotation, said means comprising a rod suspended from said lever and a movable head suspended from said rod to superpose said base and adapted to gravitate towards said base, means for varying the length of said rod between said lever and said head, and means for swinging said lever in the opposite direction of rotation.

4. The method of determining the degree of cohesion possessed by a fluid, and its adhesive qualities with respect to given surfaces, comprising the introduction of a film of the fluid between the complementary surfaces of a fixed base and a head movable towards said base, and measuring the thickness of the fluid separating said surfaces after a given pressure has exerted its full force in moving said head toward said base.

5. The method of determining the degree of cohesion possessed by a fluid and its adhesive qualities with respect to given surfaces, comprising the introduction of a film of the fluid between the complementary surfaces of a fixed base and a head movable by gravity toward said base, and measuring the thickness of the fluid separating said surfaces after gravity has exerted its full force in moving said head toward said base.

6. The method of determining the degree of cohesion possessed by a fluid and its adhesive qualities with respect to given surfaces, comprising the introduction of a film of the fluid between the complementary surfaces of a fixed base and a head movable towards said base, changing the temperature of said fluid, and measuring the thickness of the fluid between said surfaces after the fluid has reached a predetermined degree of heat and after a given pressure has exerted its full force in moving said head towards said base.

7. A testing device comprising a fixed base, a lever pivotally supported above said base, a pointer mounted on said lever, a rod depending from said lever, a movable head

loosely connected with said rod and in superposed relation with said base, and a counterbalance on said lever.

8. A testing device comprising a fixed base, a lever pivotally supported above said base, a pointer mounted on said lever, a rod, a block in bearing engagement with said lever and apertured for the free passage of said rod therethrough, a nut bearing on said block and having threaded engagement with said rod, and a movable head connected to the lower extremity of said rod.

In testimony whereof I hereby affix my signature.

AUSTIN D. EBERLY.