

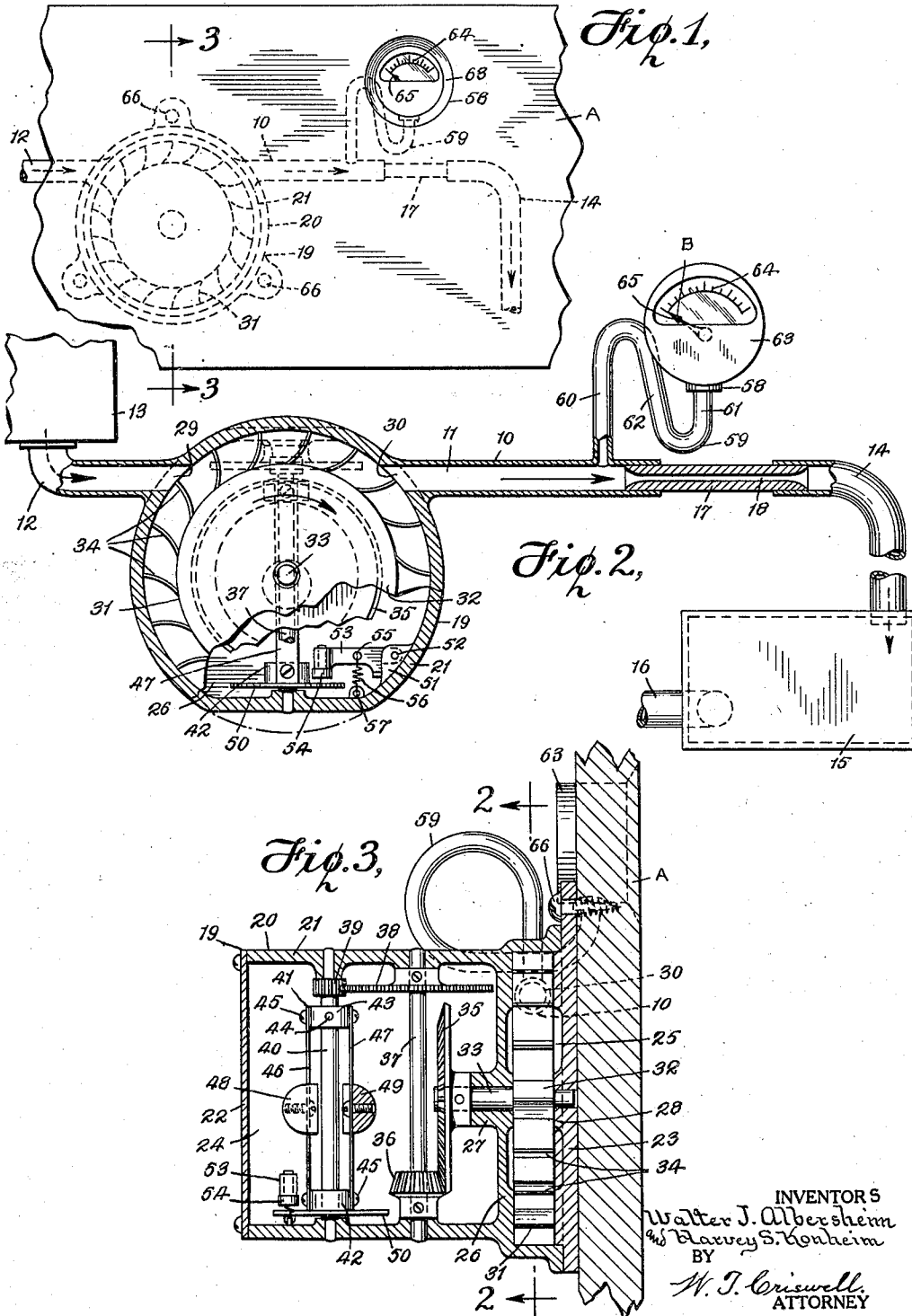
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VISCOSIMETER

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VISCOSIMETER.

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This invention relates more particularly to a class of testing apparatus.

Our invention has for its object primarily to provide an apparatus designed to be employed on motor vehicles and elsewhere for testing the viscosity especially of lubricating oils to determine their merits in a manner whereby the testing process may be observed during the delivery of the oils for use, though the apparatus may also be employed for determining the viscosity of other fluids as occasion requires, and which is of a form adapted to so control the flow of the fluid that its viscous value may be effectually tested throughout all stages of its delivery.

The invention consists essentially of means providing a passage for conveying under pressure an oil or other fluid of undetermined viscosity. The passage has a portion of restricted area whereby the fluid or oil will flow therethrough with relatively less resistance when their viscous or lubricating components are at or less than a normal standard of viscosity or lubricating value and for causing the flow of the fluid or oil to be retarded by resistance when their viscous or lubricating components exceed the normal standard of value. Associated with the conveying passage are means for controlling the speed of the flow of fluid toward the restricted area so that a fluid of greater or less viscosity value will be caused to flow in the passage with uniform speed, and in the passage is a pressure registering device for measuring and indicating the units of viscosity of the fluid.

A further object of the invention is to provide a viscosimeter of a simple, efficient and durable construction which may be made of suitable material in any appropriate size and shape.

With these and other objects in view the invention will be hereinafter more fully described with reference to the accompanying drawing forming a part of this specification in which similar characters of reference indicate corresponding parts in all the views, and will then be pointed out in the claims at the end of the description.

In the drawing, Figure 1 is a fragmentary view showing part of a support with one form of our viscosimeter applied thereto.

Fig. 2 is an enlarged fragmentary sec-

tional view, partly in elevation and partly broken away, taken longitudinally through the apparatus, and,

Fig. 3 is an enlarged sectional view, partly fragmentary and partly in elevation, taken on the line 3—3 of Fig. 1.

The apparatus has a pipe 10 which serves as means to provide a passage 11 of sufficient length and diameter for conveying a lubricating oil or other fluid whose viscosity is required to be tested. The pipe 10 has its inlet 12 leading from a tank, as 13, or other supply container arranged for causing the fluid by gravitation to flow through the pipe at a desired speed, or the fluid may be forced through the pipe by means of a suitable pump, not shown. The outlet 14 of the pipe may lead into a suitable receiving receptacle, as 15, from which the fluid may be discharged for use through an output pipe, as 16.

Interposed in the pipe 10 is a tube 17 having a passage of less diameter than the diameter of the passage 11 of the pipe to provide a restricted area, as 18, which serves as means to retard the flow of fluid through the conveying passage 11 when its viscous components exceed a normal standard of viscosity value, but when the viscous components of the fluid is at or less than a normal standard of viscosity the restricted area is such that the fluid will flow more or less freely through the tube 17 according to its proportionate viscosity.

In order to cause the fluid to flow in the conveying passage 11 toward the restricted area 18 at a uniform speed irrespective of the pressure under which the fluid is delivered at the inlet 12, we provide controlling means, as 19. This controlling means may be of any suitable form, though the means illustrated includes a casing 20 having an approximately cylindrical side wall 21, and end plates, as 22, 23. The interior of the casing is divided into two chambers 24, 25 by a circular partition, as 26, which extends between parts of the side wall 21 in proximity to the end plate 23. In the central parts of the partition 26 and the central part of the end wall 23 are alined bearings 27, 28, respectively. The casing 20 is interposed in the pipe 10 between the inlet 12 and the restricted area 18 by parts of the pipe leading into the

chamber 25 of the casing through two openings 29, 30 which are provided in opposite parts of the upper portion of the side wall 21 of the casing so that the fluid delivered into the inlet 12 of the pipe will flow into the chamber 25, and thence into the pipe for being forced to flow to the restricted area 18. In the chamber 25 of the casing is a propeller or paddle wheel 31 having a hub 32 held on a stud or short shaft 33 which is journaled in the bearings 27, 28 of the end plate 23 and partition 26 of the casing 10, and one end of the stud 33 extends beyond the bearing 27 of the partition 26 into the chamber 24. The hub 32 of the propeller 31 is preferably of a circular shape and of a diameter so that when revolved its outer peripheral edge will move on a plane corresponding to nearly the center of the passage 11 of the pipe 10. Extending from spaced parts of the entire outer peripheral edge of the hub 32 are blades 34 which are of lengths so that their free ends movably contact with the inner face of the side wall 21 of the chamber 25, and each of these blades is curved in a direction away from the inlet 12 of the pipe for allowing the fluid flowing into the chamber 25 through its opening 28 to contact the blades successively for driving the propeller from left to right and which in turn will cause the fluid to flow from the chamber 25 again into the pipe 10 for being forced to flow toward the restricted area 18 of the pipe. On the protruding end of the stud 33 is a bevel gear 35 which is in mesh with a bevel pinion 36 held at one end of a shaft 37 having its end journaled in bores provided in opposite parts of the side wall 21 of the casing. Held on the other end of the shaft 37 is a gear 38 which meshes with a pinion 39 held on another shaft 40 having its ends also journaled in bores provided in opposite parts of the side wall of the casing. The shaft 40 carries a governor 41 which may be of any preferred or well known type having the spaced sleeves 42, 43. One of the sleeves is fixed, at 44, on the shaft 40, and the other sleeve is slidable on the shaft. On opposite parts of these sleeves are fastened, at 45, the ends of two spring strips 46, 47 having on their central parts two suitable weights 48, 49 for regulating as is incident to the operation of such controlling devices the speed of operation of the propeller 31, as will be later explained. Serving as means to further check the speed of rotation of the shaft 40 and the governor 41 when driven at intervals faster than a given speed, on the sleeve 42 and surrounding the shaft 40 is a disk, as 50, for being revolved with the rotation of the shaft. On part of the inner face of the side wall 21 of the casing 20 is a lug 51, and to this lug is pivoted, at 52, one end of a

lever or bar 53 which is disposed so that its other end terminates above the disk 50. On the underside of the free end of the pivoted lever 53 is a brake shoe or cushion 54 which may be of leather, metal or rubber for being frictionally engaged by the disk. To the central part of the lever is held, at 55, one end of a spring, as 56, having its other end held at 57 to the part of the side wall of the casing under the lever, and this spring is tensioned for yieldingly holding the lever in a downward position normally in spaced relation to the disk 50. The controlling means 19 is operated for producing a uniform speed of flow of the fluid in the pipe 10 toward the restricted area 18 by the propeller 31 being operated by the fluid flowing from the inlet of the pipe 10 into the chamber 25 of the casing 20 through the opening 29, as above explained. With the operation of the propeller the stud 33 will be driven. The bevel gear 35, bevel pinion 36, shaft 37, gear 38 and pinion 39 will then be operated to drive the shaft 40. With the driving of the shaft 40 the governor 41 will operate according to the speed of rotation of the shaft by the weights 48, 49 moving centrifugally away from the shaft 40 which in turn will cause the spring strips 46, 47 to expansively move yieldingly from the shaft. The sleeve 42 will also slidably move on the shaft 40 toward the sleeve 43 as is usual with the operation of governors of this class, and the disk 50 will be likewise moved toward the friction cushion 54. The governor 41 thus operating in the well known fashion will serve to control the speed of operation of the propeller 31 and its operative gearing for causing the fluid to be delivered from the chamber 25 of the casing 20, through the opening 30 into the pipe 10 and to cause the fluid to flow at a uniform speed to the restricted area irrespective of the pressure of the fluid at its source of supply and irrespective of the density or fluidity of the fluid. However, should the pressure of the fluid at the source of supply be excessive, the speed of rotation of the propeller will still be limited by the governor operating, as explained, for causing the disk 50 to be moved by the slidable movement of the sleeve 42 into frictional engagement with the cushion 54 which in turn will by the yielding force of the lever 53 and the tension of the spring 56 check the speed of operation of the governor to such extent that the operative parts of the controlling means 19 will operate the propeller at a given speed.

For the purpose of measuring or testing the viscosity of the fluid on the pipe 10 between the restricted area 18 and the controlling means 19 is a manometer or pressure registering device 58. The manometer may be of any preferred or well known type,

such as the form illustrated which has the goose-neck or approximately N-shaped tube 59 to provide its two spaced vertically disposed members 60, 61 and the inclined connecting member, as 62. The member 60 of the tube 59 leads from the passage 11 of the delivery pipe 10 near the restricted area 18, and the member 61 of the tube leads into a casing 63 in which is provided a calibrating scale 64 and a pointer 65 adapted to be moved by air pressure in the tube 59 for indicating the degrees of pressure on the scale, as is customary with the operation of devices of this type. The viscosimeter may be mounted on any suitable support for testing the viscosity of fluids, and when employed for testing the viscosity of lubricating oil the device may be mounted on the dash board, as A, of an automobile or other motor vehicle by the end plate 23 of the casing 20 of the controlling means 19 being bolted, as at 66, or otherwise secured to the dash board in the manner shown in Fig. 1, and so that the scale 64 and pointer 65 of the registering device 58 will be exposed to view.

When oil or fluid is being tested by the apparatus, and should the viscous components of the fluid be less than its normal standard of viscosity value the fluidity of the fluid will be such that it will freely flow through the restricted area without perceptible resistance, and without causing the air in the pressure tube 59 of the manometer 58 to be perceptibly affected. The pointer 65 of the manometer will then remain in its lowest position, as shown at B, Fig. 2, with relation to the markings of the scale 64. If the viscous components of the fluid are at or exceed its standard viscosity value a proportionate resistance to its passage through the restricted area 18 of the pipe will occur and a portion of the fluid will accordingly flow into the member 60 of the pressure tube 59 of the registering device 58. The air pressure created thereby in the casing 63 of the registering device will cause the pointer 65 to move for indicating on the scale 64 the units of viscosity of the fluid. Moreover, by employing means to determine the heat of the fluid, especially a lubricating oil, its value or grade may be compared at different temperatures and the lubricating value of various fluids may be compared at the same temperatures.

In the foregoing description, we have embodied the preferred form of our invention, but we do not wish to limit ourselves thereto, as we are aware that modifications may be made therein without departing from the principle or sacrificing any of the advantages of this invention, therefore, we reserve to ourselves the right to make such changes as fairly fall within the scope thereof.

Having thus described our invention, we

claim as new and desire to secure by Letters Patent:—

1. In a viscosimeter, in combination, means providing a passage for conveying under pressure a fluid of undetermined viscosity and the passage having a portion of restricted area, means for controlling the speed of flow of the fluid in the passage toward the restricted area, means for checking said controlling means when operated in excess of a given speed, and means in the passage for measuring the pressure of the fluid according to its resistance to flow through the restricted area.

2. In a viscosimeter, in combination, means providing a passage for conveying under pressure a fluid of undetermined viscosity, means in the passage for retarding the flow of the fluid when of a viscosity exceeding a given fluidity, means for controlling the speed of flow of the fluid in the passage toward said retarding means, means for checking said controlling means when operated in excess of a given speed, and a pressure registering device in the passage for indicating the units of viscosity of the fluid.

3. In a viscosimeter, in combination, a pipe for conveying under pressure a fluid of undetermined viscosity, a tube interposed in the pipe and having a passage of less diameter than the diameter of the passage of the pipe for retarding the flow of fluid when of a viscosity exceeding a given fluidity, means for controlling the speed of flow of the fluid in the pipe toward the retarding tube, and means on the pipe for measuring the pressure of the fluid according to its resistance to flow through said retarding tube.

4. In a viscosimeter, in combination, a pipe for conveying under pressure a fluid of undetermined viscosity, a tube interposed in the pipe and having a passage of less diameter than the diameter of the passage of the pipe for retarding the flow of fluid when of a viscosity exceeding a given fluidity, means for controlling the speed of flow of the fluid in the pipe toward the retarding tube, and a pressure registering device on the pipe for indicating the units of viscosity of the fluid.

5. In a viscosimeter, the combination with means providing a passage for conveying under pressure a fluid of undetermined viscosity and the passage having a portion of restricted area, of a propeller operative by the fluid during its flow toward the restricted area, and means for regulating the speed of operation of the propeller to regulate the speed of flow of the fluid.

6. In a viscosimeter, the combination with means providing a passage for conveying under pressure a fluid of undetermined viscosity and the passage having a portion of restricted area, of a propeller operative by

the fluid during its flow toward the restricted area, means for regulating the speed of operation of the propeller to regulate the speed of flow of the fluid, and means in the passage for measuring the pressure of the fluid according to its resistance to flow through the restricted area.

7. In a viscosimeter, the combination with means providing a passage for conveying under pressure a fluid of undetermined viscosity and means in the passage for retarding the flow of the fluid when of a viscosity exceeding a given fluidity, of a propeller operative by the fluid during its flow toward the retarding means, means for regulating the speed of operation of the propeller to regulate the speed of flow of the fluid, and means for checking said propeller when operated in excess of a given speed.

8. In a viscosimeter, the combination with means providing a passage for conveying under pressure a fluid of undetermined viscosity and means in the passage for retarding the flow of the fluid when of a viscosity exceeding a given fluidity, of a propeller operative by the fluid during its flow toward the retarding means, means for regulating the speed of operation of the propeller to regulate the speed of flow of the fluid, means for checking said propeller when operated in excess of a given speed, and a pressure registering device in the passage for indicating the units of viscosity of the fluid.

9. In a viscosimeter, the combination with means providing a passage for conveying under pressure a fluid of undetermined viscosity and means in the passage for retarding the flow of the fluid when of a viscosity exceeding a given fluidity, of a propeller operative by the fluid during its flow toward the retarding means, gearing operative by the propeller, and means for regulating the speed of operation of the gearing and propeller to regulate the speed of flow of the fluid.

10. In a viscosimeter, the combination with means providing a passage for conveying under pressure a fluid of undetermined viscosity and means in the passage for retarding the flow of the fluid when of a viscosity exceeding a given fluidity, of a propeller operative by the fluid during its flow toward the retarding means, gearing operative by the propeller, means for regulating the speed of operation of the gearing and propeller to regulate the speed of flow of the fluid, and means for checking said gear-

ing and propeller when operated in excess of a given speed.

11. In a viscosimeter, the combination with means providing a passage for conveying under pressure a fluid of undetermined viscosity and means in the passage for retarding the flow of the fluid when of a viscosity exceeding a given fluidity, of a propeller operative by the fluid during its flow toward the retarding means, gearing operative by the propeller, means for regulating the speed of operation of the gearing and propeller to regulate the speed of flow of the fluid, means for checking said gearing and propeller when operated in excess of a given speed, and a pressure registering device in the passage for indicating the units of viscosity of the fluid.

12. In a viscosimeter, the combination with a pipe for conveying under pressure a fluid of undetermined viscosity, a tube interposed in the pipe and having a passage of less diameter than the diameter of the passage of the pipe for retarding the flow of the fluid when of a viscosity exceeding a given fluidity, of a propeller for controlling the speed of flow of the fluid in the pipe toward the retarding tube, gearing operative by the propeller, means for regulating the speed of operation of the gearing and propeller to regulate the speed of flow of the fluid, and means on the pipe for measuring the pressure of the fluid according to its resistance to flow through the retarding tube.

13. In a viscosimeter, the combination with a pipe for conveying under pressure a fluid of undetermined viscosity, a tube interposed in the pipe and having a passage of less diameter than the diameter of the passage of the pipe for retarding the flow of the fluid when of a viscosity exceeding a given fluidity, of a propeller for controlling the speed of flow of the fluid in the pipe toward the retarding tube, gearing operative by the propeller, means for regulating the speed of operation of the gearing and propeller to regulate the speed of flow of the fluid, means for checking the gearing and propeller when operated in excess of a given speed, and a pressure registering device on the pipe for indicating the units of viscosity of the fluid.

This specification signed and witnessed this 22nd day of December, A. D. 1925.

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