Oct. 4, 1938. H. J. ANDERSON 2,132,347

MACHINE FOR TESTING LUBRICANTS

Filed Feb. 6, 1936 2 Sheets-Sheet 1

Fig. 1

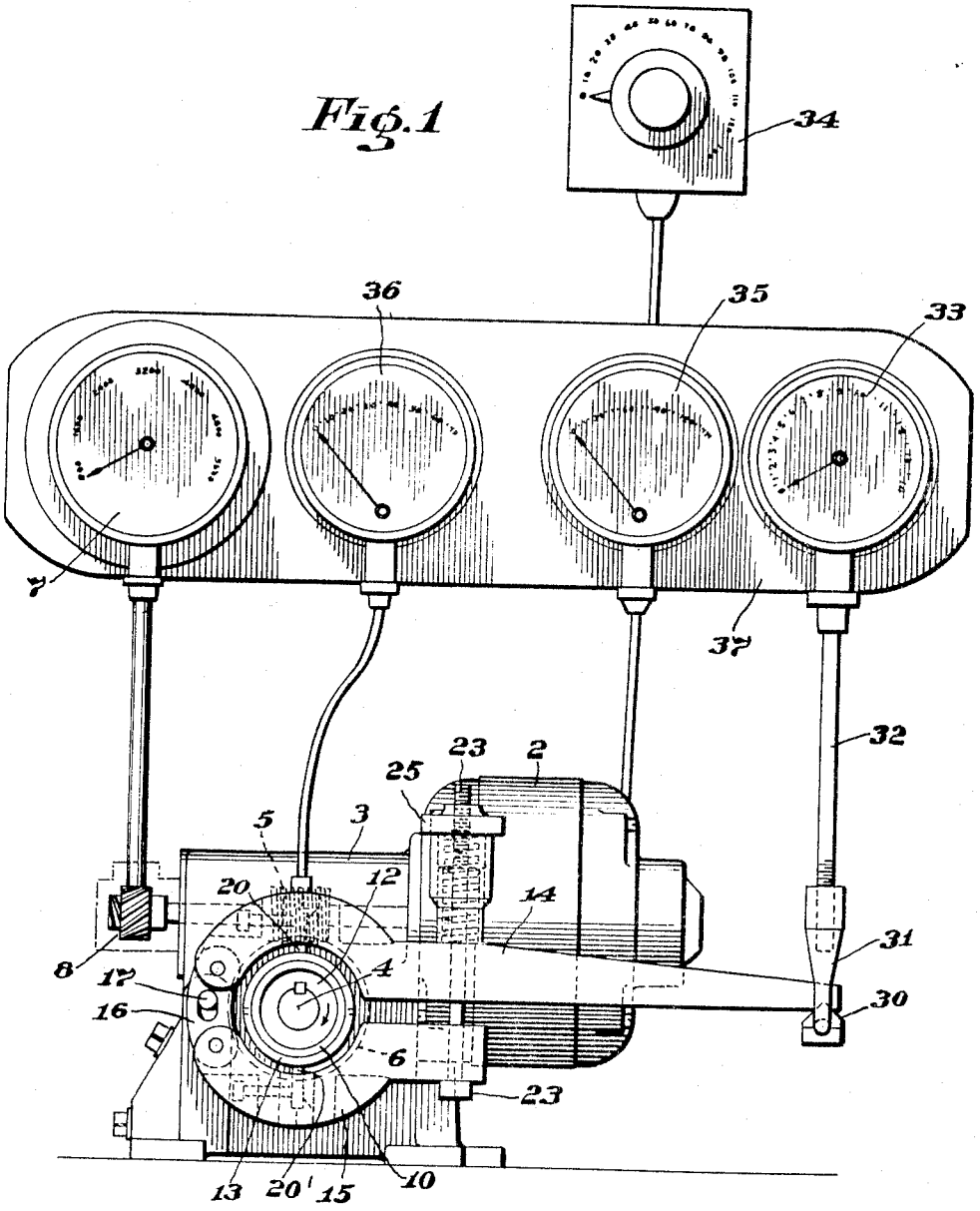
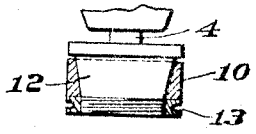


Fig. 1a



INVENTOR:
Hugo J. Anderson,
BY
J. H. McCready,
his ATTORNEY.

Oct. 4, 1938. H. J. ANDERSON 2,132,347

MACHINE FOR TESTING LUBRICANTS

Filed Feb. 6, 1936 2 Sheets-Sheet 2

Fig. 2

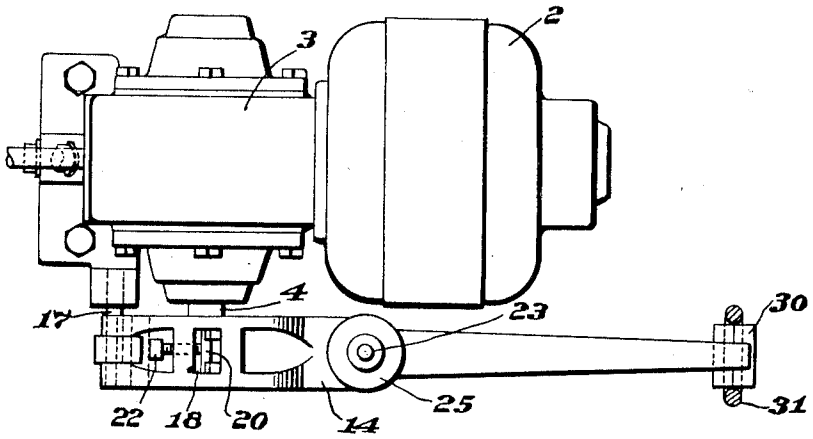
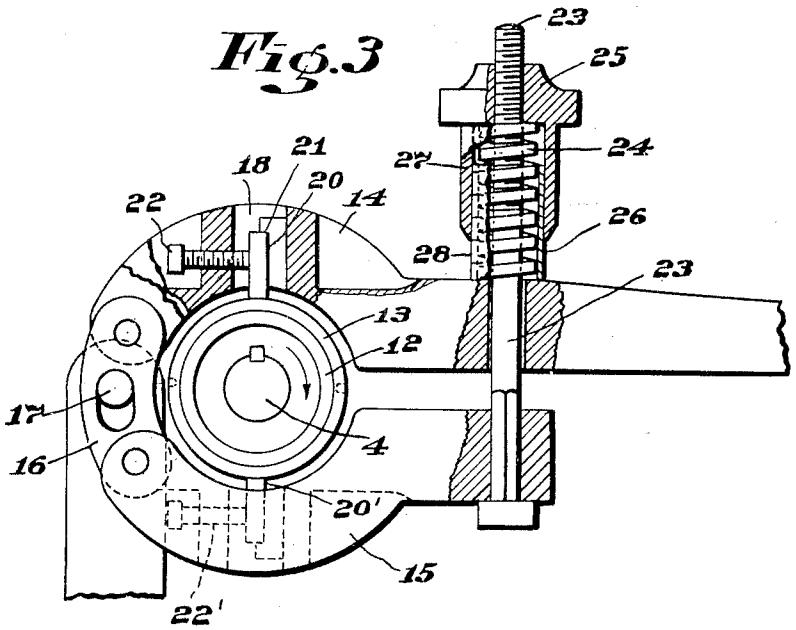


Fig. 3



INVENTOR:
Hugo J. Anderson,
BY
J. J. McCready,
ATTORNEY.

Patented Oct. 4, 1938 2,132,347

UNITED STATES PATENT OFFICE

2,132,347

MACHINE FOR TESTING LUBRICANTS

Hugo J. Anderson, Boston, Mass., assignor to Lubrx Products, Inc., Boston, Mass., a corporation of Massachusetts

Application February 6, 1936, Serial No. 62,626

4 Claims. (Cl. 265—10)

This invention relates to apparatus for testing lubricants of various kinds.

Anyone who uses oils, greases, and other lubricants in substantial volumes is vitally interested in the lubricating value of those products and in the changes in lubricating properties which take place in these materials when used under different operating conditions. This is particularly true when the lubricant is used in expensive machinery. Such a user is especially concerned with the ability of an oil or other lubricant to reduce friction in a bearing or between friction surfaces, and this property involves both the film strength of the oil, i. e. its ability to maintain two friction surfaces separated from each other under operating conditions, and also the characteristic of enabling one surface to move over the other easily and with the expenditure of a minimum amount of work. In addition, the user also is concerned with the effects of temperature changes and other variations in operating conditions on the lubricating properties of the oil.

It is an extremely difficult matter, however, for the users of lubricants to obtain this information from disinterested sources. Even if samples of a given supply of oil are tested by an industrial physicist or some other competent person or organization, there is no assurance, other than that of the word of the manufacturer or producer, that succeeding supplies of oil of the same specifications will give the same results. It is impractical to test each supply of oil, and accordingly, the user generally relies simply on the integrity of the producer, or, more commonly, merely on the trade-mark or label on the container in which he buys his oil.

The present invention is especially concerned with these considerations. It aims to devise an apparatus with which the lubricating value of lubricants can be tested quickly and conveniently so that those factors in which the user is especially interested can readily be determined. Thus the user is enabled to make his own tests on successive supplies of oil or other lubricant, under conditions closely approximating those in actual use, and he can therefore determine, before he uses a new supply of oil, whether or not it will meet his requirements.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Figure 1 is a side elevation, somewhat diagrammatic in character, of a machine or apparatus embodying this invention;

Fig. 1*a* is a sectional view, with parts in elevation, of a detail of construction;

Fig. 2 is a plan view of the motor and adjacent parts of the machine shown in Fig. 1; and

Fig. 3 is a side elevation, partly in vertical section, showing details of the friction or brake mechanism.

The construction shown in the drawings comprises a variable speed electric motor 2 connected directly to a speed reduction gearing unit 3 equipped with a driven shaft 4. In the usual arrangement the motor shaft is extended through the casing of the reduction gearing, and a worm 5 is secured fast on it and drives a worm wheel 6 which, in turn, is secured on the shaft 4. Some form of instantaneous speed indicator, such as a tachometer 7 is driven from the motor shaft, in this instance through spiral gearing 8, and thus indicates continuously the speed of the motor.

The bearing or friction elements on which the lubricants are to be tested include a collar 10, Figs. 1 and 1*a*, removably mounted on a pulley 12 which is keyed on the shaft 4. Any suitable means may be provided for removably supporting the collar, the particular construction shown consisting in tapering the surface of the pulley 12 on which the collar 10 fits, the latter being internally tapered to fit the pulley. The end portion of the pulley is externally threaded, as shown in Fig. 1*a*, to receive a nut 13 which clamps the collar securely on the tapered surface of the pulley. Thus the collar 10 can readily be removed and replaced whenever desired.

A Prony brake mechanism adapted to take removable friction bearing inserts cooperates with the collar 10. It comprises an upper arm 14 having a portion curved around the pulley and a lower arm 15, similarly curved, the two being connected at one side of the mechanism by a link 16 which is slotted to receive a centering pin 17 projecting from the frame of the machine. In the upper arm 14 a slot 18 is formed to receive a friction block 20, and the wall of the slot is undercut to provide a shoulder 21, Fig. 3, under which the upper edge of the block is placed, this shoulder serving to resist any upward thrust on the block. A screw 22 releasably secures the block in its operative position in the slot. The lower arm 15 is similarly constructed to receive another friction block 20′ which is removably secured in the arm by a screw 22′.

For the purpose of holding the blocks 20—20' against the surface of the collar 10 with an adjustable pressure, the portions of the arms 14 and 15 at the right of the pulley are connected by a bolt 23, and a coiled spring 24 is slipped over this bolt and bears at its lower end against the arm 14 and at its upper end against an adjusting screw 25 which is threaded on to the bolt. A tubular housing 26, preferably rigidly secured to the upper arm, encircles and partially houses the spring 24, and the adjusting screw 25 is equipped with a sleeve-like extension 27 loosely encircling the housing 26. By graduating the outer surface of the housing, as shown at 28, the lower edge of the sleeve 27 will cooperate with the graduations to indicate the degree of compression of the spring, and hence the pressure applied to the two arms of the brake mechanism.

When the machine is in operation, the brake mechanism will clamp the blocks 20—20' against the surface of the pulley 10 with a degree of pressure depending upon the adjustment of the spring 24. Assuming the pulley to revolve in a clockwise direction, as seen in Figs. 1 and 3, it will exert a torque on the brake mechanism tending to rotate it in the same direction. In order to measure the intensity of this torque, the upper arm 14 is extended for a considerable distance toward the right and bears on a knife edge 30, carried by a stirrup 31, this stirrup being connected by a rod 32 with a spring scale 33. It is important that the operator be able to adjust the speed of the motor, and the means provided for controlling such speed will necessarily depend upon the design and characteristics of the motor. In the construction shown, an adjustable rheostat 34, Fig. 1, is connected with the motor to serve this purpose. In a typical arrangement it is connected with the supply leads of the motor to control the voltage supplied to the motor. It is also important to be able to determine variations in the current consumption of the motor, and for this purpose a watt meter 35 is connected with the motor supply leads to show continuously the current consumption at any instant.

Preferably, also, the machine is equipped with some suitable temperature indicating apparatus, such as the thermometer or pyrometer 36, the bulb or other heat responsive element of this instrument preferably being located in the slot 18 and in contact with the block 20, so that it will continuously indicate the temperature of this member.

All of the indicators of the measuring units 7, 33, 35 and 36 preferably are located side by side on an instrument board 37 which is secured in any convenient relationship to the power unit.

The machine above described affords a very convenient means for testing various properties of lubricants. A light weight, easily portable, machine made in the manner above described has ample capacity for testing a great variety of lubricating oils and greases. In such a machine a high speed motor preferably is used in order to reduce weight and still give the desired speed range for testing purposes, while at the same time providing the necessary power at the pulley 12. Since both the collar 10 and the blocks 20—20' are easily removable, these elements may be made of the metals which are to run in contact with each other in the machine in which the lubricant under test is to be used. For this purpose it is preferable to make the blocks 20 of relatively small area so that by suitably adjusting the pressure applied through the spring 24, the pressure of these friction elements 20 and 20' on the friction ring 10 can be varied through a wide range, thus making it possible to approximate closely the running conditions under which the lubricant being tested will be used.

The testing procedure followed necessarily will be determined in accordance with the particular characteristics of the lubricant which it is desired to investigate. A comparison of the lubricating properties of oils may be very quickly made in this machine by starting the machine into operation, after it has been equipped with suitable blocks 20 and 20' and collar 10, adjusting the pressure of the blocks on the collar to the desired degree, and allowing the mechanism to heat up to a suitable temperature. By supplying one of the oils under observation to the surface of the collar 10 through the portions of the slot 18 at opposite sides of the block 20, the power required to run at a certain pressure and at a certain speed can readily be determined by reading the watt meter 35. If now a different oil is fed to the friction surfaces and the rheostat 34 is adjusted to maintain the same speed as before, the reading the watt meter will show at once whether the second oil has better or poorer lubricating properties than the first one, under the particular conditions for which the machine then is adjusted. A comparison of a range of oils under these conditions can be made in a relatively short time. Also, the conditions can readily be altered, if desired, to test the action of the oils at higher or lower temperatures, at greater or less pressures, and at different speeds.

Instead of maintaining the speed constant in making the test above described, the rheostat 34 can be adjusted to maintain the power input constant, thus allowing the speed to vary in accordance with the changes in running conditions produced by the addition of another kind of oil. The same comparative indications can be made in this manner. Either the speed or the power input, however, should be maintained constant so that the variation in the other factor will depend upon the change in conditions caused by the substitution of one oil for another. During such a substitution the pressure and temperature ordinarily will not vary, and should be held constant.

A check on the results above given can also be made by noting the reading of the scale 33. This scale structure is like the ordinary spring weighing scale, and it measures the downward force transmitted to it by the right-hand end of the arm 14. This pressure depends upon the radius of the collar 10, the areas of the friction surfaces of the blocks 20 and 20' which bear upon this collar, the pressure with which these blocks are forced against the collar, the speed of rotation of the collar, the operating temperature, and the co-efficient of friction between the blocks and the collar. All of these factors, except the last, may readily be held constant when one oil is substituted for another, if this substitution is made without stopping the machine. Consequently, the only appreciable change made in the running conditions by the substitution of another oil will be the effect of the oil on the co-efficient of friction. This effect can be read directly on the dial of the scale 33, and this dial can be calibrated to indicate co-efficients of friction for certain conditions. In using the scale for this purpose, however, great care should be exercised to see that the proper conditions are maintained.

When so used, very accurate results can be obtained and with the expenditure of very little time.

The machine is also useful in determining the critical temperatures at which oils substantially lose their lubricating properties, or at least at which those properties undergo great deterioration, in testing an oil for the break down of its film strength, and in determining other operating characteristics of lubricants.

While I have herein shown and described a typical embodiment of my invention, it will be understood that the invention may be embodied in other forms without departing from the spirit or scope thereof.

Having thus described my invention, what I desire to claim as new is:

1. In a machine for testing the lubricating properties of oils, greases, and the like, the combination of a variable speed electric motor, means adjustable to vary the speed of said motor, a member revolved by said motor, a friction element bearing on said member, means for supporting said element, mechanism for pressing said element against said member whereby said member will exert a torque on said element and on said mechanism, said mechanism being adjustable to vary the pressure so applied and consequently to vary said torque, a tachometer connected with said motor to indicate continuously the speed of the latter, a meter indicating continuously variations in the power consumption of the motor, and means for continuously measuring the instantaneous values of the torque so exerted on said element.

2. In a machine for testing the lubricating properties of oils, greases, and the like, the combination of a variable speed electric motor, means adjustable to vary the speed of said motor, a Prony brake mechanism, a rotary member upon which said mechanism acts, speed reduction gearing through which said motor drives said member, said brake mechanism including the movable friction elements of relatively small areas as compared to the area of said member, means for removably supporting said elements in fixed positions in said mechanism, said mechanism being adjustable to vary the pressure with which said elements bear on said member and consequently to vary the torque exerted on said mechanism, means for continuously measuring the instantaneous values of the torque so exerted, a tachometer connected with said motor to indicate continuously the speed of the latter, and a meter indicating continuously variations in the power consumption of said motor.

3. In a mechanism for testing the lubricating properties of oils, greases, and the like, the combination of an electric motor, a shaft driven by said motor, a friction collar removably mounted on said shaft, Prony brake mechanism acting on said collar and including a lever curved around said collar and provided with a slot extending radially through it in which a seat is formed to receive a friction element, said seat being shaped to support said element against the thrust exerted on it by said collar, means for releasably clamping said element in said seat, means adjustable to vary the pressure applied through said mechanism to said element to adjust the resistance with which it bears upon said collar, a tachometer connected with said motor to give instantaneous readings of the motor speed, means for indicating continuously variations in the power consumption of the motor, and means for continuously measuring the torque exerted on said brake mechanism by the rotation of said shaft.

4. In a mechanism for testing the lubricating properties of oils, greases and the like, the combination of a motor, a shaft driven thereby, a friction collar on said shaft, Prony brake mechanism acting on said collar and including a lever curved around said collar and provided with a slot extending through the arm, said slot being formed with a seat to receive a friction element and hold same against said collar, means adjustable to vary the pressure applied through said mechanism to said element to adjust the resistance with which it bears upon said collar, and means controlled by said Prony brake mechanism for continuously measuring the torque exerted on said brake mechanism by the rotation of said shaft.

HUGO J. ANDERSON.