No. 793,487. PATENTED JUNE 27, 1905.

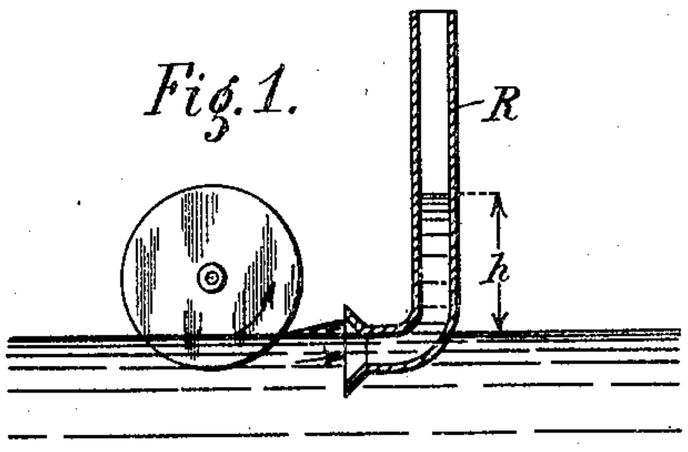
K. WILKENS.

APPARATUS FOR THE EXAMINATION OF LIQUID LUBRICANTS.

APPLICATION FILED OCT. 6, 1902.

8 SHEETS—SHEET 1.

Fig. 1.



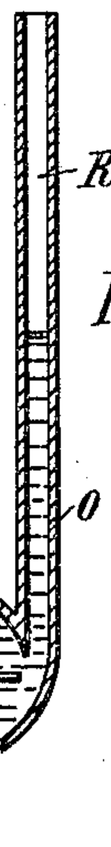


Fig. 2.

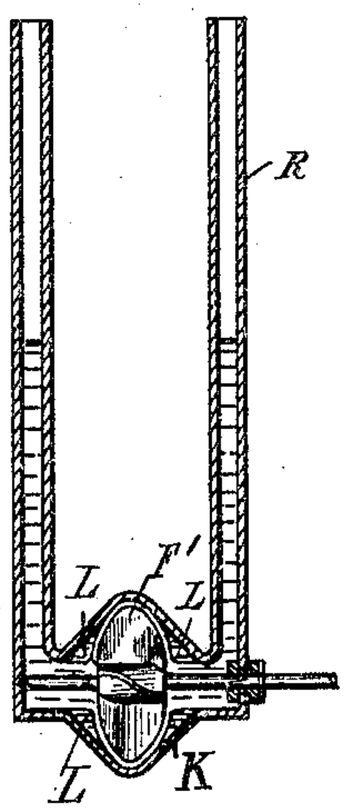


Fig. 3.

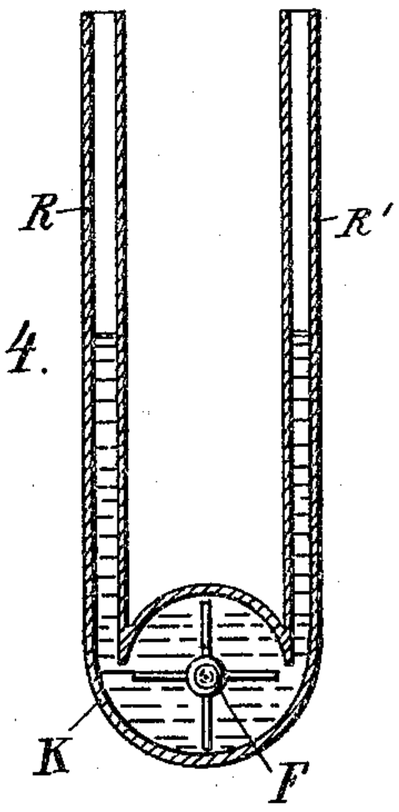


Fig. 4.

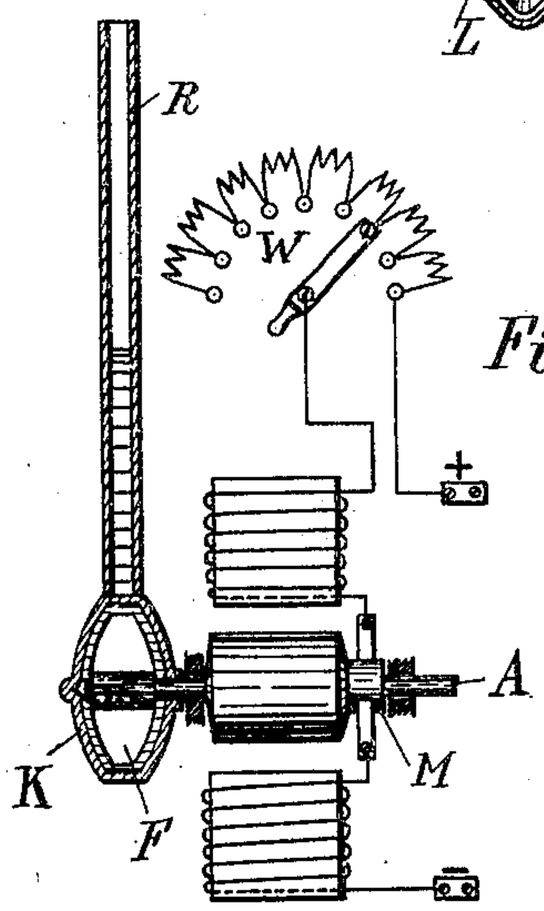


Fig. 5.

Witnesses—
Ellis Owen
John Smith

Inventor
Karl Wilkens
by W. E. Owen
Attorney.

No. 793,487. PATENTED JUNE 27, 1905.

K. WILKENS.

APPARATUS FOR THE EXAMINATION OF LIQUID LUBRICANTS.

APPLICATION FILED OCT. 6, 1902.

3 SHEETS—SHEET 2.

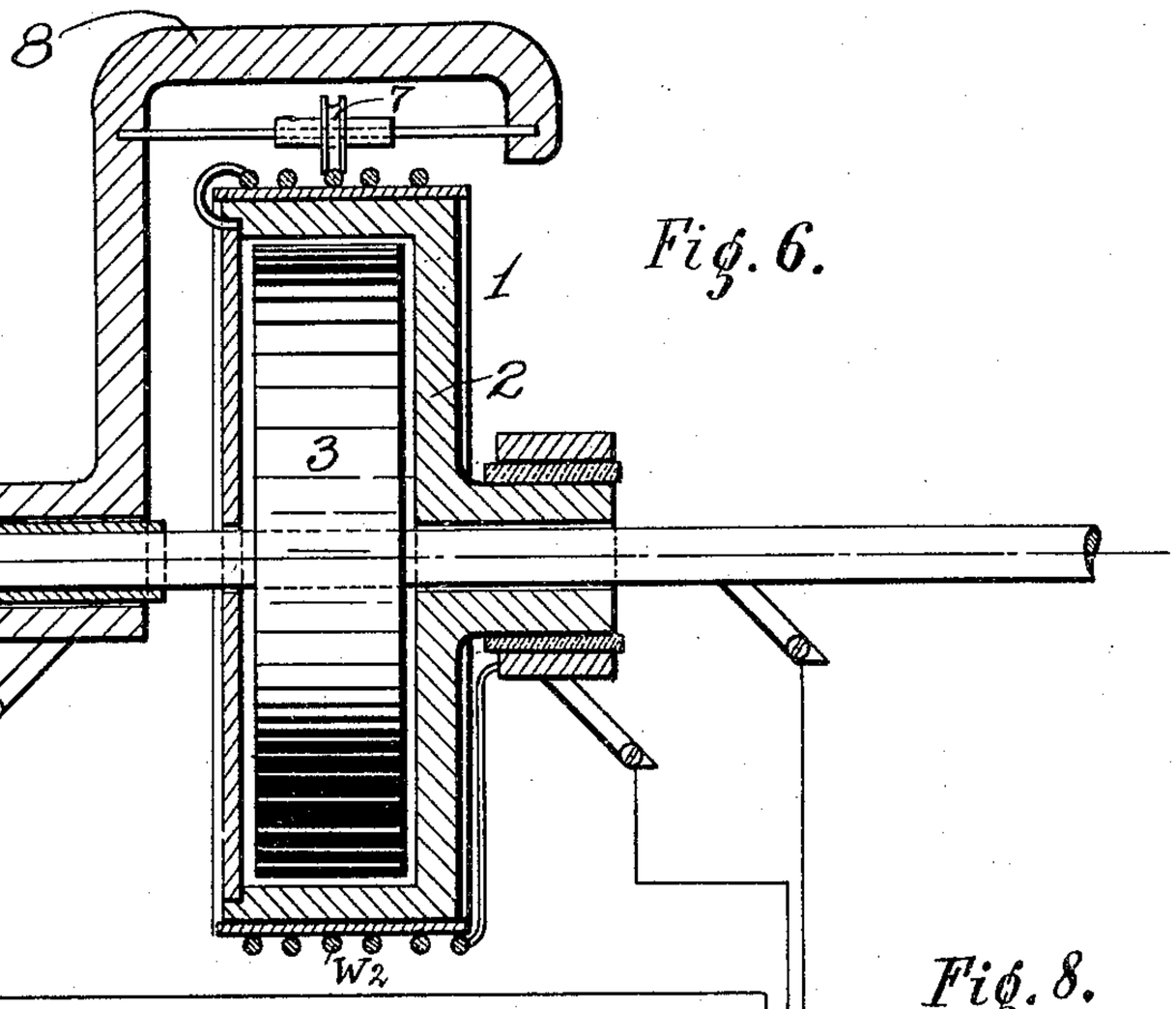


Fig. 6.

Fig. 7.

Fig. 8.

Witnesses-
Ellis Owen.
John Smith

Inventor
Karl Wilkens
by A. E. Edmunds
Attorney.

No. 793,487. PATENTED JUNE 27, 1905.

K. WILKENS.

APPARATUS FOR THE EXAMINATION OF LIQUID LUBRICANTS.

APPLICATION FILED OCT. 6, 1902.

3 SHEETS—SHEET 3.

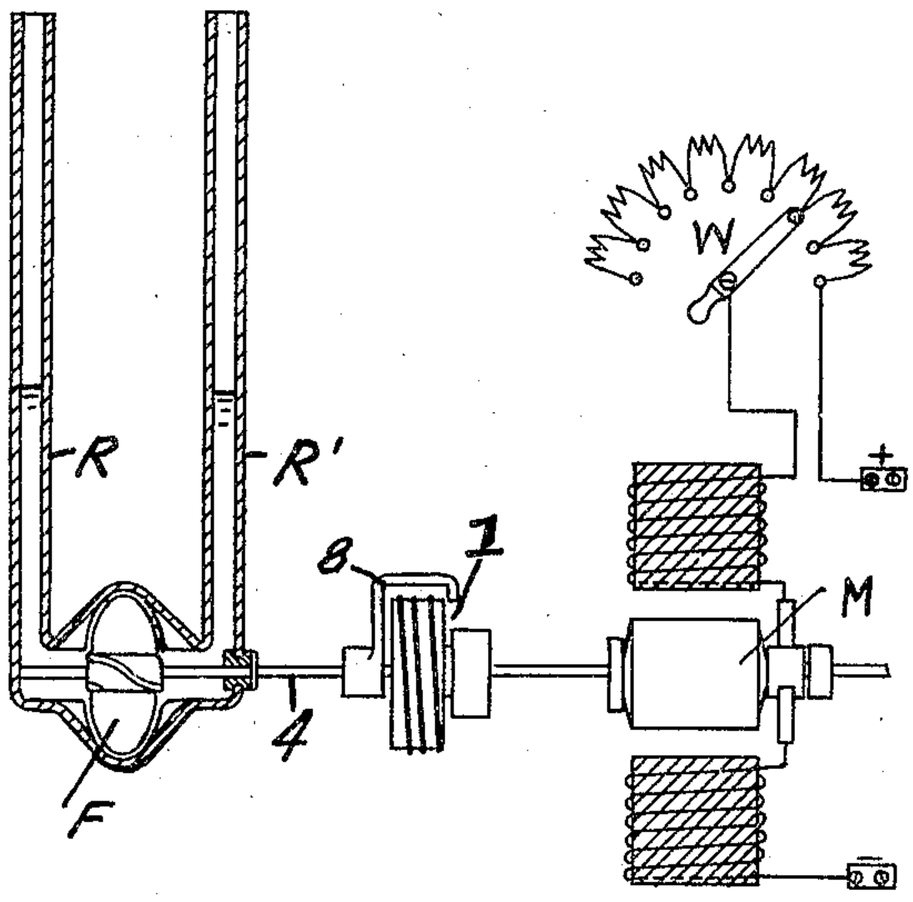


FIG. 3a

WITNESSES.—
Ellis Owen
John Smith

INVENTOR.
Karl Wilkens
by E. W. Evans.
ATTORNEY.

No. 793,487. Patented June 27, 1905.

UNITED STATES PATENT OFFICE.

KARL WILKENS, OF BERLIN, GERMANY.

APPARATUS FOR THE EXAMINATION OF LIQUID LUBRICANTS.

SPECIFICATION forming part of Letters Patent No. 793,487, dated June 27, 1905.

Application filed October 6, 1902. Serial No. 126,227.

To all whom it may concern:

Be it known that I, KARL WILKENS, a subject of the German Emperor, residing at 16/17 Juedenstrasse, Berlin, Germany, have invented a certain new and useful Apparatus for the Examination of Liquid Lubricants, of which the following is a specification.

The present invention relates to apparatus for the examination of the lubricating quality of liquids.

The principle of the invention is based upon the fact that different liquids which are set in motion by means of the expenditure of a certain amount of power will be caused to rise to different heights in ascending-tubes having their lower ends inserted in the liquid. It will be readily seen that this operation constitutes a convenient means for measuring and comparing the lubricating qualities of liquids, since the height to which any given liquid will rise in the ascending-tubes depends upon the friction between the particles thereof, the mechanism which sets up the current, and the walls of the receptacle and ascending-tubes. Furthermore, by the provision of means for heating the liquid to a definite temperature the lubricating qualities thereof may be compared at different temperatures and those of different liquids compared at the same temperature. It is of course essential that the energy expended in raising the liquid in the ascending-tubes be kept constant during the comparative testing of different liquids and that it should be readily ascertainable when comparative tests are to be made.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 shows in front elevation one simple manner in which the invention is carried into effect. Fig. 2 is a sectional elevation of a modification of Fig. 1. Fig. 3 is a sectional elevation illustrating another manner in which the invention is carried into effect in which two tubes are employed. Fig. 3^a is a sectional elevation similar to Fig. 3, but showing a spring-dynamometer applied between the motor and the vane-wheel spindle. Fig. 4 is a sectional elevation of a modification of Fig. 3, and Fig. 5 is a further sectional elevation of a modification of Fig. 3. Fig. 6 is a diagrammatic part-sectional elevation of a spring-dynamometer arrangement by which the invention is carried into effect. Fig. 7 is a diagram illustrating a modification of the arrangement illustrated in Fig. 6; and Fig. 8 is a sectional elevation of the arrangement illustrated in Fig. 4, showing means of electrically heating the oil to be tested to different temperatures.

The examination of the lubricant is made with regard to the inner frictional resistance by the height of the column attained in the ascending-pipe with reference to the velocity and in regard to the degree of consistence by the consumption of energy resulting for equal heights of the column with reference to the velocity and specific weight. If, for example, as shown in Fig. 1, the rotating body consists of a simple rotating disk, the surrounding liquid is set in motion in the direction of the arrow, and the velocity decreases rapidly or slowly, according to the distance from the rotating body and according to the nature of the liquid. If in the current of the liquid thus set in motion, a pipe with an upwardly-bent stem R is provided, Fig. 1, the liquid ascends higher or descends lower in the pipe, according to the degree of velocity, which depends again upon the nature of the liquid. The liquid stream acts with a certain constant pressure upon the mouth of the ascending-pipe directed toward the stream, and this pressure keeps the equilibrium against the liquid column h (extending beyond the level of the liquid) in the ascending-pipe. Two liquids are compared to each other in classing the respective height of ascent for equal numbers of revolutions of the rotating body. The height h is measured for the determination of the inner frictional resistance of the lubricant with reference to the specific weight. For further examining the liquids a determination is made of the power expended in driving the rotating body and the results are taken into comparison, so that the influence of the consistence can be estimated. In the practical construction of such an apparatus the height of the column in the ascending-pipe—that is, the measure for the determination of the lubricating quality for a given advantageous velocity of rotation—must of

course be made the greatest possible in order that the apparatus may be sensitive.

In Fig. 2, K is a closed chamber in the interior of which the liquid to be examined is filled, and a vane-wheel F is provided therein, the spindle of which protudes through the wall of the chamber K, so as thus to be capable of being driven on the exterior. The ascending-pipe R is connected to the closed chamber K. If the vane-wheel is set into rotation by such means as a motor in the direction of the arrow, the liquid rises in the tube R above the height *o*.

In Figs. 3, 4, and 5, K is a chamber for the liquid, in the interior of which the rotating vane-wheel F is provided. To this chamber two ascending-pipes R R′ are connected and branch off tangentially in such manner that the rotating vane-wheel effects in the one pipe a rise, and in the other pipe a fall, of the liquid column.

Instead of effecting the movement of a part of the liquid by a vane-wheel according to the arrangement of Figs. 2 and 4, the movement may be effected by a wheel F′, having vanes of screw shape, as illustrated in Fig. 3. In order to render the movement of the liquid greater in the direction of the axis, fixed guide-blades L are provided on the walls of the chamber K, which assist the helical vanes of the wheel F′ in directing the liquid in the direction of the axis of said wheel.

For the purpose of driving the vane-wheel F the spindle A is carried through a wall of the chamber K and coupled with a motor capable of yielding a variable number of revolutions—as, for example, an electromotor M with rheostat W, Fig. 5. The consumption of energy by the rotating vane-wheel may either be determined from the expenditure of energy by the motor, deducting its own consumption, or, as illustrated in Figs. 3ª and 6, by means of a spring-dynamometer, connecting the spindle of the vane-wheel F with the spindle of the motor 10. From indication of the dynamometer in connection with the measured number of revolutions the consumption of energy is calculated in a known manner.

According to the arrangement illustrated in Fig. 6 the spring-dynamometer 1 consists of a clock-spring casing 2, in which one end of the spring 3 is fixed on the spindle 4 of the oil-examining apparatus and the other end on the spring-casing 2 and with the latter on the spindle 5 of the driving-motor *m*, Fig. 3ª. Upon the circumference of the spring-casing 2 a resistance-wire W^2 is spirally wound and insulated from it. The contact-roller 7 rolls upon this spiral resistance-wire W^2, and the bearer 8 of the roller 7 is fixed upon the spindle 4 of the oil-examining apparatus. The more the clock-spring 3 is extended the more the contact advances upon the resistance-wire W^2, so that from the extent of movement of the contact-pulley 7 upon the resistance-wire W^2 the tension of the spring 3 may be determined. If this resistance-wire W^2, Fig. 7, is arranged like the bridge-wire of a Wheatstone bridge-switch and if the deflection of the galvanometer G is always brought back to zero by the alteration of the regulating-resistance W′, the energy transmitted for each special case can easily be ascertained from the position of the regulating-resistance, which for the simplification of reckoning is given directly in kilograms spring tension by the multiplication of the tractive force with the velocity.

In order to be able to examine lubricating-oils in different temperatures, an electric heating arrangement, consisting of a resistance-coil 9 in the circuit of a battery 10 or other sources of current having a switch 11 for the regulation of the current by which the amount of heat generated in the resistance-wire 9 may be varied as required, admitting of regulation for heating the oil-chamber K, is provided, as shown in Fig. 8, while by the aid of a regulator—in the present case by the aid of the resistances W—the number of revolutions of the driving-motor may be varied in wide limits.

The examination of lubricants as to their inner frictional resistance is most advantageously effected in such manner that a certain velocity is kept constant, the heating arrangement being set into operation, and that then a great number of column heights corresponding to the different temperatures are read off. For the better comparison of different kinds of oil the values of the column heights read off are reduced to any other convenient denomination.

The examination of lubricants as to the degree of consistence is advantageously effected in such manner that a certain column height is kept constant, that the heating arrangement is set into operation, and that then a great number of values of energy consumption corresponding to different temperatures are read off and compared, having regard to the velocity and specific weight.

If required to render the numerals of comparison independent from the constant of each particular case of different oil-examining apparatus, the ascertained values may be expressed in percentages, which have been obtained in one and the same apparatus with a normal oil. As a normal oil one may advantageously select petroleum, inasmuch as its behavior is little affected by differences in temperature.

What I claim as my invention, and desire to secure by Letters Patent, is as follows:

1. A mechanism for testing the lubricating quantities of liquids comprising a receptacle for the liquid to be tested, rotatable means immersed in said liquid to set the same in motion, means for measuring the power thus expended and a pipe having its lower end open-

ing into said receptacle so that the height of the liquid column caused to rise in said pipe by the expenditure of a given amount of power may be measured.

2. A mechanism for testing the lubricating quantities of liquids, comprising a casing for the liquid to be tested, a rotatable wheel having helical vanes in said casing, a pipe in open communication with said casing on each side of said wheel, and guiding-surfaces within said casing to coöperate with said vanes in causing the liquid to be forced to a greater or less height in the said pipes.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

KARL WILKENS.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.