

June 9, 1925.

1,541,083

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DYNAMOMETER

Filed April 14, 1924

2 Sheets-Sheet 1

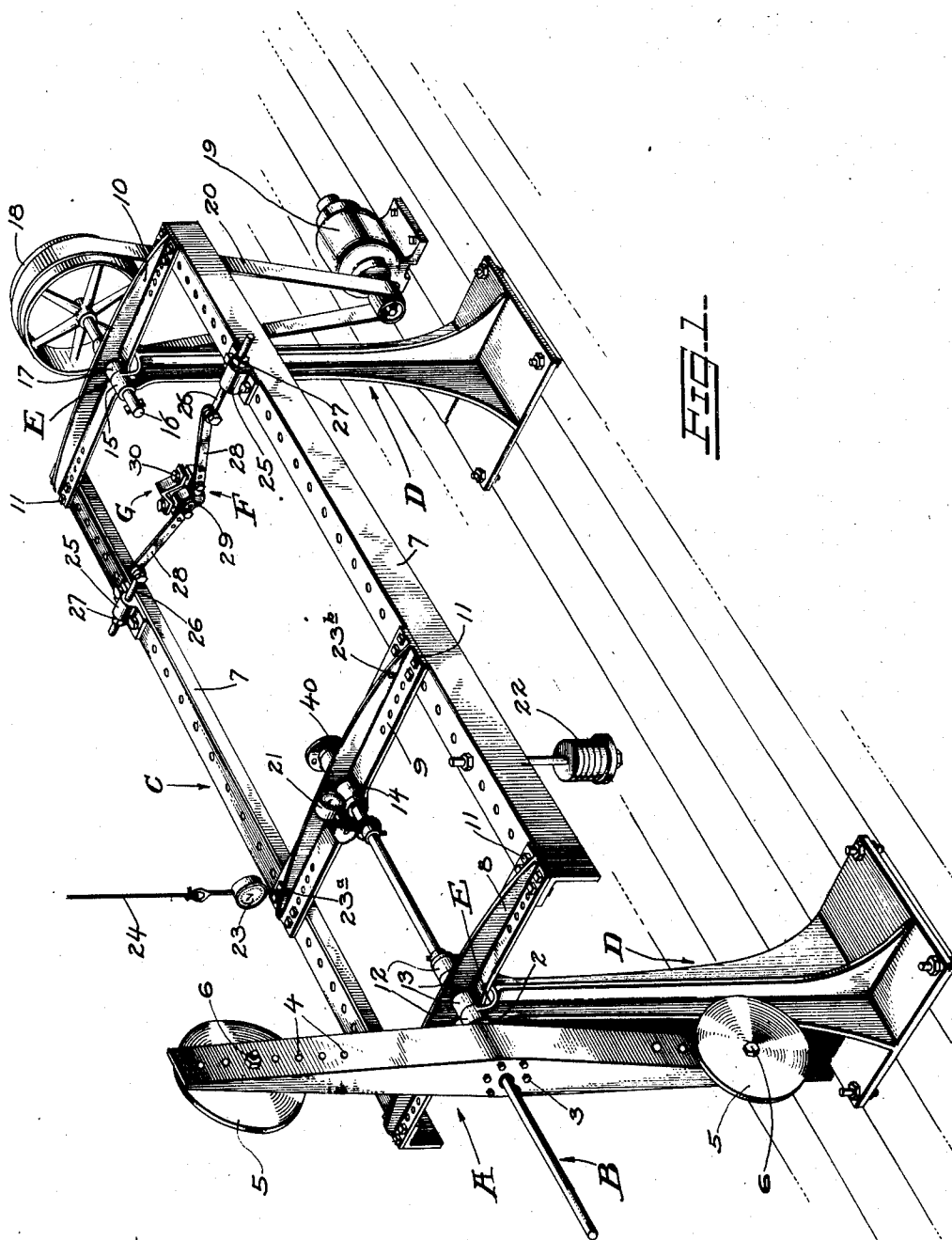


FIG. 1

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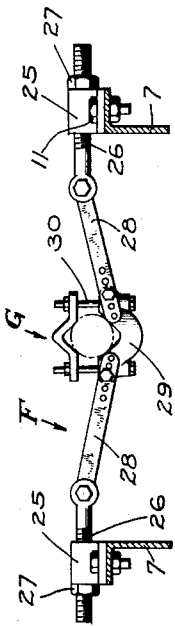


FIG. 3.

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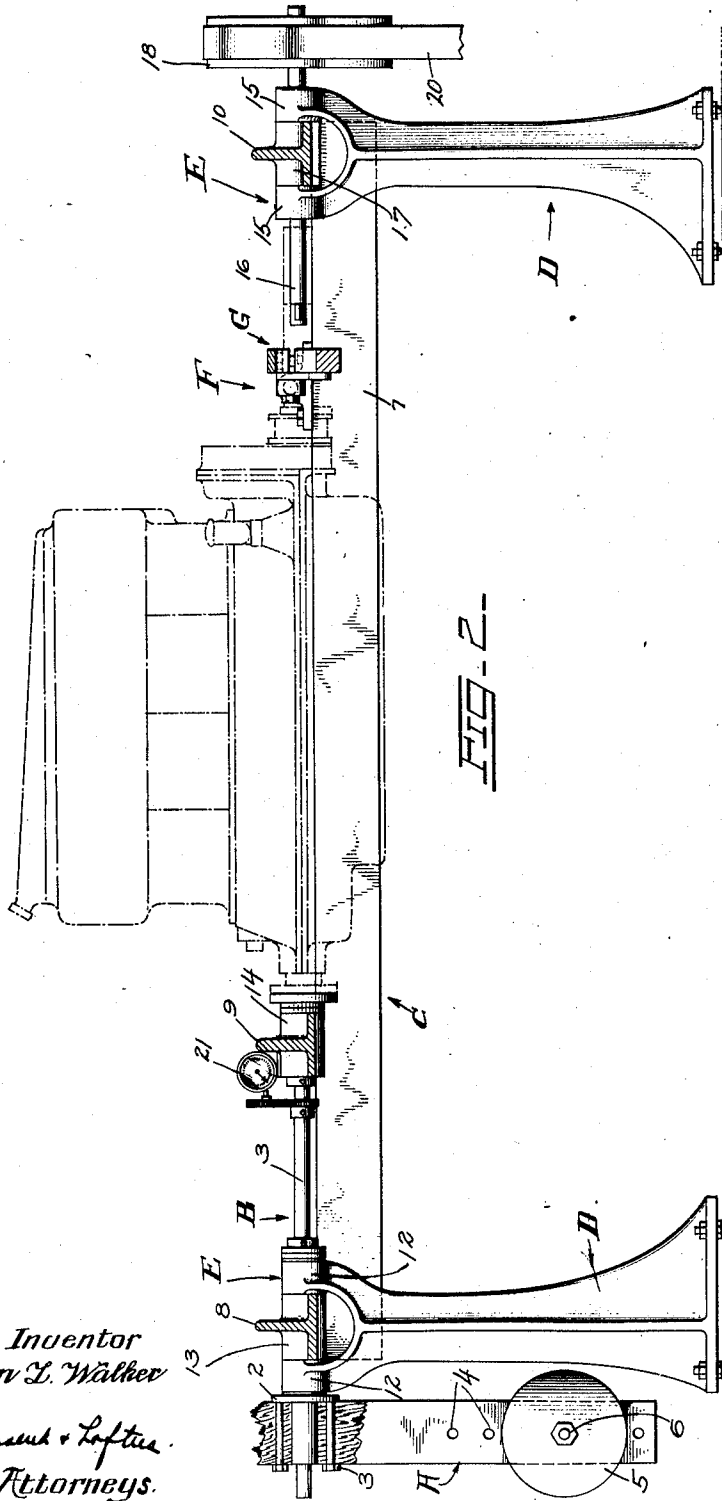


FIG. 2.

UNITED STATES PATENT OFFICE.

CLINTON L. WALKER, OF PIEDMONT, CALIFORNIA.

DYNAMOMETER.

Application filed April 14, 1924. Serial No. 706,225.

To all whom it may concern:

Be it known that I, CLINTON L. WALKER, a citizen of the United States, residing at Piedmont, county of Alameda, and State of California, have invented new and useful Improvements in Dynamometers, of which the following is a specification.

This invention relates to a dynamometer, and especially to that type employing a fan or propeller as a resistance or braking medium.

The general idea of employing a fan or propeller for testing the horse-power of an engine or of connecting the engine to a propeller to impose a working load thereon is old as a number of dynamometers of this type are on the market and in use today, but they are not entirely satisfactory as they usually depend upon a careful calibration of the propellers and changing of the propellers when testing engines or motors of different sizes or horse-power.

It might further be stated that calibrated propellers are otherwise unsatisfactory as they are dependent upon atmospheric conditions both as to pressure and moisture content, and as these conditions change from day to day and even from hour to hour considerable trouble is encountered. Changes in atmospheric conditions may, of course, be allowed for and taken into consideration when making computations, but they impose additional work and technical skill and as such are impractical when the average testing room is taken into consideration.

The object of the present invention is to generally improve and simplify the construction and operation of dynamometers of the character described and to overcome the objections above referred to; to provide a propeller which is adjustable to a considerable range or difference in horse-power; to entirely obviate the necessity of employing a calibrated propeller; to provide a mounting for the motor to be tested, which is pivotally supported and which tilts on its pivots due to the reaction set up between the propeller and the motor; and further, to provide means for simultaneously indicating the speed or revolutions per minute of the motor and the pull or reaction transmitted to the tilting frame, thus rendering

it possible to instantly compute the horse-power of a motor at any speed and without considering atmospheric conditions or otherwise.

The invention more specifically stated embodies an uncalibrated propeller, a frame for the reception of the motor, a trunnion support for the frame to permit tilting of the frame when reaction is set up between the propeller and the motor, a scale whereby the load or reaction is indicated, and a tachometer or revolution counter.

With this equipment, horse-power may be computed at any speed without changing the propeller or considering atmospheric conditions; the horse-power being computed by multiplying the revolutions per minute by the load indicated on the scale in pounds, and dividing this product by 33000 or some other suitable number as will hereinafter be described, having reference to the accompanying specification and drawings, in which—

Fig. 1 is a perspective view of the dynamometer and the trunnion supported frame upon which the motor is supported when a horse-power test is being made.

Fig. 2 is a side elevation of the propeller, the trunnion supported frame, etc., said side elevation being partially in section and also showing the position of the motor when undergoing a test.

Fig. 3 is an enlarged detail view of the adjustable cross-bar.

Referring to the drawings in detail, and particularly to Fig. 1, A indicates, in general, the propeller, B the shaft to which it is attached, C the frame upon which the motor is placed when undergoing a test, D standards upon which the frame is supported, and E trunnion bearings formed at the upper ends thereof which serve the function of forming a pivotal support for the frame and the motor positioned thereon.

The propeller is club shaped, as shown in Fig. 1, and is suitably secured to the shaft B by a flange 2 and bolts 3. The club is constructed of wood or any other suitable material and is carefully balanced to eliminate vibration. A plurality of evenly spaced holes 4 are drilled or otherwise formed in the outer face of the club and fan blades

or disks 5 are secured thereto by means of bolts 6.

The frame C consists of a pair of side bars 7 constructed of angle iron or the like, and three or more cross-bars as indicated at 8, 9 and 10; these cross-bars being preferably permanently attached by bolts or rivets as indicated at 11, where the device is employed for testing standard sized motors.

The standards D, as previously stated, form a support for the frame. Each standard is forked at its upper end to form interspaced bearings 12. The shaft B extends through the bearings 12 and also through bearings 13 and 14 formed in the cross-bars 8 and 9, respectively. The standard disposed at the opposite end is similarly forked to form a pair of bearings 15, and a shaft 16 extends through these bearings and also through bearings 17 formed in the cross-bar 10. The shafts B and 10 thus form trunnion bearings or supports for the frame which permits free tilting movement thereof.

The shaft 16 is provided with a pulley 18 and this may be driven from an electric motor 19 or other suitable source of power through means of a belt 20; the belt drive being only employed when running in a motor, and when conducting a friction test, as will hereinafter be described.

The frame is otherwise provided with a suitable form of tachometer, as shown at 21, by which the revolutions of the propeller and motor may be visibly indicated, and it is furthermore provided with adjustable weights 22 and a scale 23; the scale being attached to the cross-arm 9 and to an overhead support, not here shown, by means of a cable 24; the scale indicating in pounds the pull or reaction of the motor when under test and the tachometer the revolutions; the amounts indicated being multiplied and divided by 33000 or any other suitable number when computing the horse-power.

The frame is otherwise provided with a cross-arm generally indicated at F. This arm is vertically adjustable and it supports a central clamp, generally indicated at G, which is provided for the reception of the bearing of the motor to be tested.

The cross-member F is perhaps best illustrated in Fig. 3. It consists of bearing members 25 secured to the side frames 7. These bearings are internally threaded for the reception of bolts 26. These bolts are laterally adjustable and are secured when adjusted by means of lock-nuts 27. The inner ends of the bolts form bearing members for links 28; the links being pivotally attached to the bolts at their outer ends and to a bearing clamp 29 at their inner ends. This bearing clamp is made in two sections as shown; the upper section being adjustable and being secured by means of bolts and

nuts 30; that is, the rear bearing hub or extension on different motors varies in diameter and the adjustment provided takes care of such variations. The general adjustability of the cross-member F furthermore takes care of motors of the three point suspension type and practically any type of motor can thus be placed on the frame. If a four-point suspension type is being tested, the motor will be bolted to the side frames 7, but if a three-point suspension is employed, the forward end of the motor will be supported by the cross-arms and the rear end by the bearing clamp G. Again, if the crank shaft of the motor does not align with the cross-members 8 and 9, or in other words the shaft B, it is possible to position plates or shims between the cross-members and the side frames so as to raise the same, or it is possible to provide offset cross-arms where it is desired to lower the shaft B.

In actual operation the motor, whether of the three or the four point suspension type, is placed on the frame and suitably secured by means of bolts or the like. The crank shaft is then bolted to the shaft B by the coupling indicated at 40 and the motor when so positioned is then balanced for pivotal movement about the trunnion bearings; this being accomplished by attaching one or more adjustable weights such as shown at 22. The blades 5 are then positioned to afford the proper resistance for the motor to be tested and it is then only necessary to start the motor and to run it at any speed or revolutions per minute desired. The reaction between the motor and the fan causes a tilting movement of the frame and this tilting movement exerts a pull on the scale 23. The scale will thus indicate the pull in pounds, while the tachometer will indicate the number of revolutions. The numbers thus indicated are multiplied with each other and the product divided by 33000. In the present instance the number 3000 is preferred as the scale is attached to the cross-arm 9 at a point which measures 21 inches plus a few thousandths. In other words the point of attachment presents a lever arm of such length that the numeral 3000 may be employed as a substitute for 33000. Thus, by multiplying the revolutions per minute with the pull in pounds indicated on the scale and dividing this product by 3000, the actual horse-power produced is immediately obtained.

The use of a calibrated propeller is obviated; atmospheric conditions need not be considered, and propellers of various sizes are obviated, as the blades 5 may be adjusted by moving them inwardly or outwardly on the club as desired. Thus engines of various sizes and horse-power may be taken care of. The shaft 16 may be coupled to the crank

shaft in any suitable manner when it is desired to run it in previous to testing or otherwise, and it is for this reason that the belt drive and motor 19 are employed. This is, of course, disconnected when a horse-power test is being made and the shaft 16 then merely functions as one of the trunnion bearings.

While certain features of the present invention are more or less specifically illustrated, I wish it understood that various changes in form and proportion may be resorted to within the scope of the appended claims. I similarly wish it understood that the materials and finish of the several parts employed may be such as the experience and judgment of the manufacturer may dictate or various uses may demand.

By referring to Fig. 1 of the drawings it will be noted that the cross-bar 9 is provided with two perforations such as indicated at 23^a and 23^b. When the scale 23 is attached to one side, a horse-power reading is obtained by the reaction of the motor under its own power. When the scale 23 is attached to the other side and the motor is driven by the pulley 18, the friction load in the motor is measured and the horse-power consumed is computed in the same manner as for a power test. It is customary to run the friction test immediately following a power test so as to get the same speed and the same engine temperatures and the oil in the same condition as for the power test. Having determined the brake horse-power and the friction horse-power, the indicated horse-power is determined by adding the brake horse-power and the friction horse-power. It might be stated that it is important to measure and know the friction produced in a motor as many designs are discarded on account of excessive friction. Thus by obtaining both it is possible to determine whether the motor is practical when considered from both angles.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. A device of the character described, comprising a pivotally supported frame for the reception of a motor, a shaft extending through the pivotal support, means permitting the motor to be connected to said shaft to rotate the same, a resistance member rotatable with the shaft and attached thereto, and means for resisting tilting movement of the frame.

2. A device of the character described, comprising a pivotally supported frame for the reception of a motor, a shaft extending through the pivotal support, means permitting the motor to be connected to said shaft to rotate the same, a resistance member

rotatable with the shaft and attached thereto, and means for resisting tilting movement of the frame, and for measuring the resistance in pounds.

3. A device of the character described, comprising a pivotally supported frame for the reception of a motor, a shaft extending through the pivotal support, means permitting the motor to be connected to said shaft to rotate the same, a resistance member rotatable with the shaft and attached thereto, means for resisting tilting movement of the frame, and for measuring the resistance in pounds, and means for determining the revolutions per minute of the shaft.

4. A device of the character described, comprising a rectangular shaped frame, comprising a pair of side bars, a pair of cross-bars disposed at one end and connecting the side bars, a cross-bar disposed at the opposite end and connecting the side bars, bearing members formed on the respective cross-bars, a pair of standards, bearings formed at the upper ends of the standards, a shaft extending through the bearings of the first named cross-bars and one of the standards, and journaled in the respective bearings, a second shaft extending through the bearings of the other standard and the bearings of the last named cross-bar, said shaft and the first named shaft forming a trunnion support for the frame, and said frame adapted to receive a motor, means for connecting the motor with the first named shaft so that the motor may rotate the same, a resistance member adapted to be secured to said shaft, and a scale attached to one side of the frame for resisting tilting of the frame about the trunnion bearings, and for visibly indicating the resistance in pounds.

5. A device of the character described, comprising a rectangular shaped frame, comprising a pair of side bars, a pair of cross-bars disposed at one end and connecting the side bars, a cross-bar disposed at the opposite end and connecting the side bars, bearing members formed on the respective cross-bars, a pair of standards, bearing formed at the upper ends of the standards, a shaft extending through the bearings of the first named cross-bars and one of the standards, and journaled in the respective bearings, a second shaft extending through the bearings of the other standards and the bearings of the last named cross-bar, said shaft and the first named shaft forming a trunnion support for the frame and said frame adapted to receive a motor, means for connecting the motor with the first named shaft so that the motor may rotate the same, a resistance member adapted to be secured to said shaft, a scale attached to one side of the frame for resisting tilting of the frame about the trunnion bearings, and for visibly

indicating the resistance in pounds, and thereto, means for rotating the connected
means for balancing the motor and the shafts to determine the friction produced 10
frame. in the motor, and means for resisting tilting

6. A device of the character described, movement of the frame caused by reaction
5 comprising a pivotally supported frame for of the motor and for measuring the resist-
the reception of a motor, a shaft extending ance in pounds.
through the pivotal support, means permit-
ting the motor crank shaft to be connected

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