(No Model.)

J. WARING.

MAGNETIC TACHOMETER.

No. 446,488. Patented Feb. 17, 1891.

Fig. 1

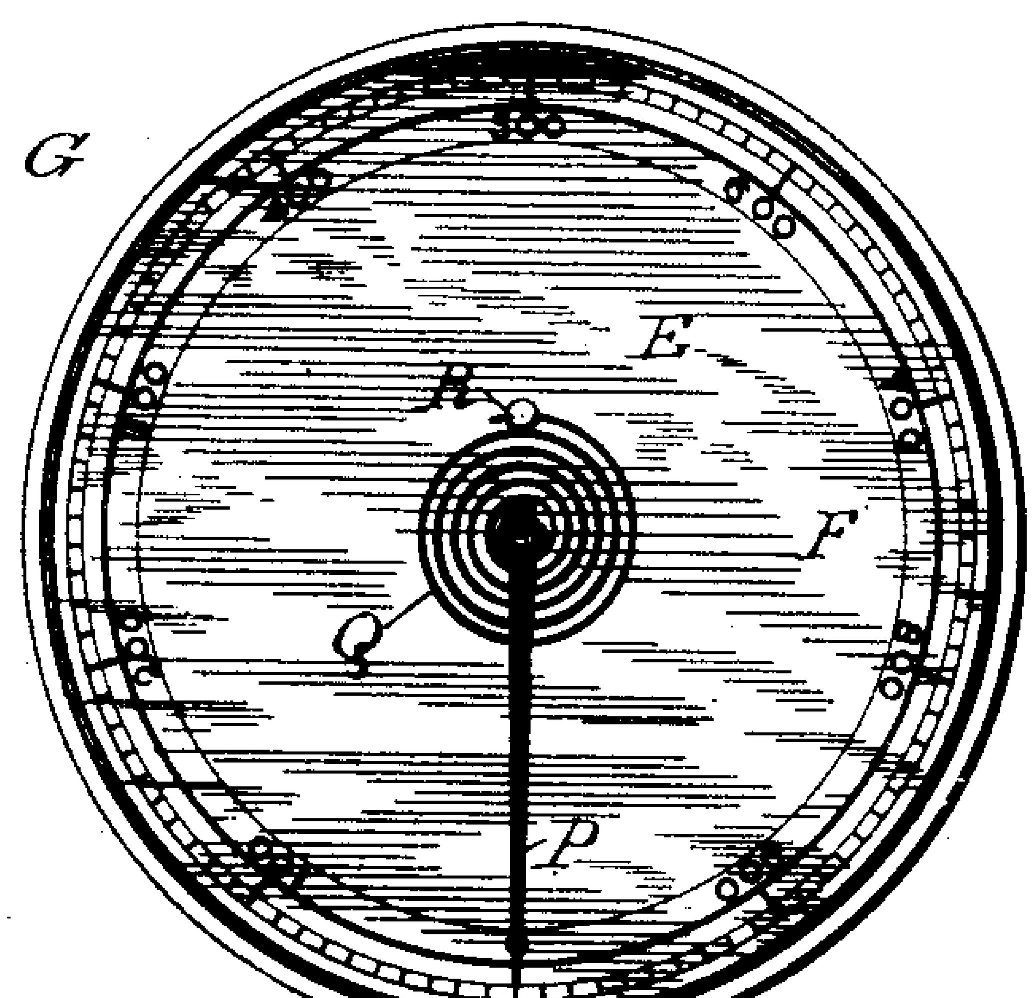


Fig. 2

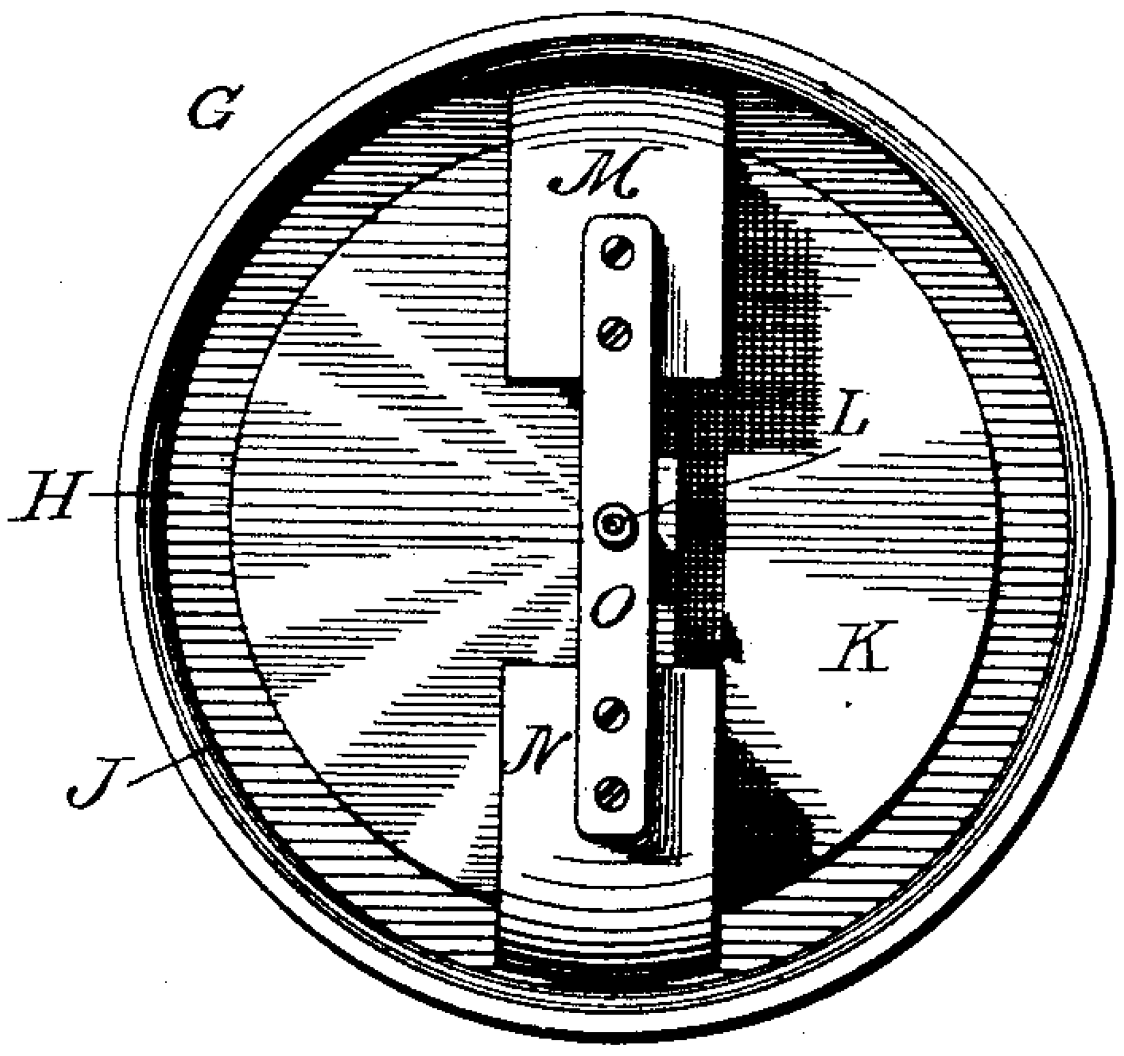
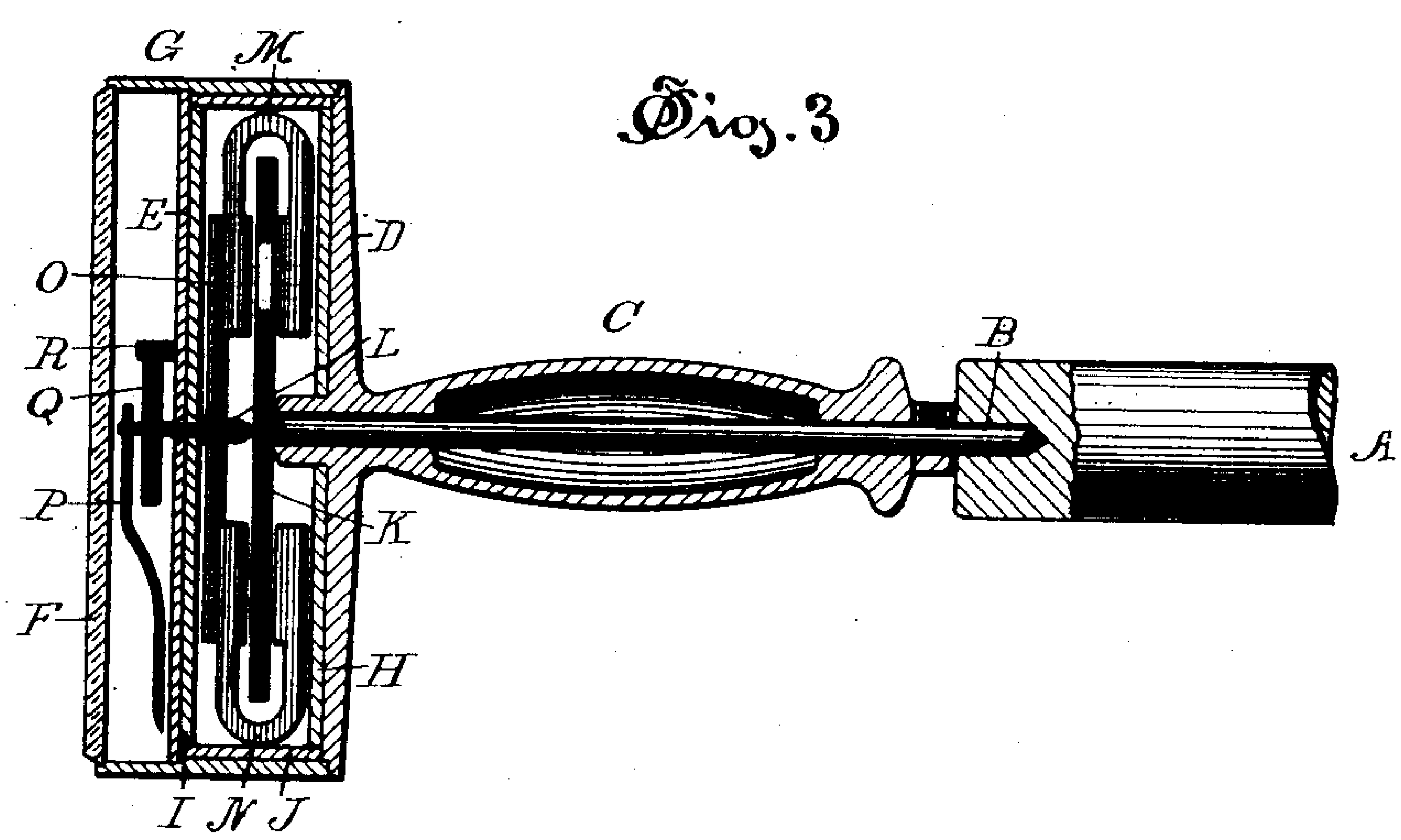


Fig. 3



Witnesses:

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UNITED STATES PATENT OFFICE.

JOHN WARING, OF MANCHESTER, CONNECTICUT.

MAGNETIC TACHOMETER.

SPECIFICATION forming part of Letters Patent No. 446,488, dated February 17, 1891.

Application filed September 4, 1890. Serial No. 363,947. (No model.)

To all whom it may concern:

Be it known that I, JOHN WARING, of Manchester, Connecticut, have invented a new and useful Tachometer, of which the following description and claims constitute the specification, and which is illustrated by the accompanying sheet of drawings.

This is a magnetic tachometer, and is believed to be the first magnetic tachometer.

Figure 1 of the drawings is a view of the face of the instrument. Fig. 2 is a view of the interior of the instrument; and Fig. 3 is central vertical longitudinal section of the same, showing also the end of a shaft to the axis of which it is applied.

The letter A indicates a shaft of any machine, to which the tachometer may be applied by the rigid insertion in the end of the axis thereof of the shaft B of the instrument. The latter shaft revolves in bearings in the stationary handle C, and that handle carries a stationary outer case, which is composed of the disk D, the dial E, the glass face F, and the annular part G uniting their peripheries, as shown in Fig. 3. A stationary inner case, consisting of the disks H and I and the annular part J uniting them and made of soft iron, is preferably placed within the outer case behind the dial. That end of the shaft B which extends from the inner end of the handle C is fixed to the center of the flat copper disk K. The spindle L turns in a bearing in the center of the disk K and in another bearing in the center of the dial E, so that its axis is on a line with the axis of the shaft B. The permanent horseshoe-magnets M and N are fixed to the outer ends of the double arm O, so that the opposite poles of each magnet are at opposite sides of the disk K, and so that the two magnets are at diametrically-opposite sides of the center of the disk K, and the center of the arm O is fixed to the spindle L. The pointer P is fixed to the outer end of the spindle L, and the coiled spring Q has one of its ends fixed to the spindle L and its other end fixed to the stud R.

The mode of operation is as follows: The shaft B and the disk K being fixed together, and the former being axially fixed to the shaft A, the disk K revolves with the speed of the shaft A, which is the speed to be measured by the instrument. The revolution of the disk K between the poles of the magnets M and N tends to draw those magnets along with the disk and thus to cause the arm O to revolve in the same direction with the disk K; but the revolution of the arm O is resisted by the spring Q, and the effect of that resistance is in inverse proportion to the tendency of the magnets M and N to revolve with the disk K, and that tendency is in direct proportion to the speed of the revolutions of that disk. Therefore the magnets M and N and the arm O revolve through a greater or less number of degrees of a circle before that revolution is stopped by the resistance of the spring Q, according as the revolutions of the disk K are more or less rapid and according as the magnets M and N are more or less magnetic and the spring Q is less or more strong. It is expedient to so adjust the magnetism of the magnets and the strength of the spring to each other as that the greatest speed of the shaft to be measured will cause the arm O, the spindle L, and the pointer P to turn through not more than one revolution. Thus, for example, if the greatest speed to be measured is one thousand revolutions per minute, and if the magnetism of the magnets and the strength of the spring are so related to each other that that speed will cause the arm O, the spindle L, and the pointer P to revolve through one revolution and then rest, a speed of five hundred revolutions per minute would cause the arm O, the spindle L, and the pointer P to revolve through one-half of a revolution and there rest. The dial of Fig. 1 is graduated on this basis and shows how the pointer P will indicate by its more or less advanced position on the dial the number of revolutions per minute of the shaft B and the disk K at any particular moment of time.

The inner soft-iron case is not indispensable to the instrument, but it is preferably employed to partly shield the disk K and the magnets M and N from exterior magnetism. The disk K may be made of some other metal than copper, and an armature having any one of many other forms than that of a disk may be employed instead of the disk K. One magnet of proper strength may be used instead of two, and such magnet or magnets may be fixed to the shaft B so as to revolve therewith, while the disk K is fixed to the spindle L instead of contrariwise, as shown in the drawings, and electro-magnets may be used instead of permanent magnets, and may be energized by a current conducted to them in any one of several ways which will suggest themselves to electricians. Indeed, this instrument is capable of many modifications of form, arrangement, and combination, and therefore, and because the invention is a primary one, I do not confine myself to any particular combination, arrangement, or form.

I claim as my invention—

1. A magnetic tachometer consisting of an armature fixed to one shaft or spindle, one or more magnets fixed to another shaft or spindle, and a spring or its equivalent so constructed and placed as to resist the tendency of the armature and the magnet or magnets to revolve together.

2. The combination of the shaft B, the disk K, the magnets M and N, the spindle L, and the spring Q, all substantially as described.

JOHN WARING.

Witnesses:

ALBERT H. WALKER,
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