N. GRAY.

MAGNETIC REVOLUTION COUNTER.

APPLICATION FILED OCT. 8, 1920.

1,419,253.

Patented June 13, 1922.

4 SHEETS—SHEET 1.

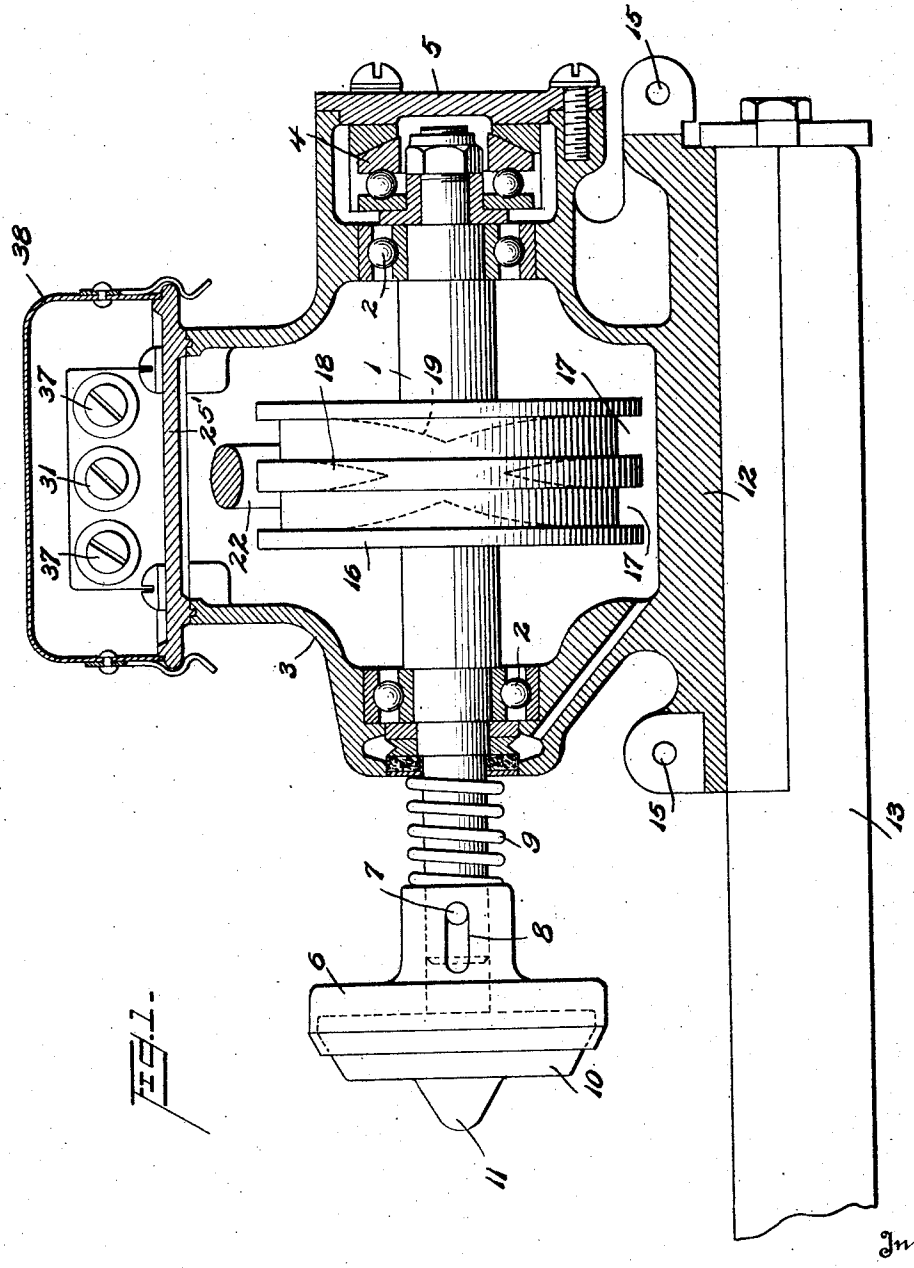


FIG. 1.

Inventor

Neil Gray

By Robert H. Young

Attorney

N. GRAY.

MAGNETIC REVOLUTION COUNTER.

APPLICATION FILED OCT. 8, 1920.

1,419,253. Patented June 13, 1922.

4 SHEETS—SHEET 2.

FIG. 4.

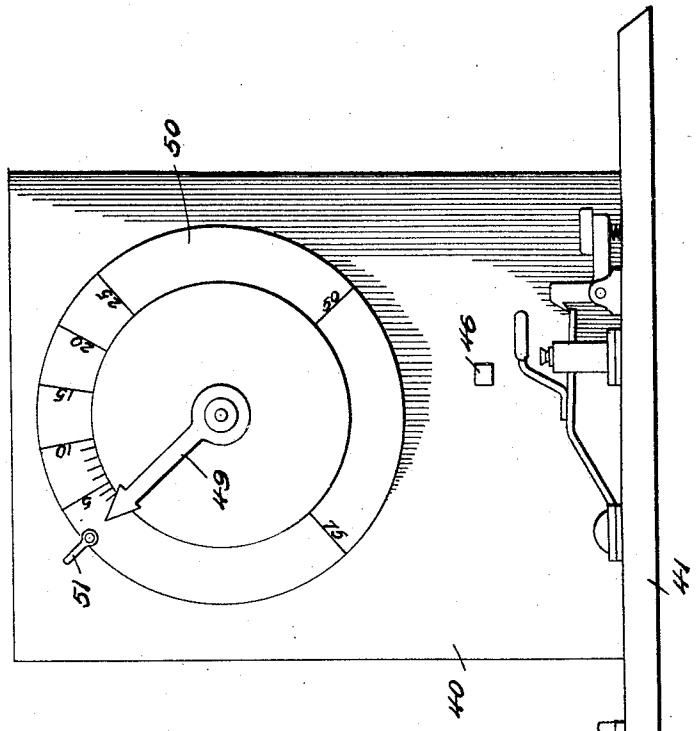
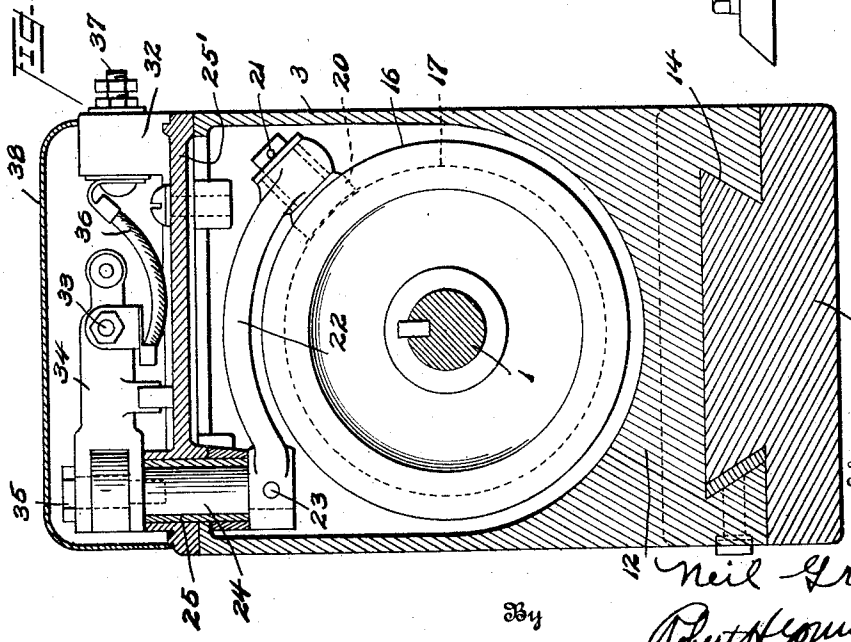


FIG. 2.



Inventor

Neil Gray.

By Robert H. Young

Attorney

N. GRAY.

MAGNETIC REVOLUTION COUNTER.

APPLICATION FILED OCT. 8, 1920.

1,419,253. Patented June 13, 1922.

4 SHEETS—SHEET 3.

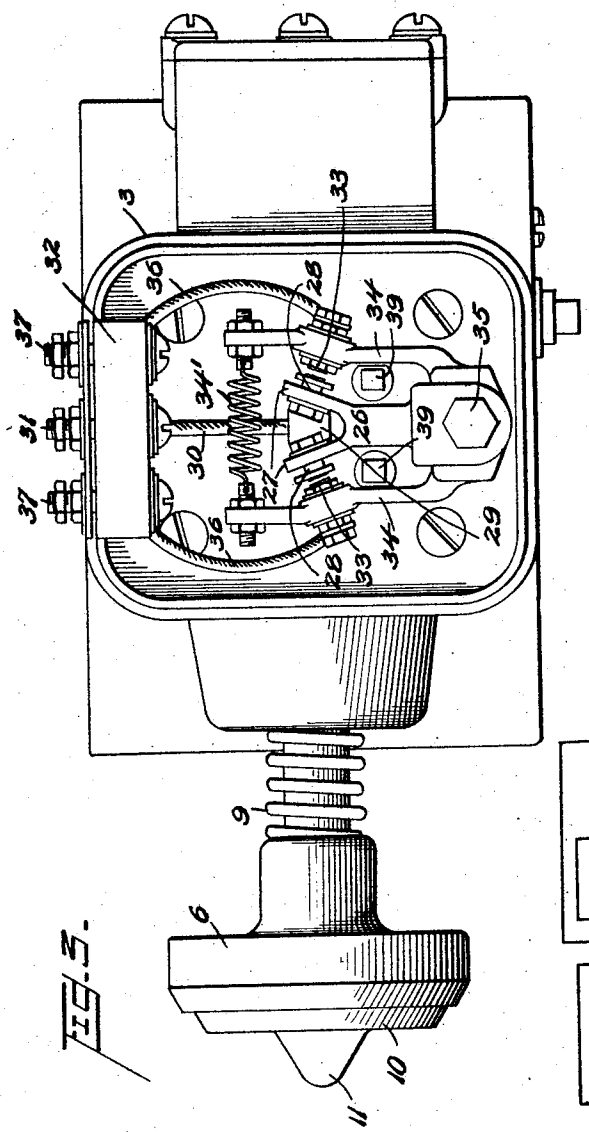


FIG. 5.

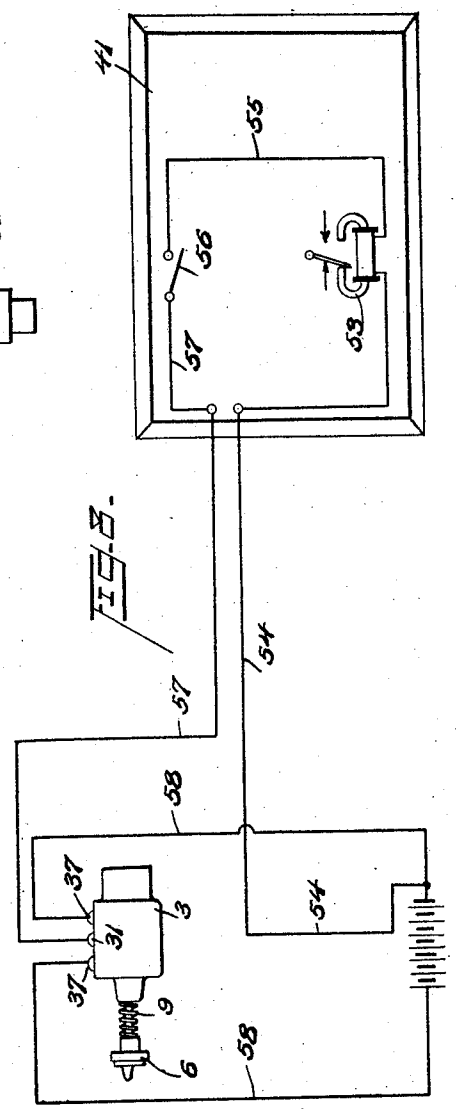


FIG. 6.

Inventor

Neil Gray

By Robert Young

Attorney

N. GRAY.

MAGNETIC REVOLUTION COUNTER.

APPLICATION FILED OCT. 8, 1920.

1,419,253.

Patented June 13, 1922.

4 SHEETS—SHEET 4.

FIG. 6.

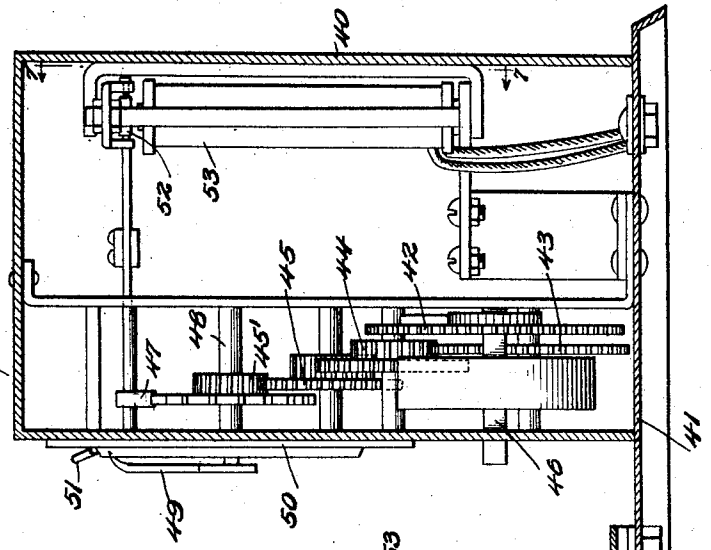


FIG. 7.

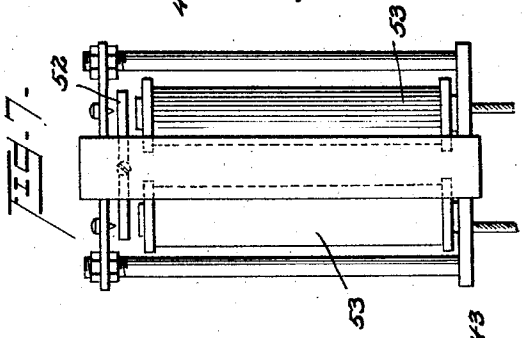


FIG. 5.

Inventor

Neil Gray

By Robert H. Young

Attorney

UNITED STATES PATENT OFFICE.

NEIL GRAY, OF DAYTON, OHIO.

MAGNETIC REVOLUTION COUNTER.

1,419,253. Specification of Letters Patent. **Patented June 13, 1922.**

Application filed October 8, 1920. Serial No. 415,528.

To all whom it may concern:

Be it known that I, NEIL GRAY, a citizen of the United States, residing at McCook Field, Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Magnetic Revolution Counters, of which the following is a specification.

My invention relates to a magnetic revolution counter, the broad object in view being to provide an apparatus of the character referred to which will accurately count or register the revolutions of any shaft, engine, motor, or machinery of any kind where it is required to note the speed of the shaft at different stages, as for example when computing the horse power of an engine of any kind, motors and propellers.

In calculating the horse power of engines and the thrust of propellers, for example, it is important to note the speed of rotation of the shaft at different times and under different operating conditions in order to lay off the horse power curves and compare the efficiency of different engines under same conditions and different types of propellers.

The invention hereinafter particularly described is especially valuable in places where it would be inconvenient to get access to the end of a shaft with the ordinary hand revolution indicator or counter. The improved counter is adapted to be attached to any engine, turbine or shaft, the indicating member or unit of the instrument being placed in any convenient position and at any desired distance from the remainder of the device, as, for example, on the engineer's operating deck or in the captain's cabin or the pilot's house of a vessel, the apparatus embodying circuit wires which may be led from one part of the apparatus to the other irrespective of location and distance. The apparatus forming the subject-matter of this invention has been accurately tested up to the speed of 3,000 R. P. M.; it operates by a positive movement for each revolution, differing therein from the ordinary electric or friction drive tachometer or speed counter.

The apparatus comprises two main units consisting of a rotary polarity reversing switch and an indicating mechanism controlled by such reversing switch.

With the above and other objects in view the invention consists in the novel construction, combination and arrangement herein fully described, illustrated and claimed.

In the accompanying drawings:

Figure 1 is a vertical longitudinal section of the rotary polarity reversing switch;

Figure 2 is a vertical cross section through the same taken about in line with the cam;

Figure 3 is a plan view thereof with the snap cover removed;

Figure 4 is a front elevation or face view of the indicator;

Figure 5 is a vertical transverse section through the same showing the gearing of the escapement mechanism;

Figure 6 is a fore and aft section through the indicator taken about in line with the arbor of the indicating hand or pointer;

Figure 7 is a fragmentary vertical section on the line 7—7 of Figure 6; and

Figure 8 is a diagram of the complete apparatus showing the wiring system.

The rotary polarity reversing switch will first be described. Said switch comprises a rotary shaft 1, which is preferably mounted in anti-friction ball bearings 2 adjacent to the opposite ends thereof and supported within a casing or housing 3, preferably oil tight, for a purpose which will appear. Associated with the shaft 1 is also an end thrust bearing 4 held in place within an extension of the housing 3 by means of a detachable end plate 5.

At the end of the shaft 1 opposite the bearing 4 there is secured to the shaft 1, so as to rotate therewith, a friction head 6 capable of a limited movement longitudinally of the shaft 1 by means of a pin or key 7 and slot 8, the head 6 being backed by a thrust spring 9 to maintain permanent frictional contact between the friction head 6 and the end of a shaft, the speed of rotation of which is to be registered. The head 6 carries a face member 10 of frictional material, such as rubber or a composition of rubber, said friction face member being shown as provided with a central frictional protuberance 11 for direct contact with the shaft end.

The casing or housing 3 embodies a supporting base 12 having a dovetailed sliding engagement with a stationary base 13 as shown at 14. The base 12 is provided at opposite ends thereof with eyes 15 in order to enable an operating cable (not shown) to

be attached thereto, thus enabling an operating cable to be passed around suitable guiding pulleys and connected with an operating member, such as a hand lever, for example, whereby the operator may at any time throw the shaft 1 into and out of frictional engagement with the shaft, the speed of rotation of which is to be noted.

Fast on the shaft 1 within the casing 3 is a generally cylindrical cam 16 having circumferential grooves 17 in the outer peripheral face thereof, said grooves being laterally spaced from each other by means of an intervening web or annular rib 18. The grooves 17 are interconnected by cross over grooves or ways 19 extending in reverse and oblique directions, and in conjunction with the cam 16 I employ a swiveled or pivotally mounted shoe 20. The shoe 20 has a shank or stem 21 which is journaled in a bearing opening in the free end of an operating arm 22 extending above the cam and connected by a key or pin 23 to the lower end of an upright rock shaft 24. The shaft 24 passes through an oil tight bearing 25 in the top wall or cap plate 25′ of the housing 3. Above the plate 25′ and fastened to the rock shaft 24 by means of a key or equivalent thereof is an oscillatory contact or switch arm 26, having its free end forked as indicated at 27. Attached to the forked ends of the arm 26 are circuit contact pieces 28 facing in opposite directions, said contact pieces being insulated by means of a block 29 of insulating material. The contacts 28 are electrically connected by a conductor 30 to a central binding post 31 extending through and insulated from a supporting block 32. Arranged at opposite sides of the switch arm 26 are other contacts 33 which are insulated from but carried by opposed arms 34 mounted upon a common pivot post 35 which however enables the arms 34 to swing independently of each other. A contractile spring 34′ connects the arms 34 to maintain one set of contacts in contactual relation to each other but permitting the opposite arm 34 to move independently. The contacts 33 are connected by flexible conductors 36 to binding posts 37 at opposite sides of the binding post 31, above referred to, and supported by the same block 32. A snap cover or hood 38 extends over the mechanism just above described and is detachably applied to the plate 25′ hereinabove referred to. Stops 39 are provided to limit the inward movement of the arms 34 toward each other.

The indicator, forming the other main unit of the apparatus, comprises a casing or framework 40 mounted upon a suitable supporting base 41 and containing a train of gears 42, 43, 44, 45 and 45′ similar to the ordinary escapement movement of a clock mechanism, 46 designating the winding arbor of such clock mechanism, and 47 representing the escapement pawl or lever, the parts just referred to being clearly shown in Figure 5. The arbor 48 of the escapement wheel extends through the front of the casing and has an indicating hand 49 fast thereon. The hand 49 is adapted to sweep around a graduated dial 50, which is normally stationary but which may be adjusted axially around the arbor 48 by means of a suitable thumb piece or handle 51. This enables the dial 50 to be moved until the zero mark thereon registers with the pointer or hand 49. This renders it unnecessary to set the hand 49 in starting a new operation of the indicator, the dial 50 being adjusted or set in lieu thereof.

Referring particularly to Figures 6 and 7 it will be observed that the arbor of the verge 47 carries a permanent bar magnet or armature 52, the opposite ends of which are alternately attracted and repelled by polarized relay magnets 53 suitably fast in casing 40 and electrically connected with the rotary polarity reversing switch hereinabove described. The wiring connections are illustrated in the diagrammatic view, Figure 8, wherein it will be seen that the neutral wire 54 of the battery extends to one side of the polarized relay 53, the opposite side or magnet of said relay being connected by wire 55 with one pole of a quick action snap switch 56 which may be quickly manipulated by hand when the counting is to begin. From the opposite side of the switch 56 a wire 57 extends to the central binding post 31 of the reversing switch. Wires 58 extend from the opposite negative binding posts 37 of the reversing switch to the positive and negative binding posts of the battery.

The operation of the apparatus is as follows: The polarity reversing switch is moved into position by any suitable means, such as the means above described. Such movement is continued until the frictional contact member at the end of the rotary shaft 1 moves to driving contact with the shaft, the revolutions of which are to be counted. As the shaft 1 rotates, the direction of flow of the current is changed, causing the magnets of the relay to alternately attract and repel the armature, thereby causing a rocking movement of the verge arbor and a corresponding rocking movement of the escapement pawl 47. As this takes place, the hand 49 revolves with an intermittent movement entirely around the dial. In actual use contact is first made with the shaft, the speed of rotation of which is to be registered. The dial is then turned so as to register zero with the hand. The operator then quickly closes the snap switch 56 at the moment that the second hand of his watch reaches the point where the observation is to be made. The operator now notes

the number of revolutions made by the pointer or hand 49 and when the second hand of his watch reaches the point determined by him, the switch 56 is opened. Thus is determined the exact number of revolutions of the shaft per minute. It matters not how far the indicator may be removed from the polarity reversing switch as the only connections between the switch and indicator consist of wires or electrical conductors which of course may be of any length. Furthermore, the polarity reversing switch may be operated in any position or at any angle.

I claim:

1. A magnetic revolution counter embodying an indicating member, an escapement mechanism to operate said member, an electric circuit, a polarity-reversing switch in said circuit, and a polarized relay between said switch and escapement mechanism, said switch comprising a rotary shaft, an oscillatory switch arm, a cam on said shaft to operate said arm, and circuit contacts in the path of said arm.

2. A magnetic revolution counter embodying an indicating member, an escapement mechanism to operate said member, an electric circuit, a polarity-reversing switch in said circuit, including a rotary shaft adapted to be driven by frictional contact, and a polarized relay between said switch and escapement mechanism.

3. A magnetic revolution counter embodying an indicating member, an escapement mechanism to operate said member, an electric circuit, a polarity-reversing switch in said circuit, and a polarized relay between said switch and escapement mechanism, said switch comprising a rotary shaft, a cam on said shaft, a rock shaft, an operating arm on said shaft oscillated by said cam, a switch arm on said rock shaft, and opposed circuit contacts in the path of said arm.

4. A magnetic revolution counter embodying an indicating member, an escapement mechanism to operate said member, an electric circuit, a polarity-reversing switch in said circuit, and a polarized relay between said switch and escapement mechanism, said switch comprising a rotary shaft, a cam on said shaft, a rock shaft, an operating arm on said shaft oscillated by said cam, a switch arm on said rock shaft, and opposed yieldably sustained circuit contacts in the path of said arm.

In testimony whereof I have affixed my signature.

NEIL GRAY.