D. M. BELL.

SPEEDOMETER.

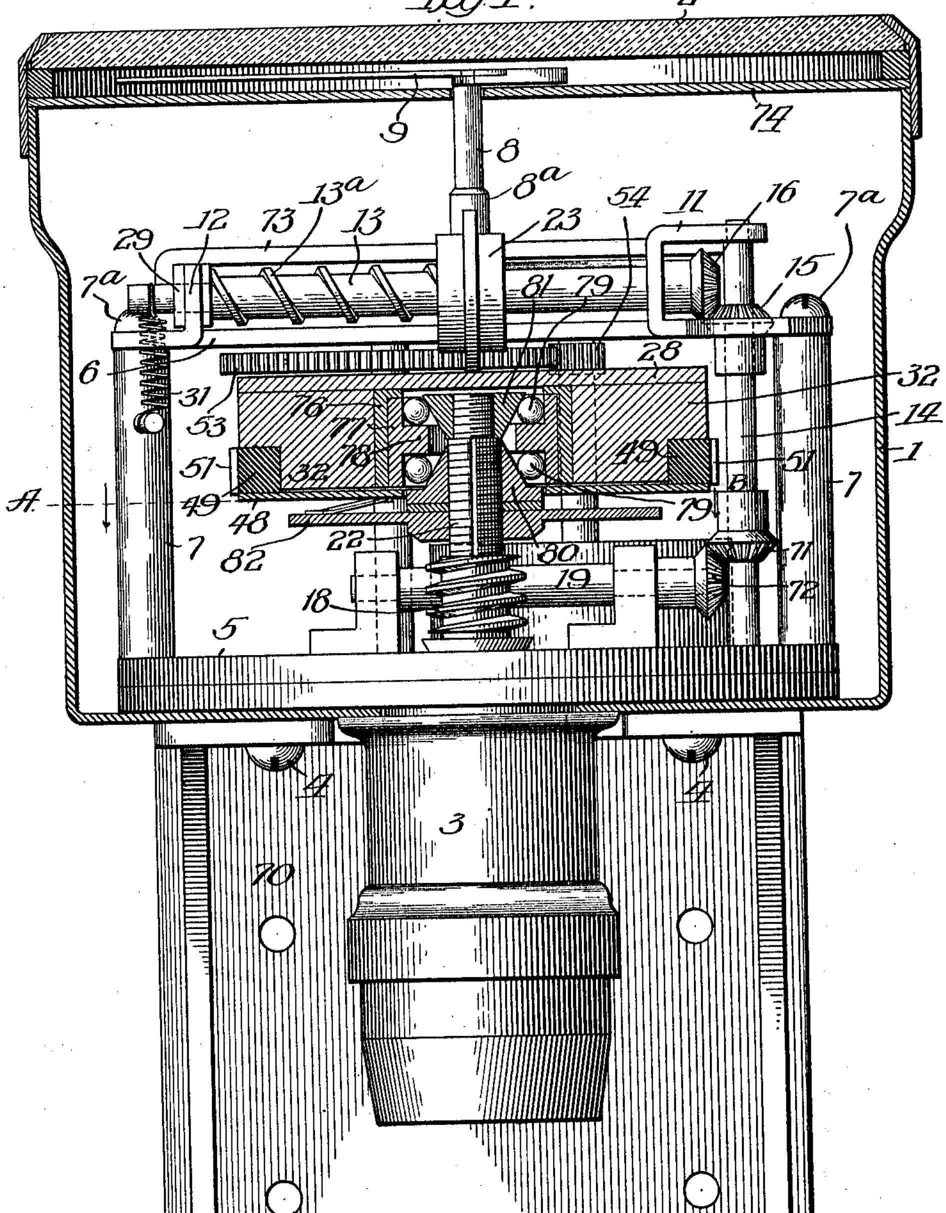
APPLICATION FILED JUNE 2, 1911.

1,004,347.

Patented Sept. 26, 1911.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

Geo. C. Davison

Harold G. Barrett

Inventor:

Dillwyn M. Bell

By Barton & Folk,

Attys.

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3 SHEETS—SHEET 2.

Fig. 2

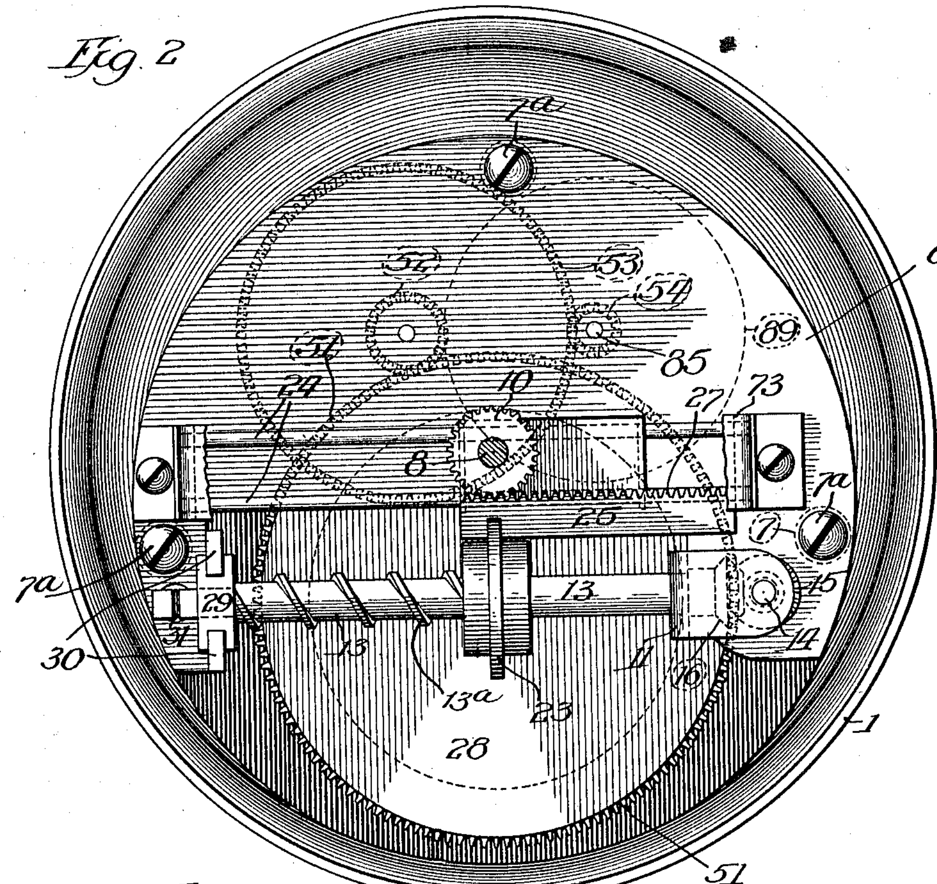
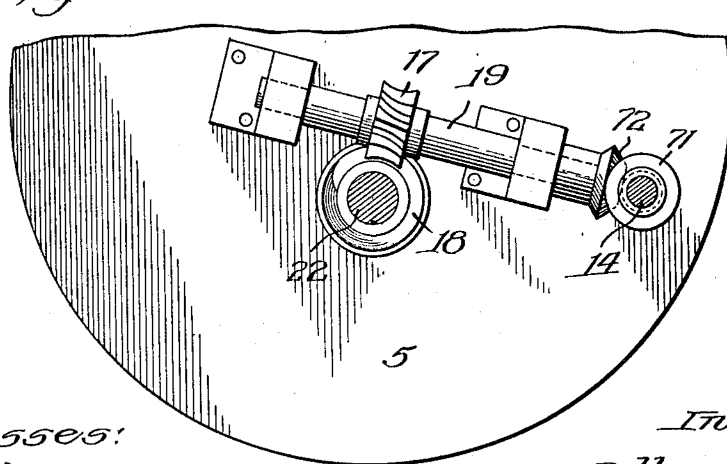


Fig. 3



Witnesses:
Geo. C. Irvine
Harold G. Barrett

Inventor
Dillwyn M. Bell.
By Barton & Folk Attys.

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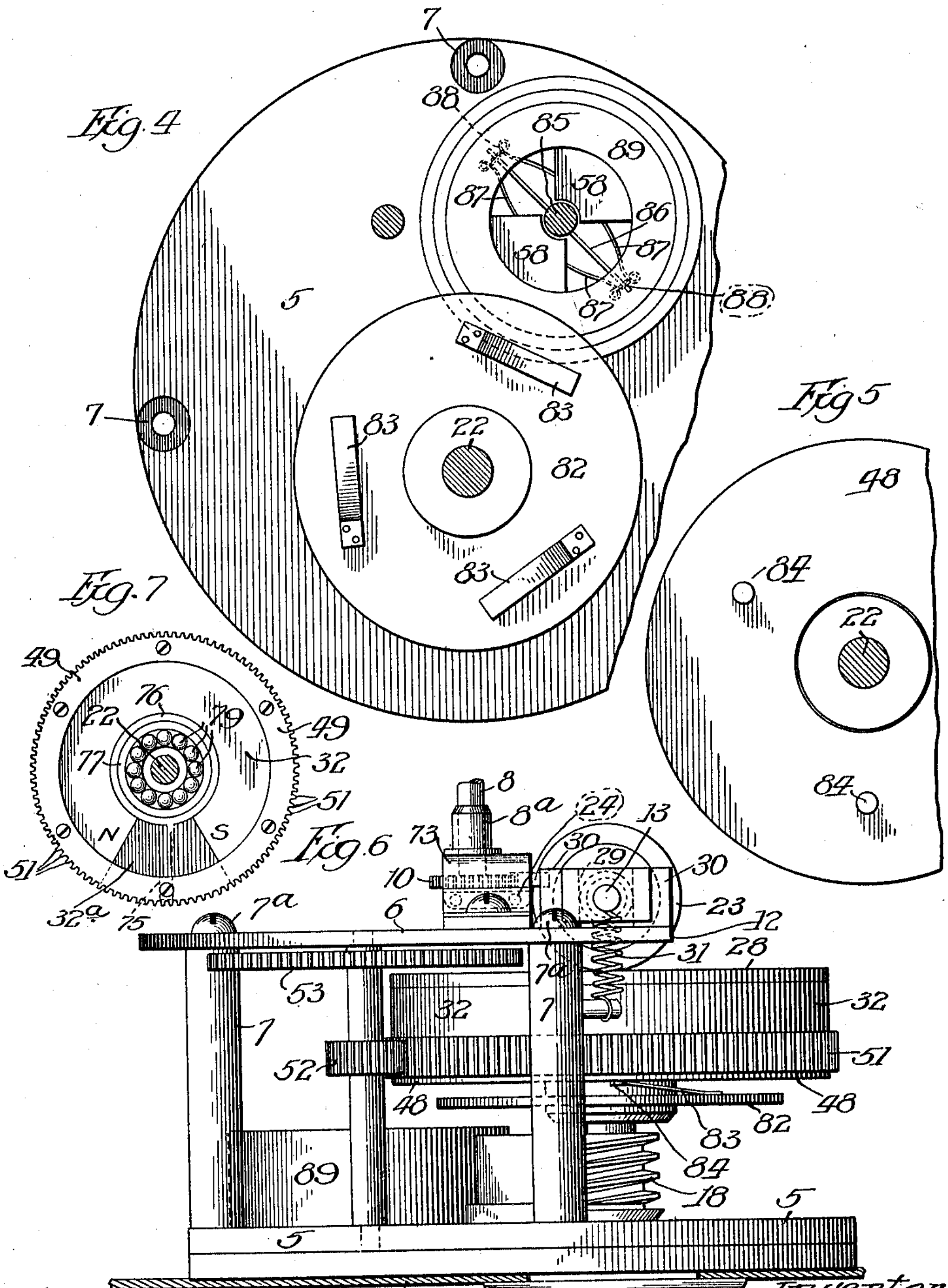
3 SHEETS—SHEET 3.



Witnesses:
Geo. E. Jorison
Harold G. Barrett

Inventor
Dillwyn M. Bell
By Barton & Folk,
Attys.

UNITED STATES PATENT OFFICE.

DILLWYN M. BELL, OF OAK PARK, ILLINOIS, ASSIGNOR TO WILLIAM J. ANDERSON AND GEORGE F. LEWIS, BOTH OF CHICAGO, ILLINOIS.

SPEEDOMETER.

1,004,347. Specification of Letters Patent. **Patented Sept. 26, 1911.**

Application filed June 2, 1911. Serial No. 630,840.

To all whom it may concern:

Be it known that I, Dillwyn M. Bell, citizen of the United States, residing at Oak Park, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Speedometers, of which the following is a full, clear, concise, and exact description.

My invention relates to speedometers and constitutes an improvement upon the speedometer disclosed in my Letters Patent No. 957,727, granted May 10th, 1910. Its object is to simplify the structure of the invention of the above-mentioned Letters Patent and to reduce the cost of manufacturing the speedometer.

Both in the invention of my aforementioned patent and in my present invention the principle of operation of the speedometer is based upon the actuation of an indicating means, such as an index needle, by the resultant action of two movements, one a constant predetermined movement given to a rotary object, preferably a rotary disk, and the other a variable movement proportional to the speed which is to be indicated by said indicating means. Likewise in both cases the rotary disk is driven through the action of the magnetic attraction between a rotary magnet and its rotary armature. In the former case the magnet is shown as driven from a shaft coupled to the object the speed of rotation of which is to be measured, and said magnet in turn drives, by magnetic pull, the rotary armature to which the disk is mechanically coupled; in my present invention, the rotary armature is driven from said shaft, and said armature in turn drives, by magnetic pull, the rotary magnet to which the disk, in this instance, is mechanically coupled. While my present invention is thus broadly the same as that of my aforementioned patent, there are certain improvements in details which constitute my present invention.

The several features of my present invention may be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a vertical central section through the casing of the speedometer and through the mechanism inclosed therein; Fig. 2 is a plan view with the face of the casing and the dial plate removed; Fig. 3 is a detail view partly in horizontal section and partly in plan; Fig. 4 is a detail top plan view on the line A—B of Fig. 1; Fig. 5 is a bottom plan view of the armature disk; Fig. 6 is a side elevation, viewed from the left of Fig. 1 of the mechanism contained in the casing, with parts broken away for the sake of clearness of illustration; Fig. 7 is a bottom plan view on a reduced scale of the rotary magnet.

Like figures of reference refer to like parts throughout the several views. It will also be noted that parts shown in the accompanying drawings are designated by the same reference figures heretofore given to similar parts in the drawings of my aforementioned Letters Patent.

In the embodiment of my invention shown in the drawings, the speedometer casing 1 is provided with the usual crystal or protecting glass cover 2 for the top thereof and a journal bearing 3 is preferably arranged beneath the casing. The speedometer mechanism itself is self-contained and is removable as a unit from said casing, being held therein by screws 4 which extend through the bottom of the casing into a circular plate 5 forming the base of said self-contained mechanism. The screws 4 also serve to secure the casing to the supporting bracket whereby the speedometer may be suitably mounted. The circular lower plate 5 and an upper segmental plate 6 are connected near their peripheries by a plurality of standards 7, said plates and standards constituting a supporting frame for the mechanism. Screws 7^a serve to clamp the plate 6 to the standards 7.

Mounted in suitable bearings provided in brackets 11, 12 is a rotary shaft or screw 13, provided with a thread 13^a. The shaft 13 is driven from the vehicle wheel, axle or other rotating object, the speed of which is to be measured, in any desirable manner, preferably, by a vertical spindle 14 provided at its upper end with a bevel gear 15 which meshes with a similar gear 16 carried upon the end of the shaft 13. The lower end of said spindle is provided with a bevel gear 71 which meshes with a similar gear 72 carried by a spindle 19. The spindle 19 is provided at its other end with a worm wheel 17 which is in engagement with a worm 18 of a rotary spindle 22. The rotary spindle 22 may in turn be connected in any suitable manner with the wheel or other rotary object whose speed is to be measured. It is evident, therefore, that the shaft 13 is rotated at a speed proportionate to the speed of rotation of the rotating mechanism to which the speedometer is connected.

Mounted on the shaft 13 and engaging the thread 13^a thereof is a traveler wheel 23. When the speedometer is attached to an automobile, for example, to measure the speed thereof the traveler wheel 23 tends, while the automobile is in motion, to move from approximately the center of the shaft 13 over the threads 13^a toward the end of the said shaft.

Mounted upon one side of the shaft 13 and in parallel relation thereto are two rods 24, 24 which are supported by the yoke or bracket 73 mounted on top of the plate 6 and extending approximately diametrically of the casing 1. The rods 24, 24 constitute tracks for a carriage 25. Said carriage 25 is slotted to receive the rim of the traveler wheel 23, the carriage being thus adapted to be moved by said traveler wheel. The carriage 25 carries a rack 27 which meshes with a pinion 10 affixed to the lower end of a rotatable pin 8. Said pin 8 has bearings in a sleeve 8^a mounted upon the yoke 73. The upper end of the pin 8 projects through the dial plate 74 and carries an index needle or hand 9. The motion of the traveler wheel 23 is thus communicated to the index needle 9.

The shaft 13 extends diametrically across a disk 28 to which a constant predetermined rotary motion is given in a manner to be presently described. The traveler wheel may thus have a movement radially of the disk 28. The periphery of the traveler wheel 23 is brought into such engagement with the face of the disk 28 that the rotation of said disk tends to move said wheel in a direction opposite to the movement imparted to it by the screw 13, the result of such differential action being that said traveler wheel will assume a position at which the two opposite driving actions to which it is subjected exactly balance each other. It is desirable that the engagement of the traveler wheel with the face of the disk be such as to insure the proper coöperation of said disk with said wheel, but it is also desirable that no such unnecessary pressure be exerted as would cause undue wear or other detrimental action. For this reason the disk 28 is preferably made of iron or other magnetic material and is magnetized in the manner hereinafter set forth. One end of the shaft 13 is preferably mounted in a yielding bearing 29 supported in guide blocks 30, a slight downward pressure being exerted upon the spindle 13 by a spring 31. If the disk 28 is made of magnetic material the pressure of the spring 31 need not be more than is necessary to bring the periphery of the traveler wheel 23 in contact with the face of the disk 28, since the magnetic attraction exerted by the disk 28 upon the wheel 23 is sufficient to produce a proper coöperation between said wheel and disk. The traveler wheel is preferably made of hard steel, such material being capable of resisting wear and at the same time possessing such magnetic properties as will cause it to coöperate with the magnetic disk 28.

The disk 28 is given a rotary movement by means of a magnet 32. In the present case the disk 28 is secured to the magnet 32 by welding or in other suitable manner, the disk 28 thus in effect being integral with the magnet 32. The magnet 32 is preferably annular in shape, the two poles N and S of which are suitably spaced apart and a filling block 32^a of brass or similar non-magnetic material is interposed between the two poles of the magnet. A screw 75 is preferably used to secure the brass block 32^a to a brass bushing 76 which surrounds the interior perimeter of the annular magnet.

The magnet 32 is rotatably mounted upon the rotary spindle 22. Secured in the bushing 76 is a hub 77 having an interior annular flange 78 forming a track for balls 79 which are held upon said track by cones 80, 81 threaded upon the spindle 22. The magnet 32 is thus rotatably mounted on the spindle 22 so that it can rotate independently of said spindle. The brass bushing 76 is employed in order to afford considerable reluctance to the flux from the magnet 32 and thus to prevent such magnetization of the parts of the ball-bearing as would interfere with the proper operation thereof.

Immediately below the magnet 32 is an annular armature 48 of iron or other suitable magnetic material which loosely surrounds the cone 80 carried by the spindle 22. The armature 48 is preferably maintained out of direct contact with the magnet 32 though it is desirable to bring it in as close proximity as possible without direct contact. For this reason a washer 49 is placed between the annular magnet 32 and the annular armature 48, the armature being cut away about its circumference to receive said washer. The washer 49 is preferably made of fiber or other suitable material which will be both durable and of such character as will produce practically no friction between the armature and the magnet. The armature is thus supported upon the magnet through the washer 49 and is held in place by the magnetic attraction between said armature and said magnet.

Threaded on the spindle 22 beneath the armature 48 is a disk 82, said disk being secured to and rotating with the spindle 22. Said disk 82 is provided upon its upper surface with a series of spring fingers 83, the free ends of which are adapted to engage with pins 84 projecting from the under side of the armature 48. The fingers 83 and the pins 84 provide, as it were, a pawl and ratchet connection between the disk 82 and the armature 48, whereby in the forward rotation of the spindle 22 the armature 48 is thereby rotated, through the disk 82, fingers 83 and pins 84, at the same speed of rotation as the spindle 22. The magnet 32 is made of such strength that the magnetic attraction between said magnet and its armature 48 is sufficiently great for the magnet 32, and hence the disk 28, to be rotated by the armature 48 at the same rate of rotation as said armature, except that means, now to be described, are provided by which the magnet and the disk carried thereby are prevented from exceeding a predetermined speed.

The periphery of the washer 49 is provided with pinion teeth 51 which drive a train of gears 52, 53, 54 and through said train of gears a centrifugal governor provided with weighted governor arms 58, 58. Such centrifugal governor is preferably of the construction shown more fully in Fig. 4 in which a spindle 85, which carries the pinion 54 of the last of said train of gears, is provided with a pin 86 extending therethrough. Both springs 87, 87 are provided at their opposite ends with loops 88 which loosely surround the pin 86. Midway between the ends of each of the springs 87 are supported the weights 58, 58 which are preferably segmental. When the speed of rotation of the magnet 32 and the disk 28 reaches the maximum velocity for which said disk is adjusted, the centrifugal action of the governor throws the weights 58 into frictional engagement with a casing 89 surrounding said weights, thereby producing a braking action which prevents the disk from exceeding a predetermined speed. It is obvious, therefore, that the magnet 32 and the disk 28 are capable of being driven, by reason of the magnetic pull between the magnet and its armature 48, up to a certain predetermined speed, whereupon increased speed of rotation of the armature 48 will fail to produce any additional speed of rotation of the disk 28, owing to the provision of the means for preventing said magnet from exceeding a predetermined speed.

The predetermined maximum speed of rotation of the disk 28 is regulated to correspond with the graduations of the speed indicating dial or vice versa. It is necessary to have the speed of the disk 28 constant under normal operating conditions, and such constant speed may be, for example, approximately sixty revolutions per minute. As soon as a speed is reached which represents the lowest speed which the speedometer is designed to indicate, the speed of rotation of the spindle 22 and armature 48 carried thereby will be that determined upon as the operative, constant speed of the disk 28. This latter speed, it will be understood, is likewise the maximum speed of rotation of said disk 28. While, therefore, an increase in speed of rotation of the vehicle wheel, or other rotating object whose speed is to be measured, will drive the spindle 22 and in turn the armature 48 and the screw 13 at correspondingly increased speed, nevertheless the speed of the magnet 32 and the disk 28 carried thereby will remain unaltered owing to the action of the braking mechanism which prevents the disk from exceeding its predetermined operative speed.

Briefly the operation of the speedometer is as follows: At speeds lower than that which the speedometer is designed to indicate and consequently before the disk 28 gets up to its normal speed, the spindle 22, armature 48, magnet 32 and disk 28 rotate at the same rate. At such low speeds the shaft 13 rotates at such low rate that, as soon as the wheel 23 travels a slight distance away from the center of said disk, the tendency of the wheel 23 to travel on the thread 13^a is overcome by the opposing action of the disk 28. Thus the traveler wheel is maintained so near to the center of the disk that it does not appreciably actuate the index needle, said needle being moved very slightly and therefore merely indicating that the object to which it is attached is in motion, but not indicating the rate of motion.

As the speed of the spindle 22 increases, the disk 28 continues to be driven from said spindle, through the magnet 48, at the same rate as said spindle until finally a speed is reached which the speedometer is designed to indicate. When this latter speed is reached, the disk 28 is rotating at its normal or operative speed, which is likewise the maximum speed of said disk. The traveler wheel 23 meanwhile has moved on the thread 13^a to a position radially of the disk 28 at which the driving action of the shaft 13 on said wheel 23 is balanced by the counterdriving action of said disk. The position of the wheel 23 determines the position of the carriage 25. As hereinbefore described the index needle is actuated from said carriage 25 through the rack 27 and pinion 10. A further increase in the speed of rotation of the spindle 22 will produce a corresponding increase in speed of rotation of the shaft 13, but the governor mechanism associated with the magnet and disk will prevent any corresponding increase in the speed of the disk 28. Though the magnet 32 is driven through the magnetic pull between it and its armature 48, the governor mechanism maintains the magnet 32, and consequently the disk 28 carried thereby, at a constant speed. Though there is thus, under operative conditions, relative movement between the magnet and its armature, wear due to friction is negligible, since the washer 49 maintains the armature out of frictional engagement with the magnet. In short, under operative conditions, the speed of the disk 28 is a constant factor and the speed of the shaft 13 is a variable factor corresponding to the speed of rotation of the rotating object whose speed is being measured. Upon an increase in the speed of rotation of the shaft 13, the traveler wheel 23 moves over the thread 13^a and therefore radially of the disk 28, said wheel always assuming a position at which the two opposing actions to which it is subjected exactly balance each other. The actuation of the traveler wheel produces a corresponding actuation of the indicating needle.

If the speed of the spindle 22 is decreased at any time, the traveler wheel is correspondingly moved nearer to the center of the disk 28. If the movement of the spindle 22 be suddenly stopped, as by the stopping of the vehicle to which the speedometer is attached, the shaft 13 likewise comes to rest, and the rotation of the magnet 32, due to inertia, quickly returns the traveler wheel 23 to the center of the disk 28 and thus moves the index needle to its zero position. The pawl and ratchet drive between the spindle 22 and the armature 48 readily lends itself to such return of the parts to zero indicating position, the spring fingers 83 of the disk 82 riding over the pins 84.

What I claim is:

1. In a speedometer, the combination with two rotary elements, one of said elements comprising a magnet and the other an armature for said magnet, of a rotary driving spindle upon which said rotary elements are loosely mounted, pawl and ratchet mechanism for driving one of said rotary elements from said rotary spindle, whereby the other of said elements is indirectly driven from said spindle through the magnetic attraction between said magnet and its armature, means associated with said indirectly driven rotary element and responsive to the speed of rotation thereof for preventing said indirectly driven rotary element from exceeding a predetermined speed, indicating means, variable speed mechanism and means for driving the same at a speed proportionate to the speed to be indicated by said indicating means, and means responsive to the resultant action of said indirectly driven rotary element and said variable speed mechanism for actuating said indicating means.

2. In a speedometer, the combination with a rotary spindle adapted to be driven by an object whose speed is to be measured by the speedometer, of an annular magnet-armature surrounding said spindle, means whereby said armature is driven from said spindle, a rotary magnet mounted in proximity to said magnet-armature and adapted to be driven from said spindle by the magnetic attraction between said magnet and said armature, governor mechanism associated with said magnet and responsive to the speed of rotation thereof for preventing said magnet from exceeding a predetermined speed, indicating means, variable speed mechanism driven at a speed proportionate to the speed of said rotating object, and means responsive to the resultant action of said magnet and said variable speed mechanism for actuating said indicating means.

3. In a speedometer, the combination with a rotary driving spindle, of two rotary elements loosely mounted to rotate about said driving spindle, one of said elements comprising a magnet and the other an armature for said magnet, pawl and ratchet mechanism for directly driving one of said rotary elements from said spindle, whereby the other of said rotary elements is indirectly driven from said spindle through the magnetic attraction between said magnet and its armature, a disk carried by said indirectly driven rotary element, means associated with said indirectly driven rotary element and responsive to the speed of rotation thereof for preventing said indirectly driven rotary element and the disk carried thereby from exceeding a predetermined speed, a rotary screw, a traveler-wheel mounted on said screw, said traveler wheel having its periphery in engagement with the surface of said disk, means for driving said rotary screw from said rotary spindle, indicating means, and means actuated from said traveler wheel for actuating said indicating means.

4. In a speedometer, the combination with a casing, of a bearing supported upon the exterior of said casing, a rotary spindle journaled in said bearing and extending into the interior of said casing, said spindle being provided with a worm, a shaft having a worm wheel meshing with said worm, a rotary screw, said shaft and screw being each provided with a bevel-gear, a connecting shaft having at its opposite ends bevel-gears meshing with said bevel-gears on the shaft and screw, a traveler wheel threaded on said rotary screw, a rotary disk with which said traveler wheel contacts, means whereby said disk is driven from said rotary spindle, said means including a magnet and its armature, means associated with said disk and responsive to the speed of rotation thereof for preventing said disk from exceeding a predetermined speed, indicating means, and means actuated from said traveler wheel for actuating said indicating means.

5. In a speedometer, the combination with

a rotary armature and means for driving said armature, a rotary magnet mounted in proximity to said armature and adapted to be rotated by the rotation of said armature, a disk carried by said magnet, means associated with said magnet and responsive to the speed of rotation thereof for maintaining a constant maximum speed of rotation of said disk, a traveler wheel having its periphery in engagement with said disk, said traveler wheel being mounted to rotate upon its own axis and to travel radially of said disk, means tending to impart to said traveler wheel a speed of rotation proportional to the speed to be measured, indicating means, and means actuated from said traveler wheel for actuating said indicating means.

6. In a device for indicating the speed of rotation of a rotating object, the combination with a rotary driving spindle, of a cylindrical magnet having a rotary ball-bearing mounting upon said rotary spindle, an annular armature for said magnet, said armature loosely surrounding said spindle, means for driving said armature from said spindle and thereby driving said magnet, governor mechanism associated with said magnet whereby said magnet is regulated to rotate at a predetermined speed, variable speed mechanism and means for driving the same at a speed proportional to the speed of said rotating object, and speed-indicating mechanism constructed and arranged to be differentially actuated by said magnet and said variable speed mechanism.

7. In a speedometer, the combination with a driving spindle, of a disk secured to said spindle to rotate therewith, a cylindrical magnet rotatably mounted upon said spindle above said disk, said magnet being provided at its upper end with a disk surface, an annular armature loosely surrounding said shaft between said disk and said magnet, a pawl and ratchet connection between said disk and armature, a rotary screw and means for driving the same from said driving spindle, a traveler wheel mounted on said screw, said traveler wheel having its periphery in engagement with said disk surface of said magnet, governor mechanism associated with said magnet for preventing said magnet from exceeding a predetermined speed, indicating means, and means actuated from said traveler wheel for actuating said indicating means.

In witness whereof, I hereunto subscribe my name this 23rd day of May, A. D., 1911.

DILLWYN M. BELL.

Witnesses:

McClelland Young,

Raymond M. Place.