R. K. EVANS.

MAGNETO IMPULSER.

APPLICATION FILED JULY 29, 1918.

1,287,659.

Patented Dec. 17, 1918.

2 SHEETS—SHEET 1.

Fig. 1

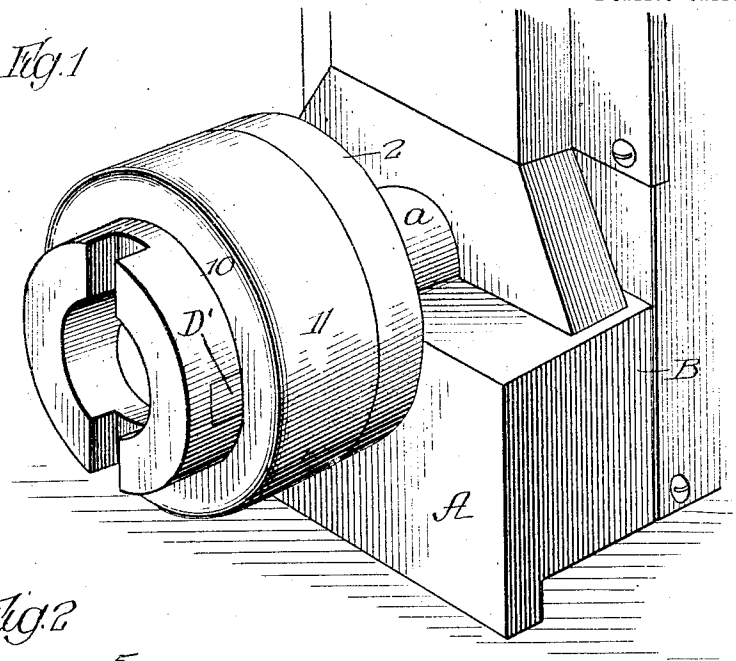


Fig. 2

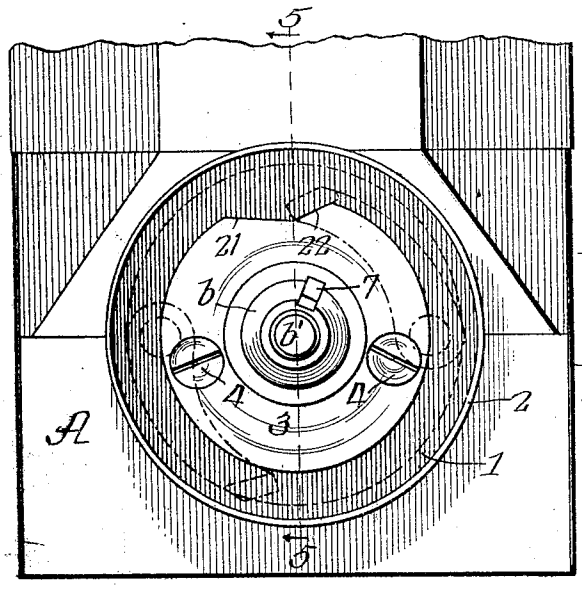


Fig. 3

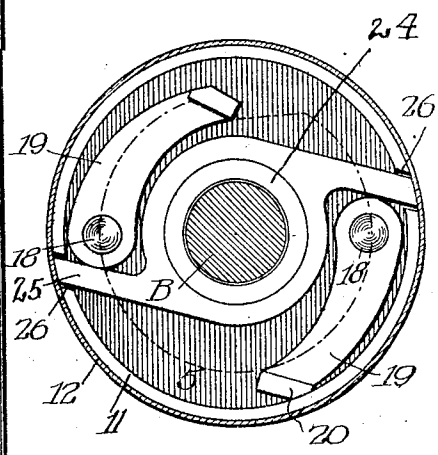
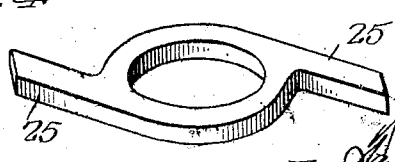


Fig. 4



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2 SHEETS—SHEET 2.

Fig. 5

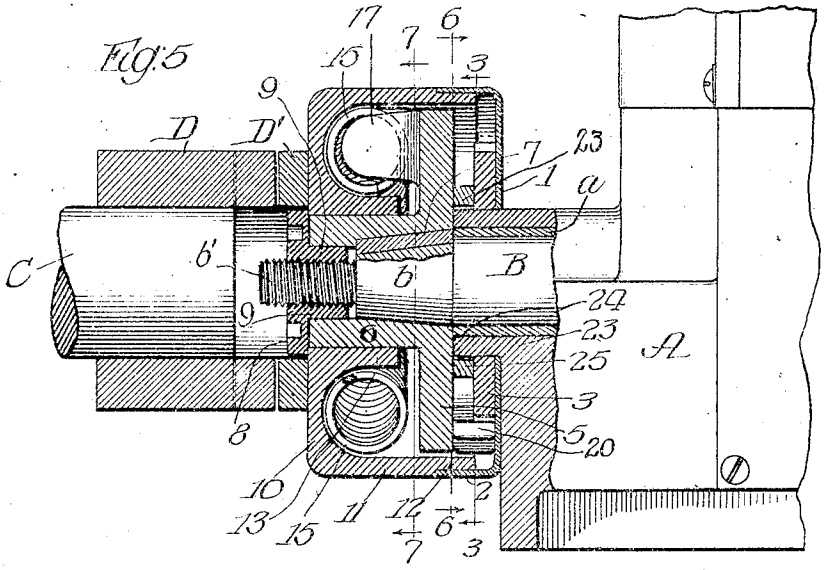


Fig. 6

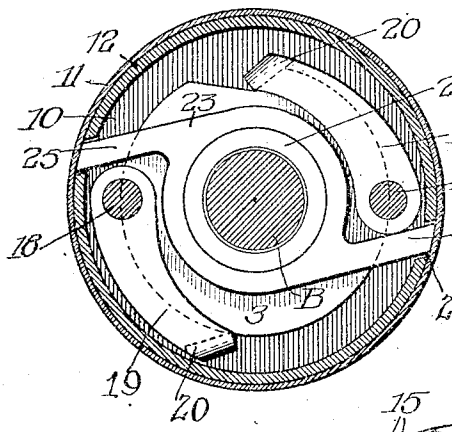


Fig. 7

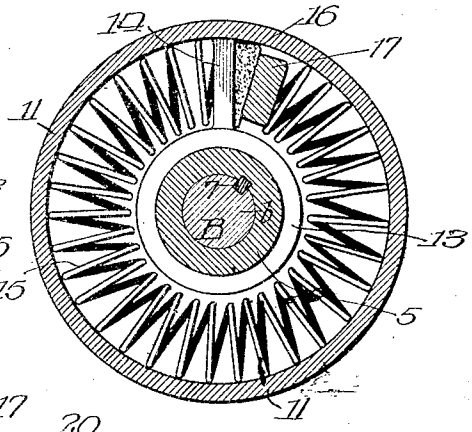
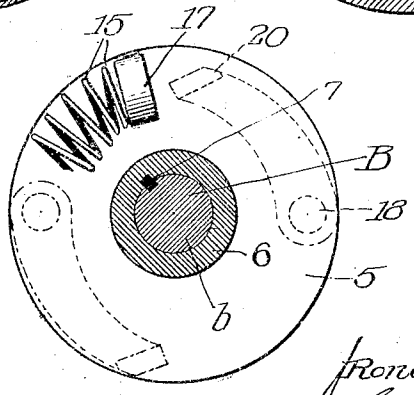


Fig. 8



Inventor
Ronald K. Evans
by Taylor & Brown Attys

UNITED STATES PATENT OFFICE.

RONALD K. EVANS, OF CHEBOYGAN, MICHIGAN, ASSIGNOR TO JOHN F. O. STRATTON, OF ELKHART, INDIANA.

MAGNETO-IMPULSER.

1,287,659. Specification of Letters Patent. Patented Dec. 17, 1918.

Application filed July 29, 1918. Serial No. 247,326.

To all whom it may concern:

Be it known that I, RONALD K. EVANS, a citizen of the United States, and a resident of Cheboygan, in the county of Cheboygan and State of Michigan, have invented certain new and useful Improvements in Magneto-Impulsers; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention relates to mechanism for driving a magneto used in connection with internal combustion engines for producing the current to effect the ignition of the charges in the engine, and relates more particularly to that class of mechanisms which operate to produce the maximum current flow or spark introduced into the cylinder or cylinders of the engine by means of a momentary acceleration of one of the moving parts of the magneto.

In starting a motor, the normal average sparking moment of the magneto connected therewith occurs when the crank of the piston compressing the gases in the cylinder is from zero to ten degrees ahead of the dead center on the upward stroke.

One of the objects of my invention, therefore, is to retard or arrest the normal rotation of the armature in relation to the crank shaft, while the crank shaft continues to advance, and then to release the armature at that minute element of time which intervenes between the extreme moment of compression and the moment of explosion, so as to produce not only the explosion or impulse at the correct time but also to produce the maximum current flow or spark at that particular moment.

Another object of my invention is not only to produce the explosion or impulse at the correct moment but predetermines the firing moment of the motor at all speeds under 180 R. P. M. regardless of any spark control which may have been provided for the purpose of advancing or retarding the firing moment of the motor.

Another object is to eliminate all danger of backfire when the magneto is properly timed with the motor so that the operator need give no attention to the position of the spark control when cranking the motor.

Another object is to provide a device which may be so adjusted that the motor and magneto may be properly timed for starting and for very low speed conditions and, which immediately upon the motor attaining a speed sufficient for the impulser to become inoperative, the firing moment will advance to any desired degree of angularity thereby providing a much more desirable running condition of the motor without dependence on manual operation.

In other words, one of the principal objects of my invention is to so regulate the mechanism with respect to the magneto as to produce the maximum spark at low speed at any desired moment of ignition.

Another object of my invention is to automatically retard the spark when it is in action by causing the armature to be at rest during the period that the driving shaft advances a predetermined annular distance, and then releasing the armature and automatically causing it to advance to its normal position in relation to the motor crank shaft under an accelerated speed; the moment of acceleration being fixed in relation to the desired and predetermined moment of explosion in the cylinder on the compression and explosion stroke. Thus, no matter when the firing moment of the motor may occur at all speeds under 180 R. P. M. regardless of any spark which may have been provided for the purpose of advancing or retarding the firing moment of the motor, it is the object of my device to time the motor to fire at a position coinciding with the correct impulsing moment of the magneto.

It is desirable, in magnetos for multiple cylinder motors, that the impulser act with each explosion stroke. It is one of the principal objects of my invention, therefore, to provide a mechanism which in operation will result in two impulses for each revolution of the magneto shaft, each one corresponding to the two explosion strokes of a four cylinder motor.

It is another object of my invention to produce a simple, durable, relatively cheap mechanical construction, in a spark regulator and impulser, for the purposes above stated, in which all the working and fixed parts are contained within a casing or jacket, and in which the parts function automatically, so that the operator has only to apply, externally, the necessary power to rotate

the magneto shaft,—a mechanism which shall be so constructed as to produce the maximum of desired results with the minimum of vibration, jarring and wearing of the various parts.

In the drawings:

Figure 1 is a perspective view of the casing of a magneto to which my improved spark regulator and impulser is attached.

Fig. 2 is an elevation of the same with the rotatable driving member removed, showing the fixed cam member, and showing in dotted lines the relative location of the circular driving, pawl carrying member in one position.

Fig. 3 is a view looking at the inside of the removed, rotating driving member, showing in dotted lines the relative location of the fixed cam; the view being taken on the plane indicated by the dotted line 3—3 of Fig. 5.

Fig. 4 is a perspective view of a yoke member carried by the rotatable driving member.

Fig. 5 is a vertical, sectional view of the spark regulator and impulser, taken upon the plane indicated by the dotted line 5—5 of Fig. 2.

Fig. 6 is a view corresponding to that of Fig. 2 but taken upon the plane indicated by the sectional line 6—6 of Fig. 5, and looking in the direction indicated by the arrows.

Fig. 7 is a sectional view, taken on the plane indicated by the dotted line 7—7 of Fig. 5, looking in the direction indicated by the arrows.

Fig. 8 is a vertical, sectional view through the tapered portion of the armature shaft and the bearing hub of the driven member, showing more clearly the integral lug and its relation to a yielding member or spring and showing also in dotted lines, the relative location on the opposite side of said driven member of the two pawl members.

Referring to that embodiment of my invention shown in the accompanying drawings, the casing A of the magneto contains the usual horse-shoe magnets, armature, and the like, not shown, and a journal bearing *a* for the armature or magneto shaft B. The shaft B is preferably provided with a tapered portion *b* and a threaded end portion *b'*. C is a drive shaft connected by suitable couplings D with the coupling D', the latter being secured to or integral with a rotatable driving member 10.

The stationary support 1, suitably secured to the magneto frame A, is provided with an outwardly projecting, circular flange or wall 2. Upon the inner face of the support 1 is a cam member 3, suitably secured by screws 4 or otherwise in a predetermined position to said support. A rotatable driven member 5, of disk form, provided with an apertured bearing hub 6, is secured to the armature shaft B by the key 7. As shown in the drawing, the aperture of the driven member 5 and a portion of the aperture of its bearing hub 6, are tapered to fit over the correspondingly tapered portion *b* of the shaft B. A spanner lock nut 8, provided with a hub 9, is interiorly screw threaded for engagement with the threaded end *b'* of the shaft, the diameter of the nut being greater than the diameter of the end of the hub bearing 6 so as to have overlapping engagement with the driving member 10. The nut 8 being thus locked by the screw threads onto the armature shaft and the driven member 5 and its hub 6 being keyed to said shaft, said three parts rotate together and at the same time the nut 8 bearing against the face of the driving member 10 holds the latter in place. In practice, I recommend a small clearance, say .005 of an inch between the end of the hub 6 and the adjacent surface of the nut 8. The external diameter of the hub 9 is such as to afford bearing engagement thereof within the untapered apertured portion of the hub 6 of the driven member 5.

The driving member 10 is provided with an annular, upwardly extending wall 11, which at its upper margin is exteriorly recessed at 12, so that said wall 11 at its upper end will fit within and register with the wall 2 of the support 1, as clearly shown in Figs. 1 and 5. Said driven member 10 is provided with an interior bearing hub 13, which is centrally apertured to fit about and to have rotative, bearing engagement with the hub 6. Between the bearing hub 13 and the circular wall 11, is an annular recess, spanned at one portion only by a radial rib 14. This recess provides space for the yielding member 15, which in the present instance takes the form of a spiral spring. One end of the spring 15 has permanent bearing against one side or face of the radial rib 14. The length of the spring 15 is such that its other end would rest against the opposite side of said radial rib 14 and would so rest, except for the inter-position of a movable lug 17 and a yielding stop or cushion 16 which, in the present instance, takes the form of leather packing (see Fig. 7). Said lug 17 is integral with or fixedly connected to the driven member 5, and extends from that face thereof from which the bearing hub 6 extends.

On that side of the driven member or disk 5, opposite that carrying the lug 17, are two studs or pins 18, 18. Each of said pins affords a pivotal bearing support for a locking pawl 19, suitably apertured to fit over said pin. Each pawl 19, at its outer end, is provided with a lug 20, adapted to engage the cam 3. The cam 3 is provided on its peripheral margin with a cut away

portion 21 which terminates in a cam-shoulder 22. The lug 20 of the pawl is adapted, at certain periods in the movement hereinafter described, to fall into the cut-way portion 21 and to have locking engagement with the cam shoulder 22, as clearly indicated in Figs. 2 and 6.

23 is an apertured yoke, loosely and rotatively mounted upon a bearing shoulder 24 of the armature shaft bearing. Said yoke is provided with radially, outwardly and diametrically oppositely extending arms 25, the outer ends of said arms are set in and have engagement with suitable recesses 26 in the reduced end 12 of the wall 11 of the driving member 10.

The operation of my invention is as follows: the drive shaft C is rotated in the usual manner and, through the couplings D, D', the driving member 10 is similarly rotated. By the engagement of the lug 17 on the driven member 5 between the yielding or spring member 15 with the lug 14 and the interposed cushion 16 (see Fig. 7), the driving and driven members will be simultaneously rotated, until the outer end 20 of one of the pawls 19, swinging upon its stud 18, drops into the cut-away space 21 of the fixed cam 3 and comes into contact with the cam-shoulder 22. When the lug 20 is thus engaging the non-rotatable cam shoulder 22, and the driven member 5 is thus arrested, the rotary forward movement of the driving member 10 continues, though momentarily retarded in its speed by the resisting action of the spring 15 when compressed by the lug 17 against the radial lug 14. The continued rotation of the driving member 10, however, presently brings one of the arms 25 of the yoke 23 into a position when the pawl 19 is lifted by said arm from the cam shoulder 22. Thereupon the spring 15 will immediately expand into its normal position with the effect of causing the momentarily retarded but now released driven member 5 to again move forward in its path of rotation, and with an accelerated motion, as compared with the speed of rotation of the driving member 10; and thus, so to speak, catch up with the driving member 10.

This momentary retarding of the forward movement of the driven member 5 continues while the driving member 10 travels over an area of apparently 32 degrees. Thus the current flow or spark is produced at the proper and predetermined moment of time. A similar action takes place with respect to the second pawl 19, as the revolution of the driving member 10 continues. It will be understood that while the driving member 10 is making one complete revolution, the retarding, and then the accelerated forward movement of the driven member and the magneto shaft will take place twice. There are thus produced two impulses for each single revolution of the shaft, corresponding to the two explosion strokes of a four cylinder motor.

I have stated that one of the objects of my invention is to provide such an adjustment that the motor and magneto may be properly timed for starting and for very low speed conditions and this may be accomplished by adjusting the position of the driven member 5 with respect to the armature shaft, and having in mind the accurate relation of the locking key-way of said shaft to the fixed cam. In practice, when an oscillating circuit breaker is used with my invention, this adjustment may be effected in the following manner:

The key-way in the armature shaft will be milled in accurate relation to the fixed cam. The key-way in the driven member 5 is then cut in such position that the lug 20 of the pawl 19 will engage the cam shoulder 22 at the point at which the armature circuit breaker cam is 20 degrees before the position at which the circuit breaker will open at full advance, or on the peak of the wave. It must be borne in mind that the standard range of spark control adapted for commercial use, and required by the Government, is 32 degrees, and this range starts at the full advance or high wave position in the direction of rotation. If, for example, the circuit breaker is set at full retard, it will be necessary to provide that the impulse reach this point in its forward travel. Therefore, by adding 32 degrees to the 20 degrees already allowed, and by adding 6 degrees additional as a margin of safety to insure the circuit breaker always opening,—a range of approximately 58 degrees is obtained over which the impulser must operate. It is highly desirable to add the 20 degrees referred to ahead of the full advance position, in order to insure the armature against saturation when its rotation is retarded, to allow for the armature having sufficient speed in its impulse before the circuit breaker opens and to guard against any inaccuracies in time. I then place the yoke 23 in such a position in the driving member 10, that its forward movement will continue through 68 degrees of rotation before said yoke comes in contact with and releases the lug 20 from the cam shoulder 22. Thus it will be seen that the amount of impulse when the lugs and the yoke are operating, will substantially correspond with the position at which circuit breaker will open when the impulser is not operating; the former being about 6 degrees later, on a perfect instrument. The moment of impulse may then be marked, one mark being placed on a stationary shell 1 and another mark on the driving member 10. The fly wheel of the motor is then brought to a position at which it is

desired to fire the motor when cranked, and the marks thus made should then coincide and the driving coupling keyed to the driving shaft.

Upon cranking it will be found that the rotation of the armature shaft will be interrupted at a point 58 degrees before the motor reaches its firing position. The motor, however, will continue its course, at the same time driving the member 10 forward until the motor reaches its correct firing position, at which instant of time the pawl 19 is tripped and the spark will occur regardless of what position the circuit breaker or spark control may be in, since the time which it takes the impulser to cover the 32 degrees of spark range, is negligible.

It will also be found that the motor cannot fire in advance, as it has already reached its firing position before the impulser is tripped. This operation just described refers to the use of my impulser with an oscillating circuit breaker.

In its use with a fixed circuit breaker, the latter is made to break at the peak of the wave and to secure any desired position, it is only necessary to change the location of the key-way in the armature shaft in its relation to the predetermined position to fixed cam. Having already explained that 58 degrees is the correct wind or travel of the impulser, and assuming that the operator desires to run the motor to fire 12 degrees, for example, in advance of its firing moment in starting (subtracting the 12 degrees from the 58, leaving 46 degrees) he will key the armature shaft to the driven member 5 in such position that the movement of the armature will be 46 degrees before the circuit breaker would normally open.

By timing the motor to fire at a position coinciding with the impulsing moment of the magneto, it will be found that when the motor reaches a speed at which the impulser becomes inoperative, the firing moment of the motor will automatically advance the desired 12 degrees. By thus adjusting the locking position of the cam shoulder 22 with relation to the center and to the armature, the interruption of the forward movement of the armature is caused to take place at the desired, predetermined time. Thus the cam is initially adjusted or set in a predetermined position on the support.

It will be noted that the form in which my invention is embodied, as above described, is exceedingly simple, includes the fewest number of parts, is positive and accurate in its operation, is substantially dust and fool proof, and that once adjusted it is not liable to get out of order. Its efficiency and durability are therefore limited only to the length of normal wear and tear in use.

Slight modifications may, of course, be made in the various parts, without changing the principle or mode of operation of the invention, but I recommend, from careful test and successful demonstration in use, the form illustrated and described. I do not, however, desire my invention to be limited to the precise details of construction shown, except as the same may be made the subject of specific claims.

I claim as my invention:

1. In a device of the character described, a rotatable magneto shaft, a stationary cam member in juxtaposition to said shaft, a driving member, a driven member on said shaft, means operatively connecting the driving and driven members, said means including means for accelerating the movement of the driven member, means on the driven member adapted for engagement with the stationary cam member to retard the rotary movement of the driven member during a portion of its movement, and means located between the cam and the driven member and in operative engagement with the driving member for releasing the cam engaging means.

2. In a device of the character described, a rotatable magneto shaft, a stationary cam member in juxtaposition to said shaft, a driving member, a driven member on said shaft, means operatively connecting the driving and driven members, said means including means for accelerating the movement of the driven member, means on the driven member adapted for engagement with the stationary cam member to retard the rotary movement of the driven member during a portion of its movement, and rotatable means in operative engagement with the driving member whereby the cam engaging means on the driven member will be released from engagement with the cam member.

3. In a device of the character described, a rotatable magneto shaft, a stationary cam member in juxtaposition to said shaft, a driving member, a driven member upon and rotatable with said shaft, means operatively connecting the driving and driven members, said means including means for automatically accelerating the movement of the driven member, means on the driven member adapted for automatic engagement with the cam member to retard the rotary movement of the driven member during a portion of its movement, and means located between the cam and the driven member adapted to release said cam engaging means.

4. In a device of the character described, a support having shaft bearing, a rotatable magneto shaft, a hub on said bearing, a stationary cam on the support, a driving member, a rotatable driven member within the driving member and secured to said shaft, means operatively connecting the driving

and driven members, means on the driven member adapted for engagement with the cam, and a yoke member rotatably mounted on said hub and provided with a radially extending arm in operative engagement with the driving member and adapted to contact with the cam engaging means.

5. In a device of the character described, a support having shaft bearing, a rotatable magneto shaft, a hub on said bearing, a stationary cam adjusted on the support in a predetermined position, a driving member, a rotatable driven member within the driving member and secured to said shaft, means operatively connecting the driving and driven members, means on the driven member adapted for engagement with the cam, and a yoke member rotatably mounted on said hub and provided with a radially extending arm in operative engagement with the driving member and adapted to contact with the cam engaging means.

6. In a device of the character described, a support having shaft bearing, a rotatable magneto shaft, a hub on said bearing, a stationary cam adjusted in a predetermined relation on the support, a driving member, a rotatable driven member within the driving member and secured to said shaft, means operatively connecting the driving and driven members, means on the driven member adapted for engagement with the cam, a yoke member rotatably mounted on said hub and provided with a radially extending arm in operative engagement with the driving member and adapted to contact with the cam engaging means, and means for producing relative movement between the driving and driven members and an accelerated movement of the shaft when the cam engaging means is released.

7. In a device of the character described, a support having shaft bearing, a rotatable magneto shaft, a hub on said bearing, a stationary cam adjusted in a predetermined relation on the support, a driving member, a rotatable driven member within the driving member and secured to said shaft, means on the driven member adapted for engagement with the cam, a yoke member rotatably mounted on said hub and provided with a radially extending arm in operative engagement with the driving member and adapted to contact with the cam engaging means, and means for producing relative movement between the driving and driven members and an accelerated movement of the shaft when the cam engaging means is released, said means embracing a radial rib in the driving member, a lug on the driven member projecting within the driving member and a yielding device interposed between the rib and the lug.

8. In a device of the character described, a support having a shaft bearing, a hub on said bearing, a rotatable magneto shaft in said bearing, a stationary cam on said support, a rotatable driving member, a driven member on and rotatable with the shaft, a yoke member rotatably mounted on the bearing hub and positioned between the driven member and the cam, two radially projecting arms on the yoke the ends of which are in operative engagement with the driving member, two cam engaging members pivotally mounted diametrically on the driven member adapted each in its turn to engage the cam, and means operatively connecting the driving and driven members adapted for producing relative movement between them.

9. In a device of the character described, a support having a shaft bearing, a hub on said bearing, a rotatable magneto shaft in said bearing, a stationary cam on said support, a rotatable driving member, a driven member on and rotatable with shaft a yoke member rotatably mounted on the bearing hub and positioned between the driven member and the cam, two radially projecting arms on the yoke the ends of which are in operative engagement with the driving member, two cam engaging members pivotally mounted diametrically on the driven member adapted each in its turn to engage the cam, and means operatively connecting the driving and driven members adapted for producing relative movement between them, twice in each revolution.

10. In a device of the character described, a support having a shaft bearing, a hub on said bearing, a rotatable magneto shaft in said bearing, a stationary cam on said support, a rotatable driving member, a driven member on and rotatable with the shaft, a yoke member rotatably mounted on the bearing hub and positioned between the driven member and the cam, two radially projecting arms on the yoke the ends of which are in operative engagement with the driving member, two cam engaging members pivotally mounted diametrically on the driven member adapted each in its turn to engage the cam, and means operatively connecting the driving and driven members adapted for producing relative movement between them, twice in each revolution and time during a travel of approximately 32 degrees.

11. In a device of the character described, a support, a rotatable magneto shaft projecting therefrom, a stationary cam on said support, a driving shaft coupling in alinement with the magneto shaft, a driving member interposed between the shaft and said coupling, a driven member on the shaft, means for operatively connecting the driving and driven members, means on the driven member adapted to engage the cam, releasing means located between the driven

member and the cam and in operative engagement with the driving member, and means on the shaft end adapted to hold the driving member in operative position.

12. The combination with a magneto having a rotatable shaft, a cam member, a support on the magneto for said cam member, a driving member on the shaft, a driven member mounted on the shaft, means associated with said driven member to engage the cam member and retard the movement of the driven member, means operatively connecting the driving and driven members including means for accelerating the movement of the driven member upon its release, means located between the cam and the driven member adapted to release the cam engaging means, said cam being so adjustably positioned on said support in a predetermined relation with respect to the magneto so that the release of the cam engaging means shall occur coincidentally with the high wave moment of the magneto.

In testimony, that I, claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 13th day of July A. D. 1918.

RONALD K. EVANS.

Witnesses:
WILLIAM L. MEALS,
KARL W. DOEL.