Feb. 13, 1923. 1,445,262

J. C. ANDERSON

CIRCUIT BREAKER AND CONTROLLER

Filed Dec. 12, 1919 2 sheets-sheet 1

Fig. 1.

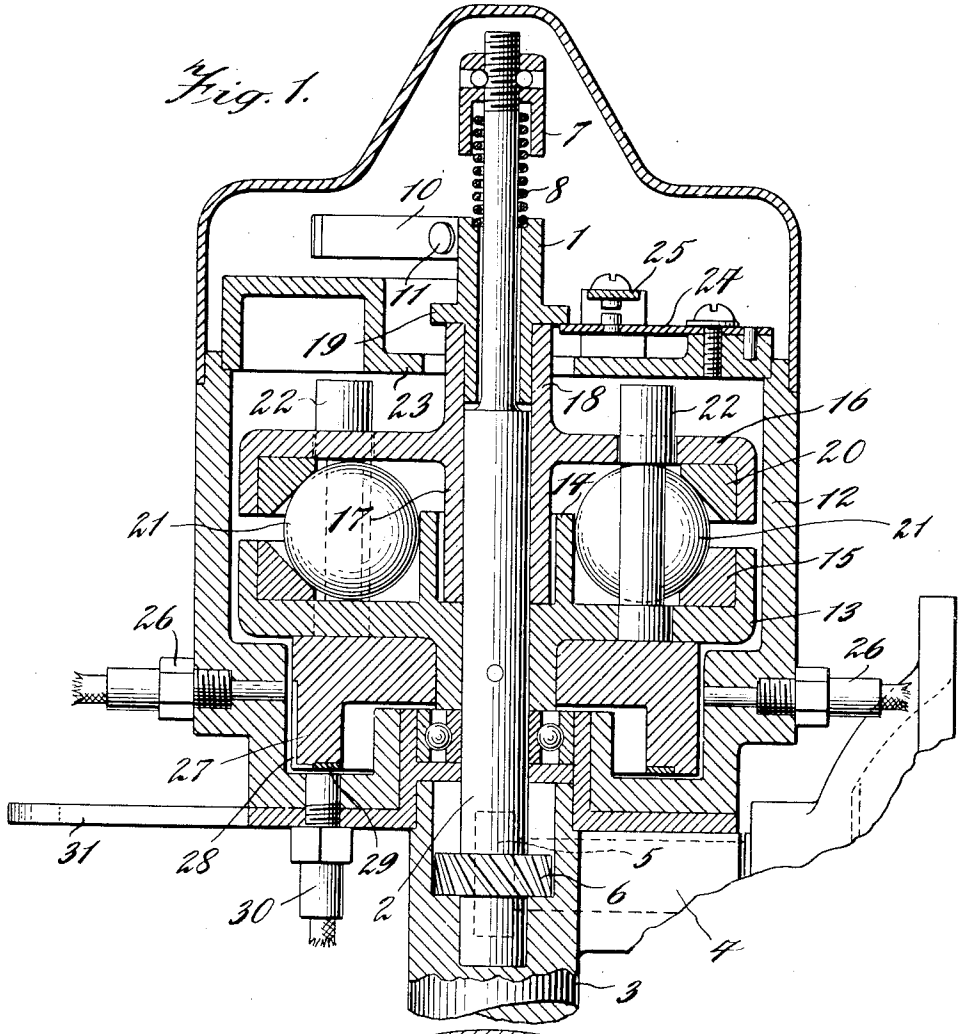
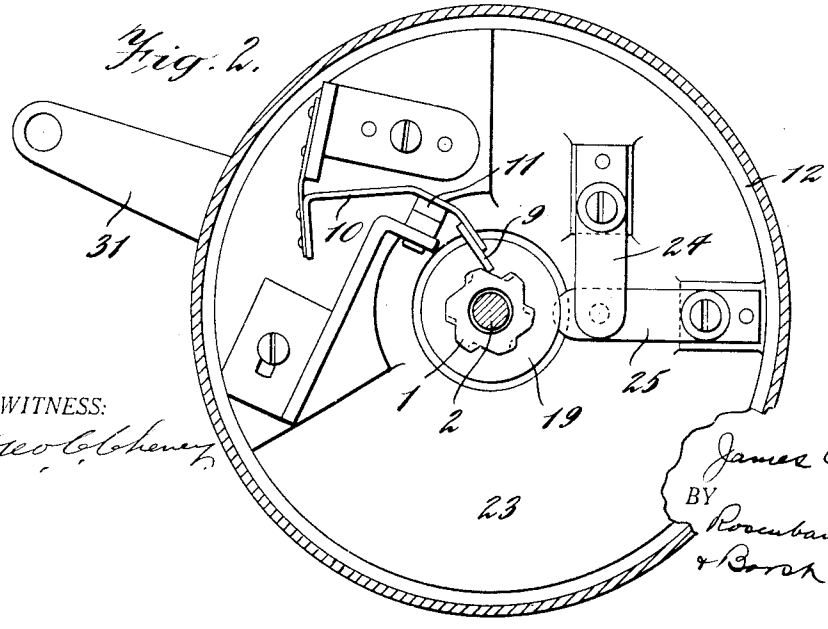


Fig. 2.



WITNESS:
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Fig. 3.

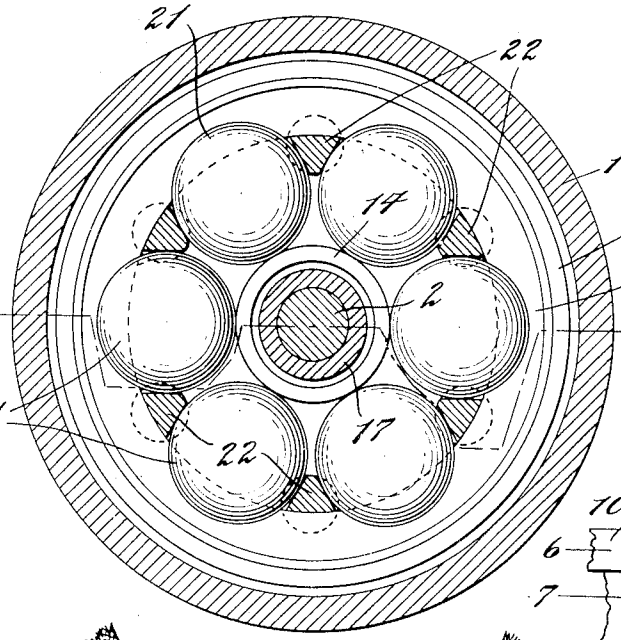


Fig. 6.

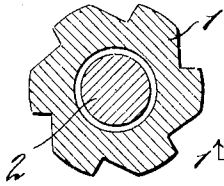


Fig. 7.

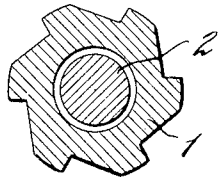


Fig. 5.

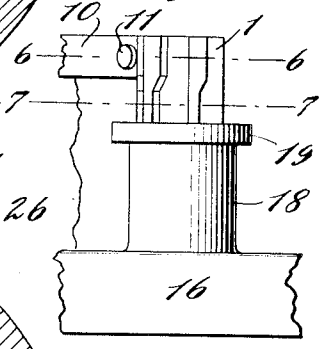
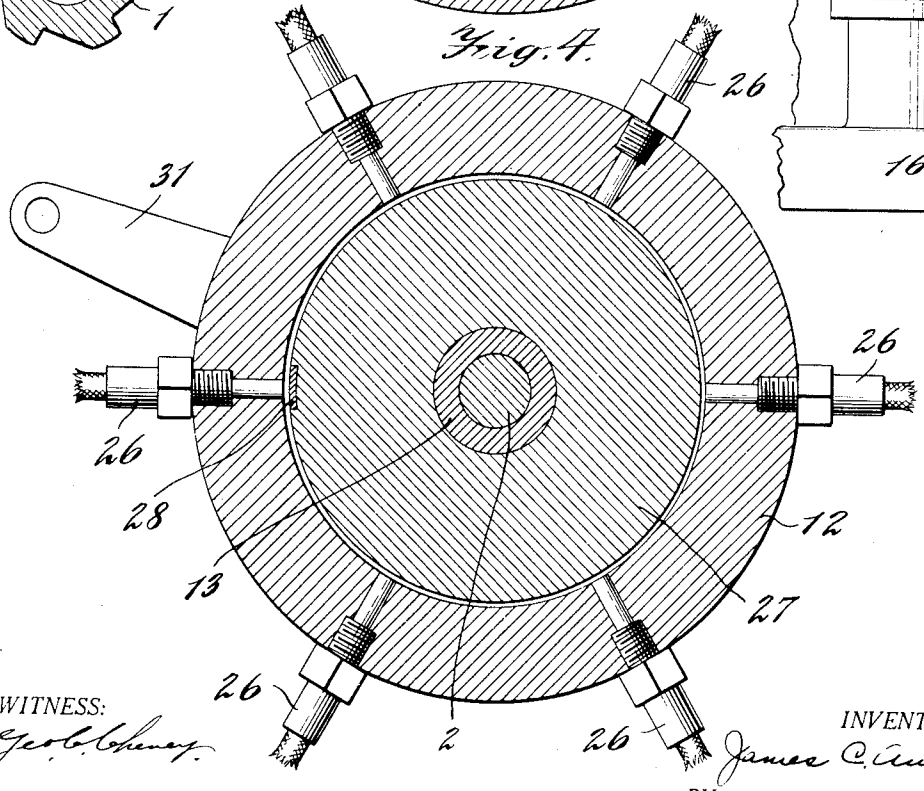


Fig. 4.



WITNESS:
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Patented Feb. 13, 1923. 1,445,262

UNITED STATES PATENT OFFICE.

JAMES C. ANDERSON, OF RUTHERFORD, NEW JERSEY, ASSIGNOR TO VARLEY DUPLEX MAGNET COMPANY, A CORPORATION OF NEW JERSEY.

CIRCUIT BREAKER AND CONTROLLER.

Application filed December 12, 1919. Serial No. 344,407.

To all whom it may concern:

Be it known that I, JAMES C. ANDERSON, a citizen of the United States, residing at Rutherford, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Circuit Breakers and Controllers, of which the following is a full, clear, and exact description.

My invention relates to the breaker systems for the ignition circuits of internal combustion engines for automobiles and the like, and has particular relation to means for maintaining various desirable durations of electrical dwell or closed condition of the circuit within predetermined ranges of engine speed. As is well known, the duration of dwell or closed condition of the breaker contacts must be for such a period as will enable the energy in the primary coil to rise to the critical value required to produce a spark of the necessary intensity, and this period must remain substantially constant or within certain permissible limits for high and low speeds. It is manifest that in order to attain this result the relationship between the periods of open and closed contact position for each actuation of the cam must be varied with the speed, the period of closed condition or electrical dwell being relatively longer at high speed.

One object of my invention is to provide simple and reliable means for effecting the regulation of the period of electrical dwell. Another object is to combine with said means a suitable circuit controller operative to positively open the primary of the ignition circuit when the engine is at rest, the two being so coordinated as to avoid rubbing contact between rotary and non-rotary parts when the engine is running and the primary circuit is closed at the points controlled by the circuit controller. Still other objects and advantages of my invention will appear from the following description.

In accordance with my invention I provide a plurality of breaker cams or cam surfaces shaped to differentially control the cam follower with respect to the relation between the open and closed contact position, together with speed controlled means for automatically shifting the cam follower from one cam surface to another in accordance with variations in speed. For this purpose it is most convenient to arrange the surfaces axially upon the cam shaft and to axially shift them relative to the follower by some suitable governor or centrifugal device, and I have found the sliding ball construction such as illustrated to be excellent for this purpose.

The shiftable member has a bias to a position of lowest speed, and it is so shaped that in this position it engages a movable contact carrier controlling the primary of the ignition circuit and holds the contact open. Immediately after the engine is cranked the shiftable member is moved by the governor sufficiently to close the contact and disengage the shiftable member from the contact carrier, thereby eliminating the wear incident to a rubbing contact.

My invention also contemplates, in combination with the automatically shiftable cam to maintain the period of electrical dwell of the breaker contacts within predetermined limits at various engine speeds, suitable means preferably manually controlled for shifting the cam follower of the breaker system angularly about the breaker cam in order to control the instant of sparking relative to the position of the respective pistons of the engine. I maintain the two functions, to wit: the control of the electrical dwell and the control of the instant of sparking, independent in accordance with my invention, for the reason that the two functions should follow different characteristics. While the change in the proportion of the open and closed contact positions should substantially follow the speed curve of the engine, the instant of sparking should more nearly follow the power curve of the engine.

In the drawings I have shown one embodiment of my invention which I shall now describe, but it will be understood that this is only intended to be illustrative and that my invention may be embodied in constructions differing widely from the form here shown.

Fig. 1 is a vertical section on the line 1—1 of Figure 3;

Fig. 2 is a plan with the cover sectioned;

Fig. 3 is a transverse section through the centrifugal device;

Fig. 4 is a transverse section through the distributor;

Fig. 5 is a detail in elevation of the cam and adjacent parts; and

Figs. 6 and 7 are transverse sections of the

cam on lines 6—6 and 7—7 respectively, of Figure 5.

In the illustrated construction the breaker cam 1 is a double faced cam connected through means hereinafter described, to the vertical shaft 2, which is supported at its lower end in a hollow standard 3 and is driven from the engine through a stub shaft 4 and gears 5 and 6. The upper end of the shaft 2 about which the cam 1 is disposed is reduced in diameter, and the cam is adapted to slide up and down about this reduced portion while being rotated with the shaft. A nut 7 on the upper end of the shaft 2 serves as an abutment for the upper end of a coil spring 8 which surrounds the shaft 2 and bears on top of the cam 1. The gravity of the spring and cam and of other parts carried thereby gives a bias to the cam to the lowermost position. In this position there is a slight clearance between the top of spring 8 and the nut 7, as is shown in Fig. 1, for a purpose which will appear hereinafter. A relatively stationary cam follower 9 on the end of a flat spring arm 10 is arranged to cooperate with either face of the cam and thereby control the breaker contact 11 carried by the spring arm 10. As shown in the drawings, the cam follower cooperates with the upper cam face in the biased position of the cam, and will cooperate with the lower cam face when the cam is moved upward against the tension of the spring 8.

The breaker cam 1 is shown as a six lobed cam for a six cylinder engine, and is rotated in a clockwise direction as viewed in Figures 6 and 7. The upper cam face, which occupies substantially the upper half of the cam, has the trailing face of its lobes somewhat longer than those of the cam face which occupies substantially the lower half of the cam, as appears clearly from Figures 5, 6 and 7. It therefore follows that when the cam follower is in cooperative relation with the upper cam face, the breaker contacts are held open for a longer portion of each actuation than they are when the cam follower is in cooperative relation with the lower cam face. Automatic means responsive to the speed of the engine are provided for raising the cam to bring the lower cam face in opposition to the cam follower when a predetermined speed is attained. In this way the duration of the period of electrical dwell is kept within desirable limits at several predetermined ranges of engine speed. The automatic speed-controlled means will now be described.

A stationary outer shell 12 of bakelite or other suitable material is carried on the upper end of the standard 3, an anti-friction bearing being provided for the shaft 2 in the bottom of the shell immediately above the upper end of the standard 3. Above this bearing the shaft carries an annular cup or ball-containing member 13, which may be broadly designated as a plate. This plate has an internal upstanding sleeve portion 14 surrounding the shaft 2 and has at its outer periphery an annular wedge member 15. This plate 13 is pinned or otherwise secured to the shaft 2 so as to be rotated therewith.

Immediately above and opposing the plate or cup member 13 is a complementary shaped plate or cup member 16 which has an internal depending sleeve member 17 bearing around the shaft 2 and fitting within the sleeve member 14 on the lower plate. The plate 16 also has an upwardly extending sleeve portion 18 which fits over and is rotatively secured to the lower end of the cam 1 below the two cam faces, the cam member being provided with a horizontal flange 19 which bears on top of the sleeve portion 18. The plate 16 is also provided at its outer periphery with an annular wedge member 20 which is arranged reversely to and opposing the lower wedge member 15.

A plurality of balls 21, shown as six in number are disposed between the two plates 13 and 16 and are spaced by vertical pins 22, carried by the lower plate and extending with a free fit into holes in the upper plate, thereby serving to impart rotation from the lower plate to the upper plate and to the cam. The intermediate portion of these pins is made triangular in cross section with their apices pointing radially inward and their sides disposed in radial planes so as to permit the balls to slide radially outward under centrifugal force. As these balls slide outwardly they wedge the plates apart, thereby elevating the plate 16 and with it the cam 1 to bring the lower cam face into cooperative relation with the cam follower. The tension of the spring 8 is such that this movement does not occur until a predetermined speed is attained.

A platform member 23 rests on top of the shell 12 and has a portion elevated as shown for carrying the parts of the breaker system. On this platform is also disposed two contact-carrying members 24 and 25 which carry cooperative contacts in the primary ignition circuit. The lower contact-carrying member 24 is a flat spring having a bias to closed contact position. The free end of this flat spring 24 extends underneath the flange 19 on the cam, and the parts are so relatively disposed that in the biased position of the cam, the flange 19 holds the spring 24 against its bias in open contact position. When the engine is turned over slowly, as in cranking, the centrifugal force of the balls 21 is sufficient to cause them to elevate the plate 16 and the cam 1 until the spring 8 comes into contact with the nut 7. This movement is sufficient to clear the flange 19 from the end of the spring 24, and

the primary circuit is thereby closed and at the same time rubbing friction between the rotative cam and the non-rotative member 24 is avoided. The cam follower remains on the upper cam face during this entirely upward movement of the cam, and the coil spring 8 effectively opposes the tendency of the balls to further elevate the cam until the necessary centrifugal force is attained at which speed the cam is quickly moved upward to bring the lower face into cooperative relation with the cam follower.

It will be readily understood that with this construction there will be sufficient lag on decreasing the speed to prevent hunting or in other words that there will be a differential of a few miles in the speed at which the automatic adjustment will take place on increasing and decreasing the engine speed.

I have combined with this device a distributor construction embodying the invention disclosed in the co-pending application of Richard Varley, Serial No. 314,643. The stationary contacts 26 are carried by the shell 12, being arranged radially around the bottom of the shell below the fixed ball-containing member 13. The internal or flier member 27 of the distributor is carried by the ball-containing member 13, being secured in any suitable way to its under side, and consists of an annulus of bakelite or other suitable insulating material having a depending skirt portion fitting within the shell 12. The flier 28 extends up from a connecting ring 29 on the bottom edge of the flier member to which current is conducted through a suitable lead 30.

To advance or retard the instant of sparking, means are provided for manually angularly adjusting the breaker system relative to the cam. In the form shown, the metallic base upon which the shell 12 rests is provided with a radially extending arm 31 which is connected through suitable linkage to any convenient place of manipulation. Since the shaft 2 and consequently the cam is rotated in a clockwise direction as shown in Fig. 2, it follows that an angular adjustment of the shell 12 and the platform 23 and the breaker system carried thereby in a counterclockwise direction will serve to advance the spark, while an adjustment in a clockwise direction will serve to retard the spark.

I claim:

1. For an internal combustion engine, a breaker mechanism comprising a double faced cam with the trailing faces of the lobes of one cam face shorter than those of the other cam face, a cam follower controlling the ignition circuit and cooperative with the cam, the cam and cam follower being relatively shiftable to bring the cam follower selectively into engagement with the two cam faces, resilient means tending to hold the parts with the cam follower on the cam face having the longer trailing faces, and means responsive to the speed of the engine for relatively shifting the cam and cam follower to bring the follower into engagement with the cam face having the shorter trailing faces, the parts being designed to restrain the relative shifting until a predetermined speed is attained and then to suddenly effect the relative shifting.

2. For an internal combustion engine, a breaker mechanism comprising a cam member having along its length two adjoining lobed cams with the trailing faces of the lobes of one cam shorter than those of the other cam, a cam follower controlling the ignition circuit and adapted to cooperate with either of said cam faces, one of the two said members being shiftable axially of the cam, resilient means tending to hold the shiftable member in an axial position with the cam follower on the cam having the larger trailing faces, and means responsive to the speed of the engine for shifting the shiftable member to bring the members into position with the follower on the cam having the shorter trailing faces, the parts being designed to restrain the said movement of the shiftable member until a predetermined speed is attained and then to cause the shiftable member to shift suddenly to the other operating position.

3. For an internal combustion engine, a breaker mechanism comprising a cam member having along its length two adjoining lobed cams with the trailing faces of the lobes of one cam shorter than those of the other cam, a cam follower controlling the ignition circuit and adapted to cooperate with either of said cam faces, one of the two said members being shiftable axially of the cam, resilient means tending to hold the shiftable member in an axial position with the cam follower on the cam having the longer trailing faces, and means responsive to the speed of the engine for shifting the shiftable member to bring the members into position with the follower on the cam having the shorter trailing faces, the parts being designed to restrain the said movement of the shiftable member until a predetermined speed is attained and then to cause the shiftable member to shift suddenly to the other operating position; and means for angularly relatively adjusting the cam member and follower to control the instant of sparking.

4. For an internal combustion engine, a breaker mechanism comprising a cam member having along its length two adjoining lobed cams with the trailing faces of the lobes of one cam shorter than those of the other cam, a cam follower controlling the ignition circuit and adapted to cooperate with either of said cam faces, one of the two said

members being shiftable axially of the cam, a rotative engine-driven shaft, a fixed plate carried by and rotative with the shaft, an axially slidable plate opposing the fixed plate and connected to be rotated therewith and having operative engagement with the shiftable member, one of the inner faces of the plates being wedge shaped, a plurality of balls loosely disposed between the plates and adapted to move outward under centrifugal force and thereby axially separate the plates and shift the shiftable member to cause the cam follower to engage the cam having the shorter trailing face, and resilient means biasing the parts with the cam follower on the other cam and opposing the said shifting and adapted to restrain the same until a predetermined speed is attained, whereby the shiftable member is restrained until said predetermined speed is attained and then is caused to shift suddenly to its other operating position.

5. For an internal combustion engine, a breaker mechanism comprising a rotative and axially shiftable cam member having along its length two adjoining lobed cams with the trailing faces of the lobes of one cam shorter than those of the other cam, a cam follower controlling the ignition circuit and adapted to co-operate with either of said cam faces, resilient means tending to hold the cam member in an axial position with the cam follower on the cam having the longer trailing faces, and means responsive to the speed of the engine for axially shifting the cam to bring the follower into engagement with the cam having the shorter trailing faces, the parts being designed to restrain the axial movement of the cam until a predetermined speed is attained and then to cause the cam member suddenly to shift to its other operating position.

6. For an internal combustion engine, a breaker mechanism comprising a rotative and axially shiftable cam member having along its length two adjoining lobed cams with the trailing faces of the lobes of one cam shorter than those of the other cam, a cam follower controlling the ignition circuit and adapted to co-operate with either of said cam faces, resilient means tending to hold the cam member in an axial position with the cam follower on the cam having the longer trailing faces, and means responsive to the speed of the engine for axially shifting the cam to bring the follower into engagement with the cam having the shorter trailing faces, the parts being designed to restrain the axial movement of the cam until a predetermined speed is attained and then to cause the cam member suddenly to shift to its other operating position; and manually operative means for angularly relatively adjusting the cam follower to control the instant of sparking.

In witness whereof, I hereunto subscribe my signature.

JAMES C. ANDERSON.