May 30, 1967 S. M. TERRY 3,322,909

BREAKER POINT MECHANISM AND CAM THEREFOR

Filed July 16, 1965

FIG. 1

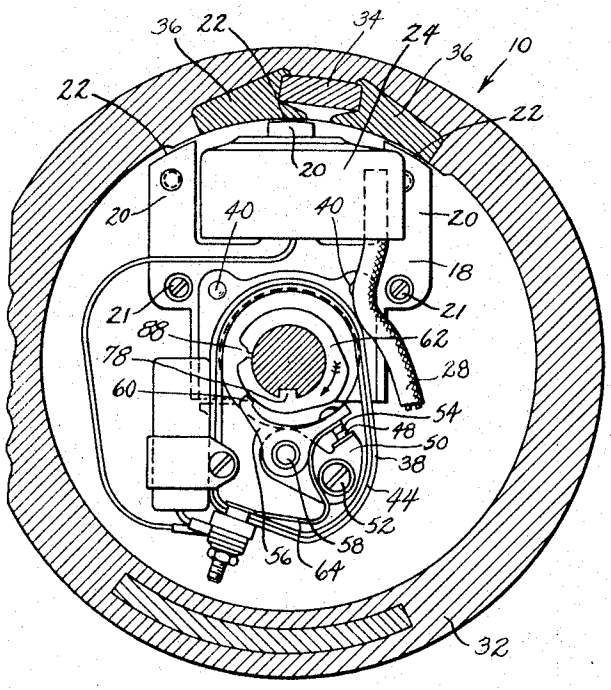


FIG. 2

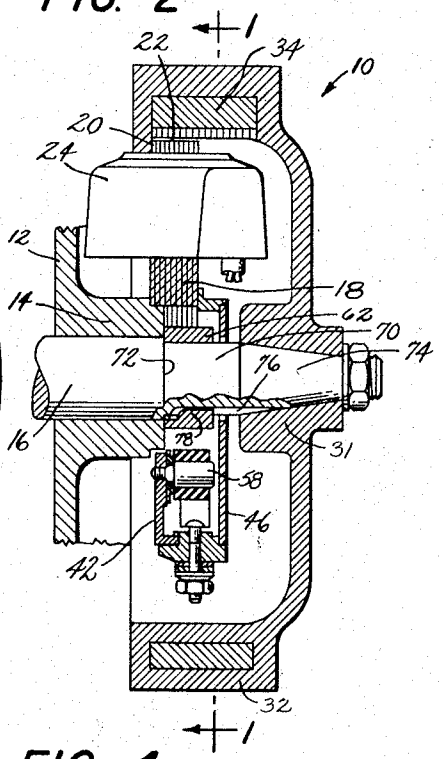


FIG. 3

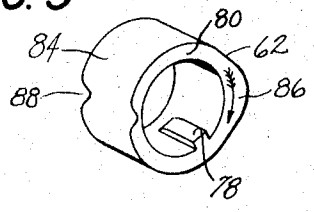


FIG. 4

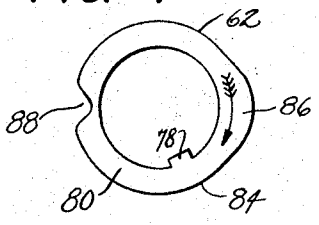
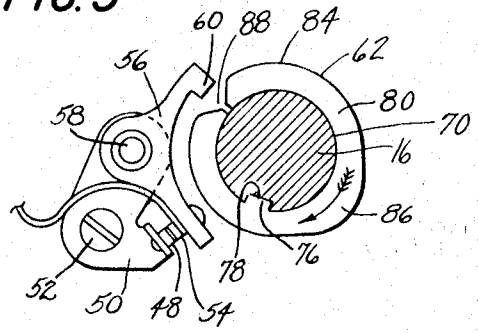


FIG. 5



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BREAKER POINT MECHANISM AND CAM THEREFOR

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7 Claims. (Cl. 200—24)

This invention relates generally to breaker point mechanisms for magnetos and the like, and deals more particularly with an improved cam for such a mechanism.

In the description which follows, the breaker point mechanism and the cam of this invention are shown as applied to a magneto similar to that shown in U.S. Patent No. 2,847,492. It should be understood, however, that this is done by way of example only and that, while the invention is particularly well suited for use in such a magneto mechanism, there is no intention to limit the invention to this use and that it may be used to advantage in other electrical devices employing a similar cam actuated mechanism for making and breaking an electrical circuit.

The general object of the invention is to provide an improved cam for the breaker point mechanism of a magneto or the like which cam, in comparison to present cams of the same general type, is more readily and easily mounted and aligned on a driving shaft and has improved resistance to shaft vibration so as to be less subject to fretting and other wear and to resulting angular misalignment between the cam and the shaft.

A further object of the invention is to provide an improved cam of the type mentioned in the foregoing paragraph which may be manufactured at relatively low cost by the use of powdered metal techniques.

Other objects and advantages of the invention will be apparent from the following description and from the drawings forming a part hereof.

The drawing shows a preferred embodiment of the invention and such embodiment will be described, but it will understood that various changes may be made from the construction disclosed, and that the drawing and description are not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawing:

FIG. 1 is a transverse sectional view of a magneto including a breaker point mechanism and cam embodying the invention, the view being taken along the line **1—1** of FIG. 2 with the cover plate of the breaker point mechanism housing being omitted.

FIG. 2 is a longitudinal sectional view taken along the line **2—2** of FIG. 1.

FIG. 3 is a perspective view of the cam employed in the FIG. 1 magneto mechanism.

FIG. 4 is an elevational view of the cam employed in the FIG. 1 magneto mechanism.

FIG. 5 is a fragmentary elevational view showing a cam and an associated breaker point mechanism of the type employed in FIG. 1.

Turning now to the drawing for a detailed description of the invention, reference numeral **10** indicates, in general, a magneto having a breaker point mechanism embodying this invention. The magneto **10** may take various different forms and in the presently illustrated case is shown by way of example as being generally similar to the one shown in Patent No. 2,847,492 to which reference may be made for further details of its construction. For the present, it is sufficient to note that the magneto includes a stator adapted for attachment to an engine frame or plate **12** having a hub **14** which rotatably receives a shaft **16**, the shaft projecting through and beyond the hub as shown in

FIG. 2. The shaft **16** may be an extension of the crank shaft of the engine with which the magneto is to be used, and in any event it is rotated in timed relationship with the engine. The stator comprises a magnetic core **18** which is preferably made of a stack of laminated sheet material so as to reduce eddy current and hysteresis losses. Screws **21, 21** passing through the core and threaded into bosses, not shown, on the engine frame hold the core in place. The core **18** provides three spaced and generally parallel poles **20, 20** having arcuate end faces **22, 22** which are concentric with the axis of the shaft **14** and equi-distant therefrom. A coil assembly **24** is received on the center stator pole **20** and includes primary and secondary windings which surround the center pole and which are made up of different number of turns of conducting wire in accordance with conventional magneto practice. The primary coil is suitably grounded at one end and its other end is connected by means of an insulated conductor **26** to a suitable breaker point mechanism. The secondary coil is also suitably grounded at one end and at its other end is connected with an insulated conductor **28** which in turn is connectible with the spark plug of the associated engine.

The magneto also includes a flywheel rotor **30** which is connected with the shaft **16** so as to be rotatable therewith. The rotor is preferably formed of a non-magnetic material and it is shown as having a disc-like wall having a central hub portion **31** and an annular peripheral flange **32** which surrounds the stator. The inner or internal face of the flange **32** is generally cylindrical in shape and embedded in the flange is a permanent magnet **34** and two associated pole pieces **36, 36**. During rotation of the rotor, the pole pieces **36, 36** move across the stator pole faces **22, 22** and complete flux circuits through the stator, the flux passing through the center pole **20** suddenly reversing in direction at one point of the rotor rotation to induce voltages in the primary and secondary coils in a manner well known in the art. The breaker point mechanism is timed to break the circuit to the primary coil at approximately the instant of maximum voltage induced therein, thereby generating a high voltage in the secondary coil which is connected with the spark plug.

The breaker point mechanism is mounted on the core **18** and includes a supporting box or housing **38** which is connected with the core **18** by rivets **40, 40**, the box including a rear wall **42** and an axially extending side wall **44**. As shown in FIG. 2, the box is normally closed by a cover plate **46** which is shown removed in FIG. 1 to reveal other parts of the breaker mechanism.

The breaker mechanism includes a fixed breaker point **48** carried by a bracket **50** secured by a screw **52** to the rear wall **42** of the box. A movable breaker point **54** is carried by a rocker arm **56** mounted on a pivot pin **58** carried by the rear box wall **42**. The rocker arm **56** includes a cam follower **60** which is engageable with a cam **62** carried by the shaft **16** for moving the movable breaker point **54** between opened and closed positions relative to the fixed breaker point **48**. A spring **64** serves to bias the rocker arm to move the movable breaker point **54** into engagement with the fixed breaker point **50**. The spring, or an auxiliary conductor associated therewith, also serves to provide an electrical connection between the conductor **28** and the movable breaker point, and by means of a conductor **66** a condenser **68** is connected and parallel with the breaker mechanism in accordance with standard practice.

The breaker point cam **62** is received on a cylindrical portion **70** of the shaft **16** which is of a somewhat smaller diameter than the inner portion of the shaft and is separated from such inner portion by a radial shoulder **72**. Adjacent the outer end of the cylindrical shaft portion **70** is

a tapered portion **74**. The tapered portion **74** has a major diameter equal to the diameter of the cylindrical portion **70** and receives the correspondingly tapered hub portion **31** of the rotor. Included in the shaft is an axially extending key way **76** which receives a key **78** included in the cam for angularly fixing the cam relative to the shaft to cause it to operate the movable breaker point in proper timed relationship to the engine and other parts of the magneto.

In the past, cams similar to the cam **62** have generally been loosely mounted on the supporting shaft. That is, the internal diameters of the cams have been made of such sizes and tolerances with respect to the external sizes and tolerances of the shaft surface that the cams are easily slipped onto the shafts during assembly. During the initial period of use following the assembly of such a cam on a shaft, the angular movement of the cam relative to the shaft is satisfactorily limited by the engagement of the key on the cam with the key way in the shaft, and usually no additional means are provided to prevent the cam from moving limited distances axially of the shaft. Initially, this looseness of the cam on the shaft has no adverse effect on the operation of the magneto. However, during use the shaft is subjected to relatively severe torsional vibrations which cause the cam to vibrate on the shaft. This relative movement between the cam and the shaft in turn causes fretting and other wear which gradually increases the angular looseness between the cam and the shaft, as by wearing down the walls of the key on the cam and/or the walls of the key way in the shaft. Eventually, this increased angular looseness of the cam caused by wear of the parts often becomes sufficient to effect the timing of the breaker point operation and to thereby cause erratic operation of the engine.

In accordance with the invention, the cam **62** is so constructed and assembled with the other parts of the breaker mechanism as to eliminate looseness between it and the shaft and thereby to eliminate wear of the cam or shaft as a result of shaft vibration. More particularly, the cam, as best shown in FIGS. 3, 4 and 5, is annular in shape and comprised of an annular wall **80** defining a radially inner surface **82** and a radially outer peripheral cam surface **84**. The inner cam surface **82** is generally cylindrical in shape so as to conform to the cylindrical shaft portion **70**, and along one angular portion of the cam the outer cam surface **84** defines a lobe **86** along which the cam surface **84** is spaced a greater distance from the axis of the cam. The angular extent of the lobe **86** may vary, but in the illustrated case is shown to comprise approximately a 70° segment of the cam. Along the remainder of the circumference of the cam the cam wall **80** has a substantially uniform radial thickness so that the cam surface **84** is spaced a uniform distance from the axis of the cam at all points along such remaining or dwell portion of the cam. The lobe **86** of the cam is engageable with the follower **60** during rotation of the cam with the shaft to cause the movable breaker point **54** to be first moved away from and then returned to engagement with the fixed breaker point **48**. The relationship of the parts is further such that while the dwell portion of the cam passes the cam follower **60** the follower is held out of engagement with the cam surface **84** by the co-engagement of the breaker points, as best shown in FIG. 5, until the lobe **86** returns to alignment with the follower.

To obtain a tight mounting of the cam to the shaft, the cam is designed so that before its assembly with the shaft the diameter of the opening provided by the inner surface **82** is slightly less than the outside diameter of the portion of the shaft to which it is to be assembled, thereby necessitating a force fit between the cam and the shaft. In addition, the cam is provided with a weakened zone to permit the cam wall **80** to fracture along an axial line and to thereby allow the cam to spread or

radially expand to accommodate the shaft. This weakened zone may be provided in a variety of ways and preferably extends over only a very short angular extent of the cam so that the cam wall **80** is of relatively high strength along substantially the full extent of its circumference. The cam is also preferably made from sintered metal in accordance with conventional powdered metallurgy techniques. By so making the cam, it may be made in a single one-step forming operation with the weakened zone and key **78** formed integral therewith so as to eliminate the need for additional machining operations. In making a sintered metal cam, however, it has been found desirable to avoid any sharp corners or discontinuities adjacent the weakened zone since the sintered metal in the vicinity of such corners or discontinuities tends to be of an inferior or porous quality. Therefore, when the cam is made of a sintered metal the weakened zone is preferably defined by a V-shaped groove **88**, as shown in FIGS. 3, 4 and 5, having a rounded bottom of substantial radius so that the metal making up the cam in the vicinity of the weakened zone follows relatively smooth contours. Also, as will be evident from FIG. 5, the groove **88** is located in the dwell portion of the cam so that the cam follower is not engageable with the cam surface on either side of the groove.

In fitting the cam **62** to the shaft **16**, it is first placed on the tapered shaft portion **74** and then pressed into the cylindrical shaft portion **70** with the key **78** of the cam received in the key way **76** of the shaft. As this pressing operation takes place, the engagement of the shaft surface with the inner surface **82** of the cam creates an outward pressure on the cam which fractures the cam along the weakened zone, as shown in FIG. 5, and allows the cam to spread by a slight separation of the ends of the cam defined by the fracture line. After the cam reaches its fully assembled position on the shaft, it remains in its spread condition and the natural resiliency of the cam material causes the inner surface **82** of the cam to tightly grip the outer surface of the shaft with a sufficient force to resist angular and axial movement of the cam relative to the shaft as a result of the torsional shaft vibrations.

The degree of the press fit between the cam and the shaft and the minimum thickness of the cam in the area of the weakened zone may vary depending on the cam material and the relative sizes of the shaft and cam. For a cam proportioned generally as shown in the application drawing and having an internal diameter of approximately five-eighths of an inch and a length of approximately one-half of an inch, it has been found, in connection with sintered metal cams, that a minimum thickness of .0020 to .0030 of an inch in the weakened zone and a press fit of from .001 to .005 of an inch provides satisfactory results.

The invention claimed is:

1. A generally annular cam for a breaker point mechanism which mechanism includes a shaft over which said cam is fitted, a fixed breaker point, a movable breaker point movable between open and closed positions relative to said fixed breaker point, means for biasing said movable breaker point toward said closed position, and a cam follower cooperating with said cam for moving said movable breaker point relative to said fixed breaker point in response to the rotation of said cam with said shaft, said cam comprising a body having an annular wall defining a radially inner surface and a radially outer peripheral cam surface including at least one lobe, said lobe during a portion of each revolution of said cam being engageable with said cam follower to hold open said movable breaker point, said wall having a short angular and axially extending portion along which its radial thickness is substantially less than elsewhere so as to provide a weakened zone along which said wall will fracture to produce an axially extending fracture line as a result of radially outwardly directed pressure applied over

said radially inner surface, said radially inner surface defining an opening sufficiently smaller in size than said shaft so that said cam during assembly with said shaft is fractured along said weakened zone by the pressure exerted by said shaft on said radially inner surface and so that said cam is thereafter held in a slightly spread condition by said shaft to cause it to tightly grip the latter.

2. A generally annular cam for a breaker point mechanism as defined in claim 1 further characterized by said cam being made from a sintered metal.

3. A generally annular cam for a breaker point mechanism as defined in claim 2 further characterized by said weakened zone being provided by a V-shaped groove in said wall having a rounded bottom of substantial radius so as to present no sharp discontinuity or corner.

4. In a breaker mechanism the combination comprising a shaft having a cylindrical portion and a tapered portion located adjacent said cylindrical portion and converging therefrom, said tapered portion having a major diameter equal to the diameter of said cylindrical portion, and a cam having an annular wall defining an axially extending cylindrical bore for receiving said shaft and also defining a radially outer peripheral cam surface including at least one lobe, said wall having a generally axially extending groove therein defining a weakened area of minimum radial thickness, said cam bore before assembly of said cam with said shaft having a diameter larger than the minor diameter of said tapered shaft portion and smaller than the diameter of said cylindrical shaft portion, said cam being fractured along said weakened area and held in a slightly spread condition as a result of being axially forced over said tapered shaft portion and onto said cylindrical shaft portion.

5. The combination defined in claim 4 further characterized by a fixed breaker point, a movable breaker point movable between open and closed positions relative to said fixed breaker point, means for biasing said movable breaker point toward said closed position, and a cam follower cooperating with said cam for moving said movable breaker point relative to said fixed breaker point in response to rotation of said cam with said shaft, said cam follower during a portion of each revolution of said cam being engageable with said lobe to hold open said movable breaker point and said cam wall being so shaped that during another portion of each revolution said cam follower is held out of engagement with said cam by the engagement of said movable breaker point with said fixed breaker point, said groove being located in that portion of said cam wall traversed by said cam follower while held out of engagement with said cam.

6. The combination as defined in claim 5 further characterized by said cam being made from a sintered metal.

7. The combination as defined in claim 4 further characterized by said shaft including an axially extending keyway, and said cam including an axially extending key received in said keyway and integral with the remainder of said cam for angularly locating said cam on said shaft.

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