Nov. 20, 1956 L. P. TROMBETTA 2,771,530

CIRCUIT BREAKER

Filed Feb. 9, 1953

FIG. 1

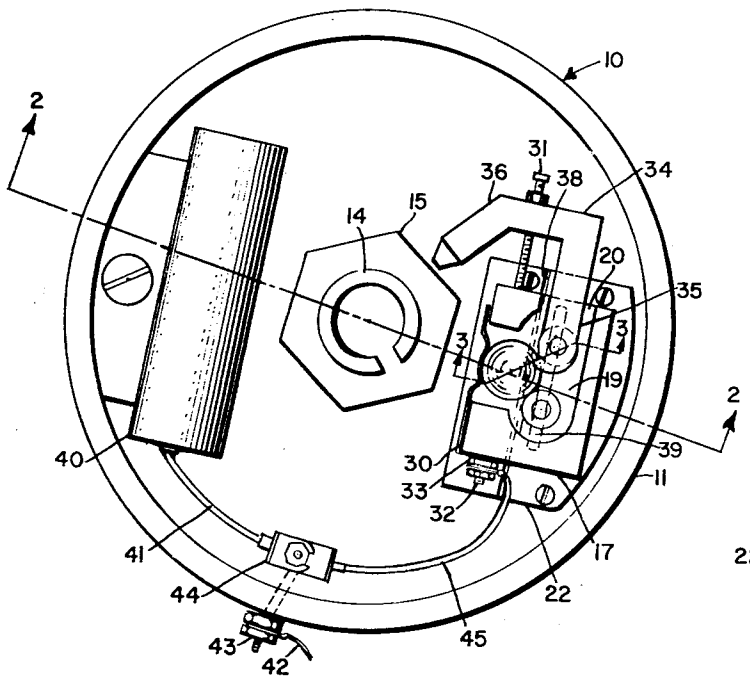


FIG. 5

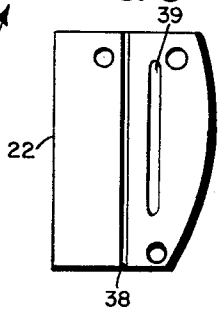


FIG. 2

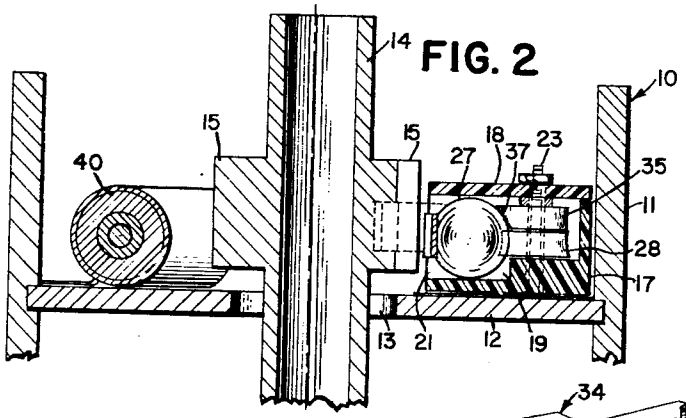


FIG. 4

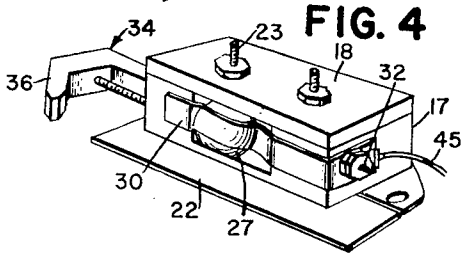
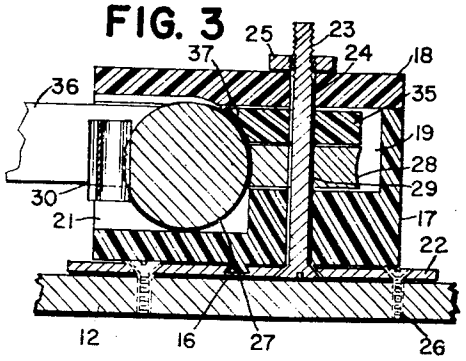


FIG. 3



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2,771,530

Patented Nov. 20, 1956

2,771,530

CIRCUIT BREAKER

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Application February 9, 1953, Serial No. 335,717

1 Claim. (Cl. 200—166)

This invention relates to circuit breakers, and is more particularly directed to cam operated contacts for making and breaking an electrical circuit.

The presently employed circuit breakers operated by a rotating cam member are known to have two serious faults; first, the contact surfaces become pitted, and secondly the cam dwell, which is the arc circumscribed by the rotating cam from the moment of the closing of the circuit to the next successive opening of the circuit, is not sufficiently large to permit a buildup of current and thereby cause the most effective spark to be produced for an internal combustion engine.

As is well known, the most common circuit breaker in use is of the oscillating type wherein two flat contact surfaces are made to move toward and away from each other to make and break a circuit, respectively, as a cam rotates and actuates the circuit breaker mechanism in proper timing with an internal combustion engine. Since the flow of current through these contact surfaces is in one direction at all times, the flow of metal particles vaporized and carried by the current will effect a pitting action on these surfaces and thereby reduce the efficiency of the circuit breaker. The present invention contemplates the provision of arcuate contact members as the contact maker and breaker, which members provide a constantly changing contact surface during the operation thereof and thereby reduce to a minimum any pitting action. Furthermore, it is well established, that an ignition system attains the highest possible efficiency when the circuit breaker maintains the circuit in an opened condition for a period equal to approximately 11 degrees of arc of cam rotation for each spark produced and the circuit closed (which period is known as cam dwell) for the remainder of the cam's rotating action in making a single complete revolution. Since a circuit cannot be physically brought to an opened or closed position by an instantaneous quick break, a portion of the rotational movement of a cam is expended in the action of opening and closing of the circuit. For example, the highest possible cam dwell for a six cylinder internal combustion engine is 49 degrees while that of an eight cylinder engine is 34 degrees. However, due to the particular construction of the presently used circuit breakers a cam dwell of less than 40 degrees is attained for a six cylinder engine while for an eight cylinder engine the highest cam dwell is found to be approximately 27 degrees, thus indicating a loss in efficiency brought about by the circuit breakers now being used in internal combustion engines. Upon replacing the latter circuit breakers by that of the present invention, the cam dwell increased in arc to within approximately one degree of the highest possible cam dwell. Therefore, an important object of the present invention is the provision of a circuit breaker operated by a rotating cam whereby a quick break is insured and the period between the making and breaking of the circuit is optimum for attaining the most efficient operation of the ignition system of an internal combustion engine.

A further object of the present invention is to provide a rotating action between the various parts of the above described circuit breaker whereby a fresh contacting surface is presented at each successive closing of the circuit.

A still further object of the present invention is the provision of a circuit breaker which is simple in construction and relatively inexpensive in cost, and is so constructed that it may be readily used as a replacement for existing circuit breaker mechanisms in automotive vehicles.

A still further object of the present invention is the provision of a circuit breaker having the above mentioned characteristics in which the operating lever is readily adjustable and does not bear against the cam surfaces of the cam shaft throughout the complete revolution thereof, and thereby reduces the wear of the cam shaft bearing to a minimum.

Other objects of the invention will appear in the specification and will be apparent from the accompanying drawing, in which:

Figure 1 is a top plan view of my invention embodied in a conventional distributor of an internal combustion engine.

Figure 2 is a sectional view taken along line 2—2 of Figure 1.

Figure 3 is an enlarged sectional view taken along line 3—3 of Figure 1.

Figure 4 is a perspective view of the circuit breaker shown removed from its position within the distributor.

Figure 5 is a top plan view of the base plate.

Referring now to the drawing wherein like numerals designate corresponding parts in all the figures, the numeral 10 refers to a conventional distributor housing (with its cover removed) consisting of a cylindrical side wall 11 and a bottom wall or base 12 at whose center portion there is an opening 13 through which extends a cam shaft 14 carrying the cam surfaces 15 all of which structure is conventional and well known in the art. Although the cam surfaces 15 shown in the drawing are adaptable only for a 6 cylinder internal combustion engine, it is to be noted that an appropriate cam for any size or type of internal combustion engine may be substituted therefor.

Mounted within the distributor housing 10 is a circuit breaker device consisting of essentially a substantially rectangular shaped housing 17 made preferably of plastic material so as to be capable of acting as an insulator as is hereinafter explained in detail. The housing 17 is provided with a cover 18 to enclose a chamber 19 formed within the housing 17, though the chamber 19 extends through two sides of the housing 17 as at 20 and 21. The housing 17 is further provided with a tapered lug 16 slidably positioned in a slot 38 formed in a base plate 22; the cover 18, housing 17 and base plate 22 being secured together by a pair of bolts 23 countersunk in an elongated opening 39 formed in the base plate 22 and extending through bores 24 formed in the housing 17 and the cover 18 and on which bolts 23 the nuts 25 are threaded. This construction permits the adjustment of the housing 17 as is explained in more detail hereinafter. The base plate 22 is itself secured to the floor 12 of the distributor housing 10 by means of the bolts 26 threaded in bores formed in the floor 12.

Within the chamber 19 of the housing 17 there is a metallic ball or sphere 27 in a normally contact relationship with a pair of metallic rollers 28, the latter being provided with bores 29 through which the bots 23 extend. The rollers 28 are positioned on either side of a vertical plane passing through the axis of the ball 27 and are provided with arcuate side walls having substantially the same curvature as that of the surface of the ball 27 so that as much as possible of the surfaces of the rollers 28 are in complete contact relationship with that of the ball 27. The ball 27 is yieldingly urged into contact rela-

tion with the rollers 28 by an L-shaped spring member 30 which has its shorter leg portion secured to the side wall of the housing 17 by a terminal bolt 32 and nut 33 and its longer leg portion extending across the opening 21 of the housing 17 in engagement with the ball 27. That portion of the spring member 30 in contact with the ball 27 is arcuate in shape to conform with that of the surface of the ball 27 in order that the surfaces thereof are in complete contact relationship with each other.

Extending through the second opening 20 in the side wall of the housing 17 is a substantially L-shaped lever 34 having one end 35 pivotally mounted on one of the bolts 23 and its other end 36 extending in a direction toward the cam surfaces 15 of the cam shaft 14. The arm 35 of the lever 36 extends beyond the pivot point 23 as at 37 in abutting relationship with the ball 27. It can be readily seen that as the cam shaft 14 rotates, the high positions of the cam surfaces 15 cause the operating lever 34 to pivot about the pivot bolt 23 to swing in a clockwise direction (as viewed in Figure 1) while the low positions of the cam surfaces 15 will permit the operating lever 34 to swing counterclockwise about the pivot 23 and back to the position shown by Figure 1, as will be explained in greater detail hereinafter.

The remaining structure which comprises the ignition circuit consists of a condenser 40 connected to a source of electrical energy (not shown) by means of the conductors 41 and 42 connected together by means of the terminal 43 and connector 44 which are connected together and properly insulated from the metallic housing 10. The circuit breaker itself is connected to the source of electrical energy by means of a conductor 45 which connects the terminal 32 and the connector 44 so that the flow of electricity will be along the spring 30 through the ball 27 to the rollers 28, down the bolts 23 to the base plate 22 which is in contact with the floor 12 of the housing 10 where the electricity becomes grounded and the circuit completed.

An adjustment bolt 31 is threadedly mounted on the arm 36 of the operating lever 34 with its free end abutting against the side wall of the housing 17, so that the arm 37 is in contact at all times with the ball 27. Therefore, any clockwise movement of the operating lever 34 and its arm 37 will effect a movement of the ball 27 in a direction away from rollers 28 so as to break the ignition circuit to the ground, and any counterclockwise movement of the lever 34 and its arm 37 will permit the spring 30 to force the ball 27 back into contact engagement with the rollers 28 and thereby complete the circuit to the ground.

It can be readily seen that as the cam shaft 14 rotates with the free end 36 of the operating lever 34 in spaced relation to the low portion of the cam surface 15 as shown in Figure 1, the ignition circuit will be grounded. Now as the higher portion of the cam surface 15 comes into contact with the free end 36 of the operating lever 34, the lever 34 begins to pivot in a clockwise direction and the arm 37 moves the ball 27 out of engagement with the grounded rollers 28. At that moment, the arm 36 of the lever 34 will be positioned a distance of approximately five and one half degrees from the high point of the cam surface 15, and at which moment a spark will be induced in the ignition system. The ignition circuit will remain opened until the arm 36 of the lever 34 is positioned approximately five and one-half degrees past

the high point of the cam surface 15 at which time the arm 34 will swing in a counterclockwise direction and the ball 27 returned into contact engagement with the grounded rollers 28. The current now builds up in the condenser 40 until the cam 15 again revolves to the position where the arm 34 is again forced to pivot in a clockwise direction to break the ignition circuit at the rollers 28 and effect a surge of current in the ignition circuit and cause a spark to be produced at the spark plug. Since the movement of the arm 37 is relatively slight in effecting the make and break of the ignition circuit, very little of the rotational movement of the cam surfaces 15 is dissipated thereby so that the cam dwell attained is the maximum possible.

To adjust the circuit breaker to suit the individual distributor, the nuts 25, 25 are unthreaded, and the housing 17 is shifted along the groove 38 and moved relative to the base plate 22. By shifting the housing 17 upwardly as seen in Figure 1, the arm 36 of the operating lever 34 moves in a direction away from the cam surface 15 and thereby increasing the cam dwell and reducing the duration of the opened ignition circuit. Movement of the housing 17 downwardly will produce a reversed effect thereby. It can be readily seen that the circuit breaker can be universally used and properly positioned to produce the best results without difficulty.

In view of the foregoing description taken in conjunction with the accompanying drawings it is believed that a clear understanding of the device will be quite apparent to those skilled in this art. A more detailed description is accordingly deemed unnecessary. It is to be understood, however, that even though there is herein shown and described a preferred embodiment of the invention, the same is susceptible to certain changes fully comprehended by the spirit of the invention as herein described and the scope of the appended claim.

What I claim is:

A circuit breaker comprising a substantially rectangular housing, a chamber in said housing, said chamber forming an opening in at least two sides of said housing, a spherical member contained in said chamber, a pair of roller members pivotally mounted within said chamber, a spring having one end secured to said housing and its other end extending across one of said openings yieldingly urging said spherical member into contact with said roller members, an operating lever extending through said other opening in said housing to a position adjacent said spherical member, and pivot means mounting said operating lever whereby upon the pivotal movement of said operating lever said spherical member is moved out of contact engagement with said rollers while substantially simultaneously effecting a rotational movement of said spherical and roller members.

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