June 27, 1961 F. M. STANBRO ET AL 2,990,459

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Filed July 24, 1959 3 Sheets-Sheet 1

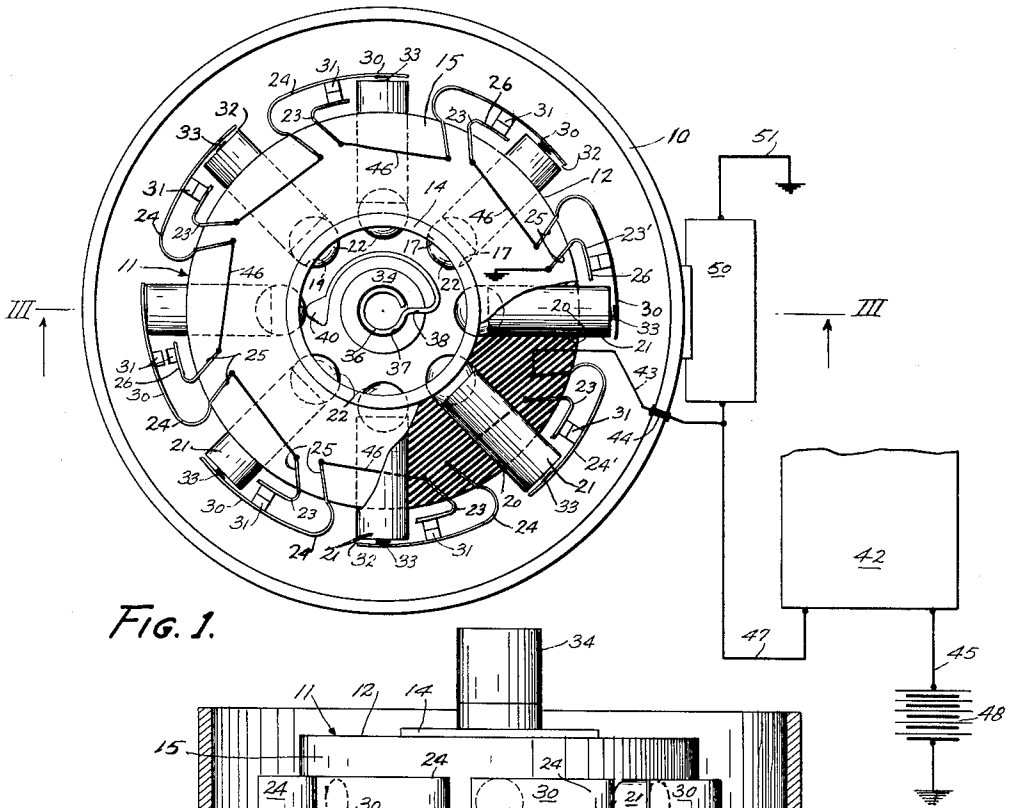


FIG. 1.

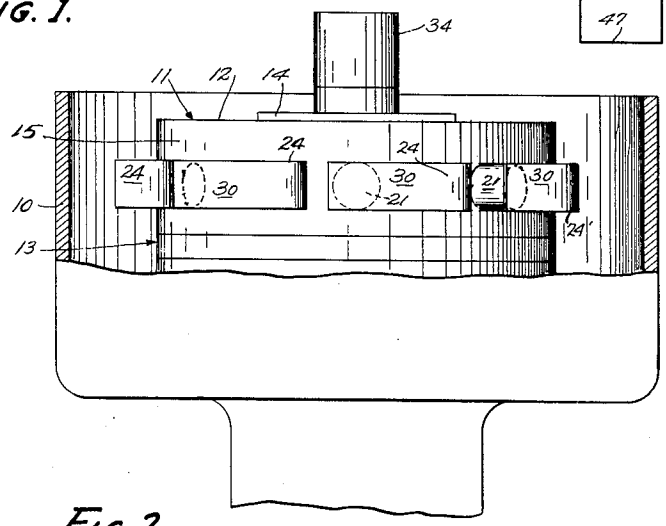


FIG. 2.

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June 27, 1961 F. M. STANBRO ET AL 2,990,459

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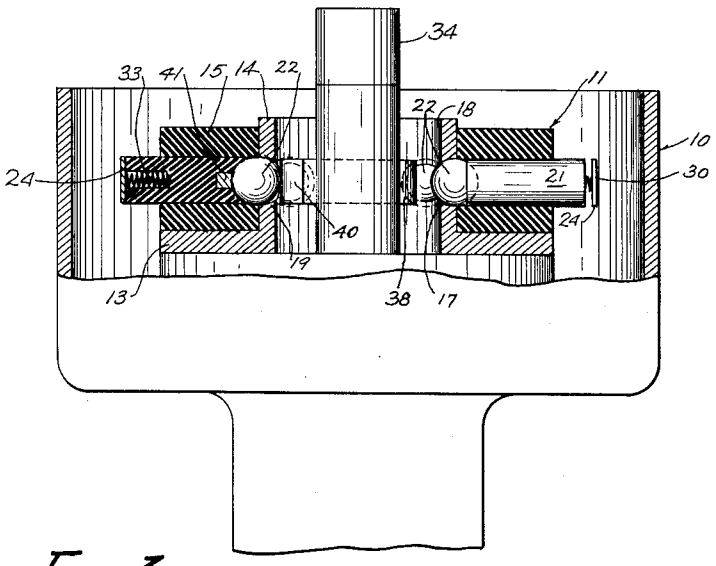


FIG. 3.

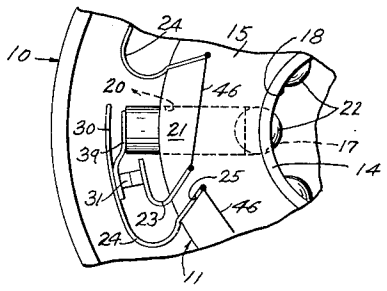


FIG. 4.

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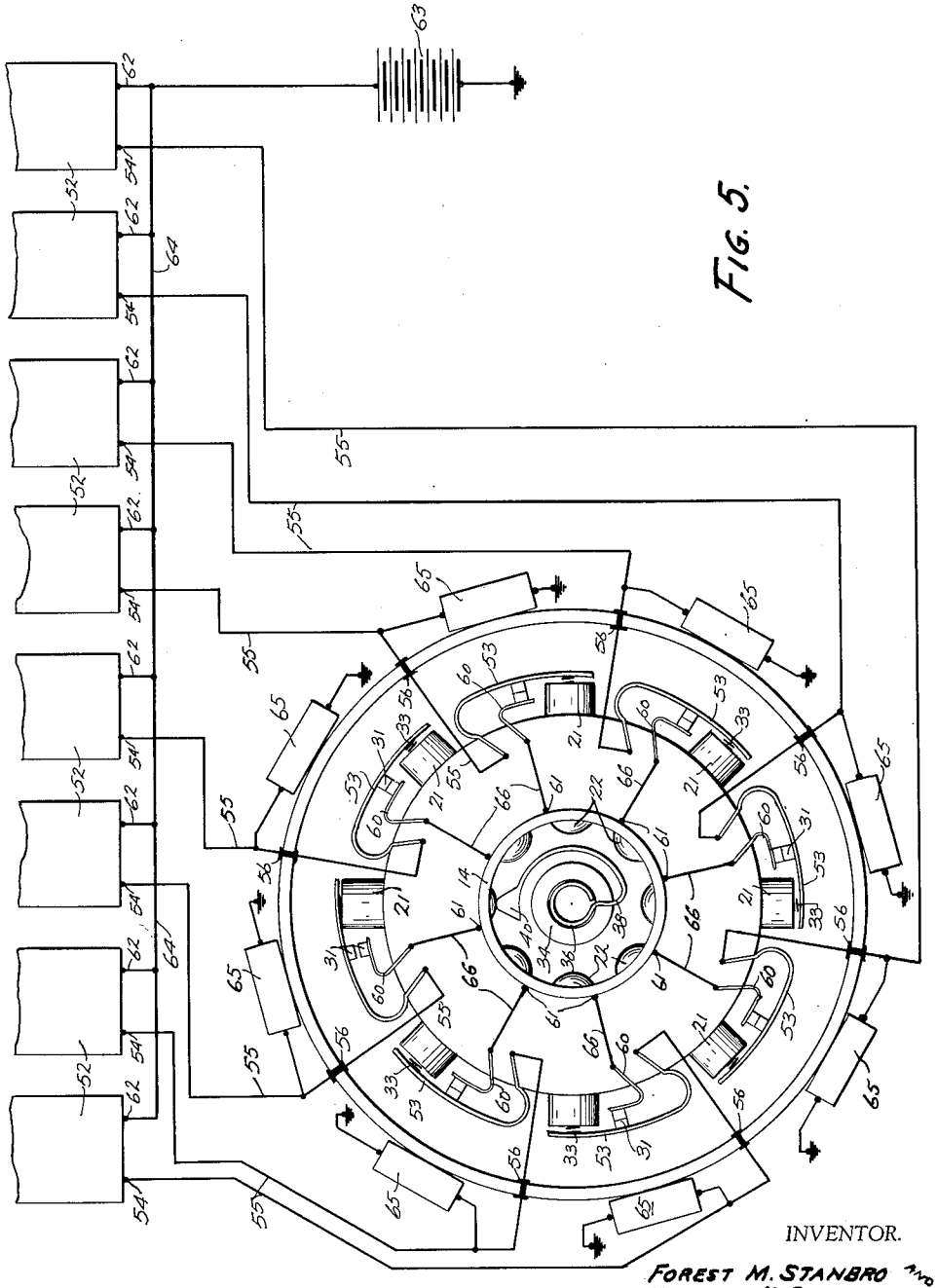


FIG. 5.

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United States Patent Office 2,990,459 Patented June 27, 1961

2,990,459

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Filed July 24, 1959, Ser. No. 829,290
8 Claims. (Cl. 200—27)

Our invention relates in general to ignition systems for internal combustion engines, and in particular to the primary breaker for the distributor of such an engine.

It is well known to those skilled in the art that where a single pair of breaker points is used in the distributor of a multi-cylinder engine, the adjustment of the gap between the breaker points is very critical and must be relatively small in dimension in order to permit the necessary return of the movable contact point after each opening thereof. Particularly this is so when the engine is run in high speed, as in racing cars. The result of such a small single breaker gap is that the contact points heat up quickly and become pitted and burned, requiring frequent replacement thereof. Moreover in some cases, the strength of the closing spring of the movable breaker contact point has to be increased to assure that the primary circuit of the spark coil will be closed at each impulse.

The principal object of our invention is to provide a distributor having a separate set of breaker contact points for each cylinder of the engine.

Another object is to provide a breaker having contact points which can be pre-set at a relatively wide gap thereby avoiding pitting and burning thereof.

A further object is to provide a breaker which will successfully operate over a long period of time without adjustment or replacement of contact points, thereby giving carefree service.

Moreover, in our device, the breaker contact points are disposed between the outer actuating end of a plunger and the flexing point of the movable breaker spring, thereby reducing the need for sensitive cam movement for actuating the gap of the breaker contact points.

Furthermore, since a separate set of breaker points is used for each engine cylinder, a separate spark coil may be used for each primary breaker thus permitting the magnetic field of the coil to build up to a higher magnetic saturation point each time the primary is energized.

Moreover, it is an object to provide a breaker cam arrangement having an actuating spring arm bearing against a spherical surface, whereby the breaking of the primary current is accelerated and given a kick at the actual point of current interruption.

The above objects and advantages have been accomplished by the device shown in the accompanying drawings, of which:

FIG. 1 is a plan view of the invention;

FIG. 2 is a side elevation thereof, partly in section;

FIG. 3 is a sectional elevation of the invention taken on line III—III of FIG. 1;

FIG. 4 is a fragmentary sectional view of a modified form of the invention; and,

FIG. 5 is a plan view, somewhat in diagram, showing an arrangement whereby one induction coil is provided for each set of breaker points.

Our invention relates in general to a casing **10** of conventional form, the top cap of the casing being omitted for clearness of illustration. The casing houses the primary breaker **11** of the distributor. The distributor is of course provided with the usual secondary switch means, not shown for clearness of illustration since it does not form a part of the invention.

The breaker is provided with a stationary member **12** which is adjustably mounted in customary manner within

the casing for timing of the breaker points. The stationary member is preferably supported by a metallic flange **13** having an upstanding sleeve **14** mounted in an annular opening formed coaxially with the stationary member. The stationary member is in the form of a ring **15** of insulated material. This ring is carried by the flange and the sleeve, and it is formed with a number of equally spaced radial apertures **20**, equal to the number of engine cylinders. Each of these apertures has a plunger **21** which is of insulating material and which is slidably mounted therein. The sleeve is formed with a circular centrally arranged opening **18**, and registering with each of the apertures **20** is a recess **17** formed in the sleeve. A ball **22** is disposed within each of the apertures and registering recesses. The recesses do not extend all the way through the sleeve at their maximum diameters but are so proportioned that the ball will pass inwardly into the recess of the sleeve but will be prevented from passing through the same, thus forming a stop **19**. The depth of the recess at its maximum diameter is such that the balls will project into the opening of the sleeve.

The breaker **11** of the distributor comprises a plurality of inner breaker members **23** and **23'** and a plurality of outer breaker members **24** and **24'**. The inner and outer breaker members are carried by the ring **15** and are each disposed and held within a slot **25** formed in the ring. The inner breaker members **23** and **23'** are arranged adjacent the associated plungers **21** and each is preferably formed with an arc-shaped contact member **26** having its free end spaced laterally from the associated plunger. Each of the outer breaker members **24** and **24'** is formed with an arc-shaped contact spring **30** which is superimposed over the contact member **26** in spaced relation therewith, and a pair of coacting contact points **31** is carried on and disposed between the adjacent surfaces of each pair of these contact members. The contact spring **30** is longer than the contact member **26** and it extends over and in registration with the outer end of the associated plunger **21**. The outer end of each of the cooperating plungers is provided with a predetermined space **32**, and a light helical tensioning spring **33** is mounted within this end of the plunger which bears against the inner surface of the contact spring **30**, whereby the plungers **21** will be maintained in their inner ball-engaging positions and against the stops **19**, thus avoiding lost motion between the balls and the contact springs **30**.

The actuating shaft **34** of the distributor is rotatably mounted within the central portion of the casing **10**, and carried by the shaft is the actuating arm **35** of the breaker. This arm is preferably in the form of a spiral spring having its inner end in the form of an open ring **36** mounted in an aperture **37** formed in the shaft and extending outwardly through a suitable peripheral slot **38** formed in the shaft and having a head **40** for successive contact with the balls **22** of the distributor. It is to be noted that since the spring of the actuating arm is spirally wound, the head **40** thereof will be pressed more firmly against the balls by reason of centrifugal action when rotating at high speed. Each of the plungers is formed at its inner end with a suitable wick **41** for contact with the surface of the associated ball **22**, whereby suitable lubrication will be provided.

The breaker shown in FIGS. 1 to 4 inclusive is designed to be used in connection with a single spark coil **42** which is provided with the well known secondary switch of the distributor (not shown). The primary lead **43** of the breaker is preferably extended from the outer breaker member **24'** through a suitable insulating bushing **44** carried by the casing **16** and is connected to the terminal **47** of the primary winding of the coil. The other terminal **45** of the primary circuit is connected to the battery **48**.

The other side of the battery and the inner breaker member **23'** are grounded so as to complete the primary circuit. As shown in FIG. 1 each of the inner breaker members **23** is connected in series to the next succession outer breaker member **24** by means of a jumper **46**, except the inner breaker member **23'** and the outer breaker member **24'** which are connected directly to the primary circuit, as hereinbefore described. Obviously, when either of the plungers **21** is pushed outwardly by the cooperating ball **22**, the helical tensioning spring **33** will be compressed into the plunger and the end of the plunger will then be pushed against the contact spring **30** of the outer breaker member **24** or **24'**, thereby separating the cooperating pair of contact points **31** and breaking the primary circuit. The primary circuit will thereby be interrupted successively as the actuating arm is caused to rotate. The condenser **50** of the distributor is suitably connected to the lead **43** and to the ground by means of lead **51** in well known manner. In the modification shown in FIG. 4, the helical tensioning spring **33** is dispensed with and a light flat tensioning spring **39** is fastened at one end to the outer end of the contact spring **30** of each outer contact members **24** and **24'**. The outer end of this flat spring bears against the outer end of the plunger and is counteracted by the contact spring **30**. It will be obvious that the tensioning springs **33** and **39** are solely for the purpose of maintaining the plungers against the stops **19**. The strength of the contact springs **30** is greater than that of these tensioning springs and they will therefore be compressed independently of and before the contact springs will be actuated.

Referring now to the form of invention shown in FIG. 5, each of the breaker members is provided with a separate spark coil **52**. As shown in this modification, the breaker contact points **31** are arranged in parallel with each other and each of the outer breaker springs **53** is connected to the associated primary lead **54** of the coil by means of a lead **55**, each of the leads **55** being passed through a suitable insulating bushing **56**. Each of the inner breaker members **60** is grounded preferably to the sleeve **14** at points indicated at **61** by means of leads **66**. In this form of the invention no secondary distributor switch is required, but each pair of contact points **31**, when separated, causes the interruption of each of the primary circuits in succession, thereby causing each cooperating secondary coil (not shown) to be energized in succession. The other terminal **62** of each of the primary circuits is connected to the battery **63** and successively to each of the primary leads **62** by means of a common lead **64**. A condenser **65** is suitably connected to each pair of contact points by means of the leads **55** and suitable ground connection.

While we have shown the use of the light helical tensioning springs mounted in the outer ends of the plungers, it is obvious that these springs may be dispensed with and a small amount of end play may be provided between the outer end of the plunger and the contact spring **30** of the outer contact member **24** so as to assure the closing of the contact points. These and other modifications may be made without departing from the spirit of our invention or the scope of the appended claims.

What is claimed is:

1. A circuit breaker for an internal combustion engine, comprising a casing, a stationary member adjustably carried by said casing and formed with an axially disposed cylindrical opening, said stationary member being formed with a plurality of radially arranged apertures, a retainer ring disposed in said opening, said ring being formed with a plurality of recesses registering with the apertures of said stationary member, a plurality of anti-friction balls slidably mounted within and projecting part way through the registering recesses of said ring thereby forming stops for limiting the inward movement of said balls, a plurality of reciprocating plungers mounted in the radial apertures of said stationary member and bearing against the associated balls, a rotary member mounted within said ring, a pair of breaker springs for each of said plungers, said springs being carried by said stationary member and each comprising an inner spring and an outer spring, said outer spring being superimposed on said inner spring and engageable with the outer end of the coacting plunger, and an actuating arm carried by said rotary member and having its outer end successively engageable with said balls.

2. A circuit breaker for an internal combustion engine, comprising a casing, a stationary member adjustably carried by said casing and formed with an axially disposed cylindrical opening, said stationary member being formed with a plurality of radially arranged apertures, a retainer ring disposed within said opening, said ring being formed with a plurality of recesses registering with the apertures of said stationary member, a plurality of anti-friction balls slidably mounted within and projecting part way through the registering recesses of said ring thereby forming stops for limiting the inward movement of said balls, a plurality of reciprocating plungers mounted in the radial apertures of said stationary member and bearing against the associated balls, a rotary member mounted within said ring, a pair of breaker springs for each of said plungers, said springs being carried by said stationary member and each comprising an inner spring and an outer spring, said outer spring being superimposed on said inner spring and engageable with the outer end of the coacting plunger, flexible means carried by the outer end of each of said plungers for engagement with the associated outer spring, and an actuating arm carried by said rotary member and having its outer end successively engageable with said balls.

3. A circuit breaker for an internal combustion engine, comprising a casing, a stationary member adjustably carried by said casing and formed with an axially disposed cylindrical opening, said stationary member being formed with a plurality of radially arranged apertures, a retainer ring disposed within said opening, said ring being formed with a plurality of recesses registering with the apertures of said stationary member, a plurality of anti-friction balls slidably mounted within and projecting part way through the registering recesses of said ring thereby forming stops for limiting the inward movement of said balls, a plurality of reciprocating plungers mounted in the radial apertures of said stationary member and bearing against the associated balls, a rotary member mounted within said ring, a pair of breaker springs for each of said plungers, said springs being carried by said stationary member and each comprising an inner spring and an outer spring, said outer spring being superimposed on said inner spring and engageable with the outer end of the coacting plunger, a helical spring mounted in an axially disposed aperture formed in the outer end of each plunger for resilient engagement with said outer spring, and an actuating arm carried by said rotary member and having its outer end successively engageable with said balls.

4. A circuit breaker for an internal combustion engine, comprising a casing, a stationary member of insulating material adjustably carried by said casing, said stationary member being formed with a plurality of equidistantly arranged apertures, a cylindrical plunger of insulating material slidably disposed within each of the apertures of said stationary member, stop means carried by said plungers and said stationary members for limiting the movement of said plungers in one direction, a rotary member carried by said stationary member, actuating means carried by said rotary member, said actuating means being in cooperative relation with said plungers for successively reciprocating the latter, a plurality of inner contact members and a plurality of resilient coacting outer contact members carried by said stationary member, said contact members being mounted independently of said plungers, a pair of coacting normally closed breaker contacts carried by each pair of coacting

contact members for successive current interruption by movement of said plungers, and resilient means carried by each of said plungers and engageable with the coacting outer contact member to normally maintain said plungers against said stop means.

5. A circuit breaker for an internal combustion engine, comprising a casing, a stationary member of insulating material adjustably carried by said casing, said stationary member being formed with a plurality of equidistantly arranged apertures, a cylindrical plunger of insulating material slidably disposed within each of the apertures of said stationary member, stop means carried by said plungers and said stationary members for limiting the movement of said plungers in one direction, a rotary member carried by said stationary member, actuating means carried by said rotary member, said actuating means being in cooperative relation with said plungers for successively reciprocating the latter, a plurality of inner contact members and a plurality of resilient coacting outer contact members carried by said stationary members, said contact members being mounted independently of said plungers, a pair of coacting normally closed breaker contacts carried by each pair of coacting contact members for successive current interruption by movement of said plungers, said outer contact member being disposed outside of said inner contact member and movable radially in relation therewith, the outer end of each of said plungers being spaced from said outer contact member, and resilient means associated with said plungers for resiliently maintaining said space.

6. A circuit breaker for an internal combustion engine, comprising a casing, a stationary member of insulating material adjustably carried by said casing and formed with an axially disposed cylindrical opening, said stationary member being formed with a plurality of equidistantly arranged radial apertures, a cylindrical plunger of insulating material slidably disposed within each of the apertures of said stationary member, stop means carried by said plunger and said stationary member for limiting the movement of each of said plungers in one direction, a rotary member carried by said stationary member, actuating means carried by said rotary member and mounted within the opening of said stationary member, said actuating means being in cooperative relation with said plungers for successively reciprocating the latter, an inner breaker point carried by said stationary member, a spring contact member mounted upon said stationary member, an outer breaker point carried by said spring contact member in cooperative relation with said inner breaker point, said spring contact member being in cooperative relation with the coacting plunger and in spaced relation therewith, and resilient means independent of each of said spring contact members and interposed between the latter and the plunger to hold the plunger against said stop means.

7. A circuit breaker for an internal combustion engine, comprising a casing, a stationary member of insulating material adjustably carried by said casing and formed with an axially disposed cylindrical opening, said stationary member being formed with a plurality of equidistantly arranged radial apertures, a cylindrical plunger of insulating material slidably disposed within each of the apertures of said stationary member and having one end thereof projecting into said cylindrical opening, stop means carried by said plunger and said stationary member for limiting the movement of each of said plungers in one direction, a rotary member mounted within said stationary member, actuating means carried by said rotary member and mounted within the opening of said stationary member, said actuating means being in cooperative relation with said plunger for successively reciprocating said plungers, a plurality of pairs of coacting inner and outer contact members for each plunger, each pair of contact members being carried by said stationary member independently of said plungers, each of said plungers being engageable with the associated outer contact member for causing the actuation of the latter, a pair of normally closed breaker contact points carried by each pair of contact members for current interruption by successive movement of said plungers, said stop means being independent of said breaker contact points when in closed positions, and resilient means actuated independently of said contact members for normally pressing said plungers against said stops.

8. A circuit breaker for an internal combustion engine, comprising a casing, a stationary member adjustably carried by said casing and formed with an axially disposed cylindrical opening, said stationary member being formed with a plurality of radially arranged apertures, a retainer ring disposed in said opening, said ring being formed with a plurality of recesses registering with the apertures of said stationary member, a plurality of antifriction balls slidably mounted within and projecting part way through the registering recesses of said ring thereby forming stops for limiting the inward movement of said balls, a plurality of reciprocating plungers mounted in the radical apertures of said stationary member and bearing against the associated balls, a rotary member mounted within said ring, a pair of breaker contacts for each of said plungers, said contacts being carried by said stationary member and each comprising an inner contact and an outer contact, said outer contact being superimposed on said inner contact and engageable with the outer end of the coacting plunger, and an actuating arm carried by said rotary member and having its outer end successively engageable with said balls.

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