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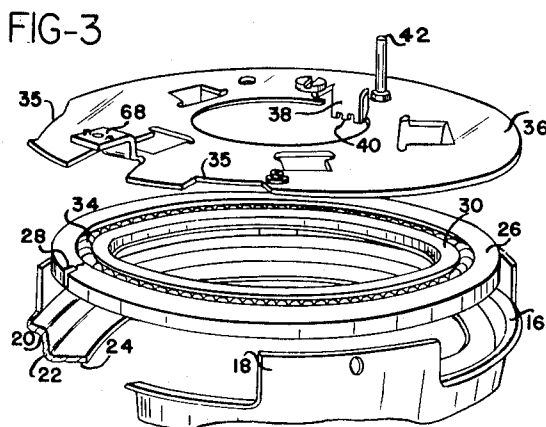
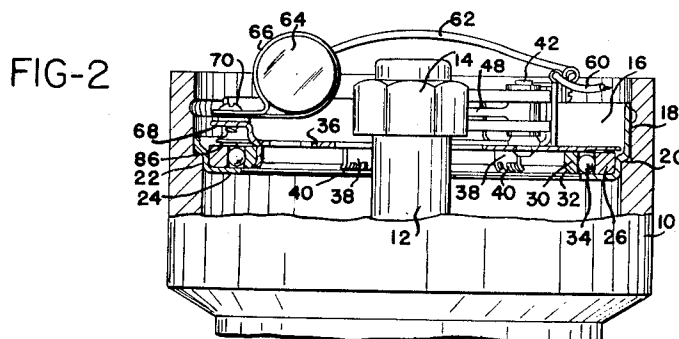
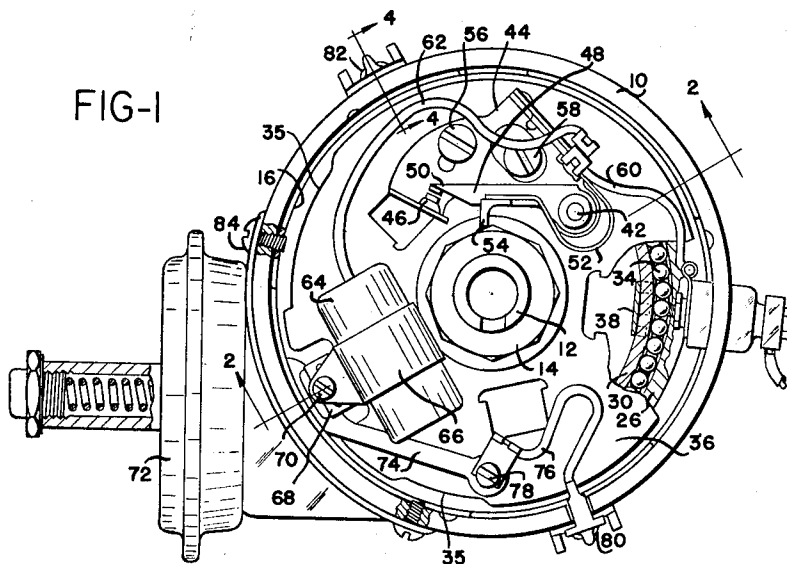
L. L. BRUNK

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DISTRIBUTOR PLATE ASSEMBLY

Filed Oct. 16, 1952

2 Sheets-Sheet 1



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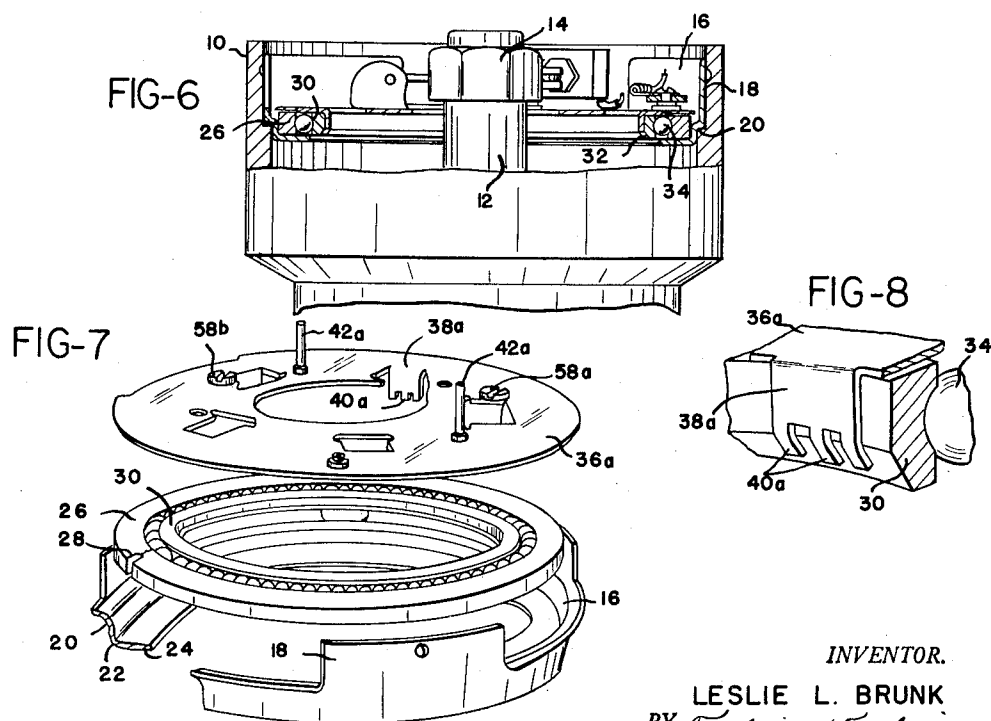
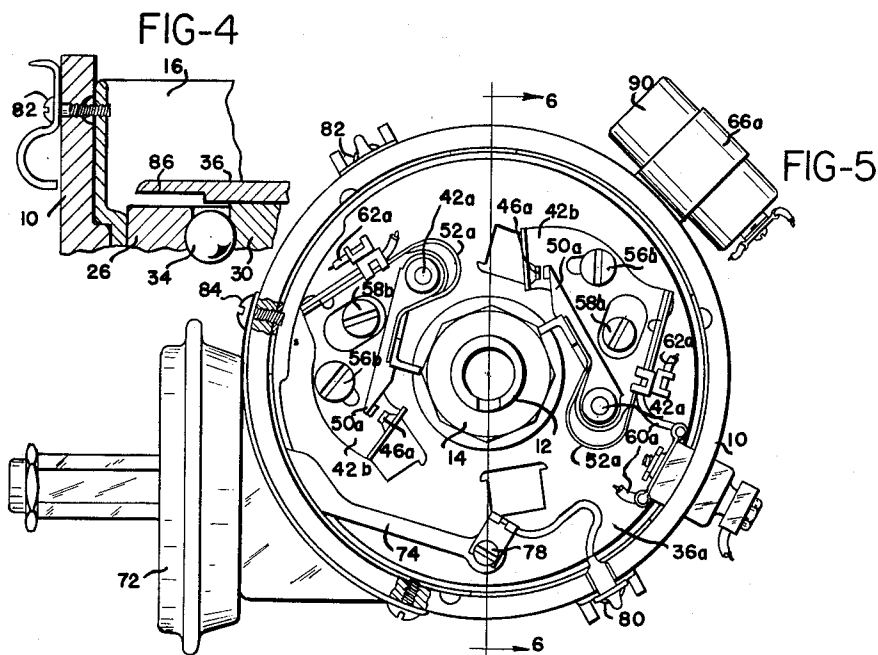
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DISTRIBUTOR PLATE ASSEMBLY

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Application October 16, 1952, Serial No. 315,040

13 Claims. (Cl. 200—31)

This invention relates to improvements in ignition systems for internal combustion engines, and particularly to improvements in the breaker and distributor plate unit.

In all modern internal combustion engines utilizing spark ignition, it is possible to obtain maximum efficiency at various conditions of engine speed and engine load by varying the instant of ignition in accordance with the said conditions. Ordinarily, this is accomplished by adjusting the position of the breaker or distributor plate of the ignition system on which the breaker points are mounted relative to the cam shaft which operates to open and close the breaker points, in combination with centrifugally operated means for advancing the said cam as the speed of the engine increases.

Conveniently, the load on the engine is measured by measuring the vacuum in the intake manifold, preferably closely adjacent the carburetor, and adjusting the breaker or distributor plate in accordance therewith, preferably by subjecting a diaphragm to the said vacuum and connecting the diaphragm with a suitable link to the breaker or distributor plate.

Inasmuch as the maximum degree of efficiency of the engine will be obtained only when the distributor plate movement is quite closely correlated with the said vacuum, it is highly important for the distributor plate to be movably supported in a substantially friction-free manner. At the same time, the distributor plate must be precisely located and be held against tilting or shifting movements in any direction other than a purely rotary movement about the axis of the cam shaft.

In my previous application, Serial No. 124,008, filed October 28, 1949, now Patent No. 2,617,899, November 11, 1952, I show a distributor plate arrangement in which the distributor plate is mounted within the distributor housing; the distributor plate arrangement has a ball bearing comprising a plurality of relatively small balls that substantially completely fill the annular space between the inner and outer races of the ball bearing. The inner race of the ball bearing is rigid with the distributor plate proper while the outer race of the ball bearing is rigid with a mounting plate adapted for being fixedly mounted in the distributor housing. The several advantages referred to above of a fixed, stable mounting for the distributor plate, and on which mounting the distributor plate is freely rotatable, is thus obtained.

Certain disadvantages are present in the construction illustrated in the said application, however, and the primary object of the present invention is the provision of a distributor plate arrangement that will overcome these disadvantages.

Among the disadvantages encountered with the construction of the above mentioned pending application was the frequent use of screws of the wrong size for fastening the distributor plate assembly in the distributor housing. Many times screws of slightly too great a length were employed and the inner ends of the screws would extend completely through the mounting plate and strike

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the movable distributor plate and thus prevent the desired free movement thereof.

In other instances, it was found that the efficiency of the ball bearing was somewhat impaired by cramping of the outer race thereof due to the pressure applied to the assembly in mounting it with the distributor housing.

Accordingly, the present invention has for its primary object the provision of a distributor plate assembly of the nature referred to which will eliminate the disadvantages referred to above, and provide for an easier and more accurate assembling of the assembly with a distributor housing.

Another object of this invention is the provision of a distributor or breaker plate and a mount therefor which will give the exact accuracy of timing that will produce the most efficient engine performance.

Still another object is the provision of a ball bearing mount for a distributor plate that will damp out flutter so that the cam angle for the breaker points is always precisely correct.

A still further object is the provision of an anti-friction bearing mount for a movable distributor plate which will prevent any tilting of the plate and will positively locate the plate at all times.

These and other objects and advantages of this invention will become more apparent upon reference to the following specification taken in connection with the accompanying drawings, in which:

Figure 1 is a plan view of a distributor housing having the cap removed therefrom and having a distributor plate assembly according to this invention mounted therein, and with a portion of the distributor plate broken away to show the ball bearing mounting thereof;

Figure 2 is a partial vertical section indicated by line 2—2 on Figure 1;

Figure 3 is a perspective view of the distributor plate, the supporting ball bearing therefor, and the mounting plate with the breaker points and ignition condenser removed from the distributor plate;

Figure 4 is a sectional view indicated by line 4—4 on Figure 1 showing the manner in which one of the screws is employed for the dual purpose of fastening the distributor plate cover snaps to the distributor housing, and also for securing the mounting plate of the distributor plate assembly in position in the housing;

Figure 5 is a plan view like Figure 1, but shows an arrangement according to my invention utilizing dual breaker points;

Figure 6 is a partial vertical section indicated by line 6—6 on Figure 5;

Figure 7 is a perspective view similar to Figure 3 but illustrating the Figures 5 and 6 arrangement; and

Figure 8 is a fragmentary perspective view showing the manner in which the distributor plates of the two modifications referred to are clamped to the inner races of their supporting ball bearings.

Referring to the drawings somewhat more in detail, and with particular reference to Figures 1 through 4, the distributor housing is indicated at 10 and may be considered to be of conventional construction. Extending along the center axis of the distributor housing 10 is a cam shaft 12 having mounted thereon a cam 14. Cam shaft 12 and cam 14 are also of conventional construction, and it will be understood that cam shaft 12 is geared to the engine so as to be driven in synchronism therewith.

The distributor housing comprises a distributor cap not shown to which the several high tension leads leading to the spark plugs are connected, as well as the incoming high tension lead from the spark coil. A rotating arm is mounted on the upper end of the cam shaft and is effective for distributing high tension impulses from the high tension

lead coming from the ignition coil to the several high tension leads leading to the spark plugs. This construction also is conventional.

Mounted in the upper end of distributor housing 10 is mounting plate 16 of the distributor plate assembly, according to the present invention. Plate 16 comprises a peripheral vertical flange portion 18 that slidably fits within the housing, and which terminates at its lower end in an inwardly projecting shoulder or step 20. Extending downwardly from the inner periphery of shoulder or step 20 is a second vertical portion 22, also having at its lower edge the inwardly extending flange portion 24. Mounting plate 16 is thus provided with two steps.

As will best be seen in Figure 3, the vertical flange portion 18 is not a continuous element, but consists of several arcuate upstanding portions, thus simplifying the manufacture of the plate and its insertion into the housing and providing access openings for the link leading from the diaphragm and for the wire leading to the breaker points.

Press fitting, or otherwise suitably rigidly mounted within vertical portion 22 and upon horizontal flange portion 24 of mounting plate 16, is outer race 26 of a ball bearing. Outer race 26, according to this invention, is provided with an axial slit 28 as shown in Figure 3, which permits breaking of the said outer race so that the balls can be placed in the bearing.

Inside outer race 26 is an inner race 30 having its inner lower corner chamfered or beveled as at 32. Races 26 and 30 are annularly grooved in the customary manner for ball bearing races and substantially completely filling the annular space between the races and extending into the said grooves are a plurality of relatively small balls 34. As will be seen in Figures 1 and 3, the balls 34 are closely adjacent each other, even to the point of touching, so that the same conditions of support and journaling of the inner race obtains about the entire circumferential extent thereof. It will, therefore, be apparent that, with the outer race 26 rigidly held in mounting plate 16 and with mounting plate 16 rigidly held with the distributor housing, the only motion that can be taken by inner race 30 is a rotary motion about a fixed axis and with any tilting or lateral shifting movements of the inner race being prevented.

The great number of small balls, on the order of $\frac{1}{8}$ " each, serves to give a damping effect on the movable plate that tends to eliminate the flutter of the plate and stabilize the action thereof, particularly where the balls are coated with oil.

The fixed position of the bearing is availed of for providing the desired support for the distributor plate on which the breaker points of the ignition system are mounted. The distributor plate is indicated at 36 and consists of a substantially flat plate having a plurality of tabs 38 struck therefrom extending downwardly so as to be a press fit inside the inner race 30 of the ball bearing. The lowermost tips of tabs 38 have a plurality of extensions 40 thereon which are bent over the previously mentioned beveled or chamfered portion 32 of the inner race of the ball bearing, as will be seen in Figure 2. This provides for an absolutely rigid connection of distributor plate 36 with the inner race of the ball bearing so that the said distributor plate is limited to the same movement previously referred to in connection with said inner race. The tabs 38 preferably extend to above the chamfer 32 so bending over of the tabs can be accomplished at a pressure that will not deform the inner race of the bearing.

Distributor plate 36 is provided with a pivot pin 42 on which is mounted the breaker point assembly 44 that comprises the stationary plate having the stationary breaker point 46 and the movable arm 48 pivotal about the axis of pin 42, and having movable breaker point 50.

A spring 52 urges the arm 40 inwardly and a cam follower 54 bears on the periphery of cam 14 so that the breaker points are opened and closed in the necessary manner.

A clamp screw 56 is provided for clamping the stationary plate in any position of adjustment, and an eccentric-

cally mounted cam 58 engages the said stationary plate for effecting adjustment thereof.

A wire 60 leads in through one wall of the distributor housing and is connected with the movable breaker point, and a wire 62 leads from the movable breaker point to one terminal of a condenser 64 that is provided with a supporting or mounting strap 66 that is secured to a small elevated platform 68 by a screw 70. Platform 68 is formed upwardly from the periphery of movable distributor plate 36. The elevated platform 68 prevents the possibility of too long a screw being employed at 70 which would engage the outer race of the ball bearing, and thus inhibit the free movement of the distributor plate.

Mounted on one side of the distributor housing is a diaphragm unit 72 having therein a diaphragm which is subjected to the manifold vacuum on one side, while on the other side a link 74 leads to a stud on the movable distributor plate which also serves as an anchor point for mounting wire 76, the said wire and link being held in place or the stud by a screw 78.

As will be seen in Figures 1 and 3, the periphery of the movable distributor plate 36 is provided with spaced cutouts 35 which give ample clearance at the point where the screw 84 secures the mounting plate 16 in position in the distributor housing. The two notches are provided so the plate 36 can be reversed for different types of distribution. The other screws holding plate 16 comprise the screws 80 and 82 which hold the members in place to which the spring snaps for the lid are pivoted. Another screw, not numbered, serves as one of the other supporting screws for the diaphragm unit 72. By providing the periphery of the mounting plate 16 with located holes for receiving the screws 80, 82 and 84, means for positively, exactly and fixedly locating the mounting plate within the distributor housing is had.

As will be seen in Figure 2, the outer periphery of rotatable distributor plate 36 extends outwardly so as to cover the space between the bearing races whereby foreign matter is excluded therefrom. In order to provide clearance between the periphery of the distributor plate 36 and the upper surface of the outer race of the ball bearing, the said outer race may be so formed as to be at a slightly lower level than the inner race, and likewise the underneath side of the outer periphery of distributor plate 36 may be somewhat under cut, or embossed, as will be seen by reference numeral 86.

The inwardly extending portion 24 of the mounting plate 16 similarly extends over the opening between the inner and outer ball bearing races of the ball bearing at the bottom thereof, and this likewise serves to prevent the entrance of foreign matter into the ball bearing race.

In the arrangement illustrated in Figures 5 through 7, substantially an identical construction is illustrated and to which corresponding numerals having been applied with an addition of a subscript "a" where applicable, except that in Figures 5 through 7 dual breaker points are provided. Because of the provision of the extra set of breaker points, the condenser is arranged for external mounting as at 90 and suitable wires are provided for interconnecting the breaker points and condenser. The advantages of a dual breaker point arrangement is that increased dwell of the points can be had while still maintaining the precise instant of interrupting the circuit through the breaker points, whereby better spark conditions are obtained in the spark plugs under all conditions of speed of operation.

The added breaker point assembly merely requires that an extra pivot pin be provided for the second breaker point assembly, as indicated at 42b, and that a clamp through 56b and an adjusting cam 58b be located in the proper position in the breaker plate assembly.

In all other respects the construction of Figures 5 through 7 is the same as that of Figures 1 through 3,

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and the same advantages and operating efficiency obtain therefor.

In the case of either of the modifications illustrated, the distributor plate, the ball bearing, and the mounting plate are pre-assembled and can readily and easily be inserted in the distributor housing merely by removing the old distributor plate and any elements pertaining only to the old distributor plate, and then inserting the distributor plate assembly according to this invention. Then, when the screws 80, 82 and 84 are replaced, the distributor plate assembly may be absolutely fixed in position and the distributor will be in operative condition.

The ball bearing employed is a precision product having hardened, ground and polished balls with the balls being as accurately made as is possible of a special chrome-vanadium alloy. Tolerances are maintained that exceed aircraft specifications and, by selective assembly, the smoothest possible operation of the bearing is obtained which, of course, results in extremely smooth and friction-free operation of the distributor plate assembly.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions, and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. In a distributor plate assembly of the nature described; a metal plate adapted for being stationarily mounted in a distributor housing and having means for supporting a ball race, a ball bearing having an outer race supported by said means and also having an inner race, balls in the space between the races, a breaker plate mounted on said inner race, tabs struck out from said breaker plate and extending downwardly inside said inner race, the lower corner of said inner race being chamfered and the lower ends of said tabs being bent over the chamfered lower edge of said inner race for fixedly connecting the breaker plate with the said inner race, and a platform carried by said breaker plate and extending above the same, said platform being adapted to support a condenser.

2. In a distributor plate assembly for an ignition system which includes a distributor housing, a mounting plate comprising an axial peripheral portion adapted for closely fitting in said housing in the upper end, step means formed near the bottom of said mounting plate, a ball bearing having its outer race engaging said step and also having an inner race and balls substantially filling the space between said races, a breaker plate resting on said inner race and having its peripheral portion extending over the space between said races, tabs carried by said breaker plate and closely fitting inside said inner race for fixedly securing said breaker plate thereto, and said tabs each having a plurality of fingers, the said fingers being bent over the bottom of said inner race to form a positive engagement of the said breaker plate with the said inner race.

3. In a distributor plate assembly for an ignition system which includes a distributor housing, a mounting plate comprising an axial peripheral portion adapted for closely fitting in said housing in the upper end, step means formed near the bottom of said mounting plate, a ball bearing having its outer race engaging said step and also having an inner race and balls substantially filling the space between said races, a breaker plate resting on said inner race and having its peripheral portion extending over the space between said races, tabs carried by said breaker plate and closely fitting inside said inner race for fixedly securing said breaker plate thereto, and said tabs each having a plurality of fingers, the said fingers being bent over the bottom of said inner race to form a positive engagement of the said breaker plate with the said inner race, said breaker plate having a pair of spaced upwardly

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extending posts and dual breaker points mounted on said pair of posts.

4. In a distributor plate assembly of the nature described; a metal plate adapted for being stationarily mounted in a distributor housing and having means for supporting a ball race, a ball bearing having an outer race supported by said means and also having an inner race, balls in the space between the races, a breaker plate mounted on said inner race, tabs struck out from said breaker plate and extending downwardly inside said inner race, the lower corner of said inner race being chamfered and the lower ends of said tabs being bent over the chamfered lower edge of said inner race for fixedly connecting the breaker plate with the said inner race, the said breaker plate having a periphery lying adjacent said distributor housing, and a plurality of cutout portions on said periphery.

5. In a distributor plate assembly for mounting in the housing of the distributor for an engine; a mounting plate having an axial peripheral portion adapted for being received in said housing and being formed with two inwardly extending steps at its lower ends, screws extending through said housing and threadedly engaging said mounting plate for locating the said mounting plate and for holding it in its located position, a ball bearing having an outer race mounted on the lower one of the steps of said mounting plate and also having an inner race and balls filling the space between the races, a breaker plate mounted on the inner race and having its periphery extending outwardly to shield the space between the races, tabs struck out from said breaker plates and extending downwardly inside the said inner race and having their extreme lower ends bent outwardly under said inner race for fixing the breaker plate to the inner race, said outer race being a pressed fit in said mounting plate and being provided with a slot in its outer periphery and a fracture through the outer race at said slot to permit deforming of said outer race to permit assembly thereof with the inner race and balls.

6. A distributor plate assembly as set forth in claim 4, in which the breaker plate has a periphery lying adjacent said distributor housing, and a plurality of cutout portions on said periphery, and said breaker plate has a pair of spaced upwardly extending posts, and dual breaker points mounted on said pair of posts.

7. In a distributor plate assembly of the nature described; a metal plate adapted for being stationarily mounted in a distributor housing and having means for supporting a ball race, a ball bearing having an outer race supported by said means and also having an inner race, balls in the space between the races, a breaker plate mounted on said inner race and tabs struck out from said breaker plate and extending downwardly inside said inner race, the lower corner of said inner race being chamfered and the lower ends of said tabs being bent over the chamfered lower edge of said inner race for fixedly connecting the breaker plate with the said inner race, the lowermost ends of said tabs being slotted to provide for fingers which are readily bent over the said chamfered portion under pressures which will not deform the said inner race.

8. In a distributor plate assembly of the nature described; a stationary mounting plate, a ball bearing having its outer race fixed to said mounting plate, an inner race, balls substantially filling the space between the races, a breaker plate mounted on said inner race and having its periphery extending outwardly to shield the space between the races, tabs struck out from said breaker plate and closely fitting within said inner race and having their lower ends bent outwardly under the inner race so that the breaker plate is fixedly connected with said inner race, and a raised platform formed in the periphery of said breaker plate to provide a space for receiving the condenser of the ignition system.

9. A distributor plate assembly as in claim 2, in which

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the mounting plate has an inwardly extending first step at the bottom of the axial peripheral portion, an axially extending second portion extending downwardly from the inner part of first step and a second step formed inwardly from the bottom of said second axial portion, the ball bearing having its outer race closely fitting within said second portion and supported on said second step, the breaker plate having its periphery extending outwardly at least partly over said outer ball bearing race, the tabs having their lower extremities formed outwardly to embrace the inner bearing race, and upstanding pivot posts fixed to said breaker plate for receiving the movable arms of the breaker points of the ignition system.

10. In a distributor plate assembly for an ignition system which includes a distributor housing, a mounting plate comprising an axial peripheral portion adapted for closely fitting in said housing in the upper end, step means formed near the bottom of said mounting plate, a ball bearing having its outer race engaging said step and also having an inner race and balls substantially filling the space between said races, a breaker plate resting on said inner race and having its peripheral portion extending over the space between said races, tabs carried by said breaker plate and closely fitting inside said inner race for fixedly securing said breaker plate thereto, said tabs being bent over the bottom of said inner race to form a positive engagement of the said breaker plate with the said inner race, and said outer race having a split whereby to assist in the insertion of said balls between said races.

11. In a distributor plate assembly of the nature described; a metal plate adapted for being stationarily mounted in a distributor housing and having means for supporting a ball race, a ball bearing having an outer race supported by said means and also having an inner race, balls in the space between the races, a breaker plate mounted on said inner race, tabs struck out from said breaker plate and extending downwardly inside said inner race, the lower corner of said inner race being chamfered and the lower ends of said tabs being bent over the chamfered lower edge of said inner race for fixedly connecting the breaker plate with the said inner race, a platform struck up from said breaker plate, and means on said platform for supporting a condenser.

12. In a distributor plate assembly of the nature described; a stationary mounting plate, a ball bearing having its outer race fixed to said mounting plate, an inner race, balls substantially filling the space between the races, a breaker plate mounted on said inner race and having its periphery extending outwardly to shield the space be-

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tween the races, the tabs struck out from said breaker plate and closely fitting within said inner race and having their lower ends bent outwardly under the inner race so that the breaker plate is fixedly connected with said inner race, and a raised platform formed in the periphery of said breaker plate to provide a space for receiving the condenser of the ignition system, said outer race having an axial split whereby to assist in the insertion of said balls between said races.

13. In a distributor plate assembly of the nature described comprising; a stationary mounting plate and a breaker plate, and means rotatably supporting said breaker plate for rotational movement with respect to said mounting plate about a fixed axis, said means comprising a ball bearing assembly having a grooved outer race, said mounting plate peripherally engaging and fixedly retaining said outer race, said assembly also comprising a grooved inner race fixed to the breaker plate, the inner race being confined for rotary movement only with respect to the outer race, the bearing also including small oil coated balls substantially completely filling the space between said races and extending into the grooves thereof, the outer bearing race having a single axially extending slot in its outer periphery extending only part-way therethrough and a single fracture only through the remainder of the thickness of the outer race communicating with the slot whereby the outer race can be sprung open so the space between the races can be completely filled with the said balls and whereby the fracture areas will precisely locate the ends of the outer race when it is closed and the mounting plate will hold the outer race closed; the mounting plate, grooved races and oil-coated balls cooperating in the assembly to restrict the inner race and the breaker plate thereon to rotary movement only, the oil-coated balls being present in sufficient number to provide a measurable damping effect and to eliminate flutter of the breaker plate fixed to the inner race.

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