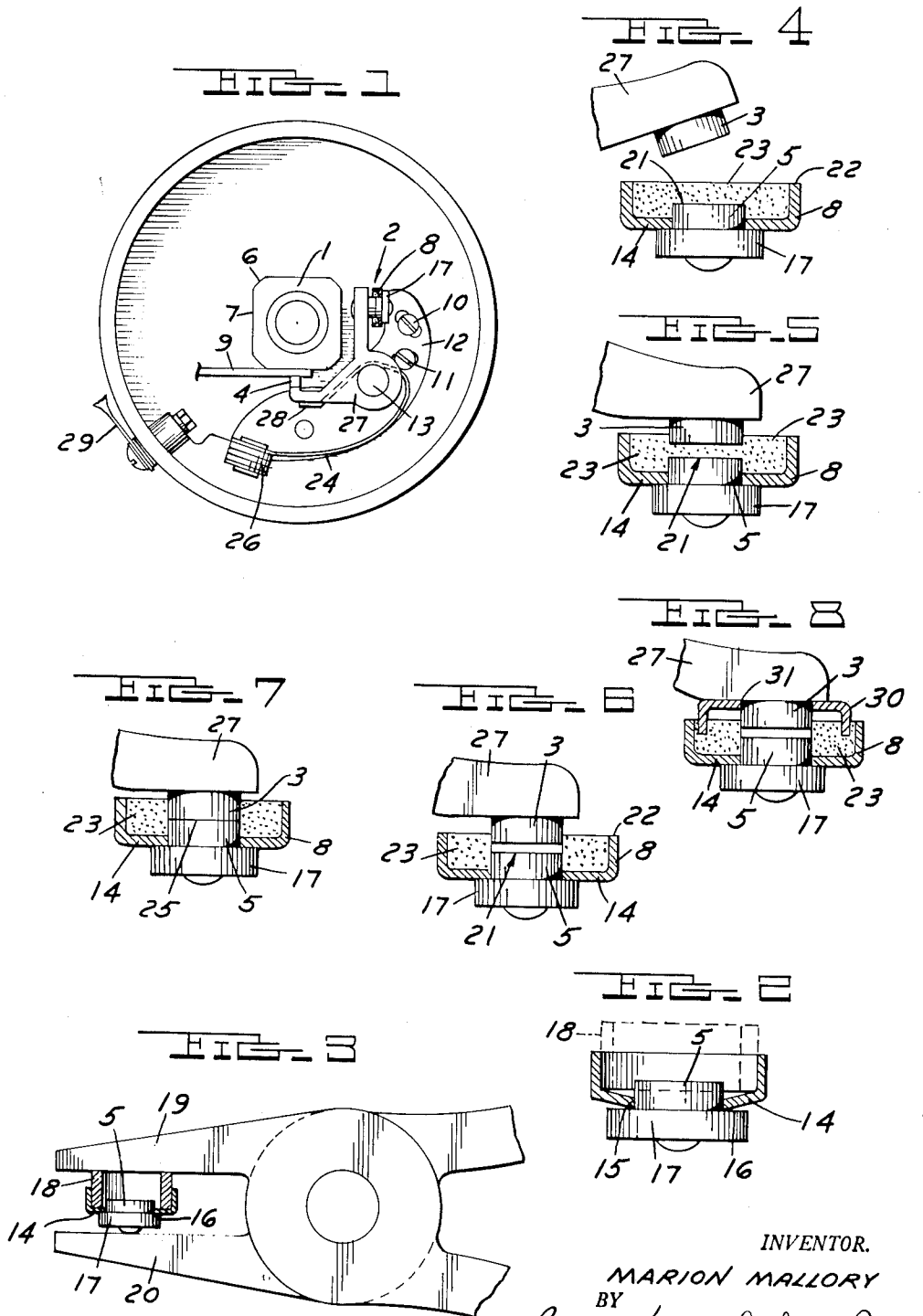


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MEANS FOR REDUCING BURNING, PITTING AND CORROSION
OF CONTACT POINTS IN CIRCUIT BREAKERS
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MEANS FOR REDUCING BURNING, PITTING AND CORROSION OF CONTACT POINTS IN CIRCUIT BREAKERS

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This invention relates to means for reducing burning, pitting and corrosion of contact points in circuit breakers.

One of the big problems in circuit breakers, especially those used in automotive electrical systems, is pitting, burning and corrosion of the contact points and because of this contact points have to be cleaned or replaced too frequently.

The cause of this burning, pitting or corrosion is due to an increased current flow and voltage in the primary circuit immediately after the circuit has been interrupted. When the contacts close, the flow in the primary winding around the core of the coil builds up the magnetic lines in one direction and during the time the magnet or core is being built up from zero to maximum, a counter E. M. F. is induced in the primary winding which tends to oppose the battery or energizing current, and when the contact points are separated, the magnetic lines in the coil core will be reversed. The changes in these magnetic lines from maximum to zero tends to set up a current which is opposite to the counter E. M. F. and is in harmony with the battery and energizing current. In fact, this current induced in the primary winding at the time the circuit is interrupted is of much greater voltage than the battery current. The battery voltage may be only 6 volts that energizes or magnetizes the coil core but, when the circuit is interrupted, the voltage in the primary circuit might go as high as 250 or 300 volts and, when the contacts are just starting to separate, the space between them is so slight that the high voltage will continue to travel or arc across it because the small air space at the beginning of the break offers little resistance and the high primary voltage at the break melts and pits the contacts.

I realize it is old to submerge switches or circuit breakers in oil but this is practically impossible in ignition circuit breakers because the oil would impede and so materially reduce the speed of the circuit breaker as to render it practically inoperative, especially at high speed. Further, it would be impractical and highly uneconomical to build an ignition circuit breaker submerged in oil due to manufacturing difficulties and expense.

It is an object of this invention to produce a circuit breaker having contacts which are free from pitting, burning and corrosion, highly efficient in operation, simple to construct and service, and the contact points of which have a remarkably longer life than the contact points of automotive ignition systems currently in use.

The invention contemplates a device for reducing or preventing pitting, burning and corrosion of the contact points which can be easily and readily assembled to the contact points of conventional ignition systems.

Another feature of my invention is a novel method for setting the contact spacing in my circuit breaker.

In the drawings:

Fig. 1 is a plan view showing the circuit breaker and cam of an ignition distributor.

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Figs. 2 and 3 are detail views illustrating my method for securing the shroud to the contact point.

Fig. 4 is a detail view showing the contact points separated and with the shroud filled with a non-fluid electrically non-conducting grease.

Figs. 5, 6 and 7 are detail views illustrating the operation of the contact points of the circuit breaker in conjunction with the means for preventing the contact flashing.

Fig. 8 is a section showing a modified form of my invention.

Referring more particularly to the drawings, I have illustrated my means for reducing contact flashing in conjunction with the circuit breaker contact points of an ignition distributor but it is, of course, understood that my device is useful with any circuit breaker which presents a problem of flashing or arcing between the contact points.

The ignition distributor comprises the usual rotating cam 1 having, by way of illustration, a circuit breaker 2 carrying a contact point 3 on one end and a rubbing block 4 which engages cam 1 on the other end. The stationary contact point is designated 5. In this particular circuit breaker the ratio is 1 to 1, in other words the distance from the contact point and rubbing block to the pivot are the same, meaning that, if the cam would lift the rubbing block .020 inch, the contact points would separate .020 inch and, of course, if the lobes 6 on the cam were .020 inch higher than the flats 7 on the cams, the distance between the rubbing block and flats on the cam would also be .020 inch when the contact points were closed. The spacing or gap setting of the contact points in my system is always determined by the spacing or clearance between the rubbing block and flat on the cam instead of placing a feeler gauge between the contact points. This method of setting the contact points makes possible the use of the shroud 8 because with the shroud on the contact points it would be difficult or practically impossible to place a feeler gauge 9 between the points for spacing; the cup or shroud would interfere. Therefore, my method of determining the gap on the contact points makes possible the use of a permanently fixed shroud around the contact points.

Although I have shown a circuit breaker having a ratio of 1 to 1, this ratio can be 1/2 to 1 or 2 to 1 without changing my method of adjusting or setting the clearance of contact points. The only difference is that with a circuit breaker ratio of 2 to 1, a .010 inch clearance between rubbing block and flat on cam would give a gap setting of the contact points of .020 inch.

In production of the circuit breaker and cam, the gap or spacing of the contact points is first determined. Say, for example, it was desired to have the contacts separate .020 inch. This is done by using a feeler gauge between the contact points. Then, whatever the distance will be between the flat on the cam with this .020 inch setting of the contact points, that will be the standard used by service men in the field to set the contact points because after the units are in the field the shroud will not permit the service men to set the gap by placing a gauge between the contact points.

In production it is necessary to line up contacts so they close as squarely as possible and the methods generally used are to bend the circuit breaker that carries one contact or the stationary contact point carrier to make the points line up. Of course, if the shrouds were on the contact points when the bending operations were being done to line up the contacts, the vision would be cut off and it would be difficult to line the contacts up with the shrouds on. It is for that reason I have devised means for placing the shrouds on after the contact points have been lined up. Then, after the shrouds are put on, the

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spacing of the contact is determined entirely by the spacing or between the flat on the cam and rubbing block. The spacing of the contact points can be made by loosening screw 10 and turning eccentric 11. Plate 12 is pivoted around circuit breaker post 13. This is a common method of adjusting contact points.

My means for reducing or stopping contact pitting and corrosion can be mounted on either of the contact points but preferably is mounted upon the fixed contact point 5. This means comprises a shroud 8 in the form of a cup, preferably a metal stamping, having its bottom wall 14 initially conical and provided with a central opening 15 so that the cup can be positioned over the cylindrical contact point 5, with the point 5 projecting upwardly through the opening 15 and the bottom wall 14 of shroud 8 resting against the face 16 of its supporting ear 17.

After shroud 8 is positioned as illustrated in Fig. 2, a cylindrical hollow bushing 18, which in effect forms a male die member, is inserted within shroud 8 and about contact 5, as illustrated in the dotted line showing Fig. 2. Thereafter the bushing 18 is pressed downwardly toward ear 17 by any suitable means, such as by the jaws 19 and 20 of a pair of pliers, so that the conical bottom wall 14 is flattened into a plane substantially perpendicular to the cylindrical side wall of shroud 8, as shown in Fig. 3. This action causes the lower wall to tightly grip or have a press fit with contact 5 about opening 15. It will be noted that shroud 8 extends above the upper face 21 of contact 5.

After shroud 8 is mounted upon fixed contact 5, I then fill the shroud, preferably level with its top edge 22, with a viscous, electrically non-conducting medium 23 such as a non-fluid grease or lubricant or a petroleum jelly such as petrolatum. I have found very satisfactory for this purpose a lubricating grease having a melting point of 370° F. As an arc quenching medium 23, I can use any of the conventional or commonly used non-electrically conducting lubricating greases. It is essential in such cases that lubricating medium 23 be sufficiently viscous and have a sufficiently high melting point so that it will not melt or flow out of the shroud 8 under the operating temperatures to which the lubricating medium will be subjected. Even where the shroud 8 is positioned with its edge 22 uppermost, I prefer that medium 23 be highly viscous or of jelly-like or grease consistency.

The closed position of contacts 3 and 5 is illustrated in Fig. 7 and the fully open position during their operation by cam 1 is illustrated in Fig. 6. The circuit breaker arm is actuated in the rotation of cam 1 by flat faces 7 and lobes 6 in a conventional manner to open (Fig. 6) and close (Fig. 7) contact points 3 and 5. The fully open position is usually between .015 and .020 of an inch. As the movable contact 3 moves up in medium 23, medium 23 tends to cling to the outside of the contacts, practically sealing out any dirt or even air from between the two contact points.

It will be noticed that shroud 8 is much higher than contact 5 and in operation the medium 23 forms a sealed cylinder around the contact gaps. There will be a certain amount of medium that will not be forced out from between the contact points but spring 24 will always exert enough pressure on movable contact 3 to puncture through the grease or medium and make a good electrical contact between the two points, as at 25, each time the contact points close.

Spring 24 has one end anchored to post 26 of plate 12 and the other end anchored to arm 27 as at 28 so as to yieldably hold the rubbing block 4 of the circuit breaker arm against the face of cam 1. One end of spring 24 is connected in electrically conducting relation with lead 29 from one terminal of a source of current, such as a battery, and the other end of spring 24 is in electrically conducting relation with metal circuit breaker arm 27 so that spring 24 and arm 27 are in electrical circuit with

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contact point 3 which is carried by arm 27. Contact point 5 and ear 17 are connected to ground or with the other terminal of the battery. This is a conventional arrangement for connecting the circuit breaker into the primary electrical circuit of an automotive ignition system.

Contact points generally do the most arcing when starting off new because it is practically impossible to line the points to get 100% surface contact and, even though alignment could be better, a little speck of dust might get between the contact points. Naturally, if the contact points were only seated on a small surface area by improper alignment or a particle of dust between the contact points, there would be a very high resistance and, when the contact points separated, the current surge and increased voltage due to the interruption to the primary circuit, would set up intense heat at this high resistance point caused either by poor alignment or particles of dust. This heat would be so terrific that melting and pitting of the contact points would start immediately even though the contact points were new, and the melting of the contact points forms a scale or corrosion which sets up still higher resistance, creating more heat to melt the contact points.

In my system there is generally a thin film of grease left on the contact surfaces even after they have operated for a considerably length of time. This grease is of high resistance and, when the contacts first separate even only .001 inch, the grease will immediately recoat the surface of the contact points and the resistance of the grease is perhaps the equivalent of .005 inch air gap. The voltage surge is greatly reduced and, even though there would be some flashing, the grease will burn instead of the contact points, which eliminates the danger of pitting and burning of contacts when they are first started off new because the grease burns over a greater area or surface than would be the case if the contact points were dry. The grease that is on the surface when the contacts start off new will eventually burn away but the arc or flash is distributed over a greater area of the contact points instead of being concentrated in one small area. Naturally the contact points will not get hot and melt away and by the time the grease is all burned out between the contact points there will be enough wear area over the contact points to give a greater surface contact. Of course, after a large surface contact is established the heat is greatly reduced and pitting and corrosion are at a minimum, but even if the medium has burned away from the contact surfaces, it still seals out the air and dirt from between the contact points. It is well known that by reducing the oxygen from between contacts the flashing is greatly reduced.

The modified form of invention shown in Fig. 8 is identical in all respects with that shown in Figs. 1 to 7, inclusive, and in addition includes an inverted cup 30 which has a loosely telescoping fit within lower cup or shroud 8. Inverted shroud 30 has a central aperture 31 through which the upper contact point 3 passes. Shroud 30 has a press fit with contact point 3 in opening 31. Shroud 30 is assembled on contact point 3 in identically the same manner as shown in Figs. 2 and 3 and described with respect to lower shroud 8. In Fig. 8 I have shown the contact points in their fully open position when the rubbing block 4 is on the high point or lobe 6 of the cam. During operation cup 30 has its circumferential edge portion always submerged in the body of the grease 23.

I claim:

1. In a circuit breaker having a fixed contact point and a movable contact point, a shroud in the form of a cup mounted in fixed relation to, and surrounding, one of said contact points, the other of said contact points extending through the open top of said cup, and a body of electrically non-conducting lubricant which is substantially non-flowing at the operating temperature of the circuit breaker, said lubricant being carried by said cup

and enveloping both of said contact points so that their contact faces are always positioned within the body of lubricant and sealed from contact with the surrounding atmosphere.

2. The circuit breaker defined in claim 1 wherein the lubricant is a grease and defines a cylinder in which the movable contact point reciprocates as the circuit breaker opens and closes.

3. A circuit breaker comprising fixed and movable contacts, a cup having a bottom wall with an opening therethrough through which one of said contact points project, said cup having a press fit with said contact point in said opening, the side walls of said cup extending above the contact face of the contact point upon which the cup is mounted, the side wall of the cup also at all times surrounding the contact surface and the adjacent portion of said other contact point, a viscous, electrically non-conducting lubricating material which is substantially non-flowing at the operating temperature of the circuit breaker carried by said cup and at all times enveloping the contact surfaces and adjacent portions of said contact points to seal the contacting surfaces from contact with the surrounding atmosphere.

4. In a circuit breaker having contact points relatively movable toward and away from each other, a body of viscous, non-electrically conducting grease forming a cylinder continuously surrounding at least the portions of both contact points adjacent their contacting surfaces whereby the cylinder of grease seals the contacting surfaces from contact with the surrounding atmosphere to protect the contact points against flashing and burning, a cup fixed relative to one of said contact points for holding said grease, a second cup fixed with respect to the other contact point in inverted telescopic relation with said other cup, the outer edge of the inner cup having a clearance with the bottom of the outer cup when the contact points are closed, the said cups being so dimensioned that they remain in telescoped relation during the normal opening and closing of said contact points.

5. The circuit breaker claimed in claim 4 wherein the edge of the inner cup is always immersed in the body of grease in the other cup.

6. A method for breaking in circuit breaker contact points comprising the steps of establishing a flow of electric current through said contact points, establishing a

thin film of electrically non-conducting grease over the entire opposed surfaces of said contact points, enveloping the contact points in a body of electrically non-conducting grease to seal out the air and dirt from between the contact points and repeatedly opening and closing the contact points to break and make the electrical circuit while maintaining the points enveloped in said body of grease and until the thin film of grease on the contact surfaces is substantially burned out.

7. A method for lengthening the life of contact points comprising the steps of establishing a flow of electric current through said contact points, establishing a thin film of electrically non-conducting grease over the entire opposed surfaces of said contact points, surrounding the opposed contacting faces and at least the adjacent portions of the contact points with a body of non-electrically conducting grease to seal out the air and dirt from the opposed contacting faces and the space therebetween and repeatedly opening and closing the contact points to break and make the electrical circuit while maintaining the points surrounded in said body of grease and until the thin film of grease on the contact surfaces is substantially burned out, and thereafter during the opening and closing of said contact points continuously maintaining the said body of grease around and in sealing relation with the contact points to continuously seal the contacting faces from contact with the surrounding atmosphere.

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