Oct. 3, 1961 E. W. MEYER, JR., ET AL 3,003,043

CONTACTS ASSEMBLY

Filed June 13, 1958

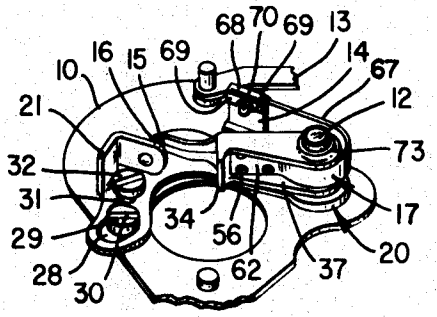


FIG. I

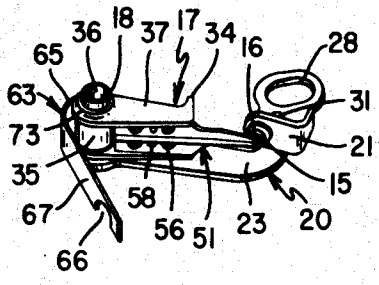


FIG. II

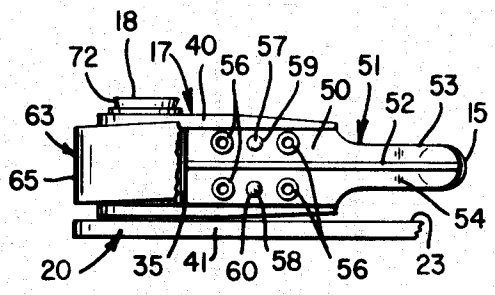


FIG. III

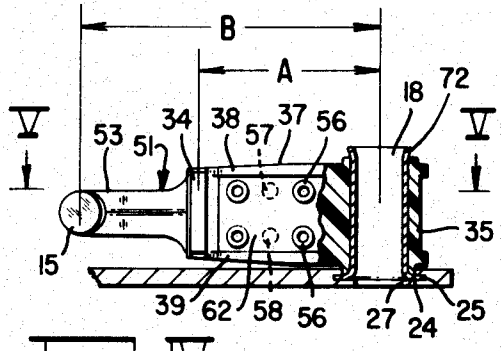


FIG. IV

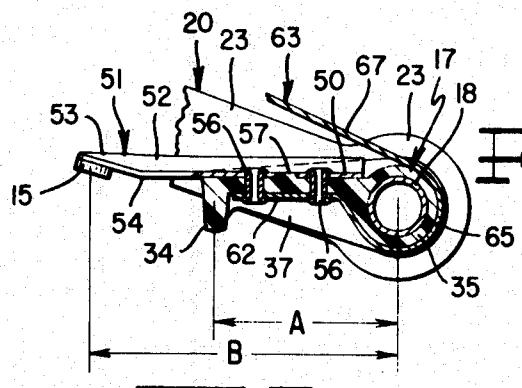


FIG. V

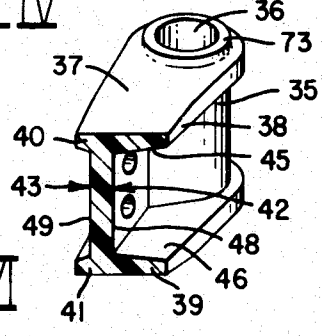


FIG. VI

EARL W. MEYER JR.
HARRY M. SEUBERT
ROBERT J. LATORRE
INVENTORS.

BY
Fabry, Souther & Stoltenberg
ATTORNEYS

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CONTACTS ASSEMBLY

Earl W. Meyer, Jr., Harry M. Seubert, and Robert J. Latorre, Toledo, Ohio, assignors to The Electric Auto-Lite Company, Toledo, Ohio, a corporation of Ohio

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10 Claims. (Cl. 200—30)

This invention relates to electrical current interrupters of the impact contact type adapted to be used as make and break timing contacts for ignition systems for engines and, in its more specific aspect, is concerned with their structural features and assembly.

The invention comprehends the production of a unitary engine timing make and break contacts assembly wherein its components are of light weight having very high fatigue strength, coupled with extremely long useful life, and are constructed and arranged to establish current flow at high engine speeds without objectionable chattering or rebounding of the contacts.

The invention contemplates a low inertia circuit breaker or pivoted timing contact unit for ignition devices for multi-cylinder high speed engines wherein the distance between the rubbing block or bumper projection and the pivotal axis is of such value with respect to the effective length of the contact unit that objectionable chattering or rebounding is practically eliminated.

The invention comprises a pivoted breaker arm contact unit wherein the bumper projection and the pivotal opening of the unit are integrally formed from a body of electrically insulating material having resilience as one of its main properties which is discretely cultivated, the said body being dimensioned as to provide a breaker arm contact unit for high engine speed operation without objectionable chattering or rebounding having low inertia and long useful life.

The invention embraces the production of a breaker arm or pivoted lever contact unit inclusive of an elongated member of non-conductive material, having low coefficient of dry friction, which integrally provides the rubbing block and the pivotal opening of the unit, to which are intimately joined a light weight contact-carrying element and a flat metallic spring to thereby produce a breaker arm contact of great durability and low moment of inertia devoid of objectionable bounce characteristics.

The invention includes an engine ignition timing circuit breaker contacts assembly for quick attachment to and detachment from a distributor plate provided with an upstanding post wherein the mating and precise alignment of the stationary and movable contact is performed and set at the factory to thereby produce a non-detachable assembly in which accurate alignment of the contacts is permanently insured, so that whenever such assembly is used, particularly as a replacement unit, reliable operation at high engine speed is obtained and extremely long-lasting, efficient performance is secured.

The invention is also concerned with a breaker arm contact unit having light weight and low polar inertia consistent with high fatigue strength capable of withstanding, without impairment, the deleterious effects produced by periodic current interruption, as well as shocks and highly recurrent impacts, and having one of its major components made of light-weight non-conducting materials having a low ratio of static friction to sliding friction, self-lubricating properties, high wear and abrasion resistance, as well as being able to give, yet spring back to original shape, without deformation.

In conventional ignition systems the make and break timing contacts have failed after comparatively short periods of use and their operation is not very reliable at high engine speeds. Such performance failures and lack of reliability are readily manifested when the contacts are

used in present high speed multi-cylinder engines when it is considered that in an 8-cylinder engine operating at 4,800 r.p.m., the breaker contacts must open and close the ignition primary circuit 19,200 times per minute. Many attempts to overcome such drawbacks and solve the complex problems present in the production of commercially reliable and long-lasting contacts, capable of efficient performance at high speed, being devoid of chattering and rebounding, has not been entirely successful. In the evaluation for the best solution of the problems encountered, we found that such drawbacks could be avoided when the make and break timing contacts assembly, in addition to accurate alignment, include certain constructional features and relationships between the spacing of its parts and is produced by utilizing components of light weight having sufficient resistance to deformation coupled with high fatigue strength, as well as the ability to give, under impact, yet return to the original shape without distortion and which are capable of high speed operation without undue friction with little or no lubrication while being highly resistant to wear and abrasion. In view of this evaluation, a search was made to locate a low-cost commercially available material capable of manifesting in the construction contemplated the characteristics hereinbefore outlined, and, therefore, one of the main objects of the invention is to provide an assembly including a breaker arm contact unit comprising several materials, each having some of the properties before enumerated to a predominant degree, so that the assembly, as a whole, has all the characteristics and constructional features required to overcome the drawbacks hereinbefore enumerated.

Moreover, in the usual ignition distributors, the inspection and replacement of the breaker contacts by mechanics in the field not only require the use of special tools and highly skilled operators, but it is also extremely difficult and costly, due to the fact that such breaker contacts have been made and sold as detachable units which require precise alignment and calibration for reliability and substantially non-bouncing operation at high speeds. It is, therefore, another object of the invention to produce the breaker contacts as a non-detachable assembly adapted to be adjusted and tested as a separate unit and permanently set, so that the precise alignment and calibration set at the factory will be continuously maintained to thereby save time and facilitate inspection and replacement whenever the same is required in the field and, at the same time, to insure the reliability of the contacts and their non-bouncing performance at high engine speeds.

Another object of the invention is to provide an ignition timing contacts assembly comprising components formed of materials having predetermined characteristics effectively manifested in constructional features which provide high strength or reinforcements at points where maximum stresses and wear occur whereby efficient performance and long life of dependable service is insured.

Another object of the invention is to greatly minimize rebounding and chattering of the ignition timing contacts secured by the correlation of structural features and by spacing the bumper projection from the pivotal axis of the movable contact arm at least 65% of the distance between the center of the contact and the pivotal axis of the movable contact arm.

Another object of the invention is the provision of a circuit breaker unit of rugged construction for high speed operation inclusive of a conductive component of extremely light gauge metal but of rugged construction, including a reinforcing rib and being correlated with a non-conductive component of high impact strength plastic material having proper resilience which is proportioned with respect to the conductive component to damp or otherwise control the natural period of vibration of the

unit under impact, as well as the rebounding or chattering characteristics of the assembly.

Another object of the invention is the provision of a breaker arm contact unit in which the rubbing block and pivotal bushing are integrally formed from a high impact resistant plastic such as nylon whereby looseness of the rubbing block or of the pivotal bushing with respect to the contact member is entirely eliminated whereby not only erratic timing is avoided but chattering or rebounding of the breaker arm contact is substantially overcome.

Another object of the invention is to provide an assembly tested and calibrated as a unit and permanently set at the factory, including means to prevent breaker arm creepage, whereby its alignment and calibration is always maintained and the possibility of binding with its locking means is eliminated.

Another object of the invention is the production of a breaker arm contact unit of extremely light construction with high fatigue strength wherein not only erratic timing is avoided but chattering of the contacts is particularly minimized as the possibility of looseness of the rubbing block is entirely eliminated.

A further object of the invention is the provision of a breaker arm contact unit comprising a composite lever having one of its components made of a material which serves as damping or as controlling means for the natural period of vibration of the breaker contact unit to thereby reduce contact rebounding at high speeds.

A further object of the invention is the provision of a breaker arm contact constructed primarily as a lever having low polar inertia and a configuration which provide high fatigue strength and wherein the distance between the rubbing block and the pivotal axis ranges between 65% to 75% of the distance between the pivotal axis and the center of the contact whereby chattering or rebounding is substantially eliminated.

A still further object of this invention is to provide an ignition contacts timing assembly which affords, as a replacement or repair unit, a more accurate control of the timing of the engine and which continuously provides proper alignment of the contacts and thereby provides long-lasting, reliable performance, particularly at high speed.

Other objects and advantages of this invention relating to the arrangement, operation, and function of the related elements of the structure, to various details of construction, to combinations of parts and to economies of manufacture, will be apparent to those skilled in the art upon consideration of the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

Referring to the drawings:

FIG. I is an isometric view showing an embodiment of the invention mounted on the post of a conventional distributor plate;

FIG. II is an isometric rear view showing an embodiment of the invention as a non-detachable assembly prior to its installation on the distributor plate;

FIG. III is a rear view showing a breaker arm unit and a portion of its supporting bracket;

FIG. IV is a front view, partially in section, showing the non-detachable relationship between the stationary and movable contacts;

FIG. V is a cross-sectional view taken substantially in line V—V of FIG. IV; and

FIG. VI is an enlarged isometric sectional view of the pivotal end of the breaker arm.

The invention has been illustrated in the drawings as embodied in an engine ignition timing contact assembly for quick attachment to and detachment from a distributor plate which is provided with an upstanding post adapted to be used in ignition systems for internal combustion engines but it is to be understood that all the principles and features of the invention are contemplated to be used whenever the same are found to be applicable.

Referring to the drawings, and particularly to FIG. I, wherein is shown, for purpose of illustration, the contact assembly of the invention mounted on a conventional movable distributor plate **10** having an upstanding rigid post **12** which is riveted or fixedly secured to the plate **10** by suitable means not shown. The plate is preferably movable with respect to the cam axis by an arm **13** suitably connected to a device responsive to engine manifold vacuum, not shown, and is also provided with an upstanding bracket **14** insulatingly mounted thereon serving as a spring support and the insulated terminal for the circuit breaker assembly.

The normally in engagement pre-aligned contacts assembly of the invention constituting the engine ignition timing mechanism operable to periodically open the primary circuit of the ignition system is shown in FIG. II as a non-detachable precalibrated unit adapted for quick installation to and removal from the distributor plate **10**. The contacts assembly comprises the interrupter contact **15** normally in engagement with the stationary contact **16**. Each contact preferably takes the form of a disc of tungsten or other suitable material capable of withstanding the mechanical stresses and the deleterious effects caused by their use as impact current interrupters in an ignition system. The interrupter contact **15** is fixed to the free end of a breaker arm **17** operable by its engagement with a cam, not shown, to separate contact **15** from contact **16** and thus open the primary circuit of the ignition coil in timed relation with the engine. The breaker arm **17** is shown in the form of a composite pivoted lever insulatingly mounted on a tubular pivot or fulcrum bushing **18** fixedly secured at the apertured end of the bracket **20** which carries the contact **16** on an upstanding ear **21** integrally formed adjacent the outer end of its horizontally disposed planar section **23**.

As shown in FIG. IV, the pivot bushing **18** is fixed to the bracket **20**, by brazing or welding, as at **24**, thereby bonding the flange or horizontal end section **25** of the bushing **18** to depressed portion formed on the top surface of the bracket **20** adjacent to the opening **27**. The inside diameter of the bushing **18** and the opening **27** provided in the bracket **20** are dimensioned to receive the fulcrum pin **12** of the base plate **10** providing a sliding fit therewith. The bracket **20** carrying the contact **16** is pivoted for adjustment through its bushing **18** on the fulcrum pin **12** of the distributor plate **10**, whereby the movement of the bracket **20** with respect to the cam axis provides means for varying the amount of separation of the contacts **15** and **16** while retaining the same in parallelism.

In order to readily obtain the proper amount of separation of the make and break ignition timing contacts **15** and **16** when actuated by the rotary cam, the pivoted adjusting bracket **20** is provided with an elongated opening **28** adapted to engage the enlarged head of an adjusting cam or eccentric member **29**, the latter being provided with a tenon secured to and mounted for rotation on the timing plate **10**. The eccentric **29** is provided on its top surface with a screw driver slot **30** whereby the same may be turned, imparting rotation to the bracket about the eccentrically positioned post **12** of the plate **10**, whereby the co-axially pivoted stationary contact **16**, as well as the movable contact **15**, are displaced on the timing plate **10** with respect to the cam axis. The bracket **20** is also provided with an elongated slot **31** adapted to accommodate the shank of the screw **32** which serves as locking means to hold the bracket in position on the timing plate **10** after the separation of the timing contacts **15** and **16** has been properly set by means of moving the eccentric member **29**. It will be apparent from the foregoing that a very minute adjustment for varying the amount of separation of the timing contacts may be made by unskilled operators without the use of special

tools, since the ignition timing contacts 15—16 are coaxially pivoted on the timing plate.

The ignition breaker arm structure or composite pivoted lever constituting the support for the movable timing contact 15 comprises an elongated body of non-conducting material having at one end an integrally formed bumper projection or inwardly directed rubbing block 34 constituting the operative connection of the contact 15 with the engine driven element or rotary cam. The other end of the elongated body is provided with a hub 35 formed with a pivotal opening 36 having its axis substantially parallel to and separated by an intermediate portion 37 from the bumper projection 34. The intermediate portion 37 of the elongated body is formed with a centrally located web or vertical section terminating into inwardly directed top and bottom reinforcing flanges 38 and 39 and the outwardly directed top and bottom reinforcing flanges 40 and 41 constituting an I-beam section providing oppositely directed channel-shaped interconnected sections 42 and 43.

The reinforcements or top and bottom flanges 38 and 39 of the channel section 42 are of a gradually decreasing width or planar dimension from their portions surrounding the hub 35 toward the cam rubbing block 34 wherein their planar dimension from the vertically disposed web 48 is at a minimum. Moreover, the wall thickness of flanges 38 and 39 also decreases from portions adjacent to the hub 35 to their merging point with the rubbing block 34. In addition, the inner surfaces 45 and 46 of the flanges 38 and 39 are slightly divergent from their connecting points with the web 48 toward their peripheries. These constructional features are also present in the reinforcements or flanges 40 and 41 of the channel section 43, which merge with the flanges 38 and 39 around the hub 35. However, the flanges of sections 42 and 43 are not identical as the outer wall or web 49 of section 43 is offset from the center of pivotal opening 36, being located as shown in FIG. V in a plane tangent to its periphery. The cam rubbing block 34, see FIG. V, merges into the web 48 by an enlarged parallel wall section and gradually tapers therefrom toward the curved end which is engaged by the rotary cam. Due to the rotary action of the cam, the rubbing block 34 is subjected to bending and shock stresses which are greatest at its merging point with the web 48. This shock and bending action is resisted by the configuration of the rubbing block 34 and by the flanges 38 and 39 which provide additional top and bottom reinforcing surfaces between the web 48 and its reduced end section.

The constructional features of the integrally formed components and of their respective reinforcements provide an elongated tapered body wherein its outer dimensions are reduced from its pivotal axis toward the bumper projection while the height of each of the webs 48 and 49 is substantially uniform from the cam rubbing block 34 to the hub 35. The particular construction of the reinforcing surfaces and reduction of their areas results in an insulated body of extremely light weight, having low moment of inertia and sufficient resistance to deformation, coupled with high fatigue strength, providing reinforcements at points where maximum stresses and wear occur.

The web 49 of the channel section 43 is dimensioned to receive the large end portion 50 of the metallic member 51 which carries at its smaller end the timing contact 15 providing a tight fit with its side walls. The member 51, which constitutes the current-conducting component of the ignition breaker arm structure, or composite pivotal lever, comprises a planar thin section having a lateral projection or reinforcing rib 52 centrally positioned to increase its strength and rigidity. The rib 52 is preferably formed as a central fold protruding from the back wall of member 51 and extending throughout its full length, thereby producing a conducting member having a T-shaped cross-section terminating into a reduced portion 53 reinforced by being slightly bent as at 54. To the end of the reduced portion 53 is bonded or brazed the timing contact 15, preferably by the fusion of non-ferrous metals such as copper alloys which also serve to join or bond throughout their length the contiguous surfaces of the walls of the reinforcing fold 52. The metallic member 51 is preferably made of high carbon thin gauge sheet steel and is coated with a corrosion or oxidizing inhibiting agent, preferably in the form of a thin coating or a full cover of nickel applied prior to the bonding or brazing the contact thereto.

The large end portion 50 of member 51 is fixedly secured against the web or face 49 tightly engaging the flanges 40 and 41 by means of a plurality of current-conducting hollow rivets 56 arranged into vertically disposed rows straddling the rib 52. In order to fully assure precise central alignment and accurate location of the contact 15 with the rubbing block 34, and, in turn, with respect to its pivotal axis, the web 49 is provided with a pair of spaced projecting lugs or integrally raised portions 57 and 58 adapted to snugly fit openings 59 and 60 provided on member 51 between the vertically disposed rows of the hollow rivets 56.

The hollow rivets 56 also serve to secure the straight end portion 62 of a ribbon-like spring or flat resilient member 63 against the web or face 48 of the channel section 42, as well as provide the additional function of current-conducting means or circuit connection for the flow of current between the metallic member 51 and the spring 63. The spring 63 has a substantially uniform width and is dimensioned to snugly fit the bottom of the channel section 42 tightly engaging the flanges 38 and 39 throughout its length and is formed with a central curved portion 65 adapted to be confined between the top and bottom flanges surrounding the hub 35 and thereafter terminated into a substantially straight portion 67. The straight sections 62 and 67 of the spring are out of horizontal alignment and thereby provided a slight tilt therebetween, thus providing a downward force on the composite breaker ar structure carrying the contact 15 when the spring 63 is secured to the bracket 14 carried by the timing plate 10.

The end of the straight section 67 of spring 63 is provided with a downwardly directed open ended slot 66 which is arranged for alignment with a threaded opening provided in the spring support 14 or insulated terminal for the timing contacts assembly, so that by screw 70 the assembly may be locked in fixed position through the spring clip having a lateral flange 68 and down-turned fingers 69 straddling the shank of the screw 70. The section of the spring between the slot 66 and its end is of a reduced width in order to enhance the quick attachment as well as the detachment of the breaker contact assembly from the distributor plate 10, as well as locking the spring 63 in position on the insulated terminal or spring support 14. The flange 68 of the spring clip serves as means to secure the full effect of the downward pressure of the spring 63 on the breaker arm or composite pivoted lever provided by the off-setting of the spring ends 62 and 67, thereby eliminating the objectionable condition known as breaker arm creepage or the tendency of the composite pivoted lever carrying the interrupted contact 15 to move upwardly.

Breaker arm creepage is manifested as the tendency of the breaker arm carrying the interrupter contact, to move upwardly during its operation from the supporting bracket or base carrying the fulcrum post, thereby losing the accurate originally set alignment of the timing contacts, as well as tending to cause binding of the upper section of the hub or conventional insulating bushing against the retaining means provided in non-detachable timing contacts assemblies. This condition is eliminated according to the present invention by the preloading condition of spring member 63 which provides the constant application of a downward force to the pivoted lever

carrying the contact 15, so that the mating and precise alignment of the stationary and movable timing contacts 15 and 16, preformed and set at the factory, is maintained throughout the long-lasting life of efficient performance of the timing contacts.

After mating and precise alignment of the movable contact 15 with the stationary contact 16 is secured, while the composite lever or breaker arm 17 is mounted on the pivot bushing 18 of the bracket 20, and after proper determination is made that the center of each face of the timing contacts is in the same axis, and that the assembly conforms to very rigid standards of performance, the assembly is placed in a suitable fixture and, while these relationships are maintained, the end portion of bushing 18 projecting beyond hub 35 is flared as at 72 providing a non-detachable timing contacts unit. It should be noted that the assembly furnishes means provided solely by the bushing 18 as the holding means include the projecting part of bushing 18 which is flared or expanded to hold the breaker arm assembly 17 against removal. The flaring operation of the bushing 18 is secured by precise means which prevent the flared or terminal section 72 of the bushing 18 which overlies the upper face of the nylon hub 35 from causing any objectionable binding.

It is contemplated that the contacts 15 and 16 be made of a suitable erosion-resistant, conducting material, or of metals having a high melting point, preferably tungsten, molybdenum, tantalum, or alloys of such metals. However, it is contemplated that other materials having the characteristics before mentioned may be used. The materials or metals used for the contacts 15 and 16 are preferably carefully controlled in relation to grain, size and direction, as well as hardness, and are so arranged that the grain is at right angles to the faces of each of the contacts in order to minimize metal transfer.

One of the features or important phase of this invention is the provision of low cost means to overcome objectionable chattering or rebounding of the ignition timing contacts at high engine speed operation which is herein secured by predetermined relationships or the location of the cam rubbing block 34 with respect to the effective length of the breaker arm contact unit 17. We have found, based on theory and tests, that these objectionable conditions are, to a large extent, overcome when the distance between the center of the bumper projection or cam rubbing block 34 and the center of the pivotal opening 36, designated by letter "A" in FIGS. V and VI of the drawings, is at least 65% of the effective length of the breaker arm which corresponds to the distance between the center of the pivotal opening 36 and of the center of the contact 15, also designated in the drawings by the letter "B." In addition, we have found, by accurate performance tests, that satisfactory results can be obtained when the spacing "A," that is the distance between the center of the rubbing block 34 and the center of the pivotal axis of the unit ranges between 65% to 75% of the spacing "B," that is, the distance between the pivotal axis of the lever and the center of the contact 15. Moreover, in practicing the invention, we have found that this phase can be best fulfilled when the dimensional relationships of rubbing block, pivotal axis, and contact, before specified, are correlated with the constructional features hereinbefore described for producing a low moment of inertia and light weight breaker arm structure or composite lever arm unit.

Another important feature of the present invention is the provision of an ignition interrupter contact assembly wherein the member which integrally provides the cam rubbing block 34 and its pivotal opening 36 is produced from suitable insulating materials capable of manifesting in the constructional features hereinbefore described a very high ratio of strength for unit of weight having resistance to deformation, coupled with high fatigue strength, as well as the ability to give under impact yet return to its original shape without distortion, and which are capable of high speed sliding engagement without undue friction with little or no lubrication while being highly resistant to wear and abrasion. In addition, the materials, including the constructional features described for such member, should have proper resilience in order to serve as damping or controlling means for the natural period of vibration of the composite breaker arm unit, of which the same is an important component. Moreover, the insulating materials should possess self-lubricating properties, low ratio of static friction to sliding friction, and be able to withstand, without impairment, the deleterious effects produced by periodic current interruption, as well as periodic shocks and highly recurrent impacts, dimensional stability under all service and environmental conditions.

We have found that this feature of the invention is fulfilled by low-cost synthetic plastic materials of a class which possess, to a very high degree, the before enumerated properties for the member which integrally provides the cam rubbing block 34 and pivotal opening 36. Such materials are of the class of superpolymeric condensation products of polyamines and polybasic acids derived from diamines and dibasic acids of which hexamethylene diamine and adipic acid are the preferred materials. These materials include synthetic linear super-polymers of which nylon is at present the best known example of this group. In addition, synthetic acetal resins, preferably of the type manufactured by E. I. du Pont de Nemours and Co., Inc. in its plant near Parkersburg, W. Va., U.S.A., under the trademark "Delrin" satisfied, to a high degree, the requirements and properties before enumerated for the elongated body integrally providing the cam rubbing block 34 and pivotal opening 36 for the composite lever of the invention.

It is contemplated that the area of contact between the breaker arm unit 17 and its supporting bracket 20 should be reduced to a minimum and, in order to fulfill this condition, the top and bottom surfaces of the hub 35 terminate into reduced annular portions 73, which also performs the additional function of more easily conforming to the radii of the top and bottom flanges of the hollow fulcrum or tubular bushing 18 upon which the breaker arm is journaled.

It can be seen from the foregoing description that, consistent with economical manufacture, the metallic component carrying the contact 15 of the breaker arm structure 17 includes the reinforcing bonded fold or strengthening rib 52 perpendicular to the plane of the main section on its axis of symmetry which extends the full length thereof contributing materially to the breaker arm strength and rigidity and thereby makes it possible to produce a very light weight member using sheet steel of high carbon content having a thickness as low as .010". This feature, coupled with the use of synthetic plastic material for the insulating component of the unit, allows this component to be molded as a unit including the reinforcing flanges located at right angles to the main section in substantially parallel relation and, therefore, this not only reduces the cost of the unit, as fewer machine operations are required, but provides a composite breaker arm of extremely light weight which will perform satisfactorily at high speed without contact rebound or chattering at as high as 5,300 r.p.m. distributor speed. Moreover, extensive performance tests have conclusively established the fact that timing or interrupter contact erosion is highly minimized by the use of our composite breaker arm when nylon is used as the insulating component.

It is to be understood that the above detatiled description of the present invention is intended to disclose an embodiment thereof to those skilled in the art, but that the invention is not to be construed as limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings since the invention is capable of being practiced and carried out in various ways without departing from the spirit of the in-

vention. The language used in the specification relating to the operation and function of the elements of the invention is employed for purposes of description and not of limitation, and it is not intended to limit the scope of the following claims beyond the requirements of the prior art.

What is claimed:

1. An ignition breaker arm contact structure comprising an elongated body of insulating material, a bumper projection formed integrally therewith at one end thereof, a pivotal opening formed on said body having its axis parallel to and separated by an intermediate portion of said elongated body from said bumper projection, the outer dimensions of said elongated body decreasing from its pivotal opening toward said bumper projection, the intermediate portion of said elongated body having the form of an I-beam secion providing oppositely directed channel-shaped faces, a thin metal member fixedly secured in one of the channel-shaped faces of said elongated body in engagement with the side walls thereof and extending beyond said bumper projection, a contact member carried by said metal member, a ribbon-like spring located in the other channel-shaped face of said elongated body in engagement with the side walls thereof, and means performing the dual function of securing said thin metal body and said ribbon-like spring to said body and establishing an electric connection therebetween.

2. An ignition breaker arm contact structure comprising an elongated body of non-conducting material, a bumper projection formed integrally therewith, a pivotal opening formed on said body having its axis parallel to and separated by an intermediate portion of said elongated body from said bumper projection, the intermediate portion of said elongated body formed with a channel-shaped face having its flanges of decreasing planar dimension from the said pivotal opening toward said bumper projection, a metal member fixedly secured by one end in the channel-shaped face of said elongated body having a tight fit with the side walls thereof, said metal member having a section projecting beyond said bumper projection, a contact member carried by the end of the projecting section of said metal member, a spring fixed at one end to the intermediate portion of said elongated body, and means performing the dual function of securing said metal member and said spring to said body and establishing an electric connection therebetween.

3. A breaker arm contact structure comprising an elongated body of nylon bound on its top and bottom by laterally extending flanges throughout its length, a pivotal opening formed at one end of said body, a transverse bumper projection having at its top and bottom reinforcing flanges, said bumper projection and reinforcing flanges, said bumper projection and reinforcing flanges forming an integral part of said body separated by an intermediate section of said body from said pivotal opening, a thin conducting member having a central fold being secured to the vertical wall of the intermediate section of said body having tight engagement with the inner walls of said laterally extending flanges and formed with a projecting portion extending beyond said bumper projection, a contact carried by said member, a spring secured at one end to the other vertical wall of the intermediate section of said body, and means transversing said body for electrically connecting said member and said spring.

4. In a breaker arm, an elongated body of insulating material having an integrally-formed bumper projection and a pivotal opening, said elongated body having tapered configuration in vertical and horizontal directions from the pivotal opening to the bumper projection, a current-conducting member carrying a contact at one end and secured to said body between said bumper projection and said pivotal opening, and said bumper projection being spaced from the center of said pivotal opening a distance ranging between 65% to 75% of the distance between the centers of the pivotal opening and of said contact members.

5. An ignition breaker contact arm structure comprising a lever having an opening at one end constituting its pivotal axis, a contact member carried by said lever at its other end, a bumper projection on said lever located between said pivotal opening and said contact, said bumper projection lying in a plane parallel to the pivotal axis of said lever, a ribbon-like spring having one end in contacting engagement with said lever at a point located between said pivotal opening said bumper projection, said spring formed with a curved intermediate portion and terminal straight sections having a slight tilt therebetween.

6. An ignition breaker contact arm structure comprising a lever having an opening at one end constituting a pivotal axis, a contact member carried by said lever at its other end, a bumper projection on said lever located between said pivotal opening and said contact, said bumper projection lying in a plane parallel to the pivotal axis of said lever, a ribbon-like spring having substantially straight sections separated by a curved portion, the straight sections of the spring being out of horizontal alignment providing a slight tilt therebetween, and one of said straight sections secured to said lever adjacent said bumper projection.

7. An ignition breaker contact arm structure comprising a lever having a pivotal opening at one end constituting the pivotal axis of the lever, a contact member carried by said lever at its other end, a bumper projection on said lever located between said pivotal opening and said contact, said bumper projection lying in a plane parallel to the pivotal axis of said lever and having integrally formed top and bottom laterally extending reinforcing flanges being tapered toward their peripheries, and the distance between the center of said bumper projection and the center of the pivotal opening of said lever being at least 65% of the distance between the center of the pivotal opening of said lever and the center of the said contact member.

8. A contact assembly for quick attachment to and detachment from a distributor plate provided with an upstanding post comprising a supporting plate adapted to be mounted on said distributor plate, a hollow member receivable over said post and having one end fixed to said supporting plate, an upstanding ear carried by said supporting plate, a contact member carried by said ear, a body of insulating material of tapered configuration in vertical and horizontal directions, said body having a vertically disposed opening for pivotally mounting and permanently securing said body to said hollow member, a vertically disposed bumper projection integrally formed at the reduced end of said body of insulating material, said bumper projection being separated from said opening by an intermediate portion having the form of an I-beam having flanges of gradually decreasing wall thickness from said opening toward said bumper projection providing a channel-shaped face at one side thereof, and a conducting member secured to the channel-shaped face of said body in tight fitting engagement with the side walls thereof, said conducting member having a contact at one end for engagement with the first mentioned contact.

9. A contact assembly for quick attachment to and detachment from a distributor plate provided with an upstanding post comprising a supporting plate adapted to be mounted on said distributor plate, a hollow member receivable over said post and having one end fixed to said supporting plate, an upstanding ear integrally formed on said supporting plate, a contact member carried by said ear, a lever having an opening for pivotally mounting the lever on said hollow member, said lever permanently secured to said supporting plate by the free end of said hollow member, a contact carried by said lever and one end thereof for engagement with the first mentioned contact, a bumper projection of insulating material having integrally formed top and bottom reinforcing flanges ta-

pered toward their peripheries, said bumper projection carried by said lever at a point located between the pivotal axis and the contact carried thereby, and the distance between the center of the bumper projection and the pivotal axis of the lever being at least 65% of the distance between the pivotal axis of the lever and the center of the contact member carried by said lever.

10. A contact assembly for quick attachment to and detachment from a distributor plate provided with an upstanding post comprising a supporting plate adapted to be mounted on said distributor plate, a hollow member receivable over said post and having one end fixed to said supporting plate, an upstanding ear carried on said supporting plate, a contact member carried by said ear, a body of non-conducting material having an opening for pivotally mounting said body on said hollow member, a bumper projection having top and bottom reinforcing flanges forming an integral part of said body separated from said opening by an intermediate portion having the form of an I-beam section providing oppositely directed channel-shaped faces having top and bottom transverse walls, the wall thickness of the flanges of said channel-shaped faces of gradually decreasing dimensions from

said pivotal opening toward said bumper projection, the said body of non-conducting material permanently secured to said supporting plate by the free end of said hollow member, a conducting member secured in one of the channel-shaped faces of said body in tight engagement with the top and bottom transverse walls thereof, and a contact carried by said conducting member at one end thereof for engagement with the first mentioned contact.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,003,043 October 3, 1961

Earl W. Meyer, Jr., et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 40, for "ar" read -- arm --; column 9, lines 52 and 53, strike out "said bumper projection and reinforcing flanges,"; column 10, line 2, for "members" read -- member --.

Signed and sealed this 13th day of March 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents

UNITED STATES PATENT OFFICE

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