

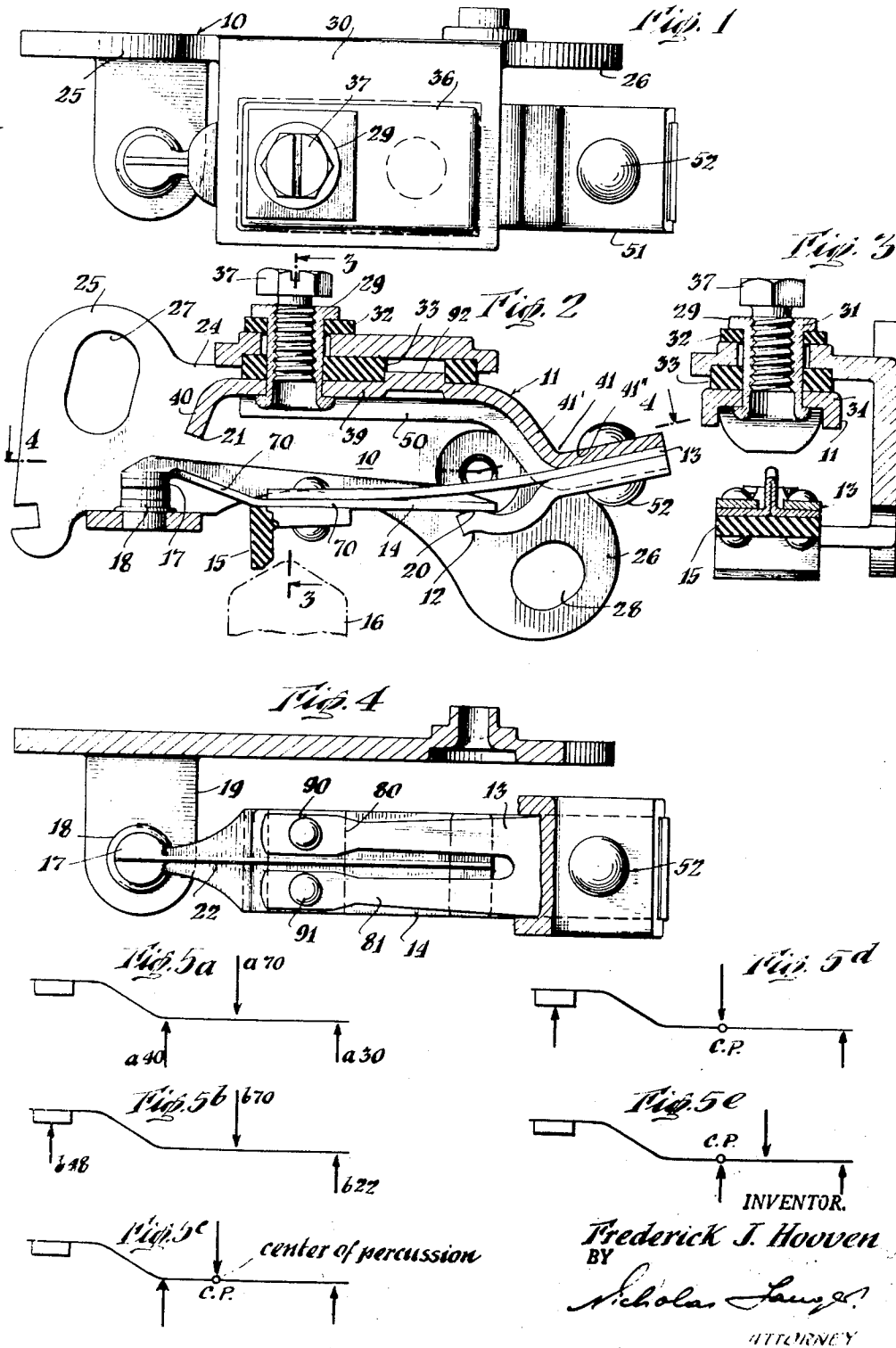
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FULCRUM-TYPE IGNITION CONTACT BREAKER

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FULCRUM TYPE IGNITION CONTACT
BREAKER

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This invention relates to periodic circuit breakers, particularly circuit breakers used by ignition timers for internal combustion engines.

A prime consideration in timer systems is to provide contact breakers wherein the alignment of contacts during the operation of the system is maintained substantially without variation and wherein any undesirable variation in effectively rotationally centering the contact arm during the process of opening and breaking contacts is avoided.

In the several types of circuit breaker systems heretofore constructed, certain disadvantages have been found. For example, in one of these systems, known as the "pivoted" breaker type system, there is the disadvantage that any clearance in the pivot bearing used in the breaker, whether radial or axial clearance, allows an undesirable variation in the relative alignment of the two contacts during operation. To keep these clearances within reasonable limits at all temperatures over a reasonable life is an exacting problem of design and production. For, as the life of the contacts progresses they develop considerable surface irregularities, and if these do not always exactly mate together both the performance and the life of the contactor are adversely affected.

In an attempt to overcome the alignment difficulty a type of contactor known as the "pivotless" contactor has been sometimes used wherein a contact arm is held and located by a flat leaf spring. Because there is no lost motion or friction in the spring itself, there is commonly no difficulty experienced with relative alignment of contacts. However, because of the fact that the spring must be free to bend over some appreciable length and since the force exerted on the arm by the cam during the open period is ordinarily applied at a different distance from the spring than the force applied to the contact when closed, there are often undesirable variations in the effective center of rotation of the contact arm during the process of opening, or breaking contact. This effect is likely to be most pronounced at high speeds, where inertia forces are relatively large in comparison with static forces. The result is poor performance and life. To combat this result the effective length of the spring is made very short. This shortening of the spring, however, results in highly concentrated stresses in the spring and necessitates very exacting tolerances of forming to maintain proper contact pressure. For this reason a satisfactory design of a pivotless breaker for modern high speed operation becomes almost prohibitive and highly expensive.

The present invention of a "fulcrum" type

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breaker provides means for obtaining the advantages of both the above types of breaker without having the accompanying disadvantages. Thus, the present novel breaker possesses the advantage of providing exact contact alignment, which is a consideration of the pivotless type of system, and it is constructed so as to provide a long and simply stressed spring particularly adapted for providing fast make and break of the contacts. Further, the system using the present novel fulcrum type breaker further is enabled to maintain the definite angular positioning of an ideal "pivoted" type of breaker having no clearance in the pivoted bearing.

It is, therefore, an object of the present invention to provide a novel ignition contact breaker providing a construction giving exact contact alignment for the breaker and wherein said breaker may be definitely angularly positioned so as to provide for an improved high speed ignition contact make and break system.

Still another object of the present invention is to provide an ignition breaker utilizing the principle of the fulcrum so as to effect a novel ignition contact breaker utilizable at high speed and for considerable lengths of time.

Still another object of the present invention is to provide a circuit breaker which will operate satisfactorily at relatively high speeds and wherein this object is accomplished through the utilization of a "fulcrum" type breaker having elements in combination which allow for the precise alignment of the contact while allowing for maintenance of a definite angular position of the contacts.

The invention, in another of its aspects, relates to novel features of the instrumentalities described herein for teaching the principal object of the invention and to the novel principles employed in the instrumentalities whether or not these features and principles may be used in the said object and/or in the said field.

Other objects of the invention and the nature thereof will become apparent from the following description considered in connection with the accompanying figures of the drawing and wherein like reference characters describe elements of similar function therein and wherein the scope of the invention is determined rather from the dependent claims.

Referring now to the drawing:

Figure 1 is a top plan view of an embodiment of the fulcrum type breaker of the subject invention useful in showing the mounting of the contactor elements to the bracket structure of the breaker;

Figure 2 is a vertical cross sectional view of an

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embodiment of the fulcrum type ignition breaker adapted to illustrate the novel construction and arrangement of parts for providing a breaker having exact contact alignment while maintaining the effective rotational center of the contact arms at all times during the operation thereof;

Figure 3 is a vertical cross sectional view taken along line 3—3 of Figure 2 as adapted to show the arrangement and mounting of the breaker arm to the bracket of the subject invention;

Figure 4 is a horizontal cross sectional view taken along line 4—4 of Figure 2 adapted to show the construction of the fulcrum arm of the breaker of the present invention;

Figures 5a—5e are diagrammatic representations of the forces affecting the breaker arm during the operation thereof.

Generally speaking, the present invention provides a fulcrum-type ignition contact breaker possessing the advantages inherent in a "pivotless" type ignition breaker so as to give exact contact alignment, yet, also provides means for maintaining substantially constant the effective center of rotation of the contact arm during the process of opening or breaking the associated contacts. The invention is novelly constructed so as to comprise a pair of members, one of which is fixedly mounted and may be resilient and clamped to a bracket structure that includes a fulcrum member adapted to support a second contact member. A rubbing block which makes contact with a rotatable cam is mounted between the free end of this second spring member which, at its opposite end, also bears a contact terminal. In the present fulcrum-type ignition breaker the positioning of the spring has been so constructed as to attach the arm thereto at a point removed from the fulcrum by about half the free length of the spring. In the construction thereof, therefore, the effective compound stresses to which the spring is subjected in other types of pivotless contactors are avoided. Moreover, in the type of construction afforded in the present invention the inertia force present during contact closing of the breaker tends to force the lever arm and fulcrum together so as to aid in maintaining the point of contact between them. In addition, the position of the rubbing block with respect to the center of the oscillation of the arm is such that at no time is the fulcrum breaker of the present invention subjected to any inertia forces which tend to separate the fulcrum and the arm.

The riveting of the rubbing block gathers together and includes both members so that they are tightly fixed at all times. The present invention, therefore, provides a simple and inexpensive fulcrum contact breaker which allows for the exact alignment of the contact while at the same time provides and maintains the effective rotational center of the contact arm during make and break thereof.

As shown in Figures 1 and 2, the fulcrum type breaker comprises an assembly 10 from which a bracket 11 is supported. Riveted to the bracket 11 and at an end thereof is a bifurcated spring 13 and a fulcrum arm 12. Spring 13, as hereinafter described, overlies contact arm 14 and is connected thereto at the free end thereof. A rubbing block 15 is adapted to be moved by a rotatable cam 16. This rubbing block is connected to the underside of the contact arm at the junction of the spring 13 and the arm 14. At one end of arm 14 there is a contact 17 adapt-

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ed to mate with a substantially fixed contact 18 connected to assembly 10 as by means of an extension plate 19 formed at right angles to the assembly 10. At the end of the contact arm opposite from the contacts is a fulcrum 20 integrally formed of arm 12. A stop 21 formed of a dependent portion of bracket 11 acts in cooperation with a ridge 22 formed in the contact arm so as to limit the amount of displacement between the contacts of the fulcrum breaker to avoid overstressing of the spring in handling and installation.

Assembly 10 comprises a side plate 24 having ears 25 and 26 formed at the ends thereof. The assembly is adapted to be mounted to a distributor plate (not shown) as by means of screws inserted within eyelets or slots 27 and 28 individually cut in the ears 25 and 26 respectively. Eyelets or slots 27 and 28 have been so constructed that the entire assembly may be positionally adjusted with respect to the distributor plate.

Assembly plate 30 is integrally formed from the side plate of the assembly and is situated at right angles thereto. This assembly plate is adapted to support the bracket and also to provide a mounting on a raised portion 36 thereof for a terminal connector 37 formed by a rivet 29. As shown in Figures 2 and 3, this rivet 29 comprises a threaded sleeve 31 which, in association with a screw 37 acts as a terminal connector and is insulatively mounted and separated from plate 30 by means of a slab of insulation 32. A second insulative slab 33 is placed beneath the assembly plate in a position above that of top face 34 of bracket so that the rivet 30, when penetrating the assembly plate and the bracket, is enabled to tightly gather the same together in an electrically insulative manner. By this means a simple construction is provided for tightly joining the separate parts of the assembly plate and the bracket while at the same time providing a conductor terminal thereof.

Bracket 11 has a sinuating cupola configuration of channel-shaped section, that is, it has a straight mid-portion 39 residing in a plane parallel to that of the assembly plate and has two oppositely situated dependent portions 40, 41 which extend downwardly at an angle with respect to the middle portion of the web of the channel. The dependent portion 40, as will be seen later, acts as a stop to limit the amount of contact displacement of the breaker arm. The oppositely situated dependent portion 41 actually comprises two sections 41', 41'' with section 41'' being horizontally bent with respect to associated section 41', in a plane at a predetermined angle to that of the mid-portion. The entire bracket, with the exception of section 40, has flanges 50, 51 on either side thereof integrally formed therewith whereby fulcrum arm and bifurcated spring are adapted to be snugly contained within end section 41'' of the bracket. The spring and fulcrum arm are staked in a fixed manner to the bracket within end portion 41 by means of a rivet 52.

The fulcrum arm thus tightly mounted and supported within the bracket has formed therein a fulcrum or seat 20 about which contact arm 14 is adapted to be rotated as hereinafter described. The contact arm 14 comprises a contact 17 carried at an end thereof which head or end portion is connected to the main section 70 of the arm 14 by means of a neck portion 70.

This neck portion 70 is bent upwardly slightly

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from the main portion of the arm so that the contact end of the arm is raised above the main portion of the arm but in a plane substantially parallel thereto. One end of the contact arm is adapted to be mounted in a substantially rotatable manner on the fulcrum formed in the fulcrum arm as above described. In the contact arm there is formed a partition 22 which centrally traverses the entire extent of the arm. Thus, the bifurcated spring, as shown in Figure 4, is adapted to ride or overlie the contact arm with each individual tong 80 and 81 placed to a side of the partition formed on the contact arm. The resilient mounting thus afforded by the overlying of the bifurcated spring on the straight portion of the contact arm, which has its free end adapted to be rotated about the fulcrum of the fulcrum arm as a center, is accomplished by staking the resilient bifurcated spring to the contact arm at substantially the mid-point of the contact arm as by means of rivets 90 and 91. Also staked to the contact arm at the same point by the above means is a rubbing block 15 having an inverted L-shape, the dependent portion of which is adapted to be engaged by a rotating cam. The fixed contact 18, which is adapted to mate with contact 17 on the contact arm is formed of an extension of the assembly plate at substantially right angles thereto.

The novel construction described above insures that the contact arm and bifurcated spring are maintained in constant positive alignment, yet, the spring is permitted to flex without any undue interference thereto. The positioning alignment of the assembly is aided by the construction of the insulator blocks as fitted to the assembly plate by means of the construction of the rivet passing through the bracket and including a raised portion 92 of bracket 11. This means of alignment insures the fact that the relative position of the contacts is automatically established upon assembly. After assembly the friction between the parts due to the pressure of the type of rivet fastenings used insures that this alignment is exactly maintained even though the parts which engage each other have small clearance tolerance in their dimensions. Thus, these tolerances may even permit, during assembly, some inexactness in the matching of the contacts, but this has no undue effect thereon because once the relation is established it is maintained throughout the life of the device.

The novel construction of the fulcrum-type breaker of the invention allows for the advantageous use of the fulcrum arm with the beneficial resulting relationship between it and the bifurcated spring and the contact arm. In Figure 5a the resultant forces operative on the contact arm when the contact is opened with the upward vertical force being applied through the cam rubbing block is shown. Figure 5b discloses the effect of the resultant force when the contact is closed with the vertical force applied through the contact. It is seen that the magnitude of the vertical load applying to the point of bearing of the arm on the fulcrum arm about the fulcrum point is determined by the relative location of this point with respect to the contact arm and bifurcated spring. As shown in Figure 5a this has been so constructed that the vertical force of the fulcrum is somewhat greater than the force present in the rubbing block so that the resultant force is usually nearer the fulcrum than the rubbing block. Therefore, in case the load is applied in an eccentric manner to the

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rubbing block, as will sometimes happen, the contact arm is not caused to lift away from the fulcrum so as to cause a twisting or misalignment.

A comparison between Figures 5a and 5b will show that the position of the resultant force is not changed by transfer of the pressure from the contacts to the rubbing block, or vice versa, which does occur during opening and closing of the contacts. Since the resultant force is applied to the arm by the spring, it thus follows that the spring stress is not caused to change during this transition. As a result of this, the bifurcated spring is relieved of complex stresses and permits the use of a relatively long and flexible spring in the construction of the fulcrum-type breaker. The distance from the clamping surface, or point where the bifurcated spring is held between members 11 and 12, and the fulcrum point, is chosen to be approximately equal to the distance from this fulcrum point to the location of the resultant force. Since the location of the resultant is a point of no bending moment in the spring, it follows that location of the resultant force must also be the point of tangency of the spring and the arm. This being a point of inflection in the spring, the tendency of the spring from this point to its outer end is to bend in a curve that is convex upward. It is prevented from so bending from the greater rigidity of the main portion of the contact arm and the result is that the rivet which holds the spring to the arm is not subject to bending loads or any eccentricity of loading.

The fulcrum being located midway between the two points of tangency of the spring is thereby very close to the true center of rotation of the arm, so that the relative sliding motion between the arm and fulcrum is negligibly small, and wear and friction as this point can be neglected. The spring thus tends in a smooth curve between the point where it is tangent to the arm and point where it is tangent to the bracket. The fulcrum point is located substantially at the point of intersection of these two tangents and thus serves to relieve the spring of complex bending forces. It is to be noted that this construction is adapted to be used with a spring which is flat in the unstressed state and which is, therefore, not required to be subjected to forming operations which cause production variations in spring loading. From Figures 5a to 5b it can be seen that under all static conditions there is a positive means of determining the angular position of the arm. The state of affairs under dynamic loading depends on the location of the center of percussion of the moving mass. Figure 5c shows the dynamic forces under opening acceleration, the arm being accelerated upward by the cam. Here the resultant is applied at the center of percussion, and it is seen that the center of percussion must be between the fulcrum and the cam follower in order to insure the maintenance of the load at the fulcrum. Figure 5d shows the conditions of dynamic loading at the instance of closing, with the upward force applied to the contact. Figure 5e shows the conditions under downward acceleration from the spring load, such as occurs at the maximum open position. Here it is seen that the spring resultant must be between the center of percussion and the fulcrum. Therefore, it follows that if the center of percussion of the moving mass is between the rubbing block and the spring resultant, the load on the fulcrum will be positive under all static and dynamic conditions, and the arm will not leave the

fulcrum under any possible conditions of operation.

The novel invention of the fulcrum-type ignition breaker, hereinabove described, is merely illustrative and not exhaustive in scope and since many widely different embodiments of the invention may be made without departing from the scope thereof, it is intended that all matter contained in the above description and shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A periodic circuit interrupter comprising in combination with a rotatable cam, a pair of relatively stationary and movable contacts, a support for said fixed contact, a bifurcated leaf spring, a contact arm carrying said movable contact joined to said leaf spring, a fulcrum placed at an end of said contact arm and pivotably supporting said arm and a rubbing block adapted for activating said contact arm upon the rotation of a cam, said rubbing block, said contact arm, and said bifurcated spring being connected at a point midway of the contact arm between the rubbing block and the fulcrum.

2. A periodic circuit interrupter comprising in combination an assembly wall, an assembly plate adapted to be attached to a distributor, an extension formed of said assembly plate extending at right angles thereto, said extension adapted to support said fixed contact of said interrupter, a contact arm, a bracket, a fixed fulcrum connected to said assembly plate by means of said bracket and, resilient means connected to the mid-point of said contact arm with said bracket adapted also to support said fulcrum so that said contact arm may be moved thereabout.

3. A fulcrum type ignition breaker comprising in combination an assembly wall, an assembly plate integrally formed thereof extending therefrom substantially at right angles thereto, a bracket connected to said assembly plate, a connector terminal comprising a hollow rivet connected to said bracket penetrating said assembly plate and insulated therefrom by means of a pair of insulator slabs, said rivet adapted to tightly connect said bracket to said assembly plate; said bracket further comprising a pair of bent portions one of which portions extends substantially in the same plane of said bracket but at an angle thereto; a pair of cooperating relatively stationary and movable contacts, a fulcrum arm connected to said bracket, a resilient bifurcated spring interleaved between said bracket and said

fulcrum arm and connected thereto, said movable contact being connected to said contact arm at an end opposite said fulcrum arm, said contact arm being adapted to move about said fulcrum arm upon movement thereof, said resilient bifurcated spring being attached to said contact arm substantially at the midpoint thereof so as to maintain said contact arm fixedly on said fulcrum arm upon rotation thereof.

4. A fulcrum type ignition breaker comprising in combination, assembly means adapted to be connected to the distributor of an automobile, said assembly means comprising an assembly plate and an assembly side wall, said assembly plate extending from said side wall at substantially a right angle thereto, a plurality of slots cut through said side wall for movably adapting said assembly to said distributor, a bracket connected to said assembly plate, said bracket having a sinuated configuration including a mid-portion and two end portions, one of said end portions being substantially in the plane of said mid-portion, and a fulcrum type contact assembly connected to said bracket, said fulcrum contact assembly comprising a fulcrum arm, a contact arm, a spring overlying said contact arm with said contact arm being movably mounted on said fulcrum arm.

5. In a fulcrum type ignition breaker having a rotary cam, a fulcrum contact breaker comprising a fixed contact, a movable contact arm, a contact on said contact arm adapted to mate with said fixed contact, a bifurcated spring connected to and overlying said contact arm, said contact arm having a ridge centrally positioned throughout its entire extent to form a partition between said tongs of said bifurcated spring, clamping means for clamping said spring to said assembly so as to fixedly support said spring therewithin, a fulcrum also connected to said clamping means supporting said contact arm and means connecting both said spring and contact arm at a point midway of said contact arm adapted to move said spring and arm on the rotation of said cam.

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REFERENCES CITED

The following references are of record in the file of this patent:

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