

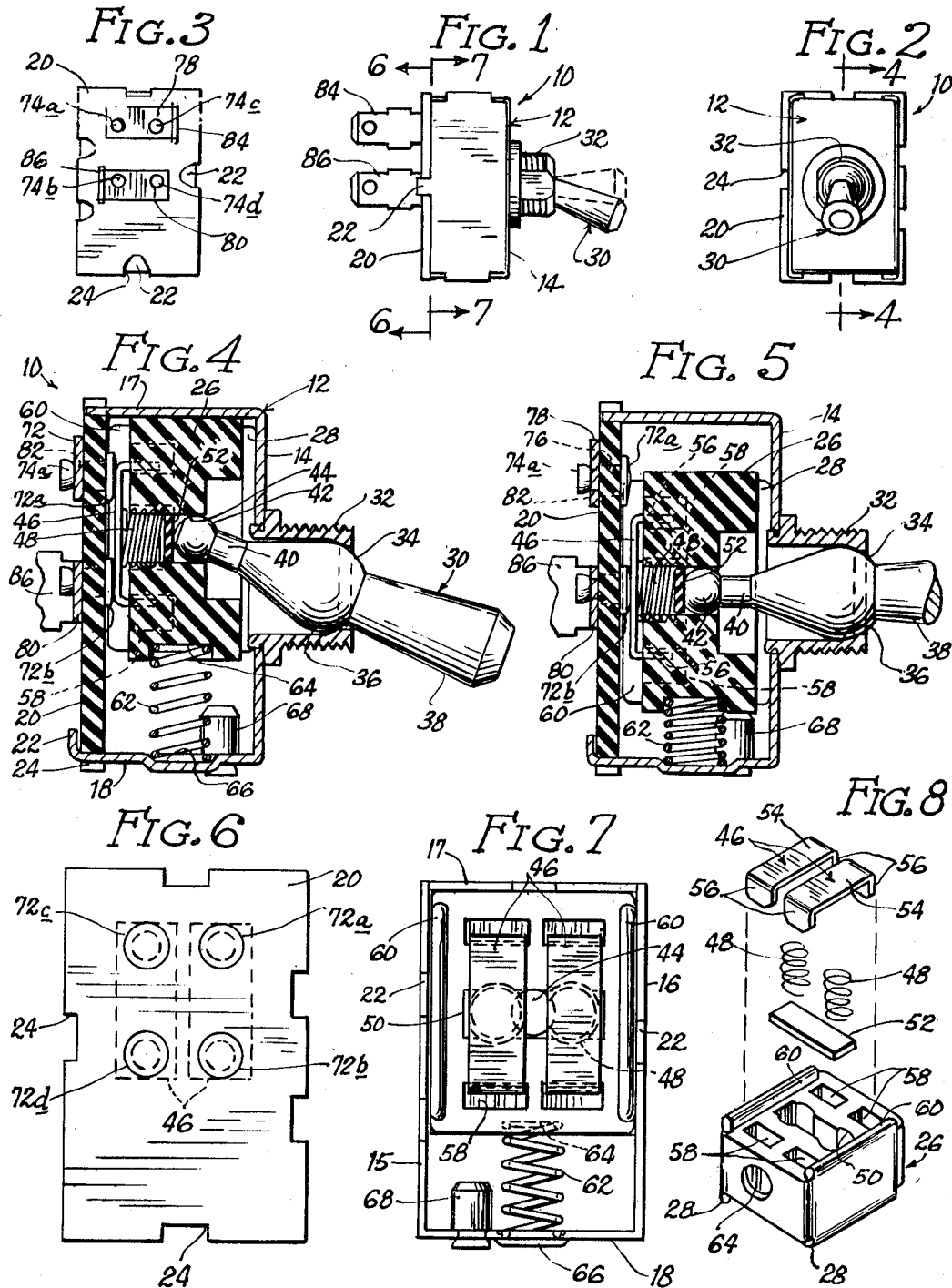
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PLURAL BREAK ELECTRICAL SWITCH

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PLURAL BREAK ELECTRICAL SWITCH

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ABSTRACT OF THE DISCLOSURE

An electrical switch, comprising a casing, a carriage movable therein, first and second pairs of contacts, first and second contactors movable with said carriage between first and second positions, each contactor when in said first position being engageable with both contacts of the corresponding pair, each contactor being movable out of engagement with the first contact while remaining in engagement with the second contact of the corresponding pair when the contactor is moved to said second position, a first terminal conductor secured between the first contacts of both pairs, and a second terminal conductor secured between the second contacts of both pairs, said contactors being movable substantially simultaneously out of engagement with both of said first contacts, whereby the wear and erosion due to arcing are distributed between said first contacts.

This invention relates to electrical switches generally, but is particularly applicable to automotive type electrical switches, intended for use on automobiles, trucks and other vehicles. In certain aspects, this invention represents an improvement and a further development of the invention disclosed and claimed in the pending application of John E. Soreng and Jesse M. Cobb, Ser. No. 641,920, filed May 29, 1967, on Electrical Switches With Plural Breaks.

Such pending application discloses switches in which a contactor breaks contact simultaneously, or nearly so, with two or more stationary contacts, connected together by a strap or some other terminal conductor. Electrical current is supplied to the contactor by another stationary contact which remains in engagement with the contactor and thus is not involved in the breaking of the circuit.

In the switch of the present invention, the current carrying capacity and efficiency of the switch are increased by providing a plurality of contactors, each of which is engageable with a separate pair of contacts. Each contactor is movable between a first position, in which the contactor engages both contacts of the corresponding pair, and a second position, in which the contactor has been moved out of engagement with the first contact while remaining in engagement with the second contact of the corresponding pair. All of the first contacts are connected together by a first terminal conductor. Similarly, all of the second contacts are connected together by a second terminal conductor. The contactors are movable substantially simultaneously out of engagement with all of the first contacts. However, due to slight variations in construction, the breaking action is not absolutely simultaneous, in the normal case. The circuit is actually interrupted at the contact where the last break occurs. The interruption of the circuit causes arcing which results in slight erosion of the contactor and the contacts. Thus, after a few cycles of operation, the point of last break shifts to another contact. In this way, the erosion is distributed among the various contacts where the simultaneous breaking action occurs. The provision of a plurality of contactors, each engageable with two contacts insures that the contacting pressure between the contactors and the contacts will be efficiently distributed.

Various other objects, advantages and features of the present invention will appear from the following description, taken with the accompanying drawings, in which:

FIG. 1 is a side elevation of a switch to be described as an illustrative embodiment of the present invention.

FIG. 2 is a front elevation thereof.

FIG. 3 is a rear elevation thereof.

FIG. 4 is an enlarged longitudinal section, taken generally along the line 4—4 in FIG. 2.

FIG. 5 is a view similar to FIG. 4, but with the switch in a changed position.

FIG. 6 is an enlarged elevation of the contact board, detached from the switch, the view being taken as indicated by the line 6—6 in FIG. 1.

FIG. 7 is an enlarged elevation of the switch with the contact board detached, the view being taken generally as indicated by line 7—7 in FIG. 1.

FIG. 8 is an exploded perspective view showing the carriage, the contactors and the contactor springs of the switch.

As just indicated, the drawings illustrate an electrical switch 10 which will find many applications, but is particularly suitable for automotive services, on automobiles, trucks, and other vehicles. The illustrated switch 10 is especially well adapted for controlling the marker lights of a truck. For such service, the purpose of the switch is to make it easy for the truck driver to turn out his marker lights momentarily, as a signal to the drivers of other vehicles to the rear. Such flashing of marker lights is commonly used as a warning signal. Thus, illustrated switch 10 is normally closed. The switch may be moved momentarily to an open position, but returns by spring action to the closed position, when the switch is released.

As illustrated, the switch 10 comprises a casing 12 having a front wall 14, two side walls 15 and 16, and two end walls 17 and 18. The rear of the casing 12 is closed by a board or plate 20, which thus forms the rear wall of the casing. The board 20 serves as a contact and terminal support, and thus is preferably made of various plastics, or some other insulating material. Suitable means are provided to secure the board 20 to the casing 12. In this case, the casing 12 is formed with a plurality of tabs 22 which extend through slots or notches 24 in the board 20. The tabs 22 are bent or clinched behind the board 20.

A carriage 26 is movable along a predetermined path within the casing 12. In this case, the carriage 26 is slidable longitudinally within the casing 12, along a linear path. The front of the carriage 26 is preferably formed with a pair of runners 28, slidable along the front wall 14 of the casing.

Means are provided to operate the carriage 26 within the casing. As illustrated, such operating means comprise a lever 30, extending through a bushing 32 which is mounted in the front wall 14 of the casing 12. The lever 30 is swingable within the bushing 32. As shown, the lever 30 has a ball portion 34 which is spherically curved. The ball portion 34 is slidably seated in a spherically curved annular socket or shoulder 36, formed within the bushing 32.

At its outer end, the lever 30 has a handle portion 38, adapted to be operated manually. The inner end of the lever 30 is in the form of an arm 40, adapted to operate the carriage 26. The illustrated arm 40 terminates at its inner end in a spherically curved ball portion 42 which is slidably received within a cylindrical opening 44, formed in the carriage 26.

A plurality of contactors 46 are mounted on the carriage 26 for movement therewith. In the illustrated switch 10, there are two such contactors 46. Springs 48 are preferably provided to bias the contactors 46 rear-

wardly, toward the contact board 20. In the illustrated construction, each spring 48 is in the form of a compression coil spring, located in a recess 50 which is formed in the rear side of the carriage 26. The rear end of each spring 48 engages the corresponding contactor 46. In the illustrated construction, the front ends of both springs 48 engage a bar 52, which is slidably received in the recess 50. It will be seen that the bar 52 engages the extreme rear end of the lever 30. Thus, the bar 52 transfers the force of the springs 48 to the lever 30, so as to bias the lever forwardly. In this way, the ball portion 34 is pressed against the annular socket 36. The spring pressure prevents the lever 30 from rattling when the switch is subjected to vibrations.

The contactors 46 are made of brass, copper or some other conductive material. Each contactor 46 is illustrated as comprising a longitudinal bar portion 54, from which two ears or prongs 56 are bent. As shown to best advantage in FIGS. 4 and 5, the prongs 56 are slidably mounted in recesses or slots 58, formed in the rear side of the carriage 26. In this way, the contactors 46 are slidably supported on the carriage 26 for rearward movement toward the contact board 20, under the urging of the springs 48.

The rear side of the carriage 26 is formed with runners or ridges 60 which are slidably engageable with the contact board 20. The carriage 26 is movable between first and second positions, as shown in FIGS. 4 and 5. Means are preferably provided to bias the carriage toward its first position. For this purpose, a spring 62 is interposed between the carriage 26 and the end wall 18 of the casing 12. The spring 62 is illustrated as a compression coil spring, having one end seated in a recess 64, formed in one end of the carriage 26. The other end of the spring 62 is preferably seated in a recess 66, formed in the end wall 18. In the illustrated construction, a stop 68 is mounted on the end wall 18 to limit the movement of the carriage 26.

As shown, the carriage 26 is generally rectangular in shape. The carriage is preferably made of various plastics, or some other insulating material.

The contactors 46 are adapted to engage a plurality of contacts, mounted on the board or wall 20. The illustrated contacts are arranged in two pairs. Each contactor 46 is engageable with one pair of contacts. In the first position of the switch, as shown in FIG. 4, each contactor 46 engages both contacts of the corresponding pair. When the switch is operated to the second position, as shown in FIG. 5, each contactor 46 is moved out of engagement with one of the contacts of the corresponding pair.

As shown to best advantage in FIG. 6, the illustrated switch 10 has four contacts 72a, b, c and d. One of the contactors 46 is engageable with the contacts 72a and b, which are spaced apart longitudinally, in the direction of movement of the contactor. The other contactor 46 is engageable with the contacts 72c and d, which are similarly spaced apart longitudinally.

While the contacts 72a-d may assume various forms, they are illustrated as the spherically rounded heads of rivets 74a-d, extending through holes 76 in the supporting board 20, which preferably is made of an insulating material. First and second terminal conductors 78 and 80 are secured to the rear side of the board 20. The first terminal conductor 78 is connected between the first contacts 72a, and c of both pairs of contacts. Similarly, the second terminal conductor 80 is connected between the second contacts 72b and d of both pairs. The illustrated terminal conductors 78 and 80 are in the form of metal straps. The rivets 74a-d extend through holes 82 in the straps. It will be seen that the terminal conductor or strap 78 is secured to the board

20 by the rivets 74a and c. Similarly, the terminal conductor or strap 80 is secured to the board 20 by the rivets 74b and d. The terminal conductors 78 and 80 are preferably formed with prongs 84 and 86, adapted to receive a suitable connector or the like.

It may be helpful to summarize the operation of the switch 10. When the carriage 26 is in its first position, as shown in FIG. 4, one of the contactors 46 engages both contacts 72a and b of the corresponding pair. The other contactor 46 engages both contacts 72c and d of the other pair. The contacts 72a and c are connected together by the terminal 78. Similarly, the contacts 72b and d are connected together by the terminal 80. Thus, the contactors 46 form dual paths completing or closing the circuit between the terminals 78 and 80. The springs 48 press the contactors 46 firmly against the contacts 72a-d. In addition, the springs 48 press the bar or plate 52 against the inner end of the lever 30, with the result that the ball-shaped portion 34 of the lever is firmly held against the annular seat 36. This arrangement prevents the lever 30 from rattling when the switch is subjected to vibration.

When the carriage 26 is moved to its second position, as shown in FIG. 5, the first contactor 46 is moved out of engagement with the first contact 72a of the corresponding pair. Similarly, the second contactor is moved out of engagement with the contact 72c. The circuit between the terminals 78 and 80 is thus interrupted or broken. The plural breaking of the circuit by the plural contactors 46 occurs virtually simultaneously at both contacts 72a and c. However, normally the breaking of the circuit is not absolutely simultaneous at both contacts 72a and c due to minor variations in the contactors and the contacts. Thus, the circuit is actually interrupted at the contact where the last break occurs. The current flowing in the circuit causes arcing at this contact. The arcing causes slight erosion of the contact and the corresponding contactor. After one or more cycles of operation, the erosion is sufficiently great to cause the interruption of the circuit to shift to the other contact. Thus, the arcing is distributed between the two contacts 72a and c, and the two contactors 46. The arcing shifts back and forth between the two contacts 72a and c in a random manner throughout the life of the switch. The distribution of the arcing equalizes the wear and erosion on the two contactors 46 and the contacts 72a and c. Moreover, the heating effect of the arcing is spread over a wide area, so that the heat is effectively dissipated. Thus, the life of the switch is greatly prolonged.

The provision of a plurality of contactors, engageable with a plurality of pairs of contacts, increases the current-carrying capacity of the switch, while also assuring that the contact pressure between each conductor and the corresponding contacts will be effectively equalized. Each contactor engages only two contacts, so that the pressure, applied to the contactor by the corresponding spring, is automatically equalized between the two contacts. The contactors 46 are supported in such a manner that the contactors are free to engage the contacts with equalized contact pressure. Thus, there is sufficient clearance between the tabs or prongs 56 on the contactors 46 and the slots 58 in the carriage 26, to permit limited rocking movement of the contactors 46, so that the spring pressure will be equalized between the corresponding contacts.

When the switch is in its first or closed position, as shown in FIG. 4, the contactors 46 actually make four points of contact with the contacts 72a-d. However, due to the provision of two separate contactors 46, only two points of contact are established between the contacts and each contactor.

In the illustrated switch, the carriage 26 is biased toward its first or closed position by the spring 62. By operating the lever 30, the carriage 26 may be moved to its second position, in which the switch is open, as shown in FIG. 5. When the lever 30 is released, the spring 62 returns the carriage 26 to its first position. Thus, the illustrated switch is of the type which is normally closed, but is adapted to be momentarily opened. It will be understood that the invention is equally applicable to other types of switches. Thus, for example, the invention is applicable to detented, non-spring return switches, as well as switches of the spring return type. Moreover, the invention is readily adaptable to double-throw switches, as well as those of the single-throw type.

Due to the provision of two contactors and two pairs of contacts, the current carrying capacity of the switch is at least double the capacity of the individual contactor. Due to the distribution of the arcing between the two contactors, the life of the switch is approximately double the life that could be achieved with a single contactor, engageable with a single pair of contacts.

Various other modifications, alternative constructions and equivalents may be employed without departing from the true spirit and scope of the invention, as exemplified in the foregoing description and defined in the following claims.

I claim:

1. An electrical switch, comprising the combination of
 - a casing,
 - a carriage movable in said casing along a predetermined path,
 - operating means for moving said carriage within said casing,
 - said casing having a contact supporting wall opposite said carriage,
 - first and second pairs of contacts mounted on said contact supporting wall,
 - each pair comprising first and second contacts which are spaced apart along the direction of movement of said carriage,
 - first and second contactors mounted independently on said carriage and movable therewith between first and second positions,
 - each of said contactors comprising a bar-shaped member extending generally parallel to the path of said carriage,
 - said contactors and said carriage having means mounting said bar-shaped members on said carriage for independent movement toward said contacts,
 - each of said contactors having independent spring means mounted on said carriage and independently biasing each contactor toward said contacts,
 - said first contactor when in said first position being engaged with both of said contacts of said first pair and being movable to said second position out of engagement with said first contact while remaining in engagement with said second contact of said first pair,
 - said second contactor when in said first position being engaged with both contacts of said second pair and being movable to said second position out of engagement with said first contact while remaining in en-

gagement with said second contact of said second pair,
 a first terminal conductor secured between said first contacts of said first and second pairs,
 and a second terminal conductor secured between said second contacts of said first and second pairs,
 said first and second contactors being movable substantially simultaneously out of engagement with said first contacts of said first and second pairs.

2. An electrical switch, comprising the combination of
 - a casing,
 - a carriage movable in said casing along a predetermined path between first and second positions,
 - operating means for moving said carriage within said casing,
 - said casing having a contact supporting wall opposite said carriage,
 - a plurality of pairs of contacts mounted on said contact supporting wall,
 - each pair comprising first and second contacts which are spaced apart along the direction of movement of said carriage,
 - a plurality of contactors mounted on said carriage and movable therewith,
 - each contactor being engageable with a corresponding pair of said contacts,
 - each of said contactors comprising a bar-shaped member extending generally parallel to the path of said carriage,
 - said contactors and said carriage having means mounting said bar-shaped members on said carriage for independent movement toward said contacts,
 - each of said contactors having independent spring means mounted on said carriage and independently biasing said contactor toward said contacts,
 - each contactor when in said first position being engaged with both of said contacts of the corresponding pair and being movable to said second position out of engagement with said first contact while remaining in engagement with said second contact of the corresponding pair,
 - a first terminal conductor secured between said first contacts of all of said pairs,
 - and a second terminal conductor secured between said second contacts of all of said pairs,
 - said contactors being movable substantially simultaneously out of engagement with said first contacts of all of said pairs.

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