United States Patent

[11] 3,604,863

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[54] **MULTIPOSITION ELECTRICAL SWITCH**
14 Claims, 12 Drawing Figs.

[52] **U.S. Cl.** ..... **200/16 R**
[51] **Int. Cl.** **H01h 15/00**
[50] **Field of Search** ..... 200/16 R, 11 C, 166 B, 166 CT, 166 BH

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Attorney—Burmeister, Palmatier & Hamby

ABSTRACT: Twin contactors are mounted on a movable carriage and are engageable with contacts arranged in first and second rows. The contacts in one row are staggered relative to the contacts in the other row. In successive positions of the carriage, the contactors alternately form conductive bridges between adjacent contacts in the rows. A first interconnecting strap extends between staggered contacts in the two rows so that both of such contacts may serve as battery or feed contacts. A second strap extends between another pair of staggered contacts in the two rows to provide duplicate switch positions. Two additional contacts are positioned opposite each other at one end of the rows. An additional contactor is mounted on the carriage to form a bridge between such additional contacts in one extreme position of the carriage. The additional contactor is of small size and is offset laterally away from one of the rows of contacts so that the additional contactor does not form a bridge between the staggered contacts.

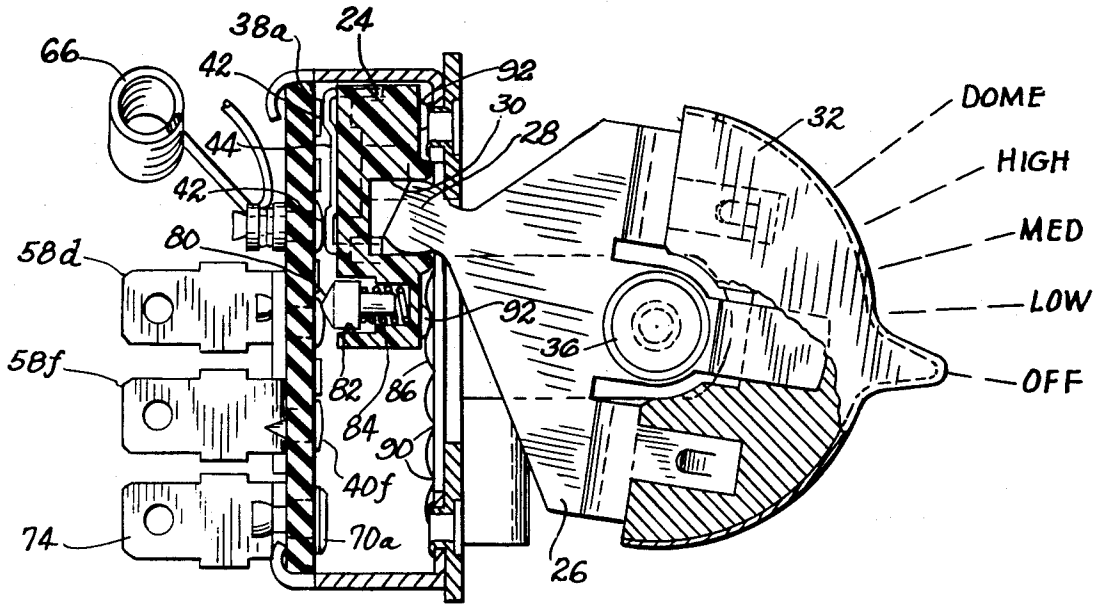


FIG. 1

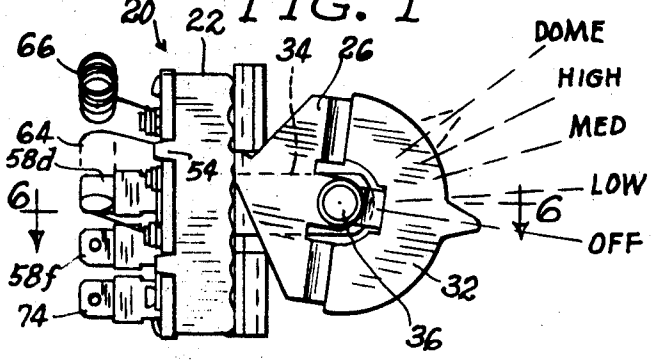


FIG. 2

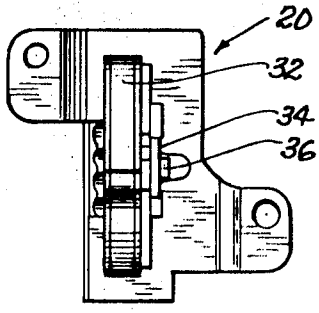


FIG. 3

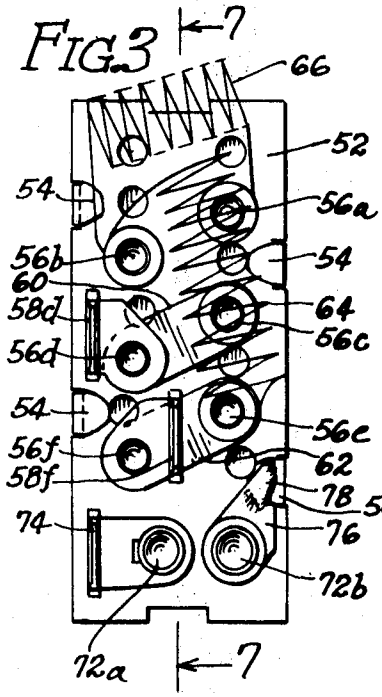


FIG. 4

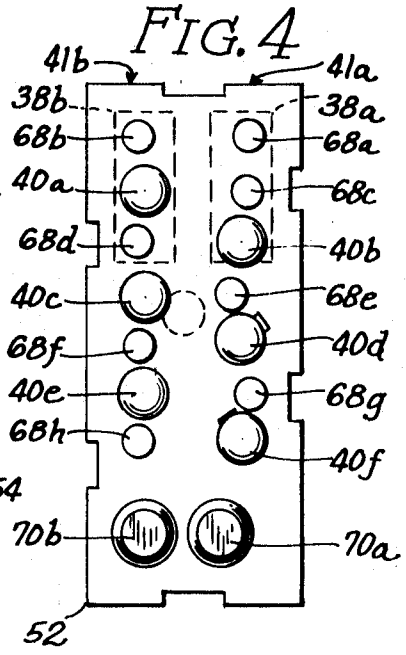


FIG. 5

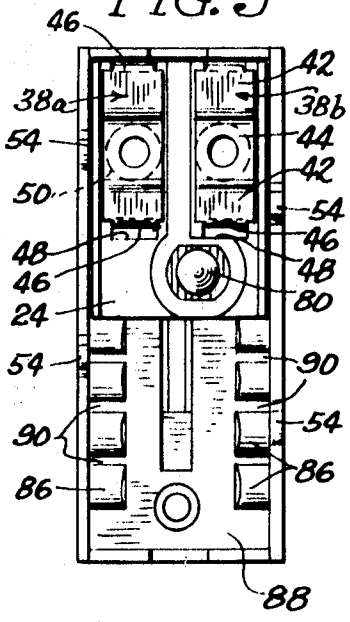
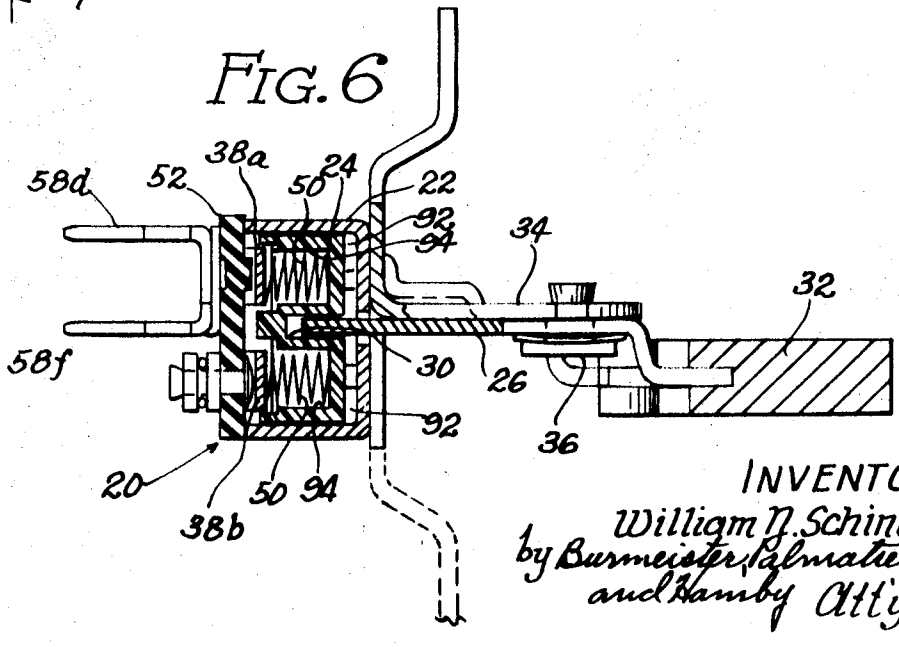


FIG. 6



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FIG. 7

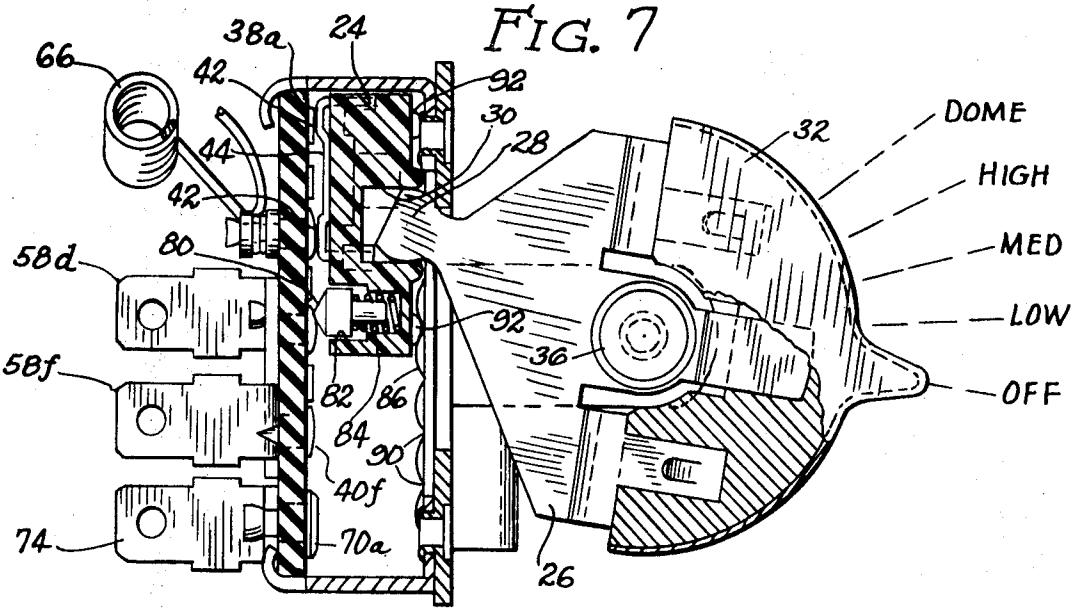


FIG. 8

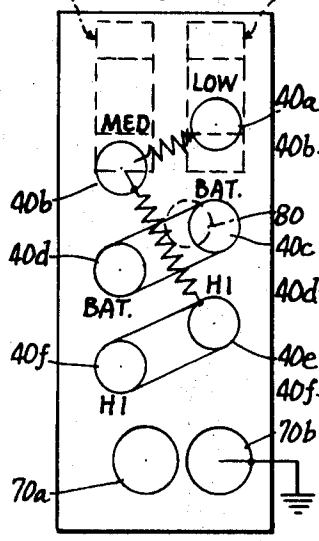


FIG. 9

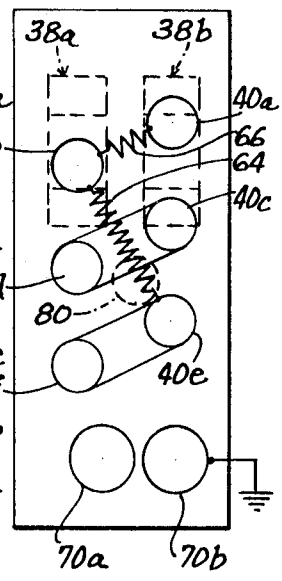


FIG. 10

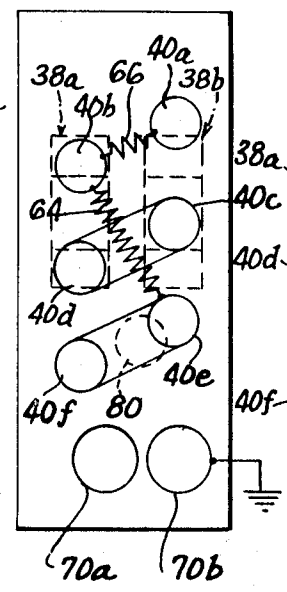


FIG. 11

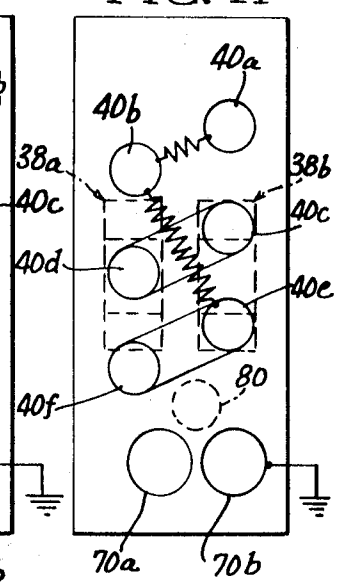
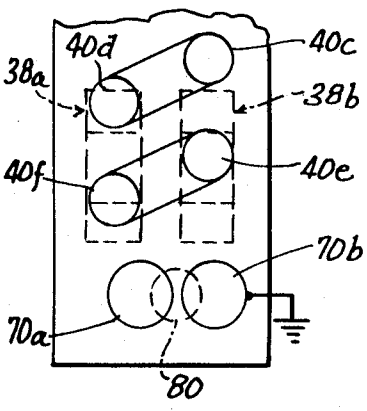


FIG. 12



MULTIPOSITION ELECTRICAL SWITCH

This invention relates to electrical switches and is particularly applicable to switches intended for automotive usage. However, the invention is applicable to many other types of electrical switches.

One object of the present invention is to provide a new and improved electrical switch which may have a multiplicity of operating positions, yet is extremely compact.

A further object is to provide such an electrical switch which combines a multipole switching operation with a single-pole switching operation.

In accordance with the present invention, the switch comprises first and second contactors mounted on a movable carriage and engageable with contacts arranged in first and second rows. Each contactor is adapted to form a bridge between adjacent contacts in the corresponding row. The contacts in one row are staggered relative to the contacts in the other row. In this way, the contactors alternately form bridges between the adjacent contacts in the corresponding rows as the carriage is moved to its successive positions. Preferably, a strap or other interconnecting member is provided between a staggered pair of contacts in the first and second rows, so that such contacts will have a common circuit connection, preferably to the battery or other source of power. A second interconnecting member extends between another pair of staggered contacts to provide for duplicate switching positions. It is preferred to provide an additional pair of contacts, disposed directly opposite each other at one end of the rows. An additional contactor is mounted on the carriage to form a bridge between the additional contacts in one position of the carriage. The additional contacts and the additional contactor are offset laterally, away from one of the rows, so that the additional contactor does not form a bridge between the staggered contacts in the rows.

With the construction of the present invention, the switch may have a multiplicity of closely spaced operating positions. At the same time, the switch is extremely compact, easy to manufacture and low in cost.

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

FIGS. **1** and **2** are side and front elevational views of an electrical switch to be described as an illustrative embodiment of the present invention.

FIG. **3** is an enlarged rear view of the switch.

FIG. **4** is a front elevation showing the contacts on the terminal board of the switch, the terminal board being removed from the switch for clarity of illustration.

FIG. **5** is a rear elevation of the switch with the terminal board removed.

FIG. **6** is a horizontal section, taken generally along the line **6—6** in FIG. **1**.

FIG. **7** is a vertical section, taken generally along the line **7—7** in FIG. **3**.

FIGS. **8–12** are diagrammatic views showing the successive positions of the switch.

It will be seen that the drawings illustrate an electrical switch **20** intended particularly for automotive service. However, the invention will have many other applications. The particular switch **20** illustrated in the drawings is especially well adapted for dimming the panel lamps of an automobile, while also controlling the operation of the dome light.

The illustrated switch **20** comprises a casing **22** which in this case is rectangular but may be of any other suitable shape. A carriage **24**, preferably made of an insulating material, such as various plastics, is movable within the casing **22**.

Various means may be provided to operate the carriage **24**. In this case, the carriage is operated by means of a lever **26** which is connected to the carriage and extends out of the casing **22**. As shown in FIG. **7**, the lever **26** has a rounded inner end portion **28** which is slidably and rockably received in a slot **30** formed in the front side of the carriage **24**.

A handle **32** is mounted on the front or outer end of the lever **26**. It will be seen that the lever **26** is swingably mounted on a bracket **34** by means of a pivot **36**, which may take the form of a rivet or the like.

Twin contactors **38***a* and *b* are mounted on the carriage **24** for movement therewith. The contactors **38***a* and *b* are engageable with a plurality of stationary contacts **40***a*, *b*, *c*, *d*, *e* and *f*, arranged in two rows **41***a* and *b* which extend parallel to the path of movement of the carriage **24**. The contacts **40***b*, *d* and *f* are in the first row **41***a*, while the contacts **40***a*, *c* and **3** are in the second row **41***b*. The contacts in the second row **41***b* are staggered relative to the contacts in the first row **41***a*.

The first and second contactors **38***a* and *b* are illustrated as being elongated and generally bar shaped. The length of the contactors **38***a* and *b* is such that each contactor is adapted to form a conductive bridge between adjacent contacts in the rows **41***a* and *b*. Each of the contactors **38***a* and *b* is formed with rearwardly projecting end portions **42**, adapted to engage the contacts **40***a–f*. Each contactor has central portion **44** which is offset or recessed as shown most clearly in FIGS. **5** and **7**.

The contactors **38***a* and *b* are connected to the carriage **24** by means of tabs **46** which project into slots or recesses **48** formed in the carriage **24**. Springs **50** are provided between the carriage and the contactors **38***a* and *b* to bias the contactors rearwardly toward the contacts **40***a–f*.

In this case, the contacts **40***a–f* are mounted on an insulating support **52** which takes the form of a board or plate made of a suitable plastic material. The insulating board **52** is secured to the rear of the casing **22** by means of clinched tabs **54** thereon.

The illustrated contacts **40***a–f* are in the form of the rounded heads of rivets **56***a–f* extending through the insulating board **52**. In this case, terminals **58***d* and *f* are mounted on the corresponding rivets **56***d* and *f*. Normally, the terminal **58***d* is connected to the battery or some other source of power, while the terminal **56***f* is connected to the lamps or other devices to be controlled by the switch.

It will be seen from FIG. **4** that the contacts **40***a*, *c* and *e* in the second row **41***b* are staggered or offset relative to the contacts **40***b*, *d* and *f* in the first row **41***a*. In this case there are three contacts in each row, but a greater or lesser number may be employed.

It is preferred to provide an interconnecting strap or other member **60** between one pair of staggered contacts in the first and second rows **41***a* and *b*. In this case, the strap **60** is secured to the rivets **56***c* and *d* so that it extends between the contacts **40***c* and *d*. Thus, both of the contacts **40***c* and *d* are normally connected to the battery or other source of power.

In this case, a second strap or other interconnecting member **62** is connected to the rivets **56***e* and *f* and thus is connected between the contacts **40***e* and *f*. This interconnecting strap **62** provides duplicate switching positions, as will be explained in detail presently.

The illustrated switch **20** is especially well adapted for dimming panel lamps or the like. For such service, the switch is adapted to connect resistors **64** and **66** into the circuit, in series with the lamps. The illustrated resistor **64** is connected between the rivets **56***b* and *e*, while the resistor **66** is connected between the rivets **56***a* and *b*.

To provide for smooth operation of the switch, the terminal board **52** is provided with a plurality of dummy contacts or bosses **68***a–h*. These bosses are preferably in the form of insulating semiperforations, punched or otherwise formed from the board **52**. In some cases the bosses may be molded integrally with the board **52**. Generally, the bosses are interspersed between the contacts **40***a–f* so that a boss is opposite each of the contacts. Specifically, the bosses **68***c–h* are opposite the respective contacts **40***a–f*. The bosses **68***c*, *e* and *g* are in the first row **41***a*, while the bosses **68***d*, *f* and *h* are in the second row **41***b*. It will be seen that the bosses **68***a* and *b* are opposite each other at one end of the first and second rows **41***a* and *b*.

The contactors **38***a* and *b* and the staggered contacts **40***a–f* employed to the perform a multipole switching function. To perform an additional single-pole switching function, the switch **20** is provided with an additional pair of contacts **70***a* and *b*, which are mounted on the insulating board **52** at one end of the rows **41***a* and *b*. The contacts **70***a* and *b* are directly opposite each other rather than being staggered. As shown, the contacts **70***a* and *b* are in the form of rounded heads on rivets **72***a* and *b* extending through the insulating board **52**. A terminal **74** is mounted on the rivet **72***a*. In this case, the rivet **72***b* is grounded to the casing **22** by means of a strap or plate **76** which is clinched under one of the tabs **54**. A soldered joint **78** is also preferably provided between the strap **76** and the corresponding tab **54**.

An additional contactor **80** (FIG. **5**) is preferably mounted on the carriage **24** to form a bridge between the contacts **70***a* and *b*. In this case the contactor **80** is in the form of a rounded contact point which is generally cylindrical in shape and is slidably received in a recess **82** formed in the carriage **24**, as shown to best advantage in FIG. **7**. A spring **84** is provided between the carriage **24** and the contactor **80**, to bias the contactor rearwardly toward the contacts **70***a* and *b*.

The carriage **24** is movable to a series of positions which preferably are definitely established by detend means. In this case, such detent means comprise a plurality of rounded detent projections **86** projecting inwardly from the front wall **88** of the casing **22**. Detent notches or seats **90** are effectively formed between the projections **86**. The contactor **24** is formed with a plurality of rounded detent projections **92** (FIGS. **6** and **7**) which are adapted to be received in the seats **90**. It is preferred to form such detent projections **92** at the four front corners of the carriage **24**. The contactor springs **50** and **84** have the effect of biasing the carriage **24** forwardly, while also biasing the contactors rearwardly.

The operation of the switch **20** will be clearly evident from FIGS. **8–12**, which show the five successive positions of the switch. In these views, the various contacts are viewed from the rear of the switch, while the contactors are shown in broken lines.

FIG. **8** represents the off position of the switch, in which the contactors **38***a* and *b* are moved to one end of their range of movement. In this position, neither of the contactors **38***a* and *b* is in bridging relation to any of the contacts **40***a–f*. The contactors **38***a* and *b* engage the insulating bosses **68***a* and *b*, and also the contact **40***b* and the insulating boss **68***d*. The additional contactor **80** is adjacent the contact **40***c* but is not in bridging relation to any of the contacts. It will be noted that the contactor **80** is offset laterally away from the contacts **40***b*, *d* and *f* in the first row of contacts **41***a*, so that the contactor will never engage these contacts. The additional contacts **70***a* and *b* are similarly offset.

FIG. **9** represents the low position of the switch in which the contactor **38***b* forms a connecting bridge between the contacts **40***a* and *c*. In this way, a circuit is established through the resistors **64** and **66** between the contact **40***c*, which is one of the battery contacts, and the contact **40***f*, which is connected to the lamps to be dimmed. Thus, the maximum resistance is in the circuit so that the brilliance of the lamps is low.

FIG. **10** represents the medium position of the switch, in which the contactor **38***a* forms a connecting bridge between the contacts **40***b* and *d*. In this way, a circuit is established through the resistor **64** between the battery contact **40***d* and the contact **40***f* which is connected to the lamps. Thus, only the resistor **64** is in the circuit, so that the lamps are lighted to medium brilliance.

FIG. **11** represents the high position of the switch, in which the contactor **38***b* forms a connecting bridge between the contacts **40***c* and *e*. Thus, a direct connection is established between the battery contact **40***c* and contacts **40***e* and *f* which are connected to the lamps. Accordingly, the lamps are energized to maximum brilliance.

FIG. **12** represents a duplicate high position, in which the contactor **38***a* forms a connecting bridge between the contact **40***d* and *f*. Accordingly, the lamps are energized directly from the battery, as in the case of the position of FIG. **11**. However, in the position of FIG. **12**, the additional contactor **80** forms a bridge between the contacts **70***a* and *b*. These contacts may be connected to a dome lamp circuit so that the dome lamp is energized by the bridging action of the contactor **80**. In the positions of FIGS. **8–11**, the contactor **80** is inactive. Only in the position of FIG. **12** does the contactor **80** provide a bridging connection between any of the contacts.

It will be evident that the switch combines a multipole switching function with a single-pole switching function, in a switch construction which is compact, economical and easy to manufacture. The single-pole contactor **82** does not interfere with the multipole switching functions performed by the contactors **38***a* and *b*. The socket or recess **30** for the rounded end **28** of the operating lever **34** is between the recesses **48** and **94** for the tabs **46** and the springs **50** so that the tabs and springs are operated and insulated from the lever.

It will be noted that the twin contactors **38***a* and *b* are effective alternately to form bridging connections between adjacent pairs of the contacts **40***a–f*. This arrangement makes it possible for the switch to have a multiplicity of closely spaced positions. At the same time, the switch is rugged in construction and dependable in operation.

It will be understood that the number of switch contacts and the number of switch positions can be varied. In some cases, the additional contacts and the additional contactor for the dome light circuit will not be needed. If the dome light contact **72***a* and *b* are omitted, the duplicate high position contact **40***f* may also be omitted, along with the strap **62**. The switch will then have four positions, instead of five. There will be three contacts in the second row **41***b*, but only two contacts in the first row **41***a*. If a three position switch is desired, the contact **40***a* may be omitted, in which case there will be two contacts in each row.

The resistors **64** and **66** constitute impedance elements. In some cases other types of impedance elements may be employed.

Various other modifications, alternative constructions and equivalents may be employed, as will be understood by those skilled in the art.

I claim:

1. An electrical switch,
comprising a casing,
a carriage movable in said casing,
operating means connected to said carriage and extending out of said casing for moving said carriage,
an insulating support on said casing and opposite said carriage,
a plurality of contacts mounted on said insulating support and arranged in first and second rows generally parallel to the path of movement of said carriage,
said first and second rows extending along respective first and second lines which are generally parallel to the path of movement of said carriage,
said contacts in each row being spaced along the corresponding line,
and first and second contactors mounted on said carriage and engageable with the respective contacts in said first and second rows,
each of said contactors being of a length along the corresponding row to form a connecting bridge between adjacent contacts in the corresponding rows,
said contacts in said second row being staggered relative to the contacts in said first row whereby said contactors are effective alternately to bridge between adjacent pairs of contacts in the corresponding rows.

2. A switch according to claim **1**,
in which said contactors are generally bar shaped extending generally parallel to the path of movement of said carriage.

3. A switch according to claim **1**,

including a stationary interconnecting member between two staggered contacts in said first and second rows whereby a common circuit connection is made to the interconnected staggered contacts.

4. A switch according to claim 1,
including a first stationary interconnecting member extending between a first pair of staggered contacts in said first and second rows,
and a second interconnecting member extending between a second pair of staggered contacts in said first and second rows,
whereby the interconnecting members provide for common circuit connections to the corresponding pairs of contacts.

5. An electrical switch,
comprising a casing,
a carriage movable in said casing,
operating means connected to said carriage and extending out of said casing for moving said carriage,
an insulating support on said casing and opposite said carriage,
a plurality of contacts mounted on said insulating support and arranged in first and second rows generally parallel to the path of movement of said carriage,
first and second contactors mounted on said carriage and engageable with he respective contacts in said first and second rows,
each of said contactors being of a length to form a connecting bridge between adjacent contacts in the corresponding row,
said contacts in said second row being staggered relative to the contacts in said first row whereby said contactors are effective alternately to bridge between adjacent pairs of contacts in the corresponding rows,
an additional pair of contacts on said insulating support at one end of said first and second rows,
and an additional contactor on said carriage to form a bridge between said additional contacts in one position of said contactor.

6. A switch according to claim 5,
in which said additional contacts are directly opposite each other rather than being staggered.

7. A switch according to claim 5,
in which said additional contactor is mounted on said carriage toward one end thereof and spaced from the corresponding ends of said first and second contactors whereby said additional contactor engages said additional contacts in one extreme position of said carriage.

8. A switch according to claim 1,
in which there are at least two contacts in each of said first and second rows.

9. A switch according to claim 1,
in which there are at least two contacts in one of said rows and at least three of said contacts in the other row.

10. A switch according claim 1,
in which there are at least two contacts in each of said rows,
said switch including an interconnecting member extending between one pair of staggered contacts in said first and second rows to provide a common circuit connection to said contacts,
and an impedance element connected between another pair of contacts in said first and second rows.

11. An electrical switch,
comprising a casing,
a carriage movable in said casing,
operating means connected to said carriage and extending out of said casing for moving said carriage,
an insulating support on said casing and opposite said carriage,
a plurality of contacts mounted on said insulating support and arranged in first and second rows generally parallel to the path of movement of said carriage,
first and second contactors mounted on said carriage and engageable with the respective contacts in said firs and second rows,
each of said contactors being of a length to form a connecting bridge between adjacent contacts in the corresponding row,
said contacts in said second row being staggered relative to the contacts in said first row whereby said contactors are effective alternatively to bridge between adjacent pairs of contacts in the corresponding rows,
at least two of said contacts being in one of said rows, at least three of said contacts being in the other row,
said switch including an interconnecting member extending between a pair of staggered contacts in said first and second rows to provide a common circuit connection to said contacts,
a first impedance element extending between two other contacts in said first and second rows,
and a second impedance element extending between another pair of contacts in said first and second rows.

12. A switch according to claim 11,
in which said first and second impedance elements are connected to one of said contacts in common.

13. A switch according to claim 11,
in which there are at least three contacts in both of said rows,
said switch including a second interconnecting member extending between staggered contacts in said first and second rows to provide duplicate adjacent positions of said switch.

14. A switch according to claim 13,
including an additional pair of contacts disposed opposite each other at one end of said rows,
and an additional contactor on said carriage to bridge between said additional contacts in one position of said carriage.