March 10, 1970 M. F. BEDOCS 3,500,002

ELECTRICAL SWITCHES WITH PRECISE LOCATING MEANS BETWEEN THE CARRIAGE AND CONTACTOR

Filed Jan. 29, 1968 2 Sheets-Sheet 1

FIG. 1

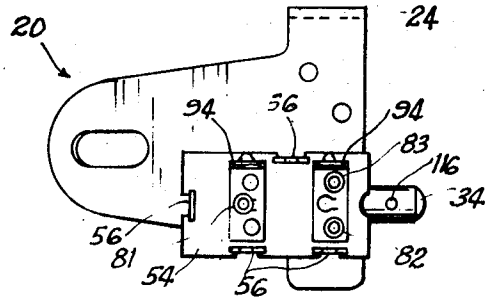


FIG. 2

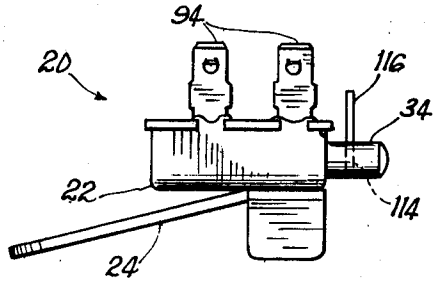


FIG. 3

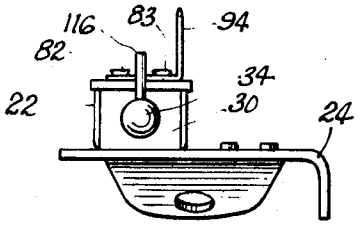


FIG. 4

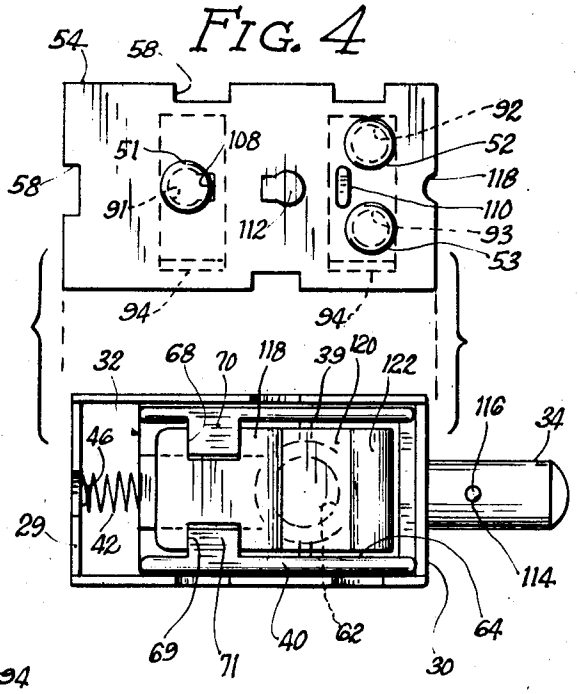
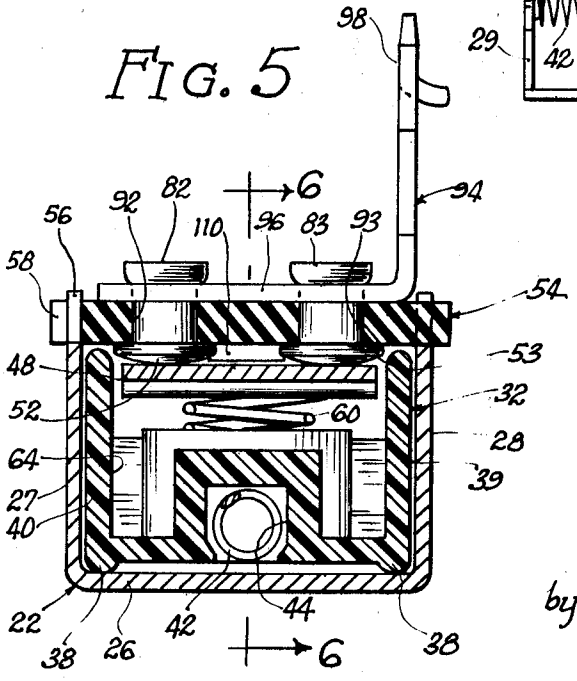


FIG. 5



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ELECTRICAL SWITCHES WITH PRECISE LOCATING MEANS BETWEEN THE CARRIAGE AND CONTACTOR

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FIG. 6

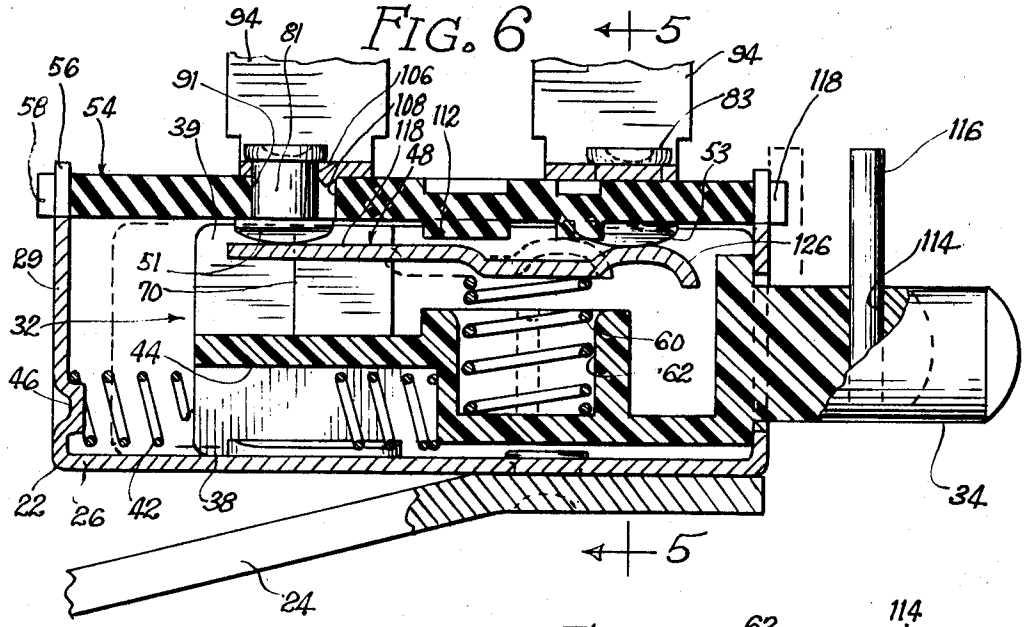


FIG. 7

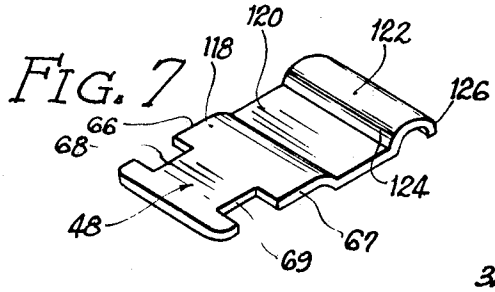
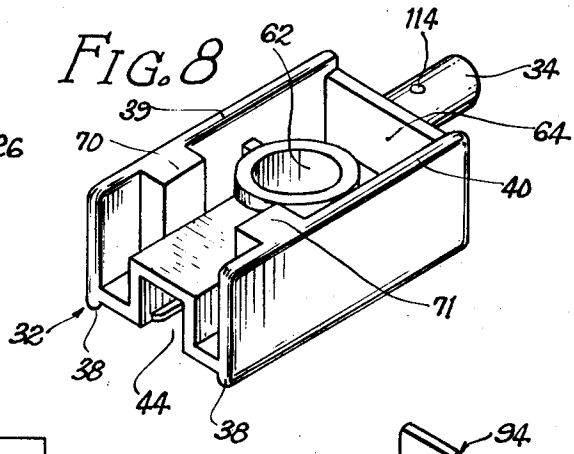


FIG. 8



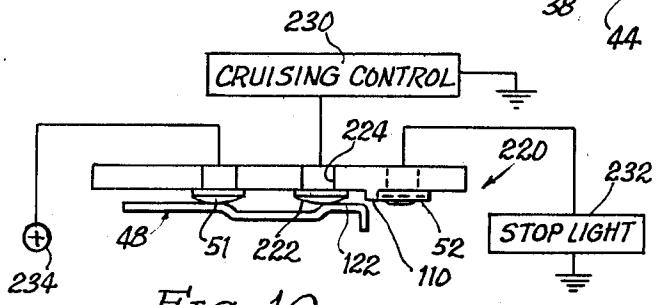


FIG. 10

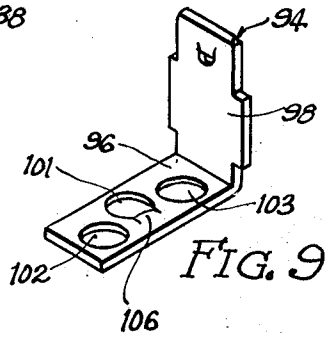


FIG. 9

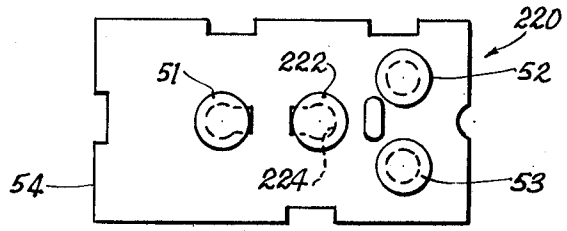


FIG. 11

United States Patent Office 3,500,002 Patented Mar. 10, 1970

3,500,002

ELECTRICAL SWITCHES WITH PRECISE LOCATING MEANS BETWEEN THE CARRIAGE AND CONTACTOR

Michael F. Bedocs, Wilmette, Ill., assignor to Indak Manufacturing Corp., Northbrook, Ill., a corporation of Illinois

Filed Jan. 29, 1968, Ser. No. 701,321
Int. Cl. H01h 15/24
U.S. Cl. 200—16 9 Claims

ABSTRACT OF THE DISCLOSURE

An electrical switch having a casing, an insulating carriage movable in said casing, an insulating wall on said casing, a plurality of contacts mounted on said wall, a contactor movable with said carriage and engageable with said contacts, and spring means biasing said contactor toward said contacts, said contactor being plate-like and having opposite edge portions formed with a pair of locating notches, said carriage having a pair of opposed lugs closely received in said notches and locating said carriage for precise movement therewith.

This invention relates to electrical switches. While the invention is applicable to switches generally, it is particularly applicable to switches intended primarily for automotive service, on automobiles, trucks and other vehicles.

Prior automotive switches have generally included a casing, an insulating carriage movable in the casing, an insulating wall on the casing, a plurality of contacts mounted on the insulating wall, a contactor movable with the carriage and engageable with the contacts, and spring means on the carriage and biasing the contactor toward the contacts. In prior switches, the contactor has generally been formed with prongs, slidably received in slots formed in the contactor. The prongs would cause the contactor to move with the carriage, while providing for sliding movement of the contactor toward the contacts.

A trend has become apparent in some types of automotive switches to require a high order of precision in the operation of the switch. It has been found that such precision is difficult or impossible to achieve with the usual construction involving prongs on the contactor, slidable in slots formed in the carriage. This construction generally results in considerable lost motion or play between the contactor on the carriage. At least one, and preferably a operating precision of the switch.

In accordance with the present invention, a high order of precision is achieved by dispensing with the usual prongs, and providing improved means for locating the contactor on the carriage. At least one, and preferably a plurality of notches or slots are formed in edge portions of the contactor. The carriage is formed with lugs or guide bars which are closely received in the notches. The engagement between the notches and the lugs provides for outward sliding movement of the contactor toward the contacts. At the same time, the lugs may be closely fitted into the notches, so as to minimize lost motion or play between the contactor and the carriage. In this way, the contactor follows the movement of the carriage with a high order of precision, so that there is very little variation in the operating cycle of the switch. Such precise switch operation is an important advantage in motion sensing switches, such as brake switches, for example.

In accordance with another feature of the present invention, the switch is preferably provided with a single contact rivet at one point along the path of movement of the contactor, and a pair of contact rivets on opposite

sides of such path, spaced therealong from the single contact rivet. First and second terminals are connected to the single contact rivet and the pair of rivets. The terminals are preferably of identical construction, with a central opening adapted to receive the single contact rivet, and a pair of openings adapted to receive the pair of contact rivets. Thus, the terminals are interchangeable, so as to facilitate the assembly of the switch. The switch may also have another contact rivet, which is also adapted to receive a terminal of identically the same construction.

The additional contact rivet is adapted to be received in an additional opening in the insulating contact board. When the additional rivet is not used, such opening is occupied by a semi-perforated member which does not interfere with the operation of the switch, and may be knocked out of the opening when the additional contact rivet is to be inserted.

Further 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 plan view of a switch to be described as an illustrative embodiment of the present invention.

FIG. 2 is a side elevation of the switch.

FIG. 3 is a front elevation of the switch.

FIG. 4 is an enlarged plan view of the switch, with the terminal board removed and shown alongside the switch.

FIG. 5 is a section, taken along the line **5—5** in FIG. 6.

FIG. 6 is a longitudinal section, taken generally along the line **6—6** in FIG. 5.

FIG. 7 is a perspective view of the contactor for the switch.

FIG. 8 is a perspective view of the carriage for the switch.

FIG. 9 is a perspective view of one of the terminals for the switch.

FIG. 10 is a diagrammatic section showing a modified construction.

FIG. 11 is a plan view showing the contact board for the modified construction of FIG. 10.

As already indicated, FIGS. 1–9 illustrate an electrical switch **20** with will find many uses, but is particularly applicable to automotive service, in connection with automobiles, trucks and other vehicles. The illustrated switch **20** is intended particularly to control the brake or stop lights on an automobile or other vehicle. The switch is adapted to be operated by the brake pedal of the automobile. When the brake pedal is in its normal or unactuated position, a portion of the pedal actuates the switch so as to open the circuit for the stop lights. When the brake pedal is actuated, the switch is allowed to return to its normal or unactuated position, in which the circuit for the stop lights is closed.

The illustrated switch **20** comprises a casing or housing **22** which is preferably made of metal, but may be made of any other suitable material. A mounting bracket **24** is shown as being secured to the casing **22**. As illustrated, the casing **22** is generally rectangular in shape, and is formed with a bottom wall **26**, a pair of longitudinal side walls **27** and **28**, and a pair of end walls **29** and **30**.

A carriage **32** is movably mounted within the casing **22**. The carriage **32** is preferably made of an insulating material, such as a suitable resinous plastic material, but various other suitable materials may be employed. Means are provided to operate the carriage **32** within the casing **22**. In this case, the carriage **32** is formed with a pin or plunger **34** which projects out of the casing **22** through an opening **36** in the end wall **30**. When the switch **20** is is used as a brake switch, the plunger **34** is adapted to be operated by a portion of the brake pedal.

The illustrated carriage **32** is generally rectangular in

shape and is movable along a linear path within the casing **22**. Runners or ridges **38** are formed on the carriage **32** for sliding engagement with the bottom wall **26** of the casing **22**. The illustrated carriage **32** has a pair of longitudinal side wall portions **39** and **40** which are slidably engageable with the longitudinal side walls **27** and **28** of the casing **22**. It will be seen that the carriage **32** is slidable longitudinally within the casing **22**, between the opposite end walls **29** and **30**.

The illustrated switch **20** is of the push button type, having resilient means in the form of a spring **42** for biasing the carriage **32** toward its initial or unactuated position. In this case, the spring **42** is of the coil compression type, acting between the carriage **32** and the end wall **29**. Thus, the spring **42** biases the carriage **32** against the end wall **30**, in the initial position of the switch. In the illustrated construction, the locating slot or channel **44** is formed in the lower portion of the carriage **32**, to receive one end portion of the spring **42**. The other end portion of the spring **42** is preferably located by a boss or projection **46**, formed inwardly from the end wall **29** of the casing **22**.

The carriage **32** is provided with a contactor **48** which is movable with the carriage. The contactor **48** is preferably made of copper, or some other conductive material. The contactor **48** is engageable with a plurality of contacts **51**, **52** and **53** mounted on a supporting board or plate **54**. The arrangement of the contacts **51**, **52** and **53** will be described in detail presently. The board **54** closes one side of the casing **22** and thus forms one wall thereof. The board **54** is preferably made of an insulating material, such as a suitable resinous plastic, but may be made of other suitable materials. In this case, the contact board **54** is secured to the casing **22** by means of a plurality of tabs **56**, formed on the upper edges of the side and end walls **27–30**. The illustrated tabs **56** project upwardly through notches or slots **58** in the edge portions of of the contact board **54**. To retain the board **54**, the upper ends of the tabs **56** are suitably spread or clinched.

The contactor **48** is preferably biased outwardly toward the contacts **51–53** by resilient means in the form of a coiled compression spring **60**, acting between the contactor and the carriage **32**. A well or socket **62** is preferably formed in the carriage **32** to receive and locate the spring **60**.

The illustrated contactor **48** is slidably mounted on the carriage **32** for outward movement against the contacts **51–53**. As shown, the contactor **48** is slidably guided and confined within a recess or slot **64**, formed in the upper portion of the carriage **32**. The recess **64** is formed between the longitudinal wall portions **39** and **40** of the carriage **22**.

The illustrated contactor **48** is in the form of a generally rectangular plate-like member. The contactor **48** has opposite longitudinal edges **66** and **67** which are slidably engageable with the side wall portions **39** and **40** of the carriage **32**.

To form precision coupling means between the carriage **32** and the contactor **48**, at least one notch or slot is formed in the contactor **48**, for slidably receiving a corresponding lug or guide bar on the carriage. In the illustrated construction, the contactor **48** is provided with two such slots or notches **68** and **69**, formed in the opposite edge portions **66** and **67** of the contactor **48**. Corresponding lugs or guide bars **70** and **71** are formed on the carriage **48**. It will be seen that the lugs **70** and **71** are slidably received in the notches **68** and **69**. The illustrated lugs **70** and **71** project toward each other and into the recess **64** from the side wall portions **39** and **40** of the carriage **48**. It will be seen that the lugs or guide bars **70** and **71** extend in the direction in which the contactor **48** is slidably movable relative to the carriage **32**. Thus, the lugs **70** and **71** extend at right angles to the direction of movement of the carriage **32**.

A close sliding fit is preferably provided between the notches **68** and **69** and the lugs **70** and **71**, so that there will be a minimum of lost motion or play between the contactor **48** and the carriage **32**. Thus, the contactor **48** follows the movement of the carriage **32** with a high degree of precision.

The contacts **51–53** may assume various forms but are illustrated as the rounded heads of rivets **81**, **82** and **83**, extending through openings **91**, **92** and **93** in the insulating contact board **54**. Terminals **94** are mounted on the rivets **81–83**, on the outer side of the contact board **54**. There are two of the terminals **94**, but they are preferably identical in construction, as will be described in detail presently.

The contact **51** is illustrated as being in the form of an isolated or single contact, disposed at a first point along the path of movement of the contactor **48**. The contacts **52** and **53** are paired on opposite sides of a second point spaced along such path of movement from the first point.

Each of the illustrated terminals **94** is in the form of an L-shaped member having two flanges **96** and **98**. The flange **96** is formed with an opening **101**, adapted to receive the contact rivet **81**, and a pair of openings **102** and **103**, adapted to receive the rivets **82** and **83**. The openings **102** and **103** are spaced on opposite sides of the opening **101**. The flange **98** of the terminal **94** provides an outwardly projecting prong, adapted to receive a connector or the like.

In the case of the terminal **94** mounted on the rivet **81**, the central opening **101** is used. In the case of the terminal **94** mounted on the rivets **82** and **83**, the outwardly spaced openings **102** and **103** are used. Thus, the same terminal construction is applicable to both situations. This arrangement facilitates the manufacture of the switch and obviates any error in the assembly of the terminals on the rivets.

It will be seen that the illustrated terminal **94** is formed with a prong or flange **106** which is bent downwardly from the flange **96**, adjacent the opening **101**. As shown to best advantage in FIGS. 4 and 6, the prong **106** is adapted to be received in a slot **108** extending laterally from the opening **91** in the insulating contact board **54**. The prong **106** acts as a key to prevent the terminal **94** from rotating about the rivet **81**. When the terminal **94** is used on the rivets **82** and **83**, the prong **106** merely engages the upper side of the insulating board **54**, and is bent upwardly by the clinching of the rivets **82** and **83**.

To guide the contactor **48**, the insulating contact board **54** is preferably formed with insulating bosses **110** and **112** which project from the inner side of the board. The boss **110** is disposed near the contacts **52** and **53**, and on the line of symmetry extending therebetween from the single contact **51**. The second boss **112** is disposed between the first boss **110** and the single contact **51**. The bosses **110** and **112** are preferably in the form of semi-perforations, extruded or punched from the insulating board **54**.

The plunger **34** of the carriage **32** is preferably formed with an opening **114** for receiving a temporary stop pin **116**. It will be seen that the stop pin **116** is engageable with the end wall **30** of the casing, when the plunger **34** is depressed. A notch **118** is formed in the insulating board **54** to receive the pin **116**, so that the pin can be moved into full engagement with the end wall **30**.

The temporary stop pin **116** is used only in connection with the installation of the switch. The installer positions the switch with the plunger **34** against the brake pedal, and with the plunger **34** depressed so that the pin **116** engages the end wall **30**. The switch is then securely mounted in this position, and the pin **116** is removed. The use of the temporary stop pin **116** insures that the switch will be installed with the switch in its off position, when the brake pedal is in its initial or unactuated position.

As shown to best advantage in FIGS. 6 and 7, the illustrated contactor **48** has a first contacting portion **118**, an offset portion **120**, and a second contacting position **122**. The first contacting portion **118**, an offset portion **120**, and a second contacting position **122**. The first contacting portion **118** is flat and is adapted to engage the single contact **51**. The second contacting portion **122** has rounded end portions **124** and **126**, and is adapted to engage the contacts **52** and **53**. The offset portion **120** is offset away from the contacts **51–53**, and away from the semi-perforated bosses **110** and **112**. In this case, the spring **60** engages the offset portion **120**.

It will be seen from FIG. 6 that the side wall portions **39** and **40** of the carriage **32** extend into closely spaced relation to the insulating terminal board **54**. The same is true of the lugs or guide bars **70** and **71** on the side wall portions **39** and **40**. This construction insures that the contactor **48** will be precisely confined and located on the carriage **32** in all positions thereof. The spring **60** biases the contactor **48** against the contacts **51–53**, while also biasing the carriage **32** against the lower wall **26** of the casing **22**.

It may be helpful to summarize the operation of the switch **20**. The return spring **42** tends to bias the carriage **32** against the end wall **30**, as shown in full lines in FIG. 6. In this position, the second contacting portion **122** of the contactor engages both of the contacts **52** and **53**. The first contacting portion **118** of the contactor engages the single contact **51**. Thus, the contactor **48** establishes a closed circuit between the contact **51** and the contacts **52** and **53**. Assuming that the switch is used to control the stop lights of an automobile, the stop lights will be energized in this position of the switch.

When the plunger **34** of the switch is depressed to or beyond the position shown in broken lines in FIG. 6, the second contacting portion **122** of the contactor **48** is moved out of engagement with both of the contacts **52** and **53**. Thus, an open circuit is produced between the single contact **51** and the dual contacts **52** and **53**. Accordingly, the stop lights will be de-energized. When the brake pedal is not actuated, this is the position to which the switch is operated by the brake pedal.

The provision of the dual contacts **52** and **53** is in accordance with the invention disclosed and claimed in the copending application of John E. Soreng and Jesse M. Cobb, Ser. No. 641,920, filed May 29, 1967. The breaking of the circuit between the contactor **48** and the contacts **52** and **53** results in a substantial amount of arcing which causes wear and erosion upon the contactor and the contacts. The provision of the dual contacts **52** and **53** distributes the erosion due to arcing, and greatly prolongs the life of the switch. The breaking of the circuit with the contactor **58** is nearly simultaneous at the contacts **52** and **53**, but not absolutely so. Normally, the contactor **48** breaks contact with the contacts **52** and **53** at slightly different instants. It is the second break which actually interrupts the circuit. Thus, the arcing occurs at the contact which is involved in the second break. Such arcing causes a slight erosion, so that the second break shifts to the other contact after a few cycles of operation. Thus, the arcing alternates in a random manner between the two contacts **52** and **53**, so that the erosion is distributed. Moreover, the heating effect of the arcing is dissipated to much better advantage.

The contacting portion **122** of the contactor **48** moves from the contacts **52** and **53** and on to the insulating boss **110** which supports the contactor and minimizes rocking movement thereof. The insulating boss **110** makes it easy for the contacting portion **122** to return into engagement with the contacts **52** and **53**. The provision of the insulating boss **110** also insures that the arcing between the contacting portion **122** and the contacts **52** and **53** will be in the air, spaced from the insulating board **44**, and not along the surface of the insulating board. Thus, the arcs are kept away from the board **54**, so that the heat generated by the arcs does not cause burning or other damage to the insulating board.

If the plunger **34** is depressed to an additional extent, the contacting portion **122** rides from the boss **110** to the insulating boss **112**. It will be understood that the boss **112** continues to hold the contactor away from the insultaing board **54**. Throughout the movement of the carriage **32**, the first contacting portion **118** of the contactor **48** engages the single contact **51**.

FIGS. 10 and 11 illustrate a modified swtich **220** which is similar to the switch **20** of FIGS. 1–9, except that the second semi-perforated boss **112** is knocked out of the insulating board **54** and is replaced with an additional contact **222**, which is similar in every respect to the single contact **51**. Thus, in addition to providing an insulating boss, the semi-perforation **112** provides a knock-out which may readily be removed to provide an opening **224** for the additional contact **222**, when a modified switch construction is desired. Another terminal **94** may be mounted on the contact **222**, in the same manner as in the case of the single contact **51**.

In the modified switch **220**, the second contacting portion **122** of the contactor **48** is movable into engagement with the additional contact **222**, after moving out of engagement with the contacts **52** and **53**. As illustrated in FIG. 10, the additional contact **222** may be connected to a crusing control device **230**, or any other desired device. As before, the contacts **52** and **53** are connected to the stop lights **232**. The contact **51** is connected to the ungrounded battery terminal **234**. The cruising control **230** is a component of the transmission which is to be deactuated as soon as the brake pedal is operated. Thus, the operation of the brake pedal deenergizes the crusing control device **230** and energizes the stop light **232**. The cruising control **230** may comprise an overdrive device, a free wheeling device, or the like.

In the illustrated switches, the contactor **48** is precisely coupled to the carriage **32** by close engagement between the lugs **70** and **71** on the carriage **32** and the notches **68** and **69**, formed in the contactor. This construction greatly reduces the lost motion or free play between the carriage and the contactor, so that the contactor follows the carriage with a high order of precision. Thus, the switch is highly dependable and accurate in its operation. This is an important advantage in position-sensing switches, such as brake light switches and the like.

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 a casing,
an insulating carriage movable in said casing,
said casing having a wall with a plurality of contacts mounted thereon,
and a contactor movable with said carriage and engageable with said contacts,
said contactor being in the form of a plate-like member with opposite edges formed with a pair of locating notches,
said carriage having a pair of locating lugs received in said notches and connecting said contactor to said carriage for movement therewith,
said lugs projecting toward each other and generally perpendicular to the path of movement of said carriage.

2. An electrical switch,
comprising a casing,
an insulating carriage movable in said casing,
said casing having a wall with a plurality of contacts mounted thereon,
and a contactor movable with said carriage and engageable with said contacts,

said contactor being in the form of a plate-like member with opposite edges formed with a pair of locating notches,
said carriage having a pair of locating lugs received in said notches and connecting said contactor to said carriage for movement therewith,
said carriage comprising a recess with opposite walls confining and guiding said opposite edges of said contactor.

3. An electrical switch,
comprising the combination of a casing,
an insulating carriage movable in said casing,
said casing having a wall with a plurality of contacts thereon,
a contactor movable with said carriage and engageable with said contacts,
said contactor having at least one locating slot therein,
said carriage having at least one lug received in said slot and locating said contactor on said carriage for movement therewith,
and resilient means on said carriage and biasing said contactor outwardly toward said contacts,
said lug being slidably received in said slot to provide for the outward movement of said contactor.

4. An electrical switch,
comprising the combination of a casing,
an insulating carriage movable in said casing,
said casing having a wall with a plurality of contacts thereon,
a contactor movable with said carriage and engageable with said contacts,
said contactor having at least one locating slot therein,
said carriage having at least one lug received in said slot and locating said contactor on said carriage for movement therewith,
resilient means on said carriage and biasing said contactor outwardly toward said contacts,
and means on said carriage guiding said contactor for outward sliding movement,
said lug being slidably received in said slot to provide for such sliding movement.

5. An electrical switch,
comprising the combination of a generally rectangular casing,
an insulating carriage movable along a linear path in said casing,
said casing having a wall with a plurality of contacts thereon,

a generally rectangular plate-like contactor movable with said carriage and engageable with said contacts,
and resilient means on said carriage and biasing said contactor outwardly toward said contacts,
said contactor having at least one locating slot therein,
said carriage having at least one lug thereon received in said slot and locating said contactor on said carriage for movement therewith.

6. A switch according to claim **5**,
in which said slot is formed as a notch in one edge portion of said contactor,
said lug projecting laterally into said notch.

7. A switch according to claim **5**,
in which said contactor is formed with a pair of such slots in the form of notches in opposite edge portions of said contactor,
and in which said carriage is formed with a plurality of such lugs projecting laterally into said notches.

8. A switch according to claim **7**,
in which said lugs project toward each other and generally perpendicular to the path of movement of said carriage.

9. A switch according to claim **7**,
in which said carriage comprises a recess having opposite lateral walls confining the opposite edge portions of said contactor,
said lugs projecting toward each other from said opposite lateral walls.

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ROBERT K. SCHAEFER, Primary Examiner

J. R. SCOTT, Assistant Examiner

U.S. Cl. X.R.

200—168

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,500,002 Dated March 10, 1970

Inventor(s) M. F. Bedocs

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 49, "At least one, and preferably a" should read --Such last motion impairs--.

Column 2, line 42, "with" should read --which--.

Column 5, lines 4 and 5, please cancel "The first contacting portion 118, an offset portion 120, and a second contacting portion 122."

Column 6, line 27, "crusing" should read --cruising--.

Column 6, line 33, "crusing" should read --cruising--.

SIGNED AND
SEALED
AUG 11 1970

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents