Aug. 27, 1968 G. M. EULER 3,399,287

ROCKABLE PLATE TYPE ACTUATOR FOR A PLURALITY OF CONTACTS

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FIG. 1.

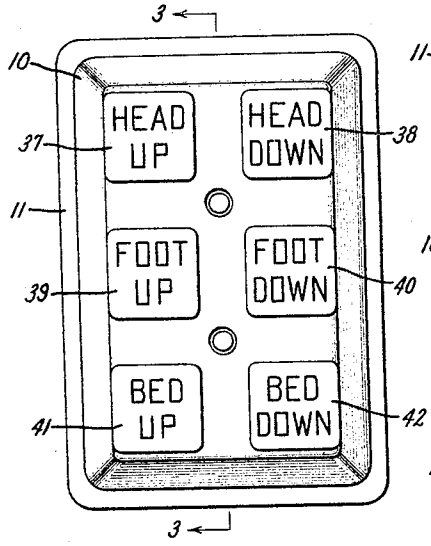


FIG. 2.

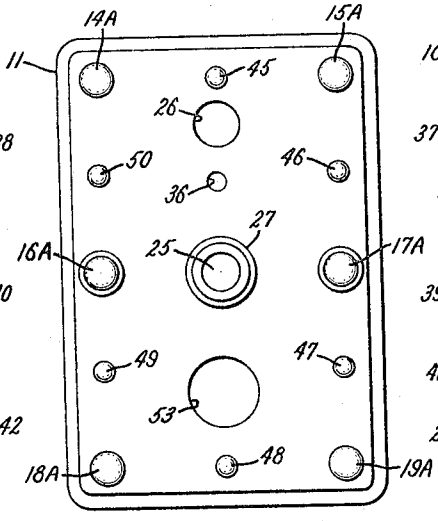


FIG. 3.

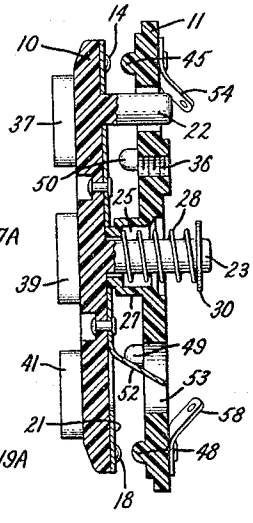


FIG. 4.

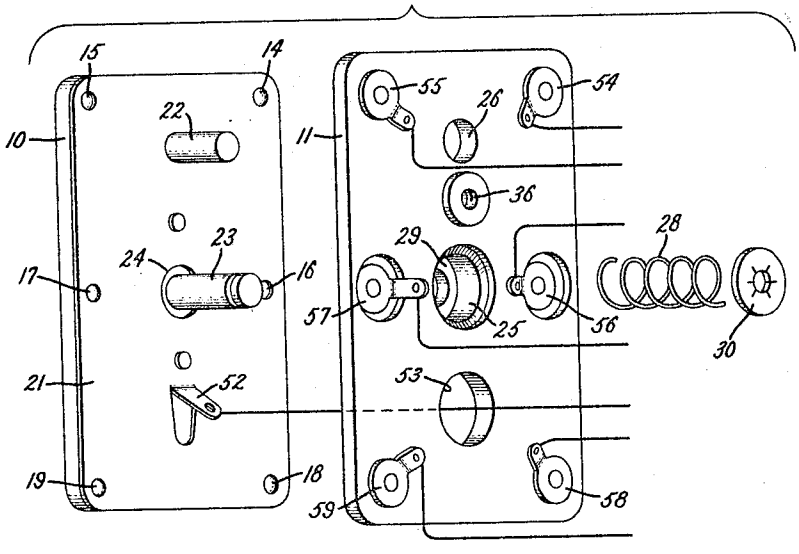


FIG. 5.

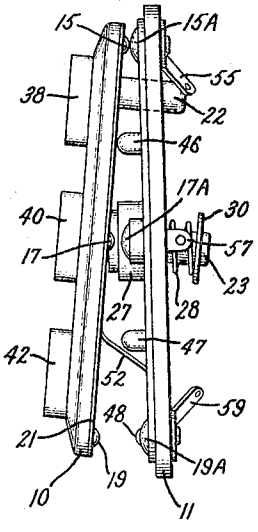
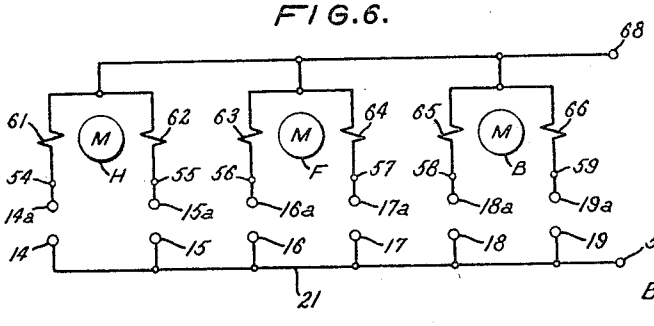


FIG. 6.



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ROCKABLE PLATE TYPE ACTUATOR FOR A PLURALITY OF CONTACTS

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FIG. 7.

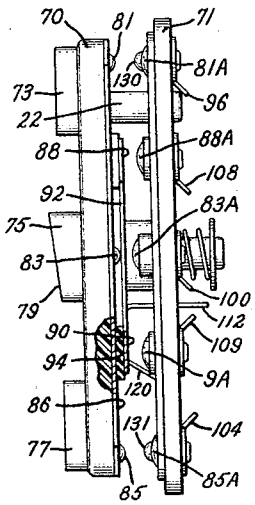


FIG. 8.

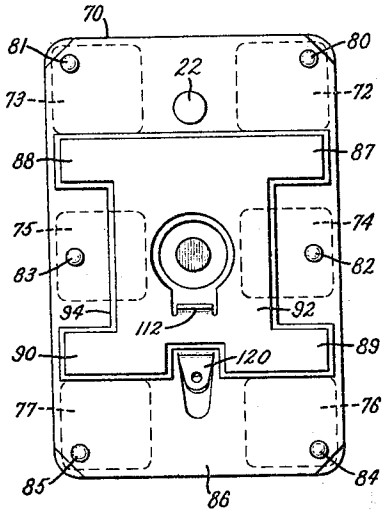


FIG. 9.

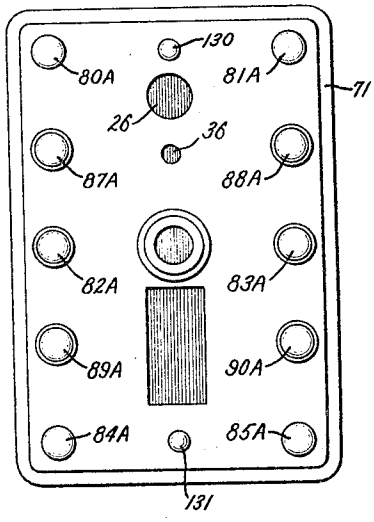
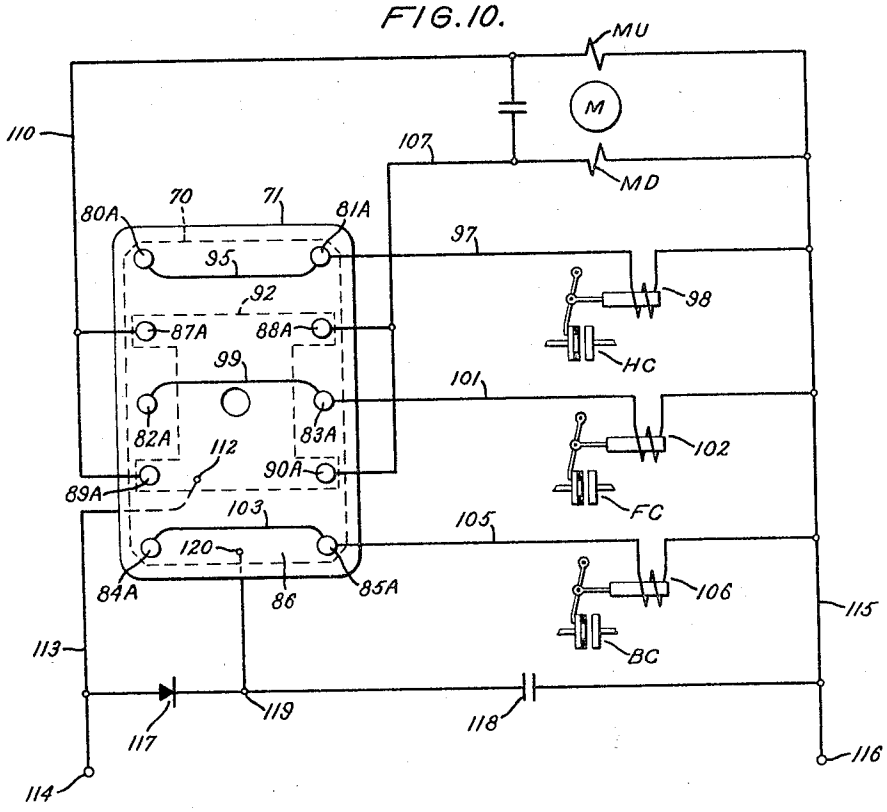


FIG. 10.



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ROCKABLE PLATE TYPE ACTUATOR FOR A PLURALITY OF CONTACTS

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FIG. 11.

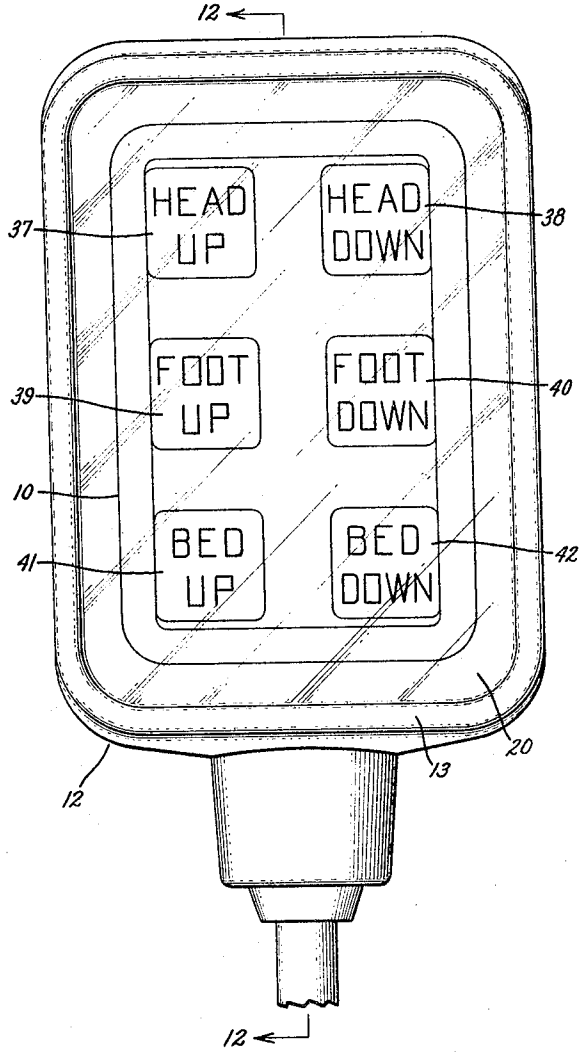
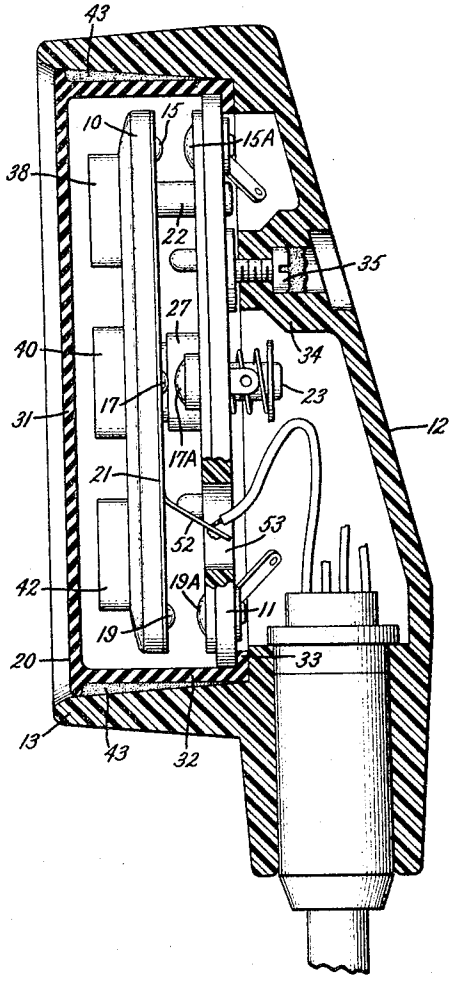


FIG. 12.



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3,399,287

ROCKABLE PLATE TYPE ACTUATOR FOR A PLURALITY OF CONTACTS

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Filed June 3, 1964, Ser. No. 372,311
9 Claims. (Cl. 200—159)

ABSTRACT OF THE DISCLOSURE

A hand control device for controlling a plurality of circuits includes an operator and a base secured together with each supporting a plurality of contacts in confronting cooperating relation. The operator is mounted for universal rocking movement in any direction relative to the base and the base carries a plurality of projections arranged to prevent engagement of more than an intended number of contacts in response to rocking movement of the operator. A housing encloses the operator and base and includes a flexible seal having a flexible wall overlying the operator to which force is applied to effect rocking movement of the operator.

This invention relates to manually operable control devices and particularly to a manually rockable device for controlling the energization of a plurality of electrical circuits.

In many installations it is desirable to provide a manually operable device for controlling energization of a number of electrical circuits. As one example, hand control devices have been employed to control motorized beds which are utilized in hospitals. Such beds conventionally include independently movable feet and head sections which can be raised and lowered by one or more motors controlled by the hand control device. In some bed constructions the entire bed itself can be raised or lowered in addition to the feet and head sections. Of course, it is highly desirable that hand controls for the above purpose be of compact and inexpensive construction and incorporate a minimum number of parts. It is also advantageous that such hand controls incorporate mechanical interlock means for positively preventing simultaneous establishment of more than a desired number of controlled circuits in response to a manual operation of the device.

Hand controls of previous construction have generally been of complex and costly construction incorporating a large number of parts which contribute to the complexity of the device and to the cost of repair. In addition, hand controls of prior design have not provided interlock means for the purpose above set forth. The hand control of the present invention overcomes these and other disadvantages of prior art constructions.

It is therefore a primary object of the invention to provide a novel and improved manually operable control device for controlling energization of a number of electrical circuits.

It is another object of the invention to provide a novel and improved hand control device of inexpensive and simple construction including a manually operable member mounted for rocking movement relative to a base member with said members carrying engageable pluralities of contacts arranged in non-circular linear patterns.

It is a further object of the invention to provide a device as defined in the preceding object including mechanical interlock means for positively preventing simultaneous engagement of more than a predetermined number of contacts in response to a rocking movement of the operable member.

It is still another object of the invention to provide a novel and improved hand control device of inexpensive

and compact construction including an operator member which is manually movable to a selected one of a plurality of operating positions and which is completely enclosed in a unique housing having a flexible wall permitting manual operation of the operator member.

It is a further object of the invention to provide a novel and improved control arrangement including a plurality of first circuits and a plurality of second circuits electrically isolated from the first circuits and including a single manually operable member mounted for movement to a selected one of a plurality of positions in each of which a separate pair of isolated circuits are established.

It is a still further object of the invention to provide a novel and improved control arrangement including a plurality of alternating current motor winding circuits and a plurality of direct current clutch coil circuits and including a single manually operable member mounted for rocking movement to a selected one of a plurality of positions in each of which a separate pair of alternating current and direct current circuits are established.

It is still another object of the invention to provide a control arrangement as defined in the preceding object including mechanical interlock means cooperating with said operable member for preventing establishment of more than a single motor winding circuit in response to a rocking movement of the operable member.

In carrying out the invention is one form a hand control is provided for controlling a plurality of electrical circuits and includes an operator member and a base member each supporting a separate plurality of spaced contacts with the contacts of each plurality arranged in a noncircular linear pattern. The members are secured together in superposed relation with the two pluralities of contacts in confronting relation. The operator member is mounted for rocking movement relative to the base member from a neutral position wherein its contacts are spaced from the contacts on the base member to a selected one of a plurality of operating positions in each of which a predetermined number of the pluralities of contacts engage. The operator member has on its exposed surface a plurality of spaced indicia-bearing areas corresponding in number to the number of operating positions of the operator member. A force applied to a selected one of these areas causes the operator member to rock to one of its operating positions wherein a predetermined number of contacts engage to effect the desired control function. A mechanical interlock is provided to prevent engagement of more than the intended predetermined number of contacts in response to a rocking movement of the operator member. A housing completely encloses the operator and base members and includes a flexible wall overlying the exposed surface of the operator member to permit manual operation thereof.

The number and types of electric circuits capable of control by the hand control may vary considerably. According to one aspect of the invention for each operating position of the operator member a pair of contacts engage for effecting energization of a predetermined one of two windings of a predetermined one of a plurality of motors for rotating the predetermined motor in a selected direction. In another aspect of the invention a plurality of independent alternating current and direct current circuits are controlled by the operator member. To this end, for each operating position of the operating member two pairs of contacts engage for energizing two independent alternating current and direct current circuits.

Other objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a view in front elevation of a hand control device with the housing removed constructed according

to the invention and showing in particular the exposed surface of the operator member;

FIG. 2 is a view in front elevation of the base member of the device of FIG. 1 showing in particular the arrangement of the contacts thereon;

FIG. 3 is a view in section taken along the line 3—3 of FIG. 1 showing the operator member in its neutral position;

FIG. 4 is an exploded perspective view showing the parts of the device of FIG. 1;

FIG. 5 is a view in side elevation of the device of FIG. 1 showing the operator member rocked from its neutral position shown in FIG. 3 to one of its operating positions;

FIG. 6 is a schematic circuit diagram illustrating one type of circuit arrangement controllable by the device of FIG. 1;

FIG. 7 is a view in side elevation with parts shown in section of an embodiment of the invention different from that shown in FIGS. 1–6;

FIG. 8 is a view in elevation of the operator member of the device of FIG. 7 showing the undersurface thereof;

FIG. 9 is a view in front elevation of the base member of the device of FIG. 7 showing in particular the arrangement of the contacts thereon;

FIG. 10 is a schematic circuit diagram showing a particular circuit arrangement which is controllable by the device of FIG. 7;

FIG. 11 is a view in front elevation of the complete control device including the housing; and

FIG. 12 is a view taken along the line 12—12 of FIG. 11 with parts shown in section.

Although the hand control device of the present invention may be employed in a wide variety of installations, it will be described in connection with the control of electrical circuits utilized in motorized beds having motor controlled independently movable sections.

Referring now to the drawings, there is illustrated in FIG. 1 a hand control device including as its basic elements an insulating operator member **10** mounted for rocking movement relative to an insulating base member **11**. The members **10** and **11** may be formed in any suitable manner, such as by molding, and are preferably of rectangular configuration. The members **10** and **11** are supported within a suitable housing **12** (FIGS. 11 and 12) in superposed relation with the members **10** and **11** carrying respectively pluralities of spaced contacts at their confronting surfaces. The housing **12** will be described in detail hereinafter. In the embodiment illustrated in FIGS. 1–6, each of the members **10** and **11** carries six spaced contacts with the member **10** carrying the contacts **14–19** and the member **11** carrying corresponding contacts **14A–19A** which are engageable with the contacts **14–19** respectively of the member **10** as will presently appear.

In accord with the present invention the contacts on each member are arranged in a noncircular linear pattern and in the illustrated embodiment, the contacts on each member are arranged in a generally rectangular pattern. It is to be understood that any number of contacts may be employed on the members and that six contacts on each member are shown by way of an example only. In the embodiment of FIGS. 1–6 all the contacts on one of the members are electrically interconnected and for this purpose the contacts **14–19** associated with the member **10** are electrically interconnected by means of an electroconductive plate **21** which mounts the contacts and which is secured to the undersurface of the member **10** in any suitable manner. The plate **21** is best shown in FIGS. 3 and 4 and is of generally rectangular configuration to conform to the configuration of the associated member **10**.

The contacts **14–19** may be formed in any suitable manner and in the illustrated embodiment, are formed integrally with the plate **21** by punching out portions of the plate **21**. The contacts **14–19** reside in a common plane with four of the contacts each being located in a separate corner of the plate **21** and with the two remaining contacts each being positioned adjacent a separate long edge of the plate intermediate and between the adjacent corner contacts. The contacts **14A–19A** on the member **11** are in the form of rivets extending entirely through the member **11**. These contacts are arranged with four corner contacts each in a separate corner of the base member and residing in a first common plane, and two intermediate contacts each adjacent a separate long edge of the base member and each intermediate and in alignment with the adjacent corner contacts. The intermediate contacts reside in a second common plane which is positioned closer to the common plane of the contacts **14–19** on the operator member than the first common plane including the corner contacts on the base member.

In order to secure the members **10** and **11** together and to mount the member **10** for rocking movement with respect to the member **11**, the member **10** is formed with a projection **23** which extends generally centrally from its undersurface through an opening **24** in the plate **21** and also through hole **25** formed in an extension **27** which projects generally centrally from the base member **11** and which bears against the plate **21**. A coil spring **28** surrounds the projection **23** with one end bearing against a shoulder **29** within the hole **25** and with the opposite end bearing against a washer **30** frictionally or otherwise secured adjacent the end of the projection **23**. The extension **27** has a transverse cross section of generally circular configuration and includes an edge which provides a fulcrum over which the operator member **10** rocks. The hole **25** has a diameter greater than the diameter of the projection **23** so as to provide clearance sufficient to permit rocking movement of the member **10** to its operating positions. With the described arrangement, the spring **28** biases the member **10** towards its neutral position shown in FIG. 3 wherein the contacts on the member **10** are spaced from the contacts on the member **11**. The member **10** is mounted for rocking movement from its neutral position to a selected one of a plurality of operating positions in each of which a separate pair of contacts engage. In FIG. 5, the member **10** is shown in one of its operating positions wherein the contacts **15** and **15A** engage. In the illustrated embodiment, the member **10** can assume six different operating positions. The member **10** is formed with a pin **22** projecting from its undersurface into an opening **26** formed in the member **11**. The diameter of the pin **22** is slightly less than the diameter of opening **26** so as to limit relative angular movement of the members **10** and **11**.

In order to mount the members **10** and **11** a suitable housing **12** is provided as best shown in FIGS. 11 and 12. The housing **12** includes a receptacle **13** formed in any suitable manner, such as by molding of a plastic material, and having an open side. The housing **12** also includes a seal member **20** having a front wall **31** and depending side walls **32** terminating in an inturned lip **33**. The member **20** is preferably formed of a flexible material such as rubber. The parts are arranged as shown in FIG. 12 with the members **10** and **11** within the member **20** so that the lip **33** engages the undersurface of the member **11** and with the outer surface of the member **10** adjacent the wall **31**. The member **20** is located within the receptacle **13** with its wall **31** exposed. The receptacle **13** includes a hollow projection **34** extending from its base and containing a screw **35** threaded into a threaded opening **36** on the undersurface of the member **11**. If desired, a suitable cement **43** may be applied between the side walls **32** of member **20** and the adjacent side walls of the receptacle **13** to firmly retain the member **20** within the receptacle **13**. As will presently appear, wires are connected to terminals on the member **11** and are contained in a flexible cord which extends through an opening in the side of the receptacle **13**. The housing **12** is configured and dimen-

sioned so that a person can hold the same and operate the device with one hand.

The outer or exposed surface of the member **10** includes a plurality of spaced areas which correspond in number to the number of operating positions of the member **10** and which are adapted to have force applied thereto to effect rocking movement of the member **10**. Suitable indicia are located adjacent such areas to indicate the particular function performed when force is applied to selected ones of such areas. The indicia can be applied to either the exposed face of the member **10** or to the flexible wall **31** of the member **20**. In the embodiment illustrated, the indicia are applied to raised buttons **37–42** which extend from the exposed surface of the member **10** and to which the operating force is applied. The buttons **37–42** are preferably formed integrally with the member **10** and carry indicia indicating the particular function which will be performed in response to the application of force to the particular button. For example, pressing the flexible wall **31** over the "head down" button **38** will effect rocking movement of the member **10** over the edge of the extension **27** in a direction to cause engagement of the contacts **15** and **15A** and downward movement of the head section of the motorized bed (not shown). In a similar manner, application of force to the wall **31** over the "foot down" button **40** will cause rocking movement of the member **10** in a direction to close the contacts **17** and **17A** which will result in downward movement of the foot section of the bed. The arrangement is such that only a single pair of contacts can engage in response to rocking movement of the member **10** to one of its operating positions. The circuits controlled by the hand control device effective to cause the various functions will be set forth in detail hereinafter.

In accord with the present invention mechanical interlock means are provided to prevent engagement of more than one pair of contacts in response to a rocking movement of the member **10**. If such interlock means were not provided in the device of FIGS. 1–6, the inadvertent application of force at an area on the exposed surface of the member **10** other than at the intended area occupied by one of the indicia-bearing buttons **37–42** would result in rocking movement of the member **10** to a position wherein two pairs of contacts engage. This undesirable result is prevented by the interlock means. For this purpose a plurality of spaced barriers of predetermined height are located between and in alignment with the contacts on the base member **11** to engage the member **10** during a rocking movement thereof in a manner to prevent simula neous engagement of the pair of contacts on opposite sides of each barrier with the corresponding pair of contacts on the member **10**.

In the embodiment illustrated in FIGS. 1–6, the barriers are in the form of insulating projections **45–50** positioned as shown in FIGS. 2, 3 and 5. As there shown, the projections **45** and **48** are positioned adjacent the short edges of the member **10** intermediate the contacts **14A** and **15A** and **18A** and **19A** respectively. The projections **46** and **47** are positioned adjacent the right hand long edge of the member **11** as viewed in FIG. 2 intermediate the contacts **15A** and **17A** and the contacts **17A** and **19A**, respectively. In a similar manner, the projections **49** and **50** are located adjacent the left hand long edge of the member **11** intermediate the contacts **18A** and **16A** and the contacts **16A** and **14A** respectively. As best shown in FIG. 3, the projection **45** has a height dimension which is greater than the height dimensions of the corner contacts **14A** and **15A** so that the projection **45** will engage the plate **21** on the undersurface of the member **10** to prevent simultaneous engagement of the contacts **14A** and **15A** with the corresponding contacts **14** and **15** on the member **10** in response to rocking movement of the member **10** resulting from inadvertent application of force at an area of the exposed surface of the member **10** between the buttons **37** and **38**. The projection **48** will similarly prevent simultaneous engagement of contacts **18A** and **19A** with the corresponding contacts **18** and **19** when force is inadvertently applied at an area between the buttons **41** and **42**. As shown in FIG. 5, the projection **46** has a height dimension which is selected so that the projection **46** will engage the plate **21** on the undersurface of the member **10** to prevent simultaneous engagement of contacts **15A** and **17A** by the corresponding contacts **15** and **17** in response to a rocking movement of the member **10** caused by inadvertent application of force at an area between the buttons **38** and **40**. The remaining projections **47**, **49** and **50** will similarly prevent simultaneous engagement of their associated pairs of contacts by the corresponding contacts on member **10** in response to inadvertent application of force at areas between the intended buttons.

In order to connect the various contacts in electrical circuits a plurality of electroconductive terminals are connected to the contacts. To this end a terminal **52** is electrically connected to the plate **21** and is conveniently formed as an integral struck out portion of the plate **21**. The terminal **52** extends through an opening **53** formed in the base member **11** to facilitate connection of a conductor to the terminal **52**. A plurality of terminals **54–59** are connected respectively to the contacts **14A–19A** on the base member and are located on the exposed surface of the base member to facilitate connection of conductors thereto.

In the particular circuit arrangement shown by way of example in FIG. 6, the terminals **54–59** are connected to windings **61–66** of a plurality of motors H, F, and B associated respectively with the mechanisms for raising and lowering the head and foot sections and the bed itself. Each motor includes two windings effective when energized to rotate the motor in opposite directions, the motor H including the windings **61** and **62**, the motor F including the windings **63** and **64**, and the motor B including the windings **65** and **66**. The windings **61**, **63** and **65** are effective when energized to rotate the associated motors in directions for raising the head and foot sections and the bed respectively whereas the windings **62**, **64** and **66** are effective when energized to rotate the associated motors in directions for lowering the head and foot sections and the bed respectively. Each of the windings is connected to a common terminal **68**, and the terminals **52** and **68** are adapted for connection to a suitable source of alternating voltage (not shown).

To illustrate the operation of the hand control device, it is assumed initially that the terminals **52** and **68** are connected to a suitable source of alternating voltage. Let it be further assumed that it is desired to lower the head section of the bed (not shown). To accomplish this, the patient or attendant merely applies a finger to the flexible wall **31** over the button **38** and exerts sufficient force thereon to rock the member **10** about the edge of the extension **27** to the limit of its movement. This action causes the contact **15** to move into engagement with the contact **15A** as shown in FIG. 5. When these contacts engage, the winding **62** of the motor H is connected across terminals **52** and **68** and is energized to rotate the motor H in a direction for lowering the head section of the bed. When the head section has been lowered to the desired extent, the finger is removed from the wall **31** whereupon the member **10** automatically returns to its neutral position illustrated in FIG. 3 by expansion of the bias spring **28** which had previously been compressed during the rocking movement. Return of the member **10** to its neutral position causes the contact **15** to become disengaged from the contact **15A** so as to deenergize the winding **62** and stop the motor H. In FIG. 6, the motors are energized directly through the contacts of the hand control and the hand control device associated with this circuit may be termed a line voltage device. It can be appreciated that other circuits are possible wherein the motors are not energized directly but are energized under control of suitable relays energized through the contacts of the hand

control. A hand control device employed with such a circuit may be referred to as a low voltage device. These devices may be either two, four, or six position devices in association respectively with one, two, or three motors.

Referring now to FIGS. 7–10, a different embodiment of the invention is shown which is adapted to establish two isolated circuits for each operating position of the operator member. In the particular circuit shown by way of example in FIG. 10, a single alternating current motor is associated with three separate direct current clutches for operatively connecting the motor to mechanisms for raising and lowering the head and foot sections and for raising and lowering the bed. Thus, each operating position of the operator member establishes a separate direct current clutch circuit and also a separate alternating current circuit for rotating the motor in a predetermined direction.

The device of FIGS. 7–9 includes an operator member **70** and a cooperating base member **71** corresponding respectively to the members **10** and **11** of the device shown in FIGS. 1–6. The same mounting arrangement employed to mount the members **10** and **11** is also utilized to mount the members **70** and **71**. A housing (not shown) corresponding to housing **12** may be utilized to house the members **70** and **71**. The member **70** includes six indicia-bearing buttons **72–77** (FIG. 8) which correspond to the buttons **37–42** of the device of FIGS. 1–6. However, the center buttons **74** and **75** differ from the corresponding center buttons **39** and **40** of the previously described device in that the buttons **74** and **75** each have an inclined exposed surface which is inclined in the direction of elongation of the member **70** for a purpose appearing hereinafter. In FIG. 7 the button **75** is shown with the inclined surface **79**.

The number and arrangement of contacts on the members **70** and **71** differ from the number and arrangement of contacts on the members **10** and **11** of the device shown in FIGS. 1–6. The modified device under discussion includes a first plurality of contacts **80–85** on a metallic plate **86** corresponding to the contacts **14–19** and the plate **21** of the previous device. As will presently appear, the contacts **80–85** are included in direct current clutch coil circuits. The member **70** also carries a second plurality of contacts **87–90** which are insulated from the contacts **80–85** and which are included in alternating current motor winding circuits. In the embodiment illustrated, the second plurality of contacts **87–90** are in the form of parts of a generally H-shaped metallic member **92** overlying a correspondingly shaped insulating plate **94** which in turn overlies the plate **86**. The items **86**, **94** and **92** are secured in any suitable manner on the underside of the member **70**. The contacts **80–85** and **87–90** on the operator member are arranged in a rectangular pattern.

In order to establish selected circuits in response to rocking movement of the member **70**, the base member **71** carries a third plurality of contacts which, in the embodiment illustrated, consists of six contacts **80A–85A** arranged for cooperation with the first plurality of contacts **80–85** on the member **70**, and also carries contacts **87A–90A** arranged for cooperation with the second plurality of contacts **87–90** on the member **70**. The contacts **80A–85A** are arranged on the member **71** in the same rectangular pattern as the contacts **14A–19A** on the base member **11** of the device of FIGS. 1–6, and are connected to direct current clutch coil circuits as will presently appear. The contacts **87A–90A** are arranged on the member **71** in the same pattern as the insulating projections **46**, **47**, **49** and **50** of the device of FIGS. 1–6 and also provide the same mechanical interlock function as the insulating projections. As will be described hereinafter, the contacts **87A–90A** are connected to alternating current motor winding circuits. The contacts on the base **71** are arranged in a rectangular pattern and are disposed in three spaced planes with the corner contacts **80A**, **81A**, **84A** and **85A** in a first plane closest to the base, with the contacts **87A–90A** in a second intermediate plane, and with the contacts **82A** and **83A** in the highest plane. This arrangement assures positive engagement between the desired sets of contacts in response to rocking of the member **70**, and also assures that the contacts **87A–90A** will provide the necessary interlock function.

In the embodiment under discussion, the member **70** is mounted for rocking movement to a selected one of six spaced operating positions in each of which two pairs of contacts engage to establish two independent clutch and motor control circuits. The connections for this purpose shown in FIG. 10 which illustrates schematically the base **71** as viewed in FIG. 9 and the operator member **70** overlying the base and rotated one hundred and eighty degrees about its longitudinal center line from its position shown in FIG. 8.

As illustrated in FIG. 10, the contacts **80A** and **81A** are electrically connected together by a connection **95** and are connected by a terminal **96** (FIG. 7) and a wire **97** to one side of a coil **98** of an electrically operated clutch HC. Also, the contacts **82A** and **83A** are connected together by a connection **99** and are connected by a terminal **100** (FIG. 7) and a wire **101** to one side of a coil **102** of an electrically operated clutch FC. Similarly, the contacts **84A** and **85A** are connected together by a connection **103** and are connected through a terminal **104** (FIG. 7) and a wire **105** to one side of a coil **106** of an electrically operated clutch BC. The various clutches when engaged operatively connect a motor M to mechanisms for raising and lowering the head and foot sections of the bed (not shown) and for raising and lowering the bed. The motor M has two windings MU and MD effective when energized to rotate the motor in opposite directions. The winding MD is connected at one side to the parellel connected contacts **88A** and **90A** through a wire **107** and terminals **108** and **109** (FIG. 7) connected to the contacts. The winding MU is connected at one side to the parallel connected contacts **87A** and **89A** through a wire **110** and terminals (not shown) connected to the contacts. The plate **92** on the member **70** has a terminal **112** connected through a wire **113** to a terminal **114**, and the other sides of the motor windings MD and MU and the clutch coils **98**, **102** and **106** are connected to a common wire **115** which in turn is connected to a terminal **116**. The terminals **114** and **116** are adapted for connection to a suitable source of alternating voltage (not shown). A diode **117** and a capacitor **118** are connected in series across the wires **113** and **115** and a terminal **119** between the diode **117** and capacitor **118** is connected to a terminal **120** on the plate **86** on the member **70**. With the described circuit connections, when the member **70** is rocked to one of its operating positions, alternating current will be supplied to the selected motor winding circuit and direct current will be supplied to the selected clutch coil circuit.

As previously stated, the device of FIGS. 7–9 is designed to provide six operating positions of the member **70**. The "head down" position is attained by applying a force to the button **73** which rocks the member **70** to a position wherein the contacts **81** and **88** engage respectively the contacts **81A** and **88A**. Engagement of contacts **81** and **81A** establishes a circuit which may be traced from the terminal **114** through the diode **117**, terminals **119** and **120**, plate **86**, contacts **81** and **81A**, wire **97**, coil **98**, and wire **115** to the terminal **116**. A unidirectional current thus flows through the coil **98** to actuate the clutch HC to connect the motor to the mechanism for moving the head section of the bed. At the same time, engagement of contacts **88** and **88A** establishes a circuit which, assuming an instantaneous positive polarity of alternating voltage at terminal **114**, may be traced from the terminal **114** through wire **113**, terminal **112**, plate **92**, contacts **88** and **88A**, wire **107**, winding MD, and wire **115** to terminal **116**. Thus, alternating current flows through the winding

MD to rotate the motor in a direction for lowering the head section of the bed.

The "foot down" position is established by application of force to the inclined surface **79** of the button **75** which is effective to rock the member **70** in a direction for causing the contacts **83** and **90** on the member **70** to engage the contacts **83A** and **90A** on the base member. It can be appreciated that this same rocking motion of the member **70** could be achieved by replacing the button **75** with a button which is located intermediate the buttons **75** and **77** and which has a flat exposed surface rather than the inclined surface of the button **75**. Closure of contacts **83** and **83A** establishes a circuit which may be traced from the terminal **114** through the diode **117**, plate **86**, closed contacts **83** and **83A**, coil **102**, and to the terminal **116**. This results in actuation of the clutch FC which operatively connects the motor to the mechanism for moving the foot section of the bed. Simultaneously, the contacts **90** and **90A** engage to establish an alternating current circuit which may be traced from the terminal **114** through the plate **92**, closed contacts **90** and **90A**, the winding MD and to the termnial **116**. Establishment of this circuit results in rotation of the motor in a direction to lower the foot section of the bed.

The "bed down" position is attained by applying force to the button **77** which causes the member **70** to rock in a direction for moving the contacts **90** and **85** thereof into engagement with the contacts **90A** and **85A** on the base **71**. As is apparent from the above circuit descriptions, engagement of the contacts **90** and **90A** effects alternating current energization of the winding MD of the motor M. At the same time, engagement of the contacts **85** and **85A** establishes a circuit which results in energization of the coil **106** of clutch BC to operatively connect the motor to mechanism for moving the bed in a downward direction. Establishment of the "head up," "foot up," and "bed up" positions are accomplished respectively by applying force to the buttons **72**, **74** and **76**. In the "head up" position of the member **70**, the contacts **80** and **87** engage respectively the contacts **80A** and **87A** to actuate the clutch HC and to also energize the winding MU of the motor. Thus, the head section of the bed is raised. Similarly, application of force to the inclined surface of the "foot up" button **74** results in engagement of the contacts **82** and **89** with the contacts **82A** and **89A**. This actuates the clutch FC and also energizes the winding MU of the motor to raise the foot section of the bed. Finally, in the "bed up" position of member **70**, the contacts **89** and **84** engage the contacts **89A** and **84A** to respectively energize the winding MU of the motor M and energize the coil **106** of clutch BC which results in raising of the entire bed.

As previously stated, the contacts **87A–90A** on the base **71** provide a mechanical interlock function identical to that provided by the projections **46**, **47**, **49** and **50** in the device of FIGS. 1–6. The interlock provided by contacts **87A–90A** prevents simultaneous establishment of two clutch coil circuits in response to a rocking movement of the operator member **70**. It will be recalled that in the device of FIGS. 1–6 a pair of insulating projections **45** and **48** is provided on the base member **11** intermediate and in alignment with the corner contacts **14A** and **15A** and **18A** and **19A** to provide an interlocking function. It is necessary in the device of FIGS. 7–9 to provide projections **130** and **131** corresponding to the projections **45** and **48** and intermediate and in alignment with the corner contacts **80A** and **81** and **84A** and **85A**. The projections **130** and **131** prevent simultaneous engagement of contacts **87**, **87A**, **88**, **88A**, **80**, **80A**, **81**, **81A** and also **89**, **89A**, **90**, **90A**, **84**, **84A**, **85**, **85A**.

While I have shown and described particular embodiments of my invention, it will be obvious to those skilled in the art that varous changes and modifications may be made without departing from my invention in its broader aspects and I, therefore, intend in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim and desire to secure by Letters Patent of the United States is:

1. A control device comprising in combination, an operator member of generally rectangular configuration having a contact surface, a base member of generally rectangular configuration having a contact surface in confronting relation with the contact surface of the operator member, a separate plurality of contacts on the contact surface of each of said members, the contacts of each plurality being arranged in a generally rectangular pattern in spaced relation adjacent edges and corners of the associated member, the edge contacts on said base member being positioned further from the associated contact surface than the corner contacts on the base member, means mounting said operator member for universal rocking movement in any direction relative to said base member, said operator member being rockable from a neutral position wherein the contacts of said pluralities are in spaced relation to a selected one of a plurality of operating positions in each of which a predetermined number of contacts engage, means biasing said operator member towards its neutral position, said operator member having a second surface opposite its contact surface to which force is applied at selected areas to effect rocking movement of said operator member to said operating positions, and a plurality of projections on said base member each between and in alignment with a separate pair of contacts on said base member to engage the operator member for preventing engagement of more than said predetermined number of contacts when said operator member is rocked by application of force at any area of the second surface of said operator member, a projection between a pair of edge and corner contacts having a greater height than a projection between a pair of corner contacts.

2. A control device comprising in combination, an operator member of generally rectangular configuration having a contact surface and having a projection extending generally centrally from its contact surface, a base member of generally rectangular configuration having a contact surface and having an extension projecting generally centrally of its contact surface, said extension having a generally circular terminal edge, said base member having an aperture extending therethrough and through said extension, said operator member being positioned with its contact surface in engagement with the end of said extension and with its projection extending through said aperture, a coil spring surrounding said projection and mounted to urge said members towards each other, said operator member being mounted for universal rocking movement in any direction about the terminal edge of said extension relative to said base member, a separate plurality of contacts on the contact surface of each of said members, the contacts of each plurality being arranged in a generally rectangular pattern in spaced relation adjacent edges and corners of the associated member, the edge contacts on said base member being positioned further from the associated contact surface than the corner contacts on the base member, said operator member being rockable from a neutral position wherein the contacts of said pluralities are in spaced relation to a selected one of a plurality of operating positions in each of which a predetermined number of contacts engage, said operator member having a second surface opposite its contact surface to which force is applied at selected areas to effect rocking movement of said operator member to said operating positions, and a plurality of projections on said base member each between and in alignment with a separate pair of contacts in said base member to engage the operator member for preventing engagement of more than said predetermined number of contacts when said operator member is rocked by application of force at any area of the second surface of said operator member, a projection between a pair of edge and corner contacts

having a greater height than a projection between a pair of corner contacts.

3. A control device comprising in combination, an operator member of generally rectangular configuration having a contact surface, a base member of generally rectangular configuration having a contact surface in confronting relation with the contact surface of the operator member, a separate plurality of spaced contacts on the contact surface of each of said members, each plurality of contacts comprising a separate corner contact adjacent each corner of the associated member and a separate intermediate contact adjacent each long edge of the associated member and intermediate the adjacent corner contacts, the corner contacts on the base member being substantially in a first common plane, the intermediate contacts on the base member being substantially in a second common plane which is closer to the operator member than the first common plane, means mounting said operator member for universal rocking movement in any direction relative to said base member, said operator member being rockable from a neutral position wherein the contacts of said pluralities are in spaced relation to a selected one of a plurality of operating positions in each of which a predetermined number of contacts engage, said operator member having a second surface opposite its contact surface to which force is applied at selected areas to effect rocking movement of said operator member to said operating positions, two pairs of first projections on the contact surface of the base member each positioned between and in alignment with a separate pair of corner and intermediate contacts, said first projections being of sufficient height to engage the operator member and prevent simultaneous engagement of the adjacent intermediate and corner contacts on the base member with the corresponding contacts on the operator member in response to rocking movement of the operator member, and a pair of second projections on the contact surface of the base member each positioned adjacent a separate short edge of the base member intermediate and in alignment with a separate pair of adjacent corner contacts, said second projections having heights less than the heights of said first projections and sufficient to engage the operator member and prevent simultaneous engagement of the adjacent corner contacts on the base member with the corresponding contacts on the operator member in response to rocking movement of said operator member.

4. A control device comprising in combination, an operator member of generally rectangular configuration having a contact surface and having a projection ertending generally centrally from its contact surface, a base member of generally rectangular configuration having a contact surface and having a generally central hollow extension projecting from its contact surface, said extension having a generally circular terminal edge, said operator member being positioned with its contact surface in engagement with the end of said hollow extension and with its projection extending through the hollow extension, spring means surrounding said projection and mounted to urge said members towards each other, said operator member being mounted for universal rocking movement in any direction about the terminal edge of said extension relative to said base member, a separate plurality of spaced contacts on the contact surface of each of said members, each plurality of contacts comprising a separate corner contact adjacent each corner of the associated member and a separate intermediate contact adjacent each long edge of the associated member and intermediate the adjacent corner contacts, the corner contacts on the base member being substantially in a first common plane, the intermediate contacts on the base member being substantially in a second common plane which is closer to the operator member than the first common plane, said operator member being rockable from a neutral position wherein the contacts of said pluralities are in spaced relation to a selected one of a plurality of operating positions in each of which a predetermined number of contacts engage, said operator member having a second surface opposite its contact surface to which force is applied at selected areas to effect rocking movement of said operator member to said operating positions, two pairs of first projections on the contact surface of the base member each positioned between and in alignment with a separate pair of corner and intermediate contacts, said first projections being of sufficient height to engage the operator member and prevent simultaneous engagement of the adjacent intermediate and corner contacts on the base member with the corresponding contacts on the operator member in response to rocking movement of the operator member, and a pair of second projections on the contact surface of the base member each positioned adjacent a separate short edge of the base member intermediate and in alignment with a separate pair of adjacent corner contacts, said second projections having heights less than the heights of said first projections and sufficient to engage the operator member and prevent simultaneous engagement of the adjacent corner contacts on the base member with the corresponding contacts on the operator member in response to rocking movement of said operator member.

5. A control device comprising in combination, an operator member of generally rectangular configuration, a generally rectangular metallic plate secured to the undersurface of the operator member, six contacts on the plate including four corner contacts each adjacent a separate corner of the plate, and including two intermediate contacts each adjacent a separate long edge of the plate and each intermediate and aligned with a pair of corner contacts, an insulating spacer mounted on the metallic plate, a second metallic plate mounted on the insulating spacer, a base member, a first set of six contacts on said base member corresponding in general location to the six contacts on said rectangular metallic plate, and a second set of four contacts on said base member each positioned to be engaged by a separate portion of said second plate, said operator and base members being positioned with their contacts in confronting relation, and means mounting said operator member for rocking movement relative to said base member from a neutral position wherein the contacts on said members are in spaced relation to a selected one of six different operation positions in each of which a predetermined number of contacts engage, said operator member when in each of said positions effecting establishment of two independent circuits, one of said circuits including one of the six contacts on said rectangular plate and one of the corresponding contacts of said first set on the base member, the other of said circuits including said second plate and one of the corresponding contacts of said second set on the base member.

6. A device as defined in claim 5 in combination with a housing having an opening, a seal member secured to said housing formed of texible material and having a flexible wall across said opening, said base and operator members being positioned within said opening with the outer surface of said operator member adjacent and underlying the flexible wall of the seal member, said flexible wall of the seal member adapted to have force applied thereto which is transmitted thereby to the outer surface of the operator member, and means securing said base member to said housing.

7. A device as defined in claim 6 in combination with a housing having an opening, a seal member secured to said housing formed of flexible material and having a flexible wall across said opening, said base and operator members being positioned within said opening with the outer surface of said operator member adjacent and underlying the flexible wall of the seal member, said flexible wall of the seal member adapted to have force applied thereto which is transmitted thereby to the outer surface

of the operator member, and means securing said base member to said housing.

8. A device as defined in claim 7 in combination with a housing having an opening, a seal member secured to said housing formed of flexible material and having a flexible wall across said opening, said base and operator members being positioned within said opening with the outer surface of said operator member adjacent and underlying the flexible wall of the seal member, said flexible wall of the seal member adapted to have force applied thereto which is transmitted thereby to the outer surface of the operator member, and means securing said base member to said housing.

9. A device as defined in claim 8 in combination with a housing having an opening, a seal member secured to said housing formed of flexible material and having a flexible wall across said opening, said base and operator members being positioned within said opening with the outer surface of said operator member adjacent and underlying the flexible wall of the seal member, said flexible wall of the seal member adapted to have force applied thereto which is transmitted thereby to the outer surface of the operator member, and means securing said base member to said housing.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,399,287 August 27, 1968

George M. Euler

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

Column 11, line 49, "ertending" should read -- extending --. Column 12, line 55, the claim reference numeral "5" should read -- 1 --; line 57, "texible" should read -- flexible --; line 66, the claim reference numeral "6" should read -- 2 --. Column 13, line 3, the claim reference numeral "7" should read -- 3 --; line 14, the claim reference numeral "8" should read -- 4 --.

Signed and sealed this 13th day of January 1970.

(SEAL)
Attest:

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