Feb. 18, 1969 R. L. GOLDEN ETAL 3,428,768

VACUUM OPERATED ELECTRICAL SWITCH CONSTRUCTION

Original Filed March 5, 1963 Sheet 1 of 3

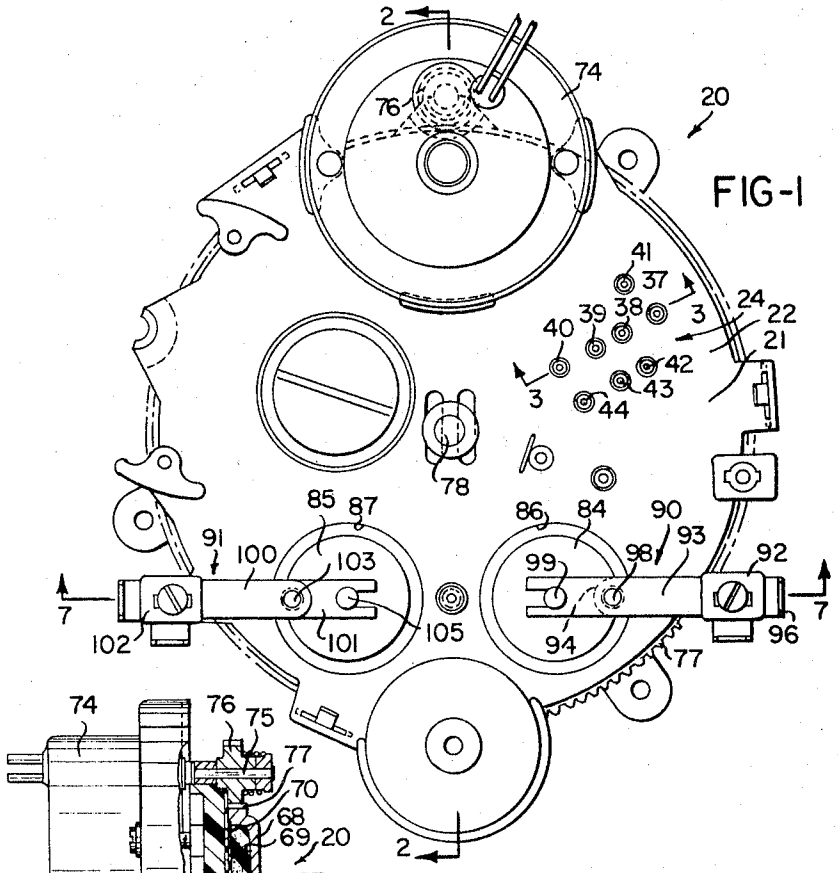


FIG-1

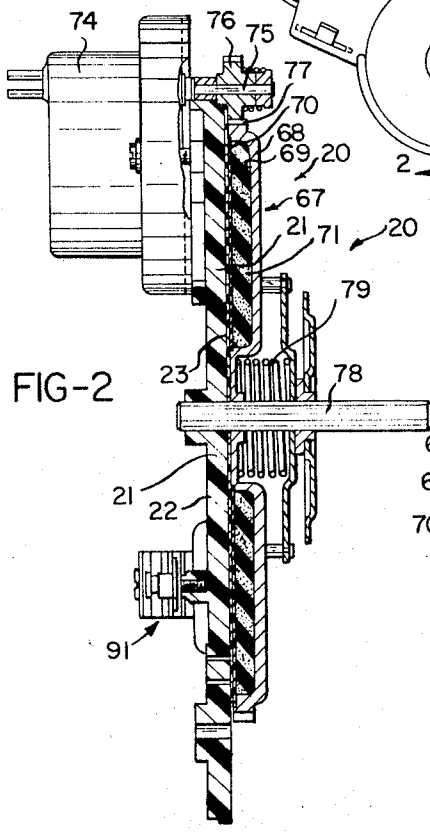
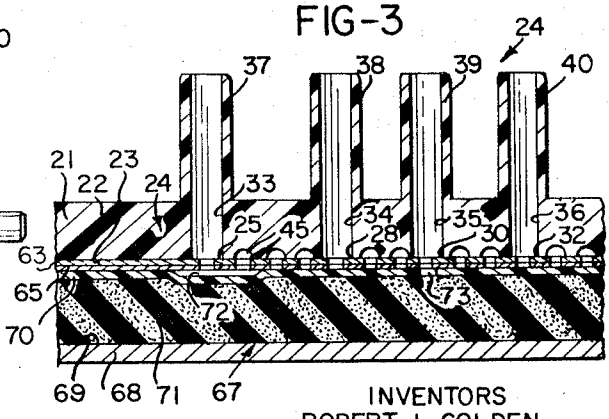


FIG-2

FIG-3



INVENTORS
ROBERT L. GOLDEN
CLARENCE WANTZ
HAROLD W. RICE
ROLAND D. BECK
REED A. PALMER

BY
Cauden & Cauden
THEIR ATTORNEYS

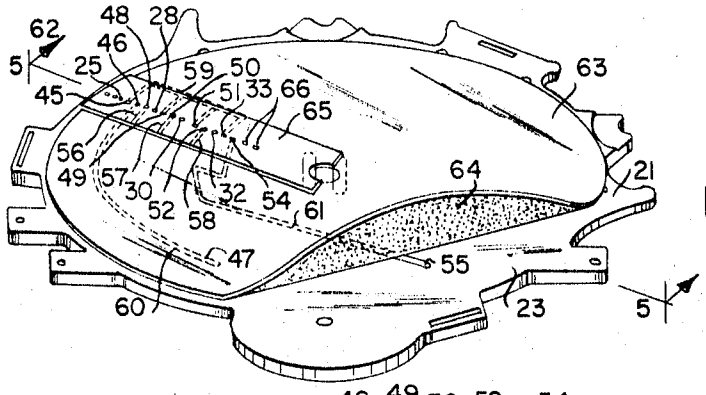


FIG-4

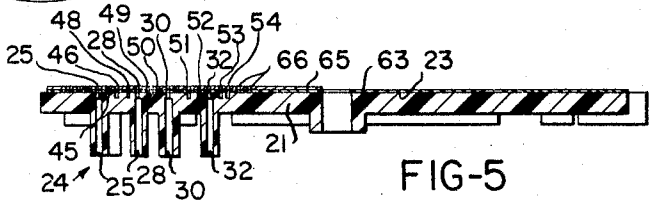
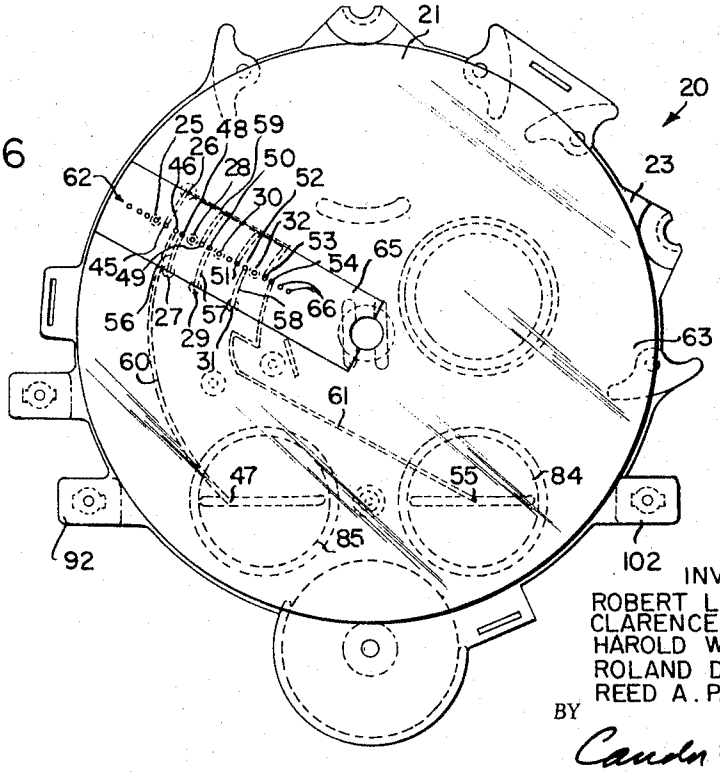


FIG-5

FIG-6



INVENTORS
ROBERT L. GOLDEN
CLARENCE WANTZ
HAROLD W. RICE
ROLAND D. BECK
REED A. PALMER

BY
Cauden & Cauden
THEIR ATTORNEYS

Feb. 18, 1969 R. L. GOLDEN ETAL 3,428,768

VACUUM OPERATED ELECTRICAL SWITCH CONSTRUCTION

Original Filed March 5, 1963 Sheet 3 of 3

FIG-7

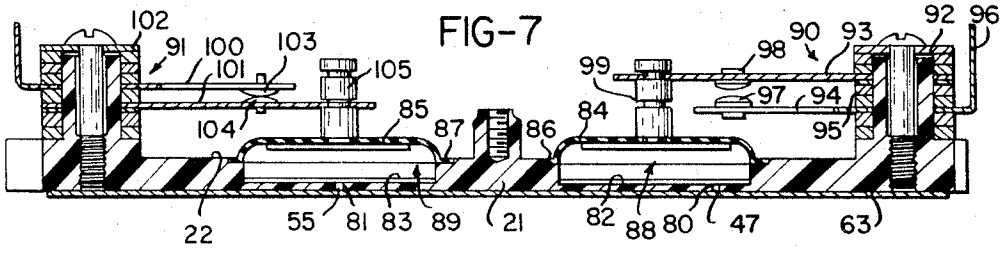


FIG-8

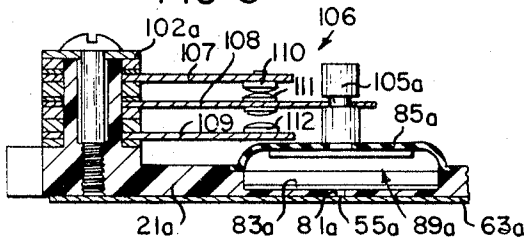
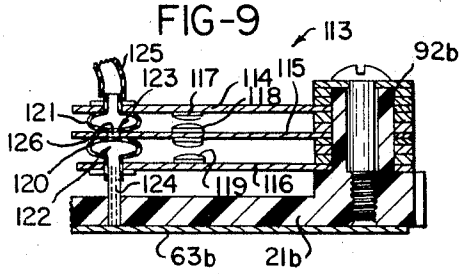


FIG-9



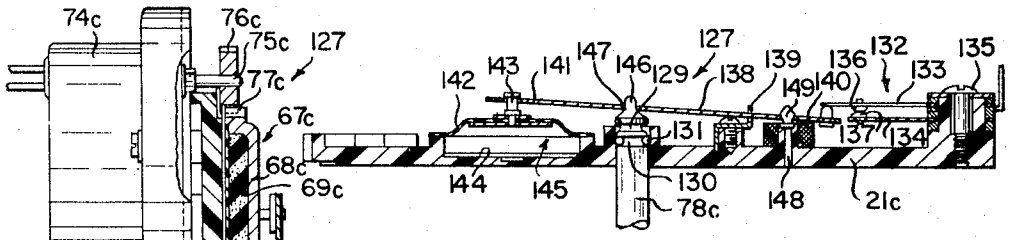


FIG-11

FIG-10

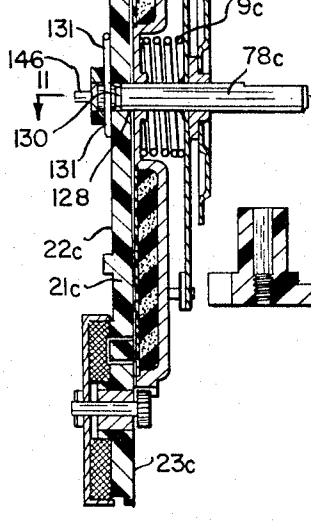
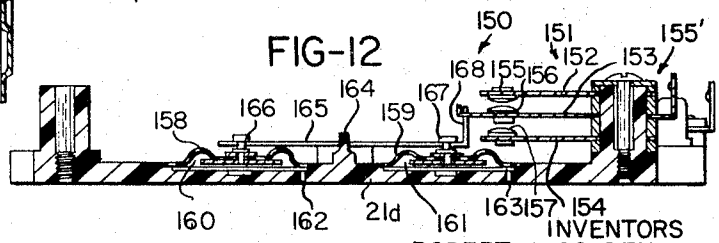


FIG-12



INVENTORS
ROBERT L. GOLDEN
CLARENCE WANTZ
HAROLD W. RICE
ROLAND D. BECK
REED A. PALMER

Cauder & Cauder
THEIR ATTORNEYS

United States Patent Office 3,428,768
Patented Feb. 18, 1969

3,428,768

VACUUM OPERATED ELECTRICAL SWITCH CONSTRUCTION

Robert L. Golden and Clarence Wantz, Greensburg, Pa., and Harold W. Rice, Fullerton, Roland D. Beck, Anaheim, and Reed A. Palmer, Los Alamitos, Calif., assignors to Robertshaw Controls Company, Richmond, Va., a corporation of Delaware

Original application Mar. 5, 1963, Ser. No. 262,885, now Patent No. 3,284,589. Divided and this application Aug. 29, 1966, Ser. No. 611,781
U.S. Cl. 200—83 19 Claims
Int. Cl. H01h 35/40

ABSTRACT OF THE DISCLOSURE

This disclosure relates to vacuum operated electrical switch constructions mounted on the rear side of a base plate having a movable program member disposed on the front side thereof, the movable program member being adapted to sequentially interconnect a pneumatic source to the vacuum operated switches to control the same. Each switch construction includes a flexible diaphragm having its outer periphery secured to the rear side of the base plate to define a chamber therebetween, the flexible diaphragm being operatively interconnected to associated switch blades and the like to control the same.

This application is a divisional patent application under Rule 147 of its co-pending parent patent application, Sr. No. 262,885, filed Mar. 5, 1963, now Patent No. 3,284,584.

This invention relates to an improved control device as well as to imporved parts therefor or the like and to the method for making such parts or the like.

More specifically, this invention relates to an improved program controller for controlling a vacuum program system or the like.

It is well known from the copending United States patent application, Ser. No. 153,300, filed Nov. 20, 1961, now abandoned, and entitled "Pneumatic Programmer," that a control device or program controller can be provided for controlling a vacuum control system for a domestic appliance, such as an automatic washing machine or the like.

In general, such a programmer includes a base plate carrying a reading head having the reading surface thereof interrupted by a plurality of passages, one or more of the passages being interconnected by flexible conduits to a vacuum source and other of the passages being interconnected by flexible conduits to vacuum operated devices, such as electrical switches or the like. A reading member is rotatably carried by the base plate and has inverted channels provided in the reading side thereof in a predetermined pattern to respectively bridge a vacuum source passage with a vacuum operated device passage at a predetermined time relation in the program cycle to cause the vacuum operated device to operate at the desired time and for the desired time interval.

Thereafter, the reading member aligns an aperture means thereof with the vacuum operated device passage to permit the vacuum operated device to return to its atmospheric condition when it is desired to have that particular vacuum operated device cease functioning.

It has been found that a programmer of the above-described type and as set forth in the above-mentioned copending patent application has an excessive number of parts and requires many assembly operations whereby the overall cost of such a prior known programmer is relatively high.

However, according to the teachings of this invention,

an improved programmer is provided wherein a great number of parts of the prior known programmer has been eliminated while the resulting programmer still perform the same functions in substantially the same manner.

In particular, the programmer of this invention includes an improved base plate wherein a large number of the prior used flexible conduits and connections thereof are eliminated.

Further, the improved base plate of this invention is adapted to uniquely carry certain of the vacuum operated devices, such as electrical switches or the like so as to reduce the number of parts of the programmer.

In addition, this invention provides improved vacuum operated electrical switches or the like to be utilized with such a programmer or the like.

Accordingly, it is an object of this invention to provide an improved pneumatic programmer having one or more of the novel features set forth above or hereinafter shown or described.

Another object of this invention is to provide an improved method for making certain parts of such a programmer or the like.

A further object of this invention is to provide improved parts for such a programmer or the like.

Another object of this invention is to provide improved vacuum operated electrical switches or the like to be utilized in connection with such a programmer or the like.

Other objects, uses and advantages of this invention are apparent from a reading of this description which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIGURE 1 is a rear view of an improved pneumatic programmer of this invention.

FIGURE 2 is a cross-sectional view of the programmer illustrated in FIGURE 1 and is taken on line 2—2 thereof.

FIGURE 3 is an enlarged cross-sectional view of the reading head portion of the programmer illustrated in FIGURE 1 and is taken on line 3—3 therof.

FIGURE 4 is a perspective view illustrating the improved base plate of the programmer of FIGURE 1.

FIGURE 5 is a cross-sectional view taken on line 5—5 of FIGURE 4.

FIGURE 6 is front view of the programmer illustrated in FIGURE 1 with the reading element thereof removed.

FIGURE 7 is an enlarged cross-sectional view taken on line 7—7 of FIGURE 1 and illustrates some of the improved vacuum operated electrical switches of this invention.

FIGURES 8 and 9 are fragmentary views similar to FIGURE 7 and respectively illustrate other embodiments of the vacuum operated electrical switches of this invention.

FIGURE 10 is a view similar to FIGURE 2 and illustrates another embodiment of the programmer of this invention.

FIGURE 11 is a cross-sectional view taken on line 11—11 of FIGURE 10.

FIGURE 12 is a view similar to FIGURE 11 and illustrates another embodiment of this invention.

While the various features of this invention are hereinafter described and illustrated as being particularly adaptable for controlling a vacuum operated control system or the like, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide structure for the other systems as desired.

Therefore, this invention is not to be limited to only the embodiments illustrated in the drawings, because the

drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

Referring now to FIGURES 1 and 2, an improved programmer of this invention is generally indicated by the reference numeral **20** and is adapted to control a vacuum operated control system for a domestic appliance or the like, such as an automatic washing machine, dishwasher or the like, in substantially the same manner as set forth in the aforementioned copending patent application.

The programmer **20** of this invention generally comprises a base plate **21** formed of plastic or other suitable material having opposed front and rear surfaces **22** and **23**.

The base plate **21** has integral therewith a reading head portion located generally in the area of the reference numeral **24** in FIGURES 1 and 3, the surface **22** of the reading head portion **24** being interrupted by a plurality of ports **25, 26, 27, 28, 29, 30, 31** and **32** as illustrated in FIGURE 6 each port **25–32** being interconnected to a passage passing through the opposed surface **23** of the base plate **21** and disposed in aligned relation with a conduit nipple extending outwardly from the rear surface **23** of the base plate **21**. For example, see FIGURE 3, wherein the ports **25, 28, 30** and **32** respectively are interconnected by passages **33, 34, 35** and **36** to conduit nipples **37, 38, 39** and **40** formed integrally with the base plate **21** and extending from the rear surface **23** thereof. Similarly, the ports **26, 27, 29** and **31** are respectively interconnected to conduit nipples **41, 42, 43** and **44** as illustrated in FIGURE 1.

The surface **22** of the base plate **21** also has a plurality of ports **45, 46, 47, 48, 49, 50, 51, 52, 53, 54,** and **55** formed therein for a purpose hereinafter described.

The ports **27, 29,** and **31** are respectively interconnected to ports **48, 50,** and **52** by grooves **56, 57,** and **58** formed in the front surface **22** of the base plate **21**. Similarly, the ports **45, 49, 51, 53** are respectively interconnected to the port **26** by a groove network **59** formed in the front surface **22** of the base plate **21** as illustrated in FIGURE 6.

The ports **46** and **47** are interconnected together by a groove **60** formed in the front surface **22** of the base plate **21**. Similarly, the ports **54** and **55** are interconnected together by a groove **61** in the front surface **22** of the base plate **21**.

In this manner, it can be seen that the ports **25, 45, 46, 48, 28, 49, 50, 30, 51, 52, 32, 53,** and **54** are disposed in aligned relation and form a row **62** in the reading head portion **24** of the base plate **21** for a purpose hereinafter described.

While the ends of certain grooves in the front surface **22** of the base plate **21** have been previously described as interconnecting together a pair of ports, it is to be understood that such grooves and ports can be simultaneously made whereby the ports would merely be the ends of the grooves.

In order to provide a fluid-tight interconnection between the various ports interconnected by the grooves formed in the front surface **22** of the base plate **21**, suitable cover means is secured to the front surface **22** of the base plate **21** to cover the grooves and ports and separate the networks from each other.

For example, as illustrated in FIGURES 3 and 4, a flexible tape **63** having any desired configuration is secured over the surface **22** of the base plate **21** to close the groove means and ports formed therein. While the tape **63** can comprise any flexible material, the embodiment thereof illustrated in the drawings, comprises a flexible tape **63** having a pressure sensitive adhesive **64** disposed on the under surface thereof so that the tape **63** can be readily secured to the surface **22** of the base plate **21** in the manner illustrated in FIGURES 4 and 6.

The tape **63** has a plurality of aperture means formed therein to be respectively aligned with the ports in the row **62** of the reading head portion **24** of the base plate **21**.

After the tape **63** has been secured in place or before, a second flexible tape **65** is disposed on top of the tape **63** in the manner illustrated in FIGURE 4 in the region of the reading head portion **24** of the base plate **21**, the second tape **65** also having aligned aperture means **66** formed therein adapted to respectively register with the aperture means in the flexible tape **63** and the ports in the row **62** of the reading head portion **24**.

While the tape **65** can comprise any suitable material, the embodiment illustrated in the drawings comprises a flexible tape also having a pressure sensitive adhesive on the undersurface thereof to enable the same to be secured on top of the flexible tape **63**.

Therefore, it can be seen that any desired number of ports can be disposed in the row **62** in the reading head portion **24** of the base plate **21** and can be interconnected to other ports or to conduit nipples disposed in any desired position on the base plate **21** without requiring an interconnection therebetween by flexible conduits as provided in prior known programmers. This feature is accomplished by forming groove means in the surface **22** of the base plate **21** and covering the same by the tape means **63** and **65** in the manner previously described to provide separate passages in the base plate **21**.

While the additional tape means **65** need not be utilized, it is desired to provide the same to provide a raised reading surface in just the region of the reading head portion **24** of the base plate **21** for a purpose hereinafter described.

One or more of the conduit nipples **27–44** can be interconnected to a vacuum source by flexible conduits or the like while the remaining conduit nipples can be interconnected to various vacuum operated devices by flexible conduits or the like. For example, the conduit nipple **41** can be interconnected to a vacuum source whereby the ports **45, 49, 51** and **53** in the row **62** of the reading head portion **24** of the base plate **21** will also be interconnected to such vacuum source because of the groove network **59**.

When it is desired to impose a vacuum on a particular vacuum operated device, a reading element **67** of the programmer **20** interconnects a vacuum source port in the row **62** with the particular port in row **62** leading to that particular vacuum operated device in a manner now to be described.

As illustrated in FIGURE 2, the reading element **67** comprises a dome-like member **68** having an annular cavity **69** formed therein and closed at the open end thereof by anular flexible tape **70**, the cavity **69** being filled with a suitable air filtering material **71**.

The flexible tape **70** of the reading element **67** has a plurality of inverted channels **72** formed therein in the manner illustrated in FIGURE 3 so that each inverted channel **72** is adapted to bridge the space between a pair of adjacent ports disposed in the row **62** of the reading head portion **24**. For example, the channel **72** in the flexible tape **70** of the reading element **67** illustrated in FIGURE 3 is interconnecting the ports **45** and **25** together whereby if the port **45** is interconnected to a vacuum source and the port **25** is interconnecting to a vacuum operated device, the reading element **67** is causing the vacuum operated device to have a vacuum imposed thereon to accomplish any desired function, such as closing an electrical switch or the like to perform a particular operation in the control cycle of the programmer **20**.

After the particular vacuum operated device has been actuated in the above manner and it is desired to terminate such operation, suitable aperture means **73**, FIGURE 3, formed through the flexible tape **70** of the reading element **67** are adapted to be aligned with the ports in the row **62** of the reading head portion **24** of the base plate **21** to permit air to enter the particular vacuum operated device so that the previously actuated vacuum operated device can return to normal atmospheric conditions.

Therefore, it can be seen that by so arranging the channels **72** and apertures **73** in the flexible tape **70** of the reading element **67**, a desired sequence of operations can take place upon movement of the reading element **67** relative to the reading head portion **24** of the base plate **21** in any desired time relation.

For example, a suitable electric timer motor **74** can be carried by the base plate **21** in the manner illustrated in FIGURES 1 and 2 and have an output shaft **75** thereof interconnected to a pinion gear **76** disposed in meshing relation with a ring gear portion **77** of the reading element **67** to cause the reading element **67** to rotate about a control shaft **78** upon movement of the pinion gear **76** by the timer motor **74**.

The reading element **67** is pushed into contact with the reading surface of the base plate **21** by a compression spring **79** in a manner fully set forth in the aforementioned copending patent application.

Therefore, it can be seen that the reading element **67** is adapted to be sequentially or continuously moved relative to the base plate **21** to respectively interconnect various ports in the row **62** together to cause a sequence of operation in a domestic appliance or the like.

While the operation of the programmer **20** has been previously described in connection with vacuum operated devices disposed remotely therefrom and interconnected thereto by flexible conduits attached to the conduit nipples, it is to be understood that the programmer **20** operates in substantially the same manner to operate vacuum operated devices carried by the base plate **21** and interconnected thereto by the previously described grooved means formed in the surface **22** of the base plate **21**.

For example, the ports **47** and **55** formed in the base plate **21** of the programmer **20** are utilized to control vacuum operated devices carried directly by the base plate **21** whereby those vacuum operated devices do not require flexible conduits and connections as in the past.

For example, reference is made to FIGURE 7 wherein the ports **47** and **55** are respectively interconnected to passages **80** and **81** formed in the base plate **21** and leading respectively to open ended cavities **82** and **83** formed in the rear surface of the base plate **21**.

A pair of flexible diaphragms **84** and **85** respectively have their outer peripheries **86** and **87** secured to the rear surface **23** of the base plate **21** and respectively cooperate with the cavities **82** and **83** to define chambers **88** and **89** therebetween which are adapted to be respectively interconnected to a vacuum source by the reading element **67** in the manner previously described.

In this manner, the diaphragms **84** and **85** are each adapted to be drawn toward the base plate **21** when vacuums are imposed in the chambers **88** and **89** thereof and thereby control various devices.

For example, the diaphragm **84** is adapted to control an electrical switch **90** carried by the base plate **21** in the manner hereinafter described while the diaphragm **85** is adapted to control an electrical switch **91** carried by the base plate **21** in a manner hereinafter described.

In particular, the base plate **21** has an integral and outwardly extending post **92** carrying a pair of switch blades **93** and **94** separated from each other by suitable insulators **95**, the switch blades **93** and **94** being electrical conductors and being adapted to be interconnected to electrical circuitry by terminals **96** thereof.

The switch blade **94** carries an electrical contact **97** adapted to cooperate with an electrical contact **98** carried by the switch blade **93**, the switch blade **93** being operatively interconnected to the flexible diaphragm **84** by a post **99** carried by the flexible diaphragm **84** and interconnected to the free end of the switch blade **93** in the manner illustrated in FIGURE 7.

When atmospheric conditions exist in the chamber **88** either the natural resiliency of the flexible diaphragm **84** or the natural resiliency of the switch blade **93** or both maintains the switch blade **93** in the position illustrated in FIGURE 7, whereby the contacts **97** and **98** are normally opened. However, when a vacuum condition is imposed in the chamber **88** under the control of the reading element **67** in the manner previously described, the flexible diaphragm **84** is drawn toward the base plate **21**, whereby the switch blade **93** is pulled downwardly to bring the contact **98** thereof into contact with the contact **97** to complete an electrical circuit which controls the operation of a desired part of the washing machine or the like.

When it is desired to open the switch **90**, air is permitted to return to the chamber **88** in the maner previously described, whereby the contacts **98** and **97** open to the position illustrated in FIGURE 7.

While the electrical switch **90** is normally an open switch, the switch **91** illustrated in FIGURE 7 is a normally closed switch and comprises a pair of switch blades **100** and **101** respectively mounted in insulated relation on a post **102** of the base plate **21**, the switch blade **100** carrying an electrical contact **103** disposed in engagement with a contact **104** carried by the switch blade **101**. The free end of the switch blade **101** is operatively interconnected to the diaphragm **85** by a post **105** secured to the diaphragm **85** and interconnected to the switch blade **101**.

Thus, when the diaphragm **85** is disposed in the position illustrated in FIGURE 7, because of normal atmospheric conditions in the chamber **89**, the contacts **103** and **104** are disposed in engagement, whereby the switch **91** is normally closed.

However, when a vacuum condition is imposed in the chamber **89** by the reading element **67** in the manner previously described, the diaphragm **85** is drawn toward the base plate **21**, causing the switch blade **101** to flex away from the switch blade **100** to move the contact **104** out of engagement with the contact **103**, whereby the switch **91** will be opened.

Another vacuum operated electrical switch of this invention is generally indicated by the references numeral **106** in FIGURE 8 and parts thereof similar to the switch **91** previously described are indicated by like reference numerals followed by the reference letter "*a*."

As illustrated in FIGURE 8, the electrical switch **106** includes three switch blades **107**, **108** and **109** respectively insulated from each other on a post **102***a* of the base plate **21***a* and respectively carrying electrical contacts **110**, **111** and **112**, the electrical contact **111** of the intermediate switch blade **108** being cooperable with the contacts **110** and **112** of the outer switch blades **107** and **109** in a manner hereinafter described.

The intermediate switch blade **108** has the free end thereof operatively interconnected to the flexible diaphragm **85***a* by a post **105***a* secured to flexible diaphragm **85***a* and connected to the free end of the switch blade **108**.

When an atmospheric condition exists in the chamber **89***a*, the switch **106** is disposed in the position illustrated in FIGURE 8, whereby electrical contact is made between the contacts **110** and **111**.

However, when a vacuum condition is imposed in the chamber **89***a*, the flexible diaphragm **85***a* is drawn toward the base plate **21***a* to cause the switch blade **108** to move away from the switch blade **107** and break electrical contact between the contacts **111** and **110**. Further movement of the diaphragm **85***a* toward the base plate **21***a* by the vacuum condition in the chamber **89***a* brings the contact **111** into electrical contact with the contact **112** to operate another electrical device or the like.

Another vacuum operated electrical switch of this invention is generally indicated by the reference numeral **113** in FIGURE 9 and parts thereof similar to the electrical switch **90** previously described are indicated by like reference numerals followed by the reference letter "*b*."

As illustrated in FIGURE 9, three switch blades **114**, **115** and **116** are respectively carried in aligned and in-

sulated relation on the post **92***b* of the base plate **21***b* in the manner previously described and respectively have switch contacts **117**, **118** and **119**, the contact **118** of the intermediate blade **115** being cooperable with contacts **117** and **119** of the outer blades **114** and **116**.

An expansible and contractible element **120** is carried by the switch blade **116**, while another expansible and contractible element **121** is carried by the switch blade **114**, the elements **120** and **121** respectively comprising flexible diaphragm defining chambers **122** and **123**.

The chamber **122** of the element **120** is adapted to be interconnected to the vacuum source by conduit means **124** of the base plate **21***b*, while the chamber **123** is adapted to be interconnected to the vacuum source by a flexible conduit **125** by a reading element in the manner previously described, the elements **120** and **121** being interconnected together by a member **126** passing through a suitable aperture in the free end of the switch blade **115**.

When normal atmospheric conditions exist in chambers **122** and **123** of the elements **120** and **121**, the switch blade **115** is disposed in the position illustrated in FIGURE 9 wherein the contact **118** thereof is disposed out of electrical contact with the contacts **117** and **119**.

However, when a vacuum condition is imposed in the chamber **123** of the element **121**, the switch blade **115** is drawn toward the switch blade **114**, whereby the contact **118** is placed in electrical contact with the contact **117**.

Similarly, when a vacuum condition is imposed in the chamber **122** of the element **120**, the switch blade **115** is drawn toward the switch blade **116**, whereby the contact **118** is disposed in electrical contact with the contact **119**.

Another programmer of this invention is generally indicated by the reference numeral **127** in FIGURES 10 and 11 and parts thereof similar to the programmer previously described are indicated by like reference numerals followed by the reference letter *"c."*

As illustrated in FIGURES 10 and 11, the control shaft **78***c* is movably mounted in an aperture **128** passing through the base plate **21***c*, the control shaft **78***c* when moved to the left from the position illustrated in FIGURE 10 to the position illustrated in FIGURE 11 causing operation of the timer motor **74***c* and, thus, operation of the program system.

In particular, the control shaft **78***c* has a pair of annular channels **129** and **130** formed therein adapted to respectively receive a snap ring **131** carried by the base plate **21***c*. For example, when the control shaft **78***c* is disposed in the position illustrated in FIGURE 10, the snap ring **131** is received in the annular channel **129** thereof and holds the control shaft **78***c* in that position whereby the timer motor **74***c* is not operating in the manner hereinafter described.

However, when the operator pushes the control shaft **70***c* inwardly toward the base plate **21***c*, the snap ring **131** is received in the annular channel **130** thereof to hold the control shaft **78***c* in the position illustrated in FIGURE 11 to cause operation of the program system in a manner hereinafter described.

As illustrated in FIGURE 11, a master vacuum operated switch **132** is carried by the base plate **21***c* and comprises a pair of switch blades **133** and **134** respectively carried in insulated relation on a post **135** of the base plate **21***c*, the switch blade **133** having an electrical contact **136** cooperable with an electrical contact **137** carried by the switch blade **134**.

When the contacts **136** and **137** are disposed in engagement with each other, electrical current is adapted to flow to the entire electrical circuitry of the system controlled by the programmer **127** as well as to the timer motor **74***c* to cause movement of the reading element **67***c* in a manner previously described.

However, when the contacts **136** and **137** are separated from each other in a manner hereinafter described, electrical current to the electrical circuitry is terminated, whereby the timer motor **74***c* ceases to operate and the program system is disposed in its "off" position.

As illustrated in FIGURE 11, a lever **138** is fulcrumed to the base plate **21***c* at a point **139** whereby the lever **138** is adapted to rock about the point **139** in a manner hereinafter described.

The end **140** of the lever **139** is operatively interconnected to the free end of the switch blade **133** so that when the lever is rocked about the fulcrum point **139** in a counterclockwise direction, the lever **138** separates the contacts **136** and **137** to dispose the program system in its "off" position.

The other end **141** of the lever **138** is operatively interconnected to a flexible diaphragm **142** by a post **143** in the manner previously described, the flexible diaphragm **142** cooperating with a cavity **144** in the base plate **21***c* to define a chamber **145** therebetween which is adapted to have a vacuum imposed in the same by the reading element **67***c* in the manner previously described.

The control shaft **78***c* has an end **146** passing through a suitable aperture **147** formed in the lever **138** for a purpose now to be described.

When the control shaft **78***b* is moved from the position illustrated in FIGURE 11 to the position illustrated in FIGURE 10, the natural resiliency of the diaphragm **142** pulls the lever **138** in a counterclockwise direction about the pivot or fulcrum point **139** to follow the new position of the end **146** of the control shaft **78***c* whereby the end **140** of the lever **138** moves upwardly and separates the contacts **136** and **137**. Thus, it can be seen that when the control shaft **78***c* is disposed in the "off" position illustrated in FIGURE 10, the electrical switch **132** is opened and remain open to terminate the operation of the program system.

However, when the control shaft **78***c* is pushed inwardly relative to the base plate **21***c* by the operator, the end **146** of the control shaft **78***c* moves upwardly to the position illustrated in FIGURE 11 to cause rocking movement of the lever **138** about the fulcrum **139** in a clockwise direction about the fulcrum **139** to permit the switch contacts **136** and **137** to be disposed in electrical engagement in the manner illustrated in FIGURE 11, whereby the control system is in its "on" position.

As the reading element **67***c* moves relative to the base plate **21***c* by means of the timer motor **74***c* and the end of the particular operating cycle of the programmer **127** is reached, it is desired that the programmer **127** be automatically returned to its "off" position.

When such a condition is reached, the reading element **67***c* interconnects the vacuum source to the chamber **145** and causes the diaphragm **142** to be drawn toward the base plate **21***c*, whereby the lever **138** moves in a counterclockwise direction about the pivot point **139** and moves the control shaft **78***c* from the "on" position illustrated in FIGURE 11 to its "off" position illustrated in FIGURE 10 while simultaneously opening the contacts **136** and **137** of the electrical switch **132** to completely terminate the operation of the programmer **127** and hold the same in its "off" position by means of the snap ring **131** even though the chamber **145** subsequently returns to its normal atmospheric condition.

When the programmer **127** has been returned to its "off" position in the automatic manner set forth above, it is also desired that the entire vacuum system of the programmer **127** be returned to its normal atmospheric condition.

Therefore, a passage **148** is formed in the base plate **21***c* and is interconnected to the vacuum system so that should the passage **148** be opened the entire vacuum system is returned to its normal atmospheric condition.

The passage **148** is adapted to be closed by a rubber grommet type valve **149** carried by the lever **138** when

the lever **138** is disposed in its "on" position, as illustrated in FIGURE 11.

However, when the control shaft **78***c* is returned automatically to its "off" position by the flexible diaphragm **142**, the lever **138** rocks in a counterclockwise direction about the pivot point **139** to cause the valve **149** to move away from the passage **148** to dump the vacuum at the same time it opens the contacts **136** and **137** of the electric switch **132**.

Thus, it can be seen that the programmer **127** of this invention provides means for not only automatically turning off the electrical circuitry of the programmer when the particular program of the reading element **67***c* has been completed, but also the programmer **127** automatically terminates the vacuum in the system thereof when the programmer **127** is automatically turned to the "off" position thereof.

Another programmer of this invention is generally indicated by the reference numeral **150** in FIGURE 12 and parts thereof similar to the programmer **20** previously described are indicated by the like reference numerals followed by the reference letter "*d*."

As illustrated in FIGURE 12, the base plate **21***c* has a vacuum operated electrical switch **151** carried thereby and comprising three switch blades **152**, **153** and **154** respectively and insulatedly carried on a post **155'** of the base plate **21***d*.

Electrical contacts **155**, **156** and **157** are respectively carried by the switch blades **152**, **153** and **154**, the contact **156** of the intermediate switch blade **153** being adapted to cooperate with the contacts **155** and **157** of the outboard switch blades **152** and **154** in a manner hereinafter described.

For example, the programmer **150** can be utilized to control the operation of a domestic washing machine or the like wherein it is desired to operate the clothes tub at two different agitating spin speeds. Thus, when the contacts **155** and **156** are disposed in electrical contact with each other, the same energize a suitable motor to cause the clothes tub to agitate or spin at a particular speed. However, when the switch contacts **156** and **157** are disposed in electrical contact, the motor operates the clothes tub at a different speed whereby a two speed operation is provided by the electrical switch **151** which is operated in a manner now to be described.

As illustrated in FIGURE 12, a pair of flexible diaphragms **158** and **159** are respectively carried by the base plate **21***d* and cooperate therewith to define chambers **160** and **161** adapted to be selectively interconnected to a vacuum source by passage means **162** and **163** under the control of a reading element in the manner previously described.

A pivot post **164** extends rearwardly from the base plate **21***d* and passes through a suitable aperture in a lever **165** to provide a fulcrum point for the lever **165**.

The lever **165** is respectively interconnected to the flexible diaphragms **158** and **159** by posts **166** and **167** in the manner previously described, the lever **165** having an arm **168** operatively interconnected to the free end of the intermediate switch blade **153**.

The operation of the programmer **150** will now be described.

When the control knob of the programmer **150** is rotated to the desired position to determine the particular cycle of the washing machine required as well as the agitation or spin speed thereof, the reading element, at the proper time, will close the switch **151** to effect the proper motor speed.

For example, should a low motor speed be selected, the vacuum source will be interconnected to the chamber **160** to cause the flexible diaphragm **58** to be drawn toward the base plate **21***d* and cause the lever **165** to move in a counterclockwise direction about the fulcrum point **164** and close contacts **155** and **156**.

Alternately, if the other motor speed has been selected, the vacuum source is interconnected to the chamber **161** to cause the flexible diaphragm **159** to be drawn toward the base plate **21***d* and thus cause clockwise movement of the lever **165** about the fulcrum point **164**, whereby the contacts **156** and **157** are brought into electrical contact.

Therefore, it can be seen that a unique switching mechanism is provided for the programmer **150** to produce two different motor speeds in a domestic washing machine or the like.

However, it is to be understood that the embodiment illustrated in FIGURE 12 is not to be limited to a control for a domestic washing machine or the like, as the same can be utilized to control other apparatus as desired.

Therefore, it can be seen that this invention provides improved pneumatic programmers for various apparatus as well as to improved parts and to methods for making such parts or the like.

While the form of the invention now preferred has been disclosed as required by the statutes, other forms may be used, all coming within the scope of the claims which follow.

What is claimed is:

1. A vacuum operated electrical switch comprising a base plate having opposed surfaces, a cup-shaped flexible diaphragm having its outer periphery secured to one of said surfaces of said base plate to define a chamber between said diaphragm and said one surface of said base plate to be selectively interconnected to a vacuum source, a first switch blade carried by said one surface of said plate outboard of said diaphragm and having a first contact, a second switch blade carried by said one surface of said plate outboard of said diaphragm and having a second contact cooperable with said first contact, and means operatively interconnecting said second switch blade to said diaphragm to cause relative movement between said contacts when said diaphragm is flexed toward said member by said vacuum source.

2. A switch as set forth in claim **1** wherein said base plate carries a reading head on the other surface thereof.

3. A switch as set forth in claim **1** wherein said base plate has a cavity formed in said one surface thereof and cooperating with said diaphragm to define said chamber.

4. A switch as set forth in claim **1** wherein said contacts are normally opened and wherein a switch blade post extends from said one surface of said base plate and carries said switch blades.

5. A switch as set forth in claim **1** wherein said contacts are normally closed and wherein a switch blade post extends from said one surface of said base plate and carries said switch blades.

6. A switch as set forth in claim **1** wherein a third switch blade is carried by said one surface of said base plate and has a third contact cooperable with said second contact.

7. A switch as set forth in claim **1** wherein said last-named means includes a post extending from said diaphragm, said post being connected to said second switch blade.

8. A switch as set forth in claim **1** wherein said last-named means includes a fulcrumed lever.

9. An electrical switch comprising a base plate, a first switch blade carried by said plate and having a first contact, a second switch blade carried by said plate and having a second contact, a third switch blade carried by said plate and having a third contact cooperable with said first and second contacts, a first expansible and contractible element carried by said first switch blade and operatively interconnected to said third switch blade, a second expansible and contractible element carried by said second switch blade and operatively interconnected to said third switch blade, means for contracting said first element to cause engagement between said third contact and said first contact, and means for contracting said second element to cause engamement between said third contact and said second contact.

10. A switch as set forth in claim 9 wherein said elements are flexible diaphragms and are vacuum operated.

11. A switch as set forth in claim 9 wherein said switch blades are disposed in aligned relation.

12. A vacuum operated electrical switch comprising a base plate, a first flexible diaphragm carried by said plate and defining a first chamber therebetween adapted to be selectively interconnected to a vacuum source, a second flexible diaphragm carried by said plate and defining a second chamber therebetween adapted to be selectively interconnected to said vacuum source, a first switch blade carried by said plate and having a first contact, a second switch blade carried by said plate and having a second contact, a third switch blade carried by said plate and having a third contact cooperable with said first and second contacts, and a lever operatively interconnected to said third switch blade and fulcrumed to said base plate, said lever being operatively interconnected to said first and second diaphragms whereby said lever moves said third contact into engagement with said first contact when said first diaphragm is drawn toward said base plate by said vacuum source and moves said third contact into engagement with said second contact when said second diaphragm is drawn toward said base plate by said vacuum source.

13. A switch as set forth in claim 12 wherein said lever is fulcrumed to said base plate at a point disposed between said diaphragms.

14. A switch as set forth in claim 12 wherein said switch blades are disposed in aligned relation.

15. In combination, a base plate, a flexible diaphragm carried by said base plate and defining a chamber therebetween to be selectively interconnected to a vacuum source, a first switch blade carried by said base plate and having a first contact, a second switch blade carried by said base plate and having a second contact cooperable with said first contact, a lever fulcrumed on said base plate and being operatively interconnected to said diaphragm and to said first switch blade, and a movable control shaft carried by said base plate and operatively interconnected to said lever, said control shaft when in one position thereof permitting said diaphragm to open said switch contacts and said control shaft when in other position thereof causing said lever to close said switch contacts.

16. A combination as set forth in claim 15 wherein said lever controls a dump valve for said vacuum source.

17. A combination as set forth in claim 15 wherein said diaphragm moves said shaft from said other position thereof to said one position thereof when said diaphragm is drawn toward said base plate by said vacuum source.

18. A combination as set forth in claim 15 wherein a dump valve for said vacuum source is carried by said lever and opens when said control shaft is in said one position thereof.

19. A combination as set forth in claim 15 wherein said control shaft is disposed between said diaphragm and the fulcrum point of said lever.

References Cited

UNITED STATES PATENTS

2,950,421	9/1960	Langstroth	200—83 XR
3,049,602	9/1962	Flatt et al.	200—83
3,049,603	9/1962	Flatt et al.	200—83
3,189,704	6/1965	Beck	200—83

ROBERT K. SCHAEFER, *Primary Examiner.*

H. BURKS, *Assistant Examiner.*