United States Patent

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[72] Inventors **Roland D. Beck**
Anaheim;
Harold W. Rice, Fullerton, Calif.

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[45] Patented **Feb. 9, 1971**

[73] Assignee **Robertshaw Controls Company**
Richmond, Va.
a corporation of Delaware

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[54] **PNEUMATIC PROGRAMMING MEANS AND THE LIKE**
7 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **137/624.18;** 91/36
[51] **Int. Cl.** **G05b 19/44**
[50] **Field of Search** 137/624.18, 624.2, 625.11; 91/36

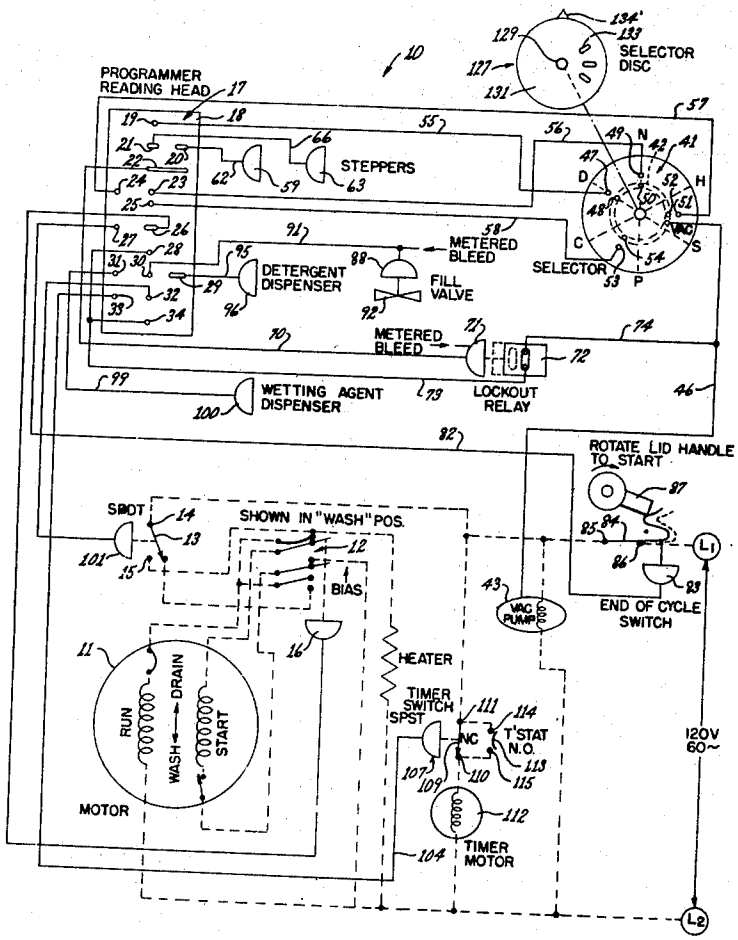
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Primary Examiner—Alan Cohan
Attorneys—Auzville Jackson, Jr., Robert L. Maruen and Candor, Candor & Tassone

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ABSTRACT: This disclosure relates to a program member that is rotated relative to a reading head to fluidly interconnect together various ports interrupting the reading surface of the reading head by a timer motor and that is rapidly rotated relative to the reading head by a pair of pneumatically operated actuators to override the timer motor with such overriding actuators being controlled by the program member itself, the disclosure also relating to a selector valve being mounted on the same plate that forms the reading head and to various shapes and combinations of channel means formed in the program member for interconnecting various ports of the reading head together.



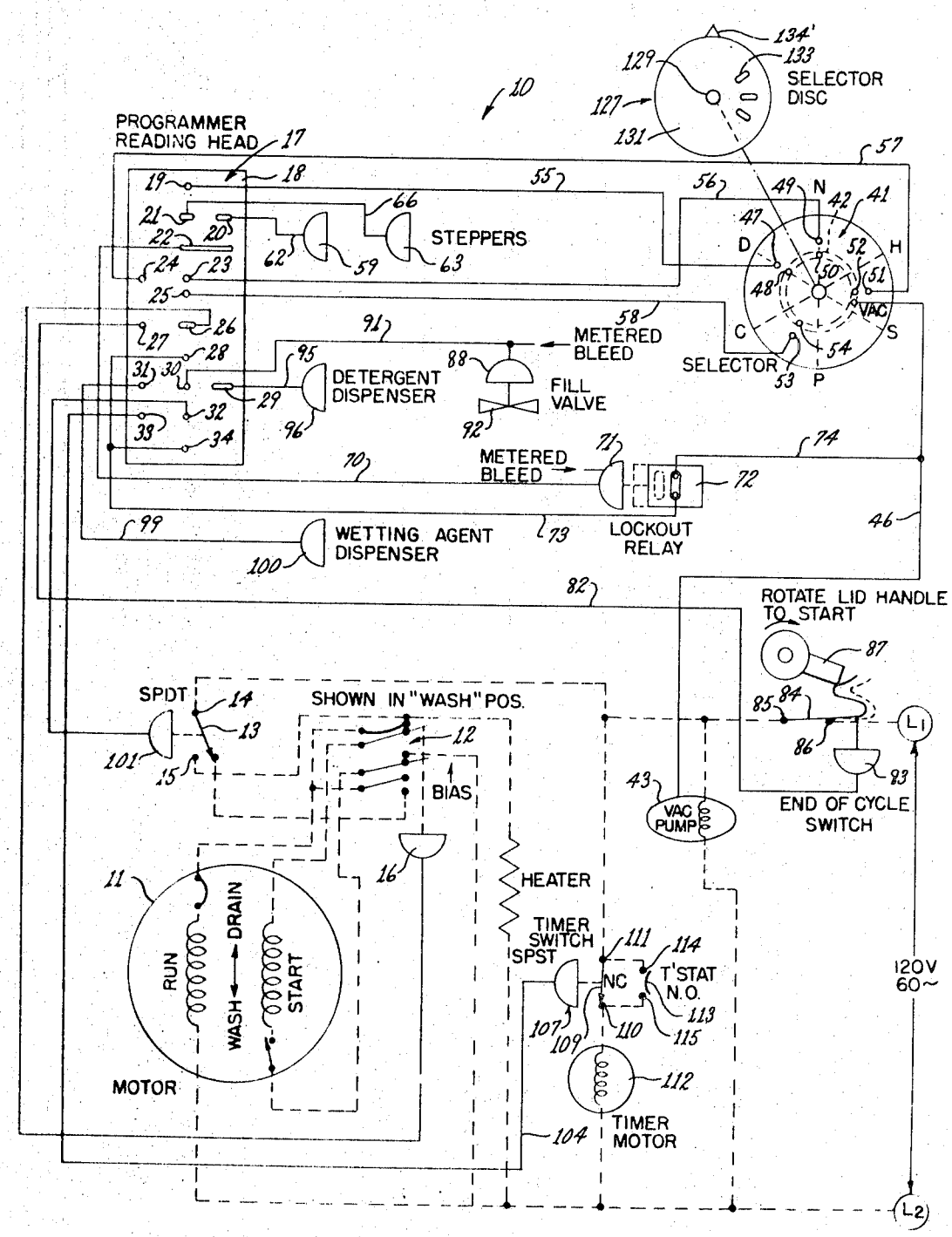


FIG.1

INVENTORS
ROLAND D. BECK
HAROLD W. RICE

Cowden & Cowden
THEIR ATTORNEYS

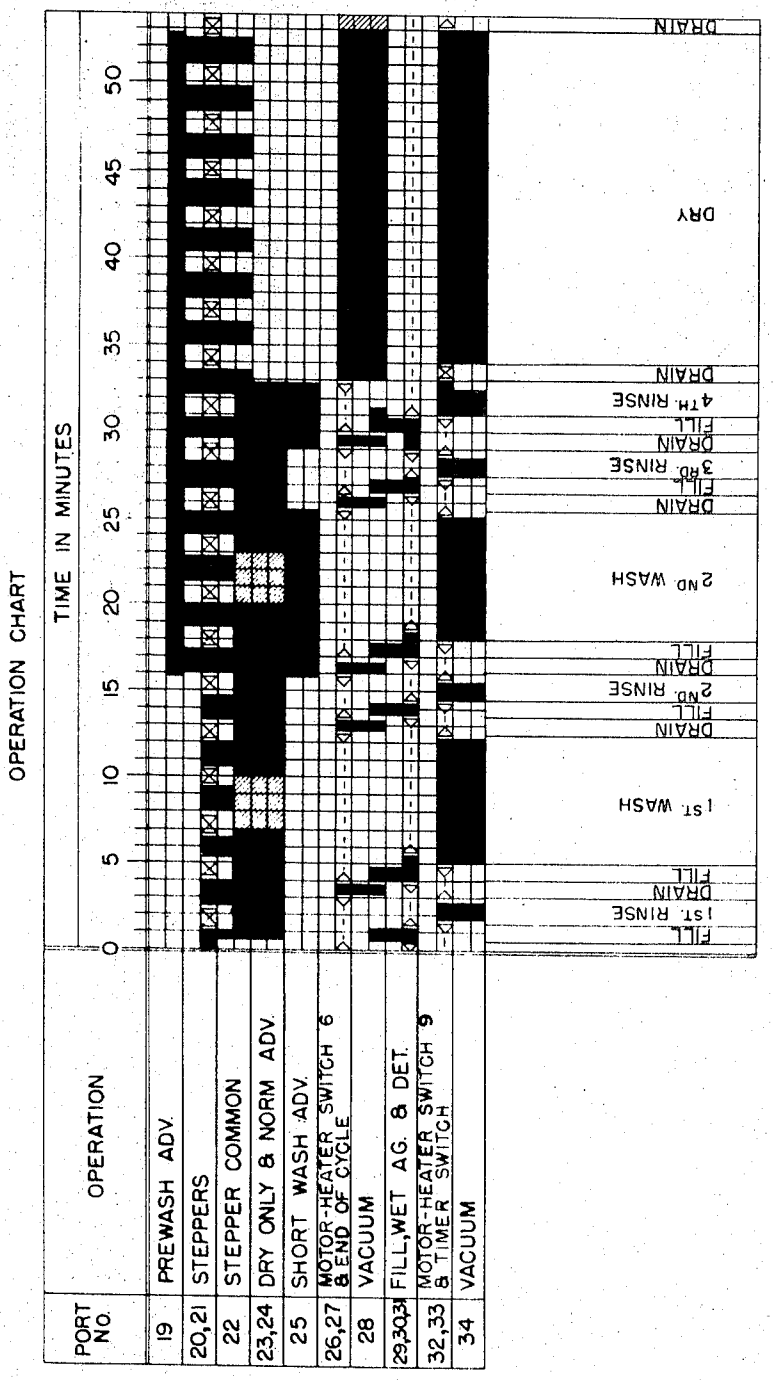


FIG. 2

INVENTORS
ROLAND D. BECK
HAROLD W. RICE

Cowden & Cowden

THEIR ATTORNEYS

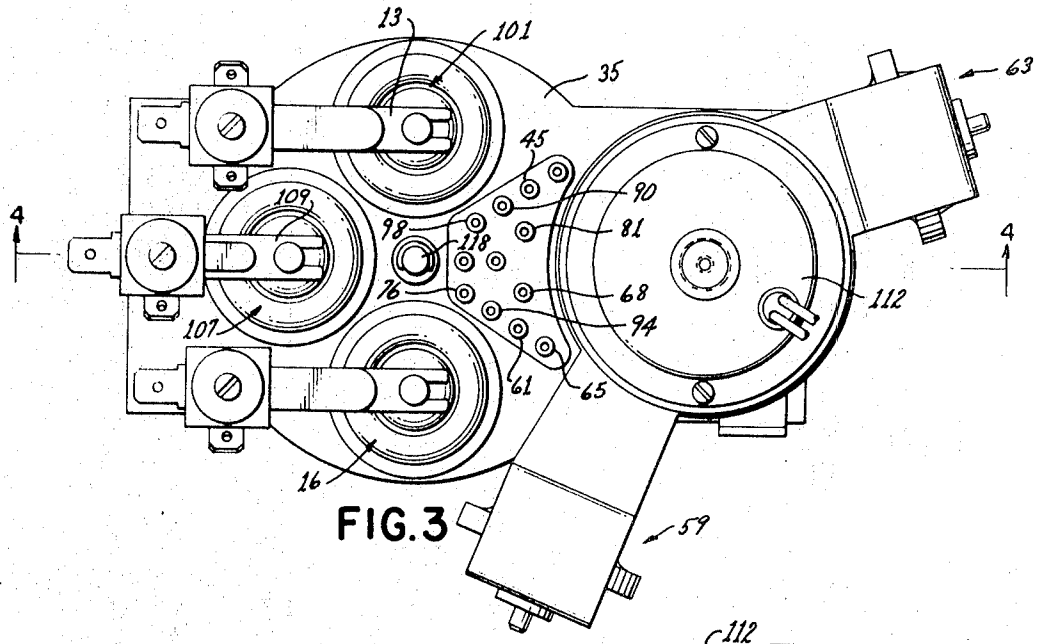


FIG.3

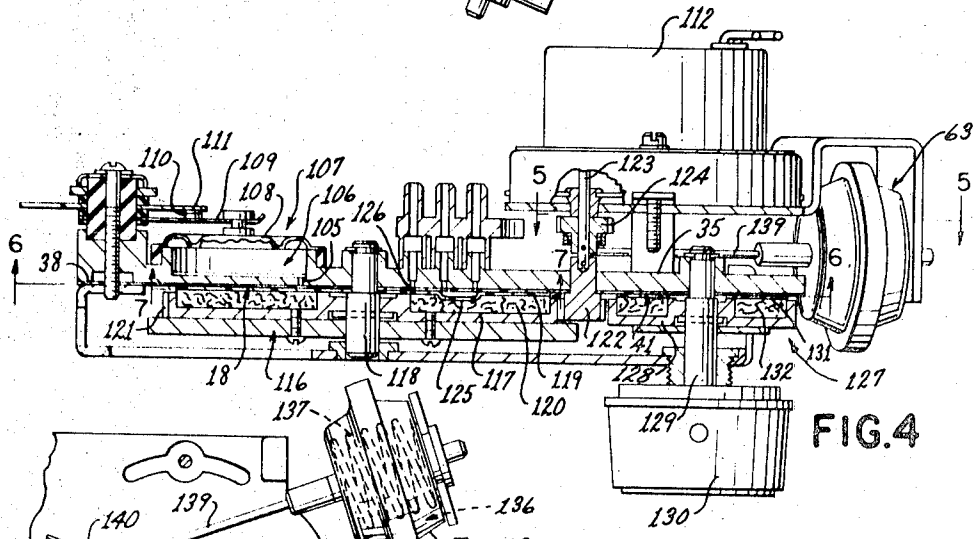


FIG.4

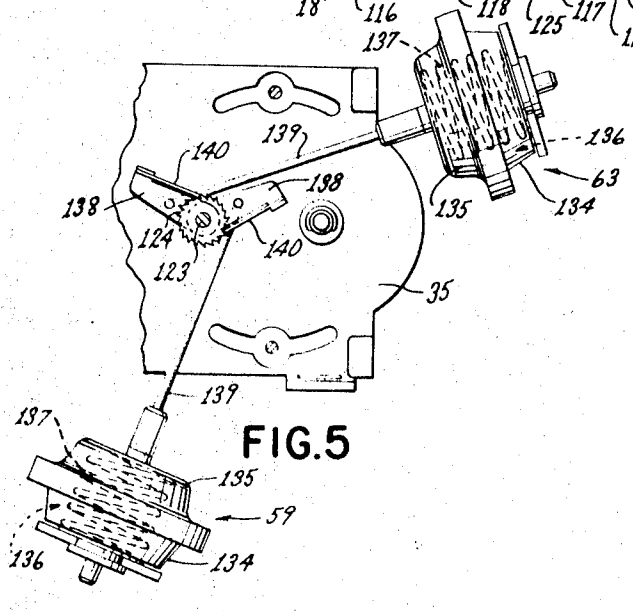


FIG.5

INVENTORS
ROLAND D. BECK
HAROLD W. RICE

Candor & Candor

THEIR ATTORNEYS

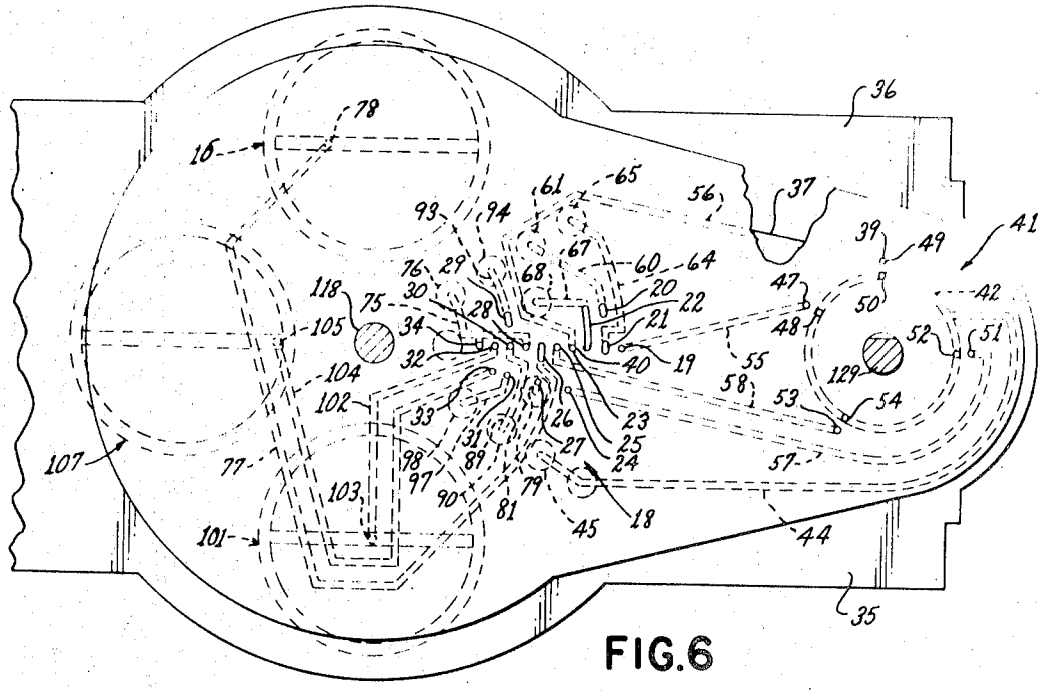


FIG.6

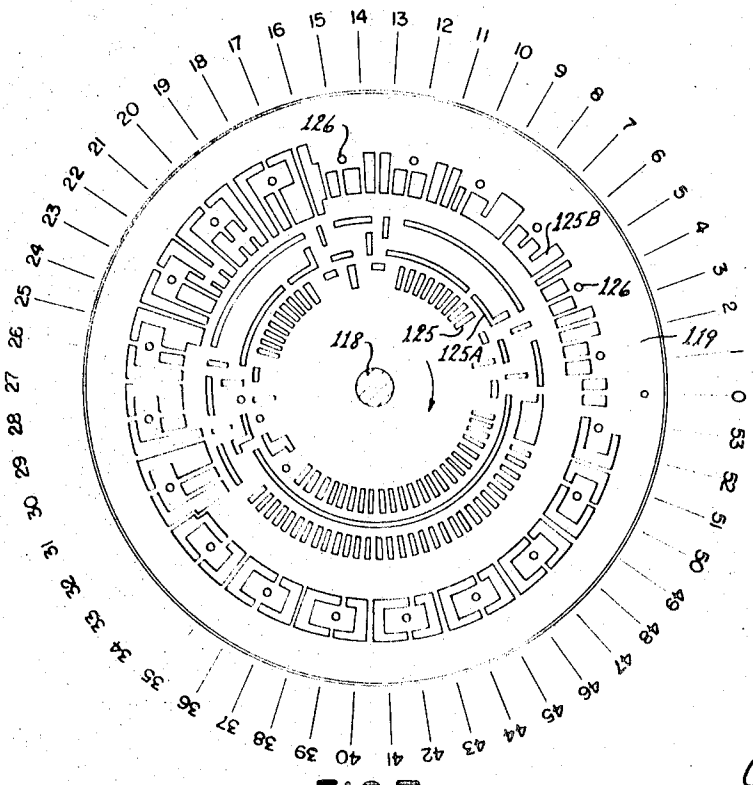


FIG.7

INVENTORS
ROLAND D. BECK
HAROLD W. RICE

Cowden & Cowden
THEIR ATTORNEYS

PNEUMATIC PROGRAMMING MEANS AND THE LIKE

This application is a divisional patent application of its copending parent patent application, Ser. No. 437,169, filed Mar. 4, 1965, now U.S. Pat. No. 3,417,663 and is assigned to the same assignee to whom the parent application is assigned. This invention relates to an improved pneumatic programming means wherein a system for an appliance or the like can be pneumatically controlled.

In particular, this invention provides a programming means which is a small compact unit while still providing a large member of system functions or operations in a manner heretofore unattainable in the prior art.

For example, one feature of this invention is to provide pneumatic steppers for rapidly advancing a main program member in a direction overriding the conventional timer motor therefor to simply and effectively eliminate portions of the program of the program member as selected. The stepping unit is relatively small in size and can utilize essentially the same space as the timer motor whereby the programming means of this invention is kept relatively small.

Another feature of this invention is to provide a selector valve arrangement for selecting the desired program of the main program member with the selector valve utilizing the same program plate as the main program member.

Another feature of this invention is to optimize blister shapes and combinations in the main program member to reduce the size requirements of the program member and, hence, the programming means itself.

Another feature of this invention is to provide means for mounting the various pneumatically operated switch actuators on the program plate itself to reduce the size of the switch assembly for the appliance or the like.

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

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

FIG. 1 is a schematic diagram illustrating the improved system of this invention.

FIG. 2 is a flow diagram illustrating the sequence of operation of the system illustrated in FIG. 1.

FIG. 3 is a top view of the improved programming means of the this invention.

FIG. 4 is a cross-sectional view of the programming means of FIG. 3 and is taken on line 4–4 thereof.

FIG. 5 is a fragmentary, cross-sectional view taken on line 5–5 of FIG. 4.

FIG. 6 is an enlarged, fragmentary cross-sectional view taken substantially on the line 6–6 of FIG. 4 and illustrates the reading heads for the main program member and the selector valve member.

FIG. 7 is a fragmentary, cross-sectional view taken substantially on line 7–7 of FIG. 4 and illustrates the blister arrangement on the program tape for the main program member.

While the various features of this invention are hereinafter described as illustrated as being particularly adaptable to provide a miniature programming means for a dishwasher or the like, it is to be understood that the various features of this invention can be used singly or in any combination thereof to provide programming means for other devices 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 FIG. 1, an improved system for controlling the operation of a domestic dishwasher is generally indicated by the reference numeral 10 and will now be described.

The system 10 includes a conventional electrical motor 11 adapted to be placed across leads L_1 and L_2 in a manner hereinafter described so that when the electrical switch means 12 is disposed in the position illustrated in FIG. 1 and a movable switch blade 13 bridges contacts 14 and 15, the motor 11 will operate the impeller of the dishwasher. However, when the switch structure 12 has the switch blades thereof pulled downwardly upon the evacuation of a vacuum-operated actuator 16 and the switch blade 13 is disposed in the position illustrated in full lines in FIG. 1, the motor 11 operates a drain pump in the dishwasher for a purpose hereinafter described.

A reading head 17 is schematically illustrated in FIG. 1 and has the reading surface 18 thereof interrupted by a plurality of ports 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33 and 34 for a purpose hereinafter described. The ports 19, 21, 22, 23, 25, 26, 28, 30, 32 and 34 are disposed in vertical alignment while the port 20 is disposed in horizontal alignment with the vertically aligned port 21, the port 24 being horizontally aligned with the vertically aligned port 23, the port 27 being horizontally aligned with the vertically aligned port 26, the ports 29 and 31 being horizontally aligned with the vertically aligned port 30 and the port 33 being horizontally aligned with vertically aligned port 32 for a purpose hereinafter described.

The reading head 17 illustrated in FIG. 1 is an integral part of a plate member 35 illustrated in FIGS. 3,4 and 6. The plate 35 has the surface 36 thereof provided with a plurality of grooves 37 leading from various parts of the surface 36.

For example, the groove 37 leads from a point 39 on the plate 35 to a point 40.

After all of the grooves have been formed in the surface 36 of the plate 35, a self-sealing tape member 38 or the like is superimposed on the surface 36 of the plate 35 to cover the grooves 37. However, the tape member 38 has openings passing therethrough and aligned with the grooves 37 in such a manner that the openings in the tapelike member 38 define the ports 19—34 previously described whereby the surface of the tape 38 in the region of the ports 19—34 provides the reading surface 18 previously described.

The tape 39 38 cooperates with the plate 35 to define another reading surface 41 as illustrated in FIGS. 6 and 1 and is defined by a circular groove 42 interconnected to the inlet of a vacuum pump 43 by groove means 44 interconnected to a nipple 45 carried by the plate 35 and interconnected to the pump fluid by flexible conduit means 46.

The tape 38 defines a plurality of ports 47, 48, 49, 50, 51, 52, 53 and 54 with the ports 48, 50, 52 and 54 each being in fluid communication with the vacuum source groove 42 for a purpose hereinafter described.

The port 47 of the reading head 41 is interconnected to the port 19 of the reading surface 18 by the groove 55. The port 49 of the reading surface 41 is interconnected to the port 23 of the reading surface 18 by a groove 56. The port 51 of the reading surface 41 is interconnected to the port 24 by a groove 57. The port 53 of the reading surface 41 is interconnected to the port 25 of the reading surface 18 by a groove 58.

The port 20 of the reading surface 18 is interconnected to a vacuum-operated actuator 59 by groove means 60, nipple means 61 and flexible conduit means 62. The port 21 of the reading surface 18 is interconnected to a vacuum-operated actuator 63 by a groove means 64, nipple 65 and flexible conduit means 66.

The port 22 of the reading surface 18 is interconnected by groove means 67, nipple means 68 and flexible conduit means 70 to a vacuum-operated actuator 71 which when in an atmospheric condition causes a valve member 72 to interconnect the flexible conduit 73 to a flexible conduit 74. However, when the actuator 71 is evacuated, the valve member 72 is moved to the dotted line position illustrated in FIG. 1 to prevent communication between the conduits 73 and 74, the conduit 74 leading to the vacuum source conduit 46 while the conduit 73 is interconnected to the ports 28 and 34 of the reading surface 18 by groove means 75 and nipple means 76.

Port 26 of the reading surface 18 is interconnected to the vacuum-operated actuators 16 by means of groove 77 leading to a port 78 passing through the plate 35 and being interconnected to the chamber of the actuator 16 mounted thereon as illustrated in FIG. 3.

The port 27 of the reading surface 18 is interconnected by groove means 79, nipple means 81 and flexible conduit means 82 to a chamber of a vacuum-operated actuator 83, the actuator 83 being interconnected to a flexible switch blade 84 placed in the line L_1.

The switch blade 84 is adapted to bridge the switch contacts 85 and 86 when the lid handle 87 of the dishwasher is rotated in a clockwise direction to start the operation of the dishwasher. However, when the actuator 83 is evacuated in the manner hereinafter described, the blade 84 is pulled further downwardly to the dotted line position illustrated in FIG. 1 whereby the lid handle returns to its off position but the contacts 85 and 86 are still bridged by the blade 84 because of the evacuated actuator 83. Subsequently, when the actuator 83 is returned to atmospheric conditions, the switch blade 84 can be moved to the open position to turn off the system 10 in a manner hereinafter described.

The port 30 of the reading surface 18 is interconnected to a vacuum-operated actuator 88 by groove means 89, nipple means 90 and flexible conduit means 91, the actuator 88 being adapted when evacuated to operate a water fill valve 92 for the dishwasher and, when returned to atmospheric conditions, to close the valve 92.

The port 29 of the reading surface 18 is interconnected by groove means 93, nipple means 94 and flexible conduit means 95 to a vacuum-operated actuator 96 which controls the dispensing of the detergent into the dishwasher when the actuator 96 is evacuated.

The port 31 of the reading surface 18 is interconnected by groove means 97, nipple means 98 and flexible conduit means 99 to a vacuum-operated actuator 100 which is adapted to dispense a wetting agent into the dishwasher when the actuator 100 is evacuated.

The port 32 of the reading surface 18 is interconnected to a vacuum-operated actuator 101 by groove means 102 leading to a port 103 in the plate 35 and interconnected to the chamber of a vacuum-operated actuator 101 mounted on the plate 35 in the manner illustrated in FIG. 3. The actuator 101 is interconnected to the switch blade 13 to bridge the contacts 14 and 15 when the actuator 101 is evacuated and to return the switch blade 13 to the position illustrated in FIG. 1 when the chamber of the actuator 101 is returned to atmospheric conditions.

The port 33 in reading surface 18 is interconnected by groove means 104 to a port 105 in the plate 35 to be interconnected to the chamber 106 of a vacuum-operated actuator 107 in the manner illustrated in FIG. 4. The actuator 107 includes a flexible diaphragm 108 interconnected to a switch blade 109 normally holding contacts 110 and 111 in contact with each other. However, when the chamber 106 of the actuator 107 is evacuated, the diaphragm 108 is pulled downwardly to break electrical contact between the contacts 110 and 111 until atmospheric conditions again exist in the chamber 106.

The contacts 110 and 111 when bridged by the switch blade 109 places a timer motor 112 across the leads L_1 and L_2 for a purpose hereinafter described.

In addition, the timer motor 112 is adapted to be placed across the leads L_1 and L_2 by a there there thermostatically controlled normally open switch blade 113 which will bridge contacts 114 and 115 when the thermostat senses a certain temperature in the dishwasher whereby the timer motor 112 will be placed across the leads L_1 and L_2 even if the switch blade 109 is opened at this time.

A program means 116 is adapted to be rotated relative to the reading surface 18 and comprises a rigid backing plate 117 rotatably mounted to the plate 35 by shaft means 118, the plate means 117 being interconnected to a flexible reading sheet 119 and being spaced therefrom by a porous resilient material 120.

The backing member 117 has an annular ring gear means 121 disposed in meshing relation with a pinion gear means 122 rotatably mounted to the plate 35 and being it interconnected to a shaft 123. The shaft 123 is interconnected by means of a one-way clutch to the output shaft of the timer motor 112 carried by the plate 35.

The shaft 123 also carries a pinion gear 124 fixed thereto whereby the pinion gear 124 a can rotate the pinion gear 122 at a rate faster than the motor 112 for a purpose hereinafter described because the motor 112 is interconnected to the shaft 123 by a one-way clutch which permits such overriding movement of the pinion 124 for a purpose hereinafter described.

The reading sheet 119 of the program means 116 has a plurality of open ended channels or blisters 125 formed therein in the pattern illustrated in FIG. 7 and also has a plurality of aperture means 126 passing therethrough, the aperture means 126 either comprising small holes or elongated channels interrupted by a hole for a purpose hereinafter described.

The reading sheet 119 illustrated in FIG. 7 is adapted to be superimposed on the reading surface 18 illustrated in FIG. 6 with the reading sheet 119 being rotatable in a clockwise direction to perform the sequence of the operation of the system 10 in a manner hereinafter described. However, in viewing FIG. 1, the reading sheet moves relative to the reading surface 18 from right to left as fully illustrated in FIG. 2 to produce the functions hereinafter described.

As illustrated in FIGS. 1 and 4, and another program member 127 is provided and comprises a backup member 128 rotatably mounted to the plate 35 by shaft means 129 manually rotated by a selector knob 130. The backup member 128 is interconnected to a reading sheet 131 and is separated therefrom by a porous resilient material 132, the reading sheet 131 having a plurality of open ended blisters 133 in the manner illustrated in FIG. 1.

The selector knob 130 has an indicator 134' which is adapted to be disposed in the positions marked with D, N, H, S, P, and C in FIG. 1.

When the selector knob 130 is disposed in the position H, the blisters 133 thereof do not interconnect together any of the ports of the reading surface 41. When the selector knob 130 is disposed in the position N, the port 51 is interconnected to the port 52. When the knob 130 is disposed in the position S, the ports 53 and 54 are interconnected together by a blister 133. When the knob 130 is disposed in the position P, the ports 47 and 48 are interconnected together by a blister 133.

When the knob 130 is disposed in the position C, the ports 47 and 48 are interconnected by a blister 133 and the ports 49 and 50 are interconnected by a blister 133. When the knob 130 is disposed in the position D, the ports 49 and 50 are interconnected together by a blister 133.

As illustrated in FIG. 7, some of the blisters 125 of the reading sheet 119 are long and narrow for only bridging vertically aligned ports in the reading surface 18 while other of the blisters 125 are dog-legged or angled to at a certain times interconnect some of the vertical ports with some of the horizontally disposed ports in the reading head 18 for a purpose hereinafter described. Further, certain of the blisters 125 in the reading sheet 119 comprise a plurality of narrow vertical blisters interconnected together by a wide horizontal blister superimposed therein to perform functions in a manner hereinafter described.

As illustrated in FIG. 5, each actuator 59 and 63 comprises a fixed cup-shaped member 134 carried by the plate 35 cooperating with a flexible diaphragm 135 to define a chamber 136 therebetween, the flexible diaphragm 135 being urged to its "out" position as illustrated in FIGS. 5 by a compression spring 137 disposed in the chamber 136.

Each diaphragm 135 is interconnected to a link 138 rotatably mounted on the shaft 123 by a connecting rod 139. Each link 138 carries a ratchet or pawl finger 140 adapted to mesh with the teeth on the pinion gear 124 and rotate the pinion gear 124 in a program member advancing direction when the particular actuator 59 or 63 is evacuated. However when that evacuated actuator returns to atmospheric condition, the respective pawl 140 thereof moves back to a position

to perform a new bite when that particular actuator is again evacuated.

The blisters **125** on the reading sheet **119** are so constructed and arranged that when the selector knob **130** determines when the actuators **59** and **63** are to be operated, the actuators **59** and **63** operate in an alternate manner by having the vacuum interconnected to one of the actuators **59** and **63** while an aperture means in the program sheet **119** interconnects the atmosphere to the other actuator so that the actuator **59** and **63** operate in an alternate manner to rapidly advance the program member **116** relative to the reading surface **18** at a speed faster than the timer motor **112** to eliminate various functions in a manner hereinafter described.

The operation of the system **10** and the various features **2** of this invention will now be described.

The operator of the dishwasher **10** grasps the knob **130** and selects the desired performance for the dishwasher **10**. For example, if the operator moves the selector knob **130** to select the H position thereof for a heavy wash, it can be seen that no ports of the reading surface **41** are interconnected together by the blisters **133** of the program tape **131** whereby the dishwasher will accomplish the complete cycle set forth in FIG. **2**.

Thereafter, the operator rotates the lid handle **87** in a clockwise direction as illustrated in FIG. **1** to cause the switch blade **84** to bridge the contacts **85** and **86** to not only place the vacuum pump **43** across the leads L_1 and L_2 but also to the timer motor **112**.

Since the program sheet **119** is disposed at the O position illustrated in FIG. **7** and will rotate in a clockwise direction upon the operation of the timer motor **112**, it can be seen from FIG. **2** that the blisters **125** of the program sheet **119** alternately interconnect the ports **23** and **24** to the ports **20** and **21** while alternately interconnecting the atmosphere to the ports **21** and **20** by aperture means thereof so that the stepper actuators would rapidly advance the program means **116** if a vacuum source is interconnected to the port **23** by the selector knob **130** being disposed in the D position thereof for drying only or if a vacuum source is interconnected to the port **24** by the selector knob **130** being disposed in the N position thereof for normal operation only.

At the ½minute increment of movement of the program sheet **119**, blister means interconnect together the port **28** to the port **30** whereby the inlet of the vacuum pump **43** is interconnected to the actuator **88** to cause the actuator **88** to open the water valve **92** and direct water into the dishwasher for approximately a 1-minute increment.

After the minute and a half interval as illustrated FIG. **2**, aperture means **126** in the program member **119** interconnects the atmosphere to the port **30** to permit the water valve **92** to close. However, other blisters means interconnect the ports **32** and **34** together whereby the vacuum pump **43** is interconnected to the actuator **101** to cause the switch blade **13** to bridge the contacts **14** and **15** and permit the motor **11** to operate the impeller of the dishwasher to cause a first rinsing operation for an interval of approximately 1 minute. Thereafter, aperture means of the program member **119** returns the actuator **101** to atmospheric condition so that the blade **13** moves to the position illustrated in full lines in FIG. **1**.

Simultaneously, other blister means of the program member **119** interconnect the ports **28** and **26** together so that the inlet of the vacuum pump **43** is interconnected to the actuator **16** to cause the same to pull the switch **12** in its down position to cause the motor **11** to operate the drain pump to drain the water from the dishwasher.

As illustrated in FIG. **7**, an L-shaped blister **125A** moves across the reading surface **18** to not only bridge the vertically aligned ports **28** and **30** but also the horizontally aligned port **29** so that the vacuum source **43** is interconnected to the actuator **38** and the actuator **96** so the that when the water valve **92** is opened, the actuator **96** dispensed detergent into the dishwasher in preparation for the first wash thereof.

Thus, it can be seen that the dog-legged blisters in the program member **119** are adapted to not only interconnect together the vertically aligned ports of the reading head **17** but also certain of the horizontally aligned ports with certain of the vertically aligned ports to perform the two functions as previously described.

Thus, it can be seen that when the selector knob **130** is disposed in the H position thereof for heavy washing operation, the entire cycle of operation illustrated in FIG. **2** is accomplished without having the stepper actuators **59** and **63** operated as no vacuum is interconnected to the ports **23** and **24** by the selector program member **131**.

However, if a vacuum would be interconnected to one of the ports **23** or **24** or to both, it can be seen that the blister arrangement on h the program member **119** would be to alternately interconnect the vacuum source to the steppers **59** and **63** to rapidly advance the program member **119** throughout the desired distance thereof in an overriding manner over the motor **112** to eliminate functions as set forth in FIG. **2**.

During the rapid advance of the program member **116**, it can be seen that the blister means which interconnects the ports **23** or **24** to the ports **20** and **21** would also interconnect with the port **22** whereby the vacuum source would operate the actuator **71** and move the valve **72** to the dotted line position so that the vacuum pump **43** would not be interconnected to the ports **28** and **34** so that no operation would take place as blister means interconnect the ports **28** and **34** to other ports during the rapid advance of the program means **116**.

As fully illustrated in FIG. **7**, it can be seen that certain of the blisters **125** comprise dog legs and the like wherein the same are substantially L-shaped, C-shaped, E-shaped and the like. Further, it can be seen that certain of the blisters of the reading sheet **119** include a plurality of narrow, vertical, spaced blisters interconnected together by a wide horizontal blister superimposed thereon. For example, see blister **125B** wherein three vertical, spaced, narrow blisters are interconnected together by a wide horizontal blister superimposed thereon to define a substantially E-shaped blister **125B**.

By forming the blisters in the irregular shapes as illustrated in FIG. **7**, the program means of this invention can be made relatively small.

For example, dog-legged blisters, such as **125A**, can have the vertical portion thereof to control repetitive, accurately timed operations while the horizontal portion is used for one-time operations such as for dispensers.

The wide blister superimposed on the narrow blisters, such as blisters **125B**, permit the narrow blisters to interconnect together vertically aligned ports while the wide superimposed blister thereof connects together angularly disposed ports whereby one channel of the reading head **17** can send two signals.

Further, by offsetting certain of the ports of the reading head in horizontal alignment, one blister and exhaust port on the program tape **119** can be utilized for alternate ports in horizontal alignment.

By combining vacuum inputs at the selector valve of this invention, various program combinations can be created. For example, ports **47** and **49** of the reading head **41** separately provide "prewash" and "dry" only rapid advance signals to the steppers **59** and **63**. However, when combined by the control knob **130** being disposed in the "cancel" position thereof, they permit the rapid advance step actuators **59** and **63** to completely rapidly advance the program member to its off position regardless of the position of the program means **116**.

The rapid advance stepping actuators **59** and **63** can omit functions normally operated by the reading sheet **119**. For example, when port **53** of the reading head **41** is interconnected to the port **54**, the second wash and rinse operation as illustrated in FIG. **2** are omitted and at the increment **31** on the program member as illustrated in FIG. **7** the thermal delay provided by the timer switch port **33** to the actuator **107** is bypassed by the rapid advance action of the steppers **59** and **63**.

While grooving has been disclosed as a means for interconnecting together various ports on the reading head surface, it is to be understood that dog-legged blisters in the reading sheet **119** can be utilized for such purposes whereby the face tape **38** could be eliminated.

By mounting the various switching actuators, contacts and blades on the program plate **35** in the manner illustrated in FIGS. **3** and **4**, it can be seen that a plurality of functions can be accomplished in a minimum of space which would normally be required just for the program means itself.

Therefore, it can be seen that an improved programming means and parts thereof have been provided by this invention.

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.

We claim:

1. In combination, a reading head having a reading surface interrupted by a plurality of ports, certain of said ports being vertically aligned and another port being horizontally aligned with one of said vertical ports whereby said other port and said one port comprise a pair of horizontally aligned ports, a pneumatic source interconnected to at least one of said ports other than said pair of horizontally aligned ports, a program member movable relative to said reading surface and having open ended channels therein for interconnecting together certain po ts and having aperture means for interconnecting a the atmosphere to certain of said ports, a pair of actuators operatively interconnected to said program member for alternately moving said program member as said actuators are alternately actuated by being interconnected to said source, and means interconnecting said pair of horizontally aligned ports respectively to said actuators whereby certain of said channels of said program member can alternately interconnect a pneumatic source port to said pair of horizontally aligned ports leading respectively to said actuators as said program member moves relative to said reading surface.

2. A combination as set forth in claim **1** wherein an aperture means of said program member sequentially comes into alignment with said pairs of horizontally aligned ports.

3. A combination as set forth in claim **1** wherein certain of said channels in said program member are angled.

4. A combination as set forth in claim **1** wherein a second reading head is provided with a reading surface interrupted by a plurality of ports, certain of said ports of said second reading head being interconnected to certain ports of said first-named reading head to form pneumatic source ports thereof, means interconnecting said source to other of said ports of said second reading head, and a second program member for selectively interconnecting a source port of said second reading head to a certain port thereof to determine which port of said first-named reading head will be a source port for operating said pair of actuators.

5. In combination, a plate means having a first reading surface and a second reading surface each interrupted by a plurality of ports, a first movable program member carried by said plate means and having means to interconnect certain ports of said first reading surface together, a second movable program member carried by said plate means and having means to interconnect certain ports of said second reading surface together a port of said second reading surface being interconnected to a port of said first reading surface by a groove in said plate means, and a tape means covering said groove and having apertures therein defining said ports.

6. A combination as set forth in claim **5** wherein said plate means carries a timer motor moving said first program member relative to said first reading surface.

7. A combination as set forth in claim **5** wherein said second program member is manually movable real relative said second reading surface.

Port **26** of the readings surface **18** is interconnected to the vacuum-operated actuators **16** by means of groove **77** leading to a port **78** passing through the plate **35** and being interconnected to the chamber of the actuator **16** mounted thereon as illustrated in FIG. **3**.