United States Patent

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[54] **SELECTABLE MODE MULTIPUSHBUTTON SWITCH**
15 Claims, 10 Drawing Figs.

[52] **U.S. Cl.** ..... **318/252,** 200/5 E, 318/305, 318/351, 318/424, 318/443
[51] **Int. Cl.** **H02p 7/10**
[50] **Field of Search** ..... 318/251, 252, 351, 353, 424, 443; 200/5 E, 5 A

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ABSTRACT: A motor-driven appliance including a multipushbutton switch with permutatable control sliders and switches providing different speeds selectively in association with a mode control to provide either a continuous or a momentary run of the appliance when any of the speed selection pushbuttons is manually pressed. The mode control in one position returns the sliders to "OFF" position when a pushbutton is released that was being pressed, while in another position the sliders remain in a continuous run position when the pressed pushbutton is released. The mode is selected by varying the tension upon a spring which urges the return of sliders and pushbuttons to a predetermined position. The mode can be changed during operation of the liquidizer and can serve as a stop control.

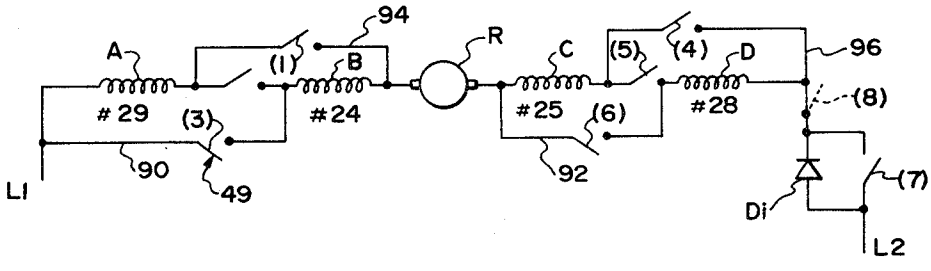
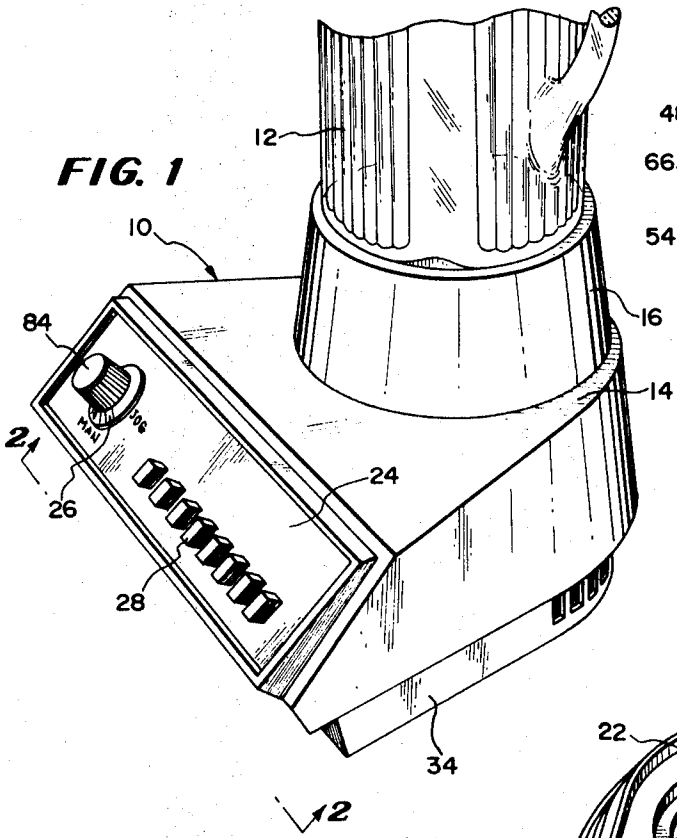


FIG. 1



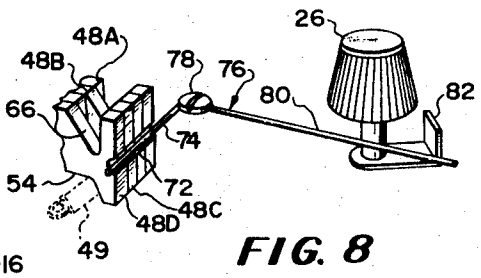


FIG. 8

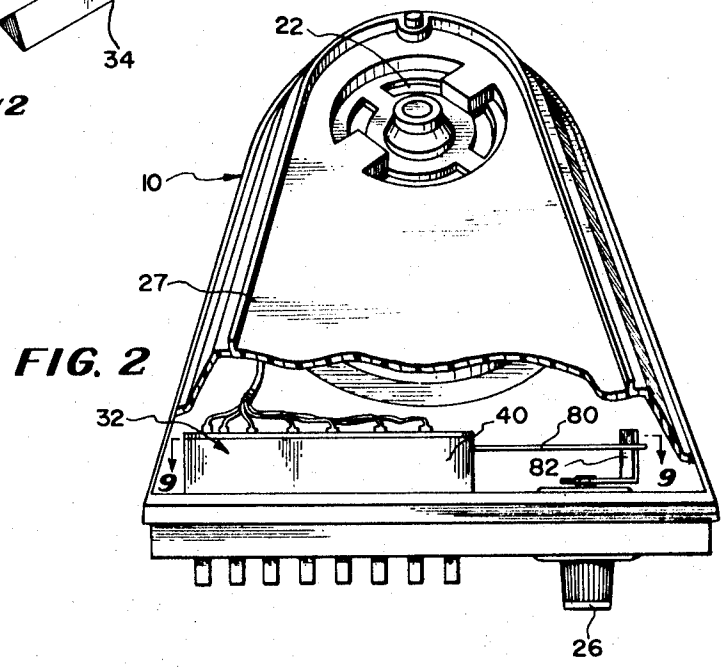


FIG. 2

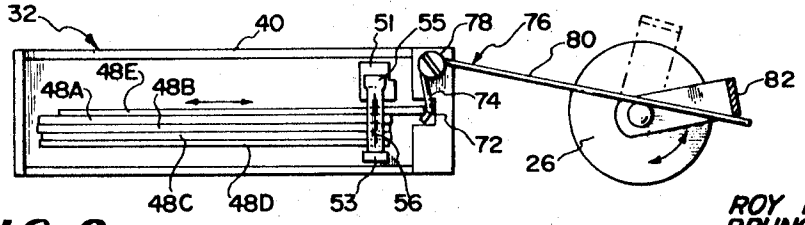


FIG. 9

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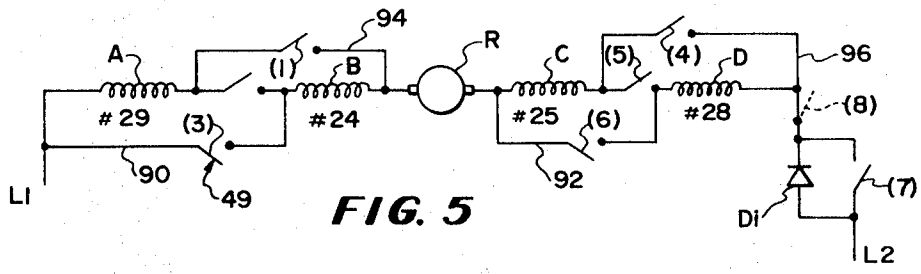


FIG. 5

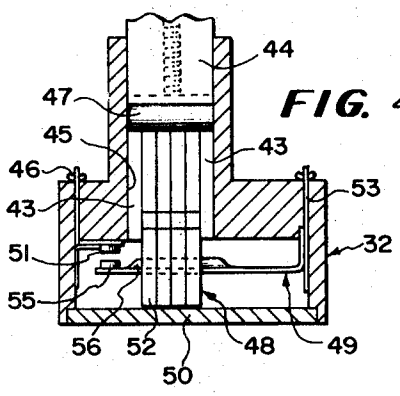
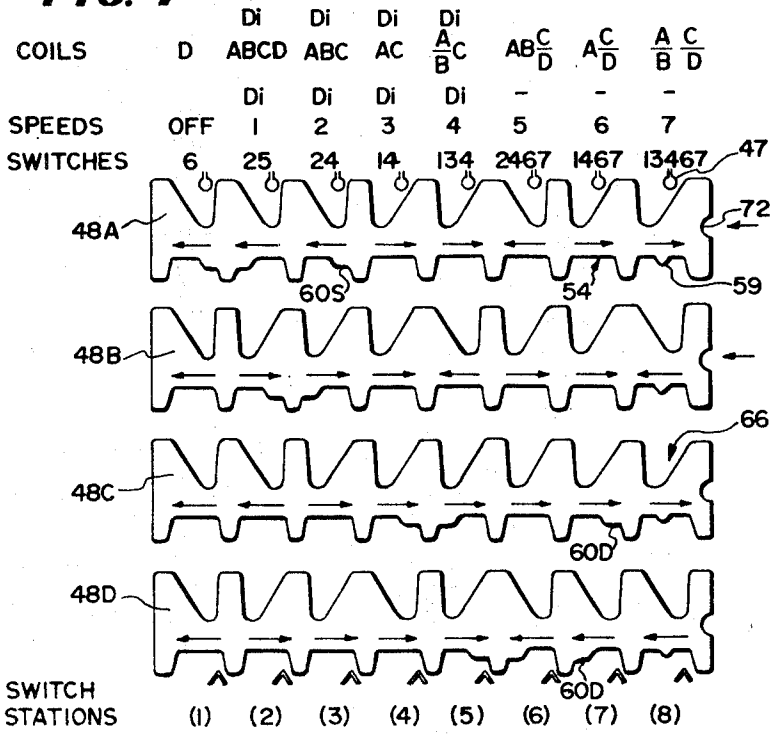


FIG. 4

FIG. 6

SPEEDS	COILS	SWITCHES
OFF	D	6
1	ABCD	25
2	ABC	24
3	AC	14
4	$\frac{A}{B}C$	134
5	$AB\frac{C}{D}$	2467
6	$A\frac{C}{D}$	1467
7	$\frac{A}{B}\ \frac{C}{D}$	13467

FIG. 7



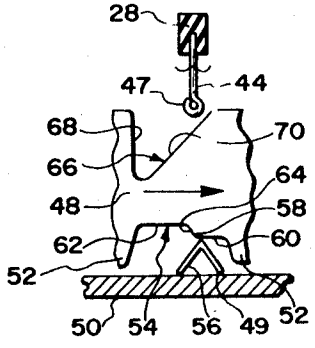
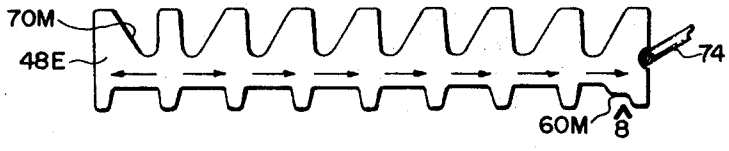


FIG. 3

FIG. 10



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SELECTABLE MODE MULTIPUSHBUTTON SWITCH

CROSS-REFERENCE

Swanke and Raymond, Ser. No. 813,957
Kelley et al., filed Oct. 15, 1969

BACKGROUND OF THE INVENTION

Although definiteness of timing, agitation speeds and volumes of ingredients have become increasingly important in recipes and formulas for desired optimum results when ingredients are being comminuted, mixed, homogenized or blended, generally referred to herein as liquidizing, occasion arises where the user, as a matter of economy or personal indulgence, or both, desires to use a liquidizer solely by manual control either in a continuous run mode or momentary run mode to accomplish particular results or vary them in accordance with the whims or experiments of the user. In brief, the users very often like to try new ideas and do things their own way with continuous run and momentary run modes actually at their fingertips.

SUMMARY OF THE INVENTION

In the present invention at least seven speeds in an eight-pushbutton permutatable slider switch are provided in combination with a diode for some of the speeds and each of these speeds are selectively available for either sustained operation or momentary operation of a liquidizer, a word used here to include blending, chopping, homogenizing and pulverizing with rotating blades.

The operation or mode of controlling a multipushbutton appliance is provided by the embodiment of the invention wherein any speed selector pushbutton can be pressed and released for a run that is continuous until another control such as an OFF pushbutton is manually actuated, or the run continues only while a pushbutton is being pressed.

For the OFF condition the permutations of switch control sliders includes a position where the sliders are brought to a particular relationship for the speed control switches. This permutation can be attained selectively in several ways, by pressing either an OFF pushbutton or changing the mode selector control, or by releasing a speed change pushbutton that has been held finger pressed during a momentary run mode setting.

In attaining the OFF position one or more sliders are selectively actuated to open a significant switch or switch combination, and, such a switch or switch combination can be either a main switch or one or more speed control switches. The selector for the alternative modes of operating contemplates a resilient force, preferably a spring whose tension is selectively applied to or removed from the sliders. In one mode the tension when applied returns one or more sliders to their OFF position as indicated, and also the released pushbutton is returned to its resting or open position. In the other mode when the tension is absent or removed, a speed selector pushbutton when depressed will remain to energize the appliance until the OFF pushbutton is pressed, or the spring tension is applied.

Two embodiments are illustrative of the inventive concept as accomplished either by a resilient control of a single slider or of all sliders.

In the use of one slider it may be a slider devoted either to the control of a main switch which is closed by any of the speed selection pushbuttons, or by the applied spring tension when a speed selection button being manually depressed is released. When more than one slider is employed the resilient pressure can be applied to urge sliders in one direction to a position in which a critical speed selection switch is opened to serve as an OFF switch. The appliance can be operated in these modes and changes made at any selected speed.

It will be appreciated that for purposes of economy the speed selection switches may be of light material rated for current carrying service alone while a heavy main switch rated for make-and-break operation momentarily opens and closes during speed change-switching.

DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view of a liquidizer and controls therefor embodying the invention including a multiple pushbutton switch for providing different speeds for selective continuous run or momentary run with the same pushbuttons and speeds controlled thereby;

FIG. **2** is a bottom perspective view of the two main housing parts of the embodiment shown in FIG. **1**, with the bottom cover partially cut away to show the components mounted on the control panel;

FIGS. **3** and **4** are enlarged fragmentary elevational views of the pushbutton, push rod, slider and switch constructions and cooperation embodied in the present invention;

FIG. **5** is an electrical schematic of a representative circuit embodied in the present invention;

FIG. **6** is a chart showing a speed control arrangement in which the circuit shown in FIG. **5** is employed;

FIG. **7** is a composite expanded view showing the configuration of the speed selector sliders of a pushbutton switch embodying the invention implementing the chart of FIG. **6** with respect to the schematic circuit of FIG. **5**;

FIG. **8** is a perspective view of the working elements of the selector and the preferred control by it of the pushbutton switches shown in FIG. **2**;

FIG. **9** is a bottom plan view of the working elements of the selector and pushbutton switch according to another embodiment of the invention;

FIG. **10** is a plan view of an added slider modification of FIG. **7** in which an "OFF" switch slider is included in the pushbutton switching permutation for operation of FIG. **9**.

DESCRIPTION OF EMBODIMENTS

In FIG. **1**, a liquidizer **10** embodying the invention is shown which includes a container **12** of the well-known cross-sectional cloverleaf design having a capacity, preferably of less than 2 quarts. The container is supported at its base against rotation in its working position within a collar **16** on a housing **14**. Cutters (not shown) are rotatably mounted in the bottom wall of the container on a shaft journaled there as driven by a series-wound motor **22** through disengageable clutch elements. On the housing **14** an instrument panel **24** is provided which carries a selector knob **26** and a multipushbutton switch **32** designed with eight pushbuttons **28**. The switch **32** is mounted on the liquidizer panel **24** where it is protected by a bottom cover **34**, with its pushbuttons **28** extending through the panel and duly labeled for convenience as to function including an OFF button **30**.

The general construction of the multiple switch is somewhat conventional in that it has a hollow elongated housing **40** molded of suitable insulating material defining a slider chest **45** which receives an assembly of switch-actuating sliders **48** (FIG. **5**) in supported relationship for relative longitudinal reciprocation. Vertical push rods **44** slidable in guideways **43** carry the push buttons **28** on their upper ends and curled elements **47** on their lower ends to actuate the sliders **48**.

The switches **49** that are actuated by the sliders **48**, as illustrated in FIG. **4**, are located below the sliders and comprise a row of stationary terminals **46** having downwardly facing fixed contacts **51**. Along the other side are other terminals **53** resiliently supporting one end of bridging conductors **56** whose other ends provide contact areas **55** urged to close against the fixed contacts **51** in an upward direction when free to do so. A flat cover plate **50** of insulating material is secured to the housing **40** by suitable means to close the switch chamber with sufficient clearance to permit operation of the bridging conductors **56** and support the sliders with respect thereto as more particularly described in Swanke, Ser. No. 813,957.

All sliders **48** are made of insulating phenolic board and, as illustrated in FIG. **3**, are supported by extensions **52** spaced along their lower edges and slidably bearing against the cover plate **50** to carry the downward thrust of the push rods **44** actuating them. Between successive extensions **52** of the sliders

have recesses **54** along the lower edges at each switch station indicated by the conductor **56** and are provided with various shapes including cams **58** to operate or not operate the conductors as their permutation requires. If a conductor **56** is to be actuated at a particular recess, the recess is provided with a cam contour having a short high-dwell **60** and a long low-dwell **62** separated by a cam incline **64** which either closes the switch or opens it depending upon the relative location of the conductor and the direction of movement of the slider when actuated. Thus, when a switch **49** is open the corresponding recesses **54** of the sliders are so arranged with respect to the switch conductors **56** that one or more high-dwells **60** of those present at that station engages the conductor to hold the switch open in a downward direction, and when a switch is to be closed the low-dwells **62** in all recesses **54** at that station coincide to permit the resilient conductor **56** to rise and close the contacts **51** and **52**.

For permutation of the sliders **48** and thereby the switch closings, the upper edges of the sliders have notches **66** receiving the curled elements **47** of the push rods **44**. The notches generally define a vertical side **68** and a side inclined thereto to provide a cam **70** actuated by a curled element **47** for moving the slider in the direction indicated by the arrows. In FIG. **7** full sliders are shown as described along with arrows to indicate the slider movement induced by the push rods at each notch **62** station.

In FIG. **5** a circuit is shown for use with the switches. The particular switches **49** are identified by numerals (**1**) to (**8**), the speeds by numerals **1** to **7**, and the field coils by letters A, B, C and D.

The field coils are 120 turns each, of the wire gauges shown, A 029, B 024, C 025, and D 028. Each coil of the armature R has 55 turns of 028 gauge wire. The impedance provided by the respective coils is represented by the gauge size of the conventional copper field-coil wire employed in them as based upon their circular mils.

Coils A and B are cowound and coils C and D are cowound for the respective poles for compactness of smaller wire nesting in the interstices of the turns in the larger wire. The switching for each pair of coils follows the same configuration in which switch (**2**) or (**5**) interconnects the coils in the respective pairs at their electrically adjacent ends for series connection; switch (**3**) or (**6**) interconnects the electrically leading ends of the paired coils to bridge coils A or C and switches (**2**) or (**5**) through connections **90** or **92**, respectively; and switch (**1**) or (**5**) interconnects the electrically trailing ends of the paired coils to bridge coils B or D and switches (**2**) or (**5**) through connections **94** or **96**, respectively. Connection **90** is connected to one lead L_1 of an AC power source and the other connection **96** is connected to the other lead L_2 through a switch (**8**), if used, that is serially connected to a diode unit which includes a rectifier Di for half wave power and a switch (**7**) connected in parallel therewith, whereby the rectifier Di is shunted for full AC current when the switch (**7**) is closed. The connections **94** and **92** are connected to opposite terminals of the armature R.

In the switching pattern one or more of the switches are involved each time a speed is selected and can be handled by two permutation sliders for each pair of coils. The switch circuit pattern for both pairs are substantially the same and referring to one pair as representative of both, each pair can be controlled by two sliders **48** for four permutations each because switch (**1**) is never closed with switch (**2**) and switch (**2**) is never closed with switch (**3**), but switches (**1**) and (**3**) can be closed separately or together.

Referring for further particulars to sliders **48A** and **48B** as representative of sliders **48C** and **48D**, slider **48A** cams switches (**1**) and (**3**) open while closing switch (**2**) when moved in the direction indicated by the left directed arrows thereon. When moved in the opposite direction, indicated by right-directed arrows, switches (**1**) and (**3**) are closed and switch (**2**) is opened. However, in cooperation with slider **48A** slider **48B** will open switch (**2**) if otherwise closed and will open switch (**3**) if free to open when moved as indicated by left-directed arrows and when moved in the opposite direction, slider **48B** will close switch (**2**) if free to close and will open switch (**3**) if otherwise closed. Thus, except when the slider **48A** is moved to the right and the slider **48B** is moved to the left to close both switches (**1**) and (**3**), the other relative positions provide a single closing of each of three switches. Thus, the four permutations available with the three switches are 13, 1, 2, 3 which in turn involves coils A/B, A, AB and B respectively. This is similarly true for coils C and D and switches (**5**), (**6**) and (**7**). However, it is to be noted in this embodiment that a cam **60***s* is provided in the recess at switch station (**3**) which opens switch (**3**) when the sliders **48A** and **48B** are both moved to the left to provide an open circuit condition controlled by the OFF pushbutton or by the tension of the spring crank **74** when applied as described.

Accordingly, the possible combinations of field coils A, B, C and D may be permutated with increased low-speed increments in the low-speed range in series with diode "Di" as shown in FIG. **7** following the words COILS, namely, ABCD (series), ABC (series), AC (series) and A/B · C (parallel-series) according to the closing of the switches following the notation SWITCHES. Higher speed coil combinations without the diode are AB · C/D (series-parallel), A · C/D (series-parallel) and A/B · C/D (parallel-parallel). The switches involved are also indicated following the notation "Switches".

The operation of the rectifier Di can be and is associated with the sliders **48C** and **48D** to close switch (**7**) at high speeds where only both switches (**4**) and (**6**) are closed in association with switch closures of switches (**1**), (**2**) or (**3**). Thus, the relative directional shifts of the sliders **48C** and **48D** can provide not only for the closure of switches (**4**) and (**6**) as part of the permutation, but also close the diode switch (**7**) by the use of high-dwells **60D** shown on sliders **48C** and **48D** cooperating with the diode switch (**7**).

Although the OFF position of the sliders may involve closing switch (**6**) it will be observed that switches (**1**), (**2**) and (**3**) can be and are held open to open the motor circuit. This opening of switches (**1**), (**2**) and (**3**) is accomplished by moving all sliders to the left as indicated by the arrows at the OFF button station.

In this connection reference is made to FIGS. **7** and **8** where the adjacent ends of the sliders are coincidentally notched as at **72** to receive the crank arm **74** of a torque spring **76** that is pivotally mounted on the switch housing **40** by a screw **78** at its bight. The crank arm is actuated by the lever arm **80** portion of the spring and is controlled by a cam arm **82** driven between two positions by the selector knob **26**. In the "-manual" position indicated the lever and cam arms are in a relaxed position. In the "jog" position, in broken lines, the cam arm displaces the lever arm with approximately 90° movement and this tensions the crank arm **72** to urge the sliders to the left.

Thereby, for momentary energization of the liquidizer, the sliders will be resiliently returned and held in their OFF permutation whenever a depressed speed selection pushbutton is not being manually held depressed. When the switch (**8**) is present, as later described, this sequence of operation is related to the long low-dwells **62** in the slider recesses **54** at the speed selection switch stations (**1**) to (**6**) and the protuberances **59** in the slider recesses at the switch (**8**) station.

Thereby the switch (**8**) may be one rated to take the surge of the making and breaking of the load current while the permutation switches can be economically made of light material rated merely to carry the current when closed. In this connection, the switch (**8**) is momentarily opened and closed by a protuberance **59** as any slider **48** is moved and thereby is open at the moment a speed selector switch, including switch (**7**), is being opened or closed by the sliders.

Although a preferred embodiment has been illustrated for the economical use of four sliders with a heavy switch (**8**), a fifth slider **48E** can be provided as illustrated in FIG. **10** in connection with FIG. **9** whereby the spring crank **74** need only

actuate one slider. In this embodiment the main switch (8) is preferably provided and it is the only switch that need be actuated by the spring 76. Slider 48E and switch (8) is also actuated by the OFF button, if desired. With the permutations of switches (1) to (7) the switch (8) is always closed whenever any pushbutton 2 to 8 for speed selection switches (1) to (7) is pressed and it is opened when the OFF pushbutton is pressed. Once the switch (8) is closed then with movement of any of the four sliders the protuberances in recesses 59 will open the switch (8) momentarily while a permutation of the speed switches is being changed.

However, whenever the tension of the spring 76 is applied to slider 48E by the selector button 84, the slider will normally be urged and held to the left as viewed in FIG. 10 unless a speed selection button is pressed and then only during the time that it is manually held depressed will it be closed to provide the jogging function already mentioned.

Otherwise the general characteristics of the four sliders 48A, 48B, 48C and 48D of FIG. 7 are substantially the same as those described when slider 48E is present.

Having thus described the structure and operation of several embodiments of the invention other and further changes and modification can be made without departing from the inventive concept involving selectively running and jogging an appliance with the same speed selection pushbuttons of a multipushbutton permutation switch.

What is claimed is:

1. In a speed control for a fractional-horsepower universal motor having a plurality of cowound field coils of different impedances on the stator, the combination of:

circuit means including a first switch having a normally closed, movable conductor between two of the coils to connect the coils in series between one side of a power source and the motor armature;

a connection between the two coils including a second switch having a normally closed, movable conductor to shunt one of the coils and said first switch;

a connection between the two coils including a third switch having a normally closed, movable conductor to shunt the other one of the coils and said first switch;

switch control means for manually controlling said switch conductors for selected permutations of said field coils to provide a speed range of various impedances and including actuator means for opening said first, second, and third switch conductors concurrently; and

selector means including a resilient element and manually movable to one position to resiliently urge said actuator means to open said first, second and third switch conductors when any of said movable conductors closing same are released from manual actuation.

2. The combination called for in claim 1 in which said switch control means includes another actuator means for closing one of said second and third switch conductors and opening the other one of said second and third switch conductors and said first switch conductor concurrently.

3. The combination called for in claim 2 in which the first-mentioned actuator means controlling said switch conductors opens said one of the second and third switch conductors concurrently with the opening of said third and said other of said switch conductors.

4. The combination called for in claim 1 including a fourth switch having a normally closed, movable conductor connected in series with said three switches;

said selector means urging said actuator means to open said fourth switch.

5. The combination called for in claim 4 in which said fourth switch is opened in timed sequential relationship following the opening of said three switches.

6. The combination called for in claim 2 in which said actuator means comprises:

a pair of switch control sliders independently movable between alternate positions to provide the permutations of said switch closures cooperatively.

7. The combination called for in claim 6 in which two cams for each slider are oppositely inclined, each at two of three switch stations separately and oppositely inclined at the common one of the three switch stations;

one of said sliders having cams to close the second and third switch conductors while opening the first switch conductor with movement in one direction and opening the second and third switch conductors while closing said first switch conductor with movement in the other direction;

the other one of said sliders having cams coordinated with the movement of said first slider to alternately open and close said third switch conductor when said second switch conductor is closed, and to alternately open and close said first switch conductor when said second and third switch conductors are open.

8. In a speed control circuit for universal motors powered by alternating current the combination of:

a plurality of field coils of predetermined electrical impedances;

manually actuated switching means in said circuit including a plurality of switches for interconnecting the coils in various permutations to vary the composite effective impedance for the motor field and including one permutation which opens the circuit; and

manually actuated selector means including a resilient element and movable between two position to resiliently urge in one position said switching means to said one permutation to open said circuit when said switching means is released from manual actuation.

9. The combination called for in claim 8 in which said selector means includes a manually movable element;

said resilient element comprising a spring interengaging said manually movable element and said manually actuated switching means; and

said manually movable element varying the resilient force urging said switching means to open the circuit when said switching means is manually released.

10. In an electrically powered appliance with current responsive elements of predetermined impedances:

a control switch means including a plurality of switch elements for selectively connecting said elements to a source of electrical power;

switch-actuating means having a permutation disposing said switch elements in an OFF condition including;

a control element movable between two positions one of which is a switch-opening position and the other a switch-closing position;

a manually advanced element to move said control element to said switch-closing position and when manually released permit said control element to remain in said switch-closing position and to hold the switch closed for energizing at least one of said current responsive elements; and

manually selective means including a releasable resilient element manually actuated to urge said control element to its switch-opening position when said control element is free to so move.

11. The combination called for in claim 10 including another manually advanced element to move said control element to its switch opening position.

12. The combination called for in claim 10 in which said plurality of switches comprise three switches and said control means comprises two reciprocable control elements actuating said three switches to provide four switch permutations in one of which the three switches are open position to deenergize said appliances, said selective means urging said control elements to said one permutation position.

13. The combination called for in claim 10 in which said plurality of switches comprise four switches and said control means comprises at least two reciprocable control elements actuating three of said switches to provide four switch permutations in which three permutations are the same and include the fourth switch;

switch means in series with said four switches for varying the impedances controlled by said three switches and opening said fourth switch means; and

a halfwave rectifier connected in parallel with said fourth switch.

14. In an electrical powered appliance having an impedance factor:

a permutation switch including a switch selection means;

a plurality of switches for varying the impedance factor of said appliance;

said switch selection means including control means movable between a plurality of switch permutation positions one of which is a switch-opening position;

a manually advanced element to move said control means to the other position and leave it there to close said switch and energize said appliance; and

selective means movable between two positions to apply a resilient force in one of said positions to said control means to return it from said other position to its OFF position when said manually movable element is free of manual restraint.

15. In an electrical powered appliance having an impedance factor:

a permutation switch including a switch selection means;

a plurality of switches for varying the impedance factor of said appliance;

said switch selection means including control means movable between a plurality of switch permutation positions one of which is a switch-opening position;

a manually advanced element to move said control means to the other position and leave it there to close said switch and energize said appliance; and

selective means manually movable between two positions in one of which it applies a resilient force to said control means to return it from said other position to its OFF position when said manually movable element is free of manual restraint.