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(54) IMPROVEMENTS IN OR RELATING TO ELECTRIC MOTOR CIRCUITS

(71) We, HO WAI CHAU of C Block 1st Floor, 20 Cheong Wah Street, Shamshuipo, Kowloon, Hong Kong, a citizen of Taiwan do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to electrical motor circuits and finds particular application as a circuit used to operate a clothes line.

According to one aspect of the present invention, there is provided an electric motor circuit comprising:

(a) an electric motor;
(b) first and second power input terminals;

(c) a first switch which is connected between the first power input terminal and the motor and which is movable into a first, conducting position;

(d) a single pole, double throw relay which has one end of its coil winding connected to the first power input terminal and to the first switch and which has its movable contact connected to the second power input terminal;

(e) a second switch which is connected between the first switch and the two fixed contacts of the relay and which is movable into a first, conducting position; and

(f) a moisture, heat or light actuable, sensing element connected between the second power input terminal and the other end of the relay coil winding via switching means actuable to a conductive state on actuation of the sensing element, the arrangement being such that, in use of the circuit and only when the first and second switches are in respective first conducting positions and when the movable relay contact is in conductive engagement with one fixed relay contact, actuation of the sensing element actuates said switching means into

its conductive state, whereby the movable relay contact is moved out of conductive engagement with said one fixed relay contact and into conductive engagement with the other fixed relay contact to cause energisation of the motor in one direction of rotation.

Further pairs of associated first and second switches may be arranged to operate respective motors in response to the triggering of a single sensing element or respective independent sensing elements.

A transformer and a rectifying circuit may be included in the circuit so as to enable the switches, relay and sensing circuit to operate, with greater safety, in a low voltage d.c. circuit.

According to a further aspect of the present invention, there is provided a clothes-line comprising an elongate support rod arranged for attachment to a wall, a pulley mounted at each end of the rod and interconnected by a drive member; a plurality of clothes-supporting hooks mounted on a spring and connected at intervals to a run of said drive member between the pulleys, one end of the spring being attached to the drive member and the other end to the rod, whereby respective rotation of one of the pulleys extends the hooks from and returns them to one end of the rod; and a circuit as defined above, the electric motor which rotatably drives at least one of the pulleys in response to the operation of the circuit.

Rotation of a drive pulley of the clothes line in response to the above-mentioned circuit is of particular use when the sensing element is arranged to detect rain. In this application, clothes may be mounted on the hooks, the hooks extended by a manual operation of the second switch of the circuit, the clothes then being returned automatically in response to the detection of the rain by the sensing element. Means may be fitted to the clothes line to actuate the first switch so

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as to switch off the motor when the hooks are fully extended and/or fully retracted.

The hooks of the line may be coat hangers, or they may be arranged to receive coat hangers, and the hooks can conveniently be mounted on rollers for ease of movement along the support rod.

One suitable coat hanger has the form of two frameworks that are arranged to be clamped together for securing the clothes therebetween.

Another form of hook that has been found particularly suitable for retaining a coat hanger on the line, particularly in windy conditions, comprises a framework having two converting sides that are grooved in their confronting surfaces to receive respective slidable members, the members being arranged to co-operate at one end of the framework so as to clamp the hook of a coat hanger therebetween and being arranged for movement from said end for releasing the coat hanger.

An awning may be provided for a clothes-line and this may be extensible and retractable by the circuit so as to cover the clothes on the clothes line when the sensing element is triggered in response to rain.

Preferred embodiments of the present invention will now be described, by way of example and with reference to the accompanying drawings in which:

Fig. 1 shows an electric motor circuit;

Fig. 2 shows a clothes line controllable by a circuit as shown in Fig. 1;

Fig. 3 shows a detail of the clothes line and a hook of Fig. 2;

Figs. 4, 5 and 6 show clothes hangers for use with the clothes line;

Figures 7 and 8 show a further hook; and Fig. 9 shows an awning for use with the clothes line shown in Figs. 2 and 3.

Referring to Fig. 1, a ganged switch 400 in the line conductor of an a.c. mains supply has terminals 402 and 404. The circuit from the switch 400 extends through the primary winding of a transformer 410 and through two further contacts 406 and 408 of the ganged switch 400, then back to the a.c. mains supply along the neutral conductor thereof. A pair of rectifiers 412, 413, connected to the secondary winding of the transformer 410, provide a d.c. output therefrom to the remainder of the control circuit, via a smoothing capacitor 414 connected across power input terminals 415 and 417. A conductor from the input terminal 415 extends to the coil winding 419 of a single-pole, double-throw relay 428. A conductor from the other input terminal 417 extends to the movable contact 432 of the relay 428.

A sensing element, in the form of a rain-sensitive plate 416 and having terminals 418 and 420, is connected between the terminal

417 and the base of a first NPN transistor 422. The emitter of the transistor 422 is connected to the base of a further NPN transistor 424 whose emitter is, in turn, connected to the base of yet a further NPN transistor 426. The emitter of transistor 426 is connected to the winding 419 of the relay 428 and, thus, is connected back to the first input terminal 415. The collectors of the transistors 422, 424, and 426 are each connected to the input terminal 417. The electromagnet winding 419 of the relay 428 is effective to move the relay armature 430 so as to carry the moving contact 432 between two fixed relay contacts 434 and 436.

The fixed relay contact 436 of the relay 428 is connected to a terminal 448 of a double-pole, double-throw switch 438, whilst the other fixed relay contact 434 is connected to an associated terminal 442 of the switch 438. Thus, power is supplied to the terminals 442 and 448 of the switch 438. With the switch 438 in its left hand position, terminals 440 and 446 are switched into the circuit and, since terminal 446 is isolated, this corresponds to the off position of the switch 438. To make the switch 438 conductive, it is switched to the right so as to bring terminals 442 and 448 into connection with terminals 444 and 450, respectively. These latter terminals 444, 450 are directly connected to respective terminals 454 and 464 of a further double-pole, double-throw switch 452. Terminals 458 and 460 of the switch 452 are ganged and connected to the first terminal 415. A low voltage DC motor 466, having terminals 468 and 470, is connected to central terminals 456 and 462, respectively, of the switch 452. Thus, with switch 438 switched to the right (i.e. ON) and switch 452 switched to the left, the motor 466 is energised. The output drive from the motor 466, arranged to control a clothes line as hereinafter described, is connected to a gear box 472.

The operation of the circuit of Fig. 1 will now be described. When the switch 400 is moved to its ON position, a.c. current flows through the transformer 410. The current in the secondary winding is rectified by the rectifiers 412, 413 to provide a low voltage d.c. current. The contacts 432 and 434 of the relay 428 are made, providing the sensing plate 416 has not been actuated.

To operate the motor 466, the switch 438 is switched to the right and the switch 452 to the left so that the current passes from the relay terminal 434, via terminals 442 and 444 of the switch 438 and terminals 454 and 456 of the switch 452, through the motor 466, and then back via the terminals 462 and 460 to the first terminal 415. The motor 466 is then arranged to turn in a counter-clockwise direction, the drive through the gear box 472 being arranged to extend a clothes line

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with laundry thereon. When the clothes line is at its fully extended position, an arrangement (to be described) automatically switches the switch 452 to the right so as to disengage contacts 454 and 460 and to switch off the motor. Connections between contacts 456 and 458 and contacts 462 and 464 of the switch 452 are simultaneously made.

The clothes line can be manually retracted by moving the switch 438 to the left so as to bring the contact 442 and 448 into circuit with contacts 440 (and thus the ganged contact 450) and 446 respectively. The current circuit from relay 428 is now via contacts 442, 440 and 450 of the switch 438, to contacts 464 and 462 of the switch 452 and then via the motor contacts 470, 468, and contacts 456 and 458 of the switch 452 to the first terminal 415. The motor 466 is then arranged to turn in a clockwise direction for retracting the clothes line. An arrangement at one end of the clothes line again disengages the switch 452 when the line is fully retracted so as to switch off the motor 466.

The rain-sensitive plate 416 is disposed adjacent the clothes line so as to be responsive to rain falling thereon. When the plate 416 becomes moist, the transistors 422, 424 and 426 are turned on so as to provide an amplified current flow through the winding 419 around the magnetic core of the relay 428. This causes switching of the contacts of the relay 428, whereby the movable contact 432 now engages the fixed contact 436. The electrical circuit that is now completed extends from the contact 436 through the terminals 448 and 450 of the switch 438, and then to terminals 464 and 462 of the switch 452, through the motor terminals 470 and 468 and back through terminals 456 and 458 of the switch 452 to the first input terminal 415. The motor 466 is thus arranged to turn clockwise so as to retract the clothes line, again being automatically switched off on complete retraction of the clothes line. On drying of the plate 416, the current through the transistors 422, 424 and 426 is cut off so that the relay 428 returns to its former position. The circuit is again completed such as to cause the motor 466 to turn counterclockwise for extending the clothes line once more. Fig. 1 also shows three additional pairs of switches, 438A and 452A, 438B and 452B, and 438C and 452C, each controlling independently its own motor which can operate on an associated clothes line, in response to a single sensing element 416.

Reference will now be made to Fig. 2. A laundry rod 87 is supported at one end on mountings 122 on a wall 120 of a house, for example, with a rain-sensitive element, such as the rain-sensitive plate 416, disposed at its far end. A pair of pulleys 78 and 80, disposed towards opposing ends of the rod 87, are connected together by an endless drive

belt 82. A spring 88 is disposed within the rod 87, is firmly anchored thereto at one end 89 and is attached at its other end 90 to the drive belt 82. A plurality of spaced clothes hooks, such as the hooks 84 and 94, are attached to the spring 88 and to the drive belt 82. The innermost hook 84 has a rod extension 86 which is connected to the switch 452 of the control circuit so as to automatically switch off the motor 466 at extreme extended and retracted positions of the clothes line, as referred to above. The mechanical drive from the gear box 472 is connected to the inner pulley 78 via an attached gear 92. Thus, operation of the motor 466 results in the gear 92 being rotated in one of its directions, so as to drive the belt 82 anticlockwise or clockwise, for respectively extending and retracting the hooks along the laundry rod 87. The length of travel along the connecting rod 86 is arranged so that the motor 466 is disconnected when the fixed point 90 of the spring 88 is adjacent the outer pulley 80.

Fig. 3 shows the hook 94 mounted on rollers 106 for ease of travel along the laundry rod 87.

Figs. 4 and 5 show one type of clothes hanger suitable for attachment to the hooks 94, the hanger 96 being shown in Fig. 2 engaged with the hook 94, but turned through 90° from its usual position, for clarification. As shown in Fig. 5, the hanger 96 comprises two frame portions 102 and 104 which are arranged to be clamped together to secure the laundry therebetween. A T-shaped portion 98 is shaped so as to engage the hook 94 of the clothes line.

Fig. 6 shows a further type of clothes hanger having a V-portion 132, adapted to be engaged by the hook 94, and two plate portions 128 and 126 depending therefrom. The plates 126 and 128 are connected together by a screw 130 which, after insertion of the clothes between the plates, can be tightened so as to secure the clothes therebetween.

The clothes hanger described with reference to Figures 4, 5 and 6 may be formed integrally with, or otherwise attached securely to, the hooks 94 of the clothes line.

Figs. 7 and 8 show, in front and end elevation respectively, a further example of a hook that can be mounted on rollers 106 within the laundry rod 87. A substantially triangularly-shaped frame 134 is provided with two plates 140, 142 which are slidably mounted in grooves on two confronting surface of the frame. When the plates 140 and 142 are in abutment towards the apex of the frame, a circular gap 143 is formed therebetween by cut-out portions. Movement of the plates towards the base of the frame opens up the aperture 143 and allows the hook 145 of a coat hanger 144 to pass therebetween. The plates are then allowed to return to

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wards the apex of the frame 134, trapping the hook 145 in the aperture 143. The plates 140 and 142 may be locked into place by the insertion of a check block 138 which is attached to the framework 134 by a rod 136.

A retractable awning arrangement for a clothes line will now be described with reference to Fig. 9. The awning material may be of a plastics material, and the covering may be extended from a fixed point 118 by means of a handle 116 so as to cover the clothes on the extended line. Alternatively, the circuit in accordance with Fig. 1 may be arranged so as to extend the awning 108 in response to rain on the sensing element.

The present invention can also be applied to open and close windows and/or doors in response to triggering of the sensing element, for example in response to rain, or to operate an alarm, for example in response to a flood from an overflowing household sink or washing machine.

Furthermore, it is envisaged that the sensing element of the circuit could be a light-or heat-sensitive element.

WHAT WE CLAIM IS:-

1. An electric motor circuit comprising:

(a) an electric motor;
(b) first and second power input terminals;

(c) a first switch which is connected between the first power input terminal and the motor and which is movable into a first, conducting position;

(d) a single pole, double throw relay which has one end of its coil winding connected to the first power input terminal and to the first switch and which has its movable contact connected to the second power input terminal;

(e) a second switch which is connected between the first switch and the two fixed contacts of the relay and which is movable into a first, conducting position; and

(f) a moisture, heat or light actuable, sensing element connected between the second power input terminal and the other end of the relay coil winding via switching means actuable to a conductive state on actuation of the sensing element, the arrangement being such that, in use of the circuit and only when the first and second switches are in respective first conducting positions and when the movable relay contact is in conductive engagement with one fixed relay contact, actuation of the sensing element actuates said switching means into its conductive state, whereby the movable relay contact is moved out of conductive engagement with said one fixed relay contact and into conductive engagement with the other fixed relay contact to cause energisation of the motor in one direction of rotation.

2. A circuit according to claim 1, where-

in the first switch is movable into a second conducting position, the arrangement being such that, in use of the circuit and only when the second switch is in its first conducting position and when the movable relay contact is in conductive engagement with said one fixed relay contact, movement of the first switch into its second conducting position causes energisation of the electric motor in the other direction of rotation.

3. A circuit according to claim 1 or 2, wherein the second switch is movable into a second conducting position, the arrangement being such that, in use of the circuit and only when the first switch is in its first conducting position and when the movable relay contact is in conductive engagement with said one fixed relay contact, movement of the second switch into its second conducting position causes energisation of the electric motor in said one direction.

4. A circuit according to claim 1, 2 or 3, wherein said switching means comprises one or more transistors.

5. A circuit according to any preceding claim, wherein the power input terminals are connected to a transformer through which power is supplied.

6. A circuit according to claim 5, wherein the transformer is a step-down transformer.

7. A circuit according to claim 5 or 6, wherein the output of the transformer passes through a rectifying circuit before passing to the power input terminals.

8. A circuit according to any of claims 5 to 7, further comprising a third switch connected to the primary winding of the transformer.

9. A circuit according to any of claims 1 to 8, comprising at least one further set of associated first and second switches, the first switch or each pair of first and second switches being connected to a respective electric motor and being independently operable in response to actuation of the sensing element.

10. An electrical motor circuit substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings.

11. A clothes-line comprising an elongate support rod arranged for attachment to a wall; a pulley mounted at each end of the rod and interconnected by a drive member; a plurality of clothes-supporting hooks mounted on a spring and connected at intervals to a run of said drive member between the pulleys, one end of the spring being attached to the drive member and the other end to the rod, whereby respective rotation of one of the pulleys extends the hooks from and returns them to one end of the rod; and a circuit as claimed in any of claims 1 to 10, the motor rotatably driving at least one of

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wards the apex of the frame 134, trapping the hook 145 in the aperture 143. The plates 140 and 142 may be locked into place by the insertion of a check block 138 which is attached to the framework 134 by a rod 136.

A retractable awning arrangement for a clothes line will now be described with reference to Fig. 9. The awning material may be of a plastics material, and the covering may be extended from a fixed point 118 by means of a handle 116 so as to cover the clothes on the extended line. Alternatively, the circuit in accordance with Fig. 1 may be arranged so as to extend the awning 108 in response to rain on the sensing element.

The present invention can also be applied to open and close windows and/or doors in response to triggering of the sensing element, for example in response to rain, or to operate an alarm, for example in response to a flood from an overflowing household sink or washing machine.

Furthermore, it is envisaged that the sensing element of the circuit could be a light-or heat-sensitive element.

WHAT WE CLAIM IS:-

1. An electric motor circuit comprising:
(a) an electric motor;
(b) first and second power input terminals;

(c) a first switch which is connected between the first power input terminal and the motor and which is movable into a first, conducting position;

(d) a single pole, double throw relay which has one end of its coil winding connected to the first power input terminal and to the first switch and which has its movable contact connected to the second power input terminal;

(e) a second switch which is connected between the first switch and the two fixed contacts of the relay and which is movable into a first, conducting position; and

(f) a moisture, heat or light actuable, sensing element connected between the second power input terminal and the other end of the relay coil winding via switching means actuable to a conductive state on actuation of the sensing element, the arrangement being such that, in use of the circuit and only when the first and second switches are in respective first conducting positions and when the movable relay contact is in conductive engagement with one fixed relay contact, actuation of the sensing element actuates said switching means into its conductive state, whereby the movable relay contact is moved out of conductive engagement with said one fixed relay contact and into conductive engagement with the other fixed relay contact to cause energisation of the motor in one direction of rotation.

2. A circuit according to claim 1, where-

in the first switch is movable into a second conducting position, the arrangement being such that, in use of the circuit and only when the second switch is in its first conducting position and when the movable relay contact is in conductive engagement with said one fixed relay contact, movement of the first switch into its second conducting position causes energisation of the electric motor in the other direction of rotation.

3. A circuit according to claim 1 or 2, wherein the second switch is movable into a second conducting position, the arrangement being such that, in use of the circuit and only when the first switch is in its first conducting position and when the movable relay contact is in conductive engagement with said one fixed relay contact, movement of the second switch into its second conducting position causes energisation of the electric motor in said one direction.

4. A circuit according to claim 1, 2 or 3, wherein said switching means comprises one or more transistors.

5. A circuit according to any preceding claim, wherein the power input terminals are connected to a transformer through which power is supplied.

6. A circuit according to claim 5, wherein the transformer is a step-down transformer.

7. A circuit according to claim 5 or 6, wherein the output of the transformer passes through a rectifying circuit before passing to the power input terminals.

8. A circuit according to any of claims 5 to 7, further comprising a third switch connected to the primary winding of the transformer.

9. A circuit according to any of claims 1 to 8, comprising at least one further set of associated first and second switches, the first switch or each pair of first and second switches being connected to a respective electric motor and being independently operable in response to actuation of the sensing element.

10. An electrical motor circuit substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings.

11. A clothes-line comprising an elongate support rod arranged for attachment to a wall; a pulley mounted at each end of the rod and interconnected by a drive member; a plurality of clothes-supporting hooks mounted on a spring and connected at intervals to a run of said drive member between the pulleys, one end of the spring being attached to the drive member and the other end to the rod, whereby respective rotation of one of the pulleys extends the hooks from and returns them to one end of the rod; and a circuit as claimed in any of claims 1 to 10, the motor rotatably driving at least one of



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the pulleys.

12. A clothes-line according to claim 11, wherein the hooks are mounted on rolling members for engaging with a track of the support rod.

13. A clothes-line according to claim 12, wherein one of the hooks is arranged to move the first switch into a non-conducting position to switch off the motor at at least one limit of travel of the drive member.

14. A clothes-line according to any of claims 11 to 13, including hangers each comprising a pair of cooperating frameworks and means arranged to clamp these together for securing laundry therebetween.

15. A clothes-line according to claim 14, wherein the clamping means is a screw.

16. A clothes-line according to any of claims 11 to 13, wherein the hooks each compromise a framework having two converging sides that are grooved in their confronting surfaces to receive respective slidable members, the members being arranged to cooperate at one end of the framework so as to clamp the hook of a coat hanger therebetween and being arranged for movement from said end for releasing the coathanger.

17. A clothes-line according to claim 16, wherein each hook further comprises means for locking slidable members in the clamping positions.

18. A clothes-line including an awning arranged to be mounted on a support member for covering laundry on the line and comprising an extensible frame carrying a protective material, the extension and retraction of the awning frame being controlled by the operation of a circuit as claimed in any of claims 1 to 10.

19. A clothes-line according to claim 18, wherein the awning is operable in unison with the operation of a clothes-line according to any of claims 11 to 17.

20. A clothes line substantially as hereinbefore described with reference to Figures 2 to 9 of the accompanying drawings.

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