

May 3, 1949.

W. MUNGALL

2,468,772

MULTIPLE LIMIT SWITCH DEVICE

Filed April 23, 1945

2 Sheets-Sheet 1

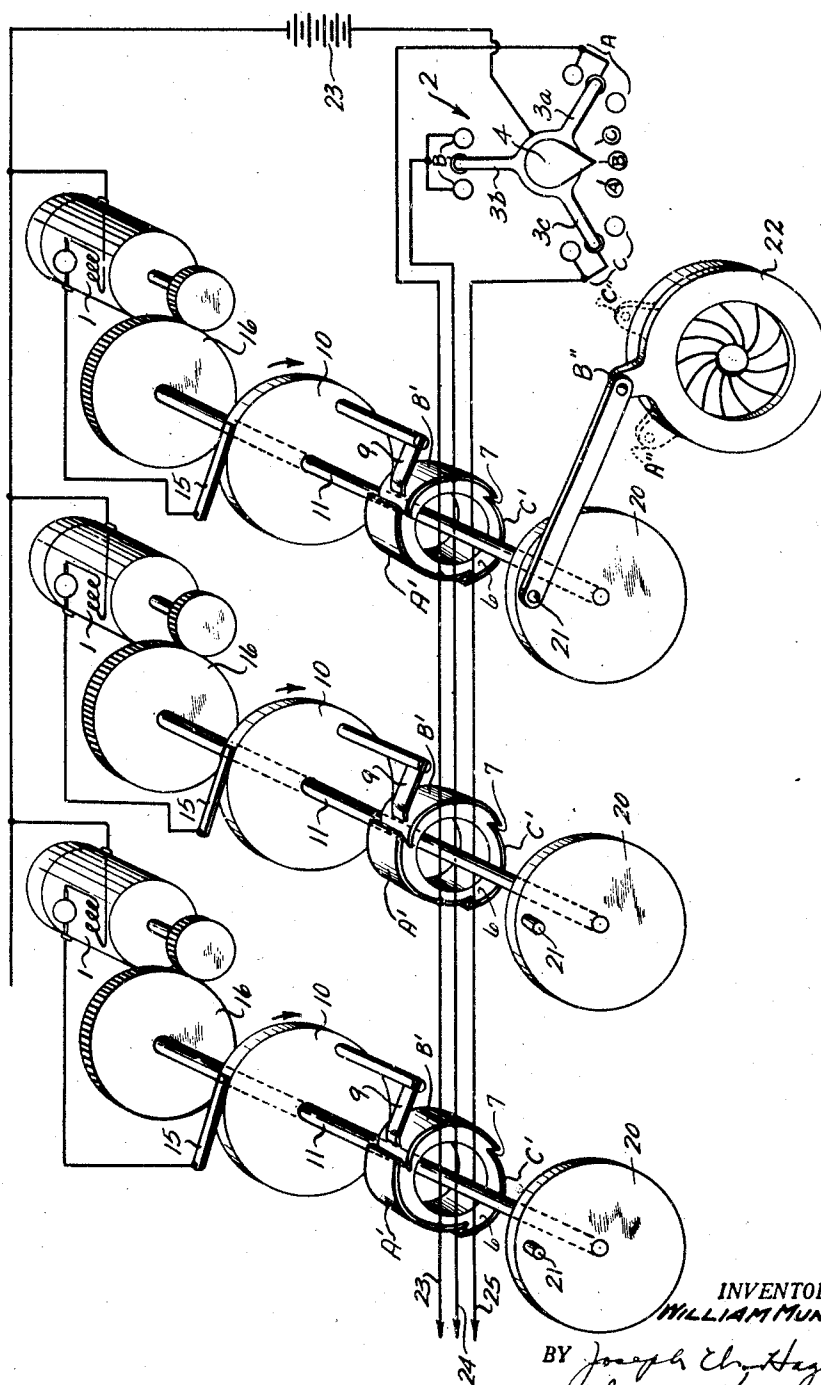


Fig. 1

INVENTOR.
WILLIAM MUNGALL
BY Joseph C. Hazell
Clare County, Mich.
ATTORNEYS

May 3, 1949.

W. MUNGALL

2,468,772

MULTIPLE LIMIT SWITCH DEVICE

Filed April 23, 1945

2 Sheets-Sheet 2

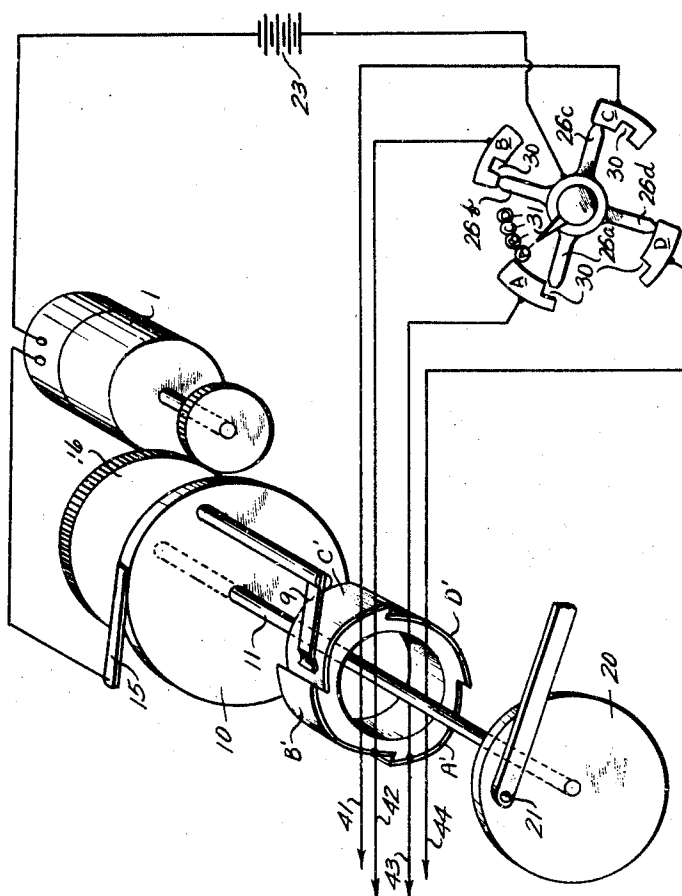


Fig. 2

INVENTOR.
WILLIAM MUNGALL
BY Joseph E. Hayell
Chas. K. Kouty and
ATTORNEYS

UNITED STATES PATENT OFFICE

2,468,772

MULTIPLE LIMIT SWITCH DEVICE

William Mungall, Dayton, Ohio

Application April 23, 1945, Serial No. 589,836

4 Claims. (Cl. 318-467)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

1

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to multiple limit switch devices and more particularly to multiple limit switch devices for synchronizing the degree of response of a plurality of electrical motors energized by a common line and which may be coupled to loads of varying degree or which may have different operating characteristics.

One of the difficulties experienced with conventional multiple limit switch devices for determining cutoff points of a plurality of electric motors energized by a common line is the hunting that occurs owing to a lack of synchronization in cutoff times of the several switches. The lack of synchronization is due either to differences in loads applied to the motors controlled by the switches or to inherent differences in the motors so used, i. e., differences in operating speeds or electrical operating characteristics. This results in bleeding of current from one or more switch circuits to one or more of the other switch circuits tending to continue operation past the respective predetermined cutoff points of the associated motors. Continual hunting of the motors is thus caused due to the unpredictable and uncertain bleeding of current among the several switch circuits which is, of course, undesirable.

Accordingly, it is a primary object of the present invention to provide a multiple limit switch arrangement wherein a plurality of motors may be connected to a common line, but in which the limit switches are so devised as to eliminate any possibility of one or more of the motors being energized by extraneous currents, even though the cutoff points of the several motors may differ widely in point of time.

A further object of the invention is to provide a simple limit switching device wherein a plurality of motors of various sizes, speeds, and operating characteristics may be coupled to a variety of loads without effecting electrical interference or leakage between individual motor circuits.

In accordance with the stated objects, I provide a novel arrangement of a manually selective multiple point switch in combination with a plurality of limit switch means, each of which has successively engaging contact members through which the associated motor current flows. The contact members correspond to selective cutoff points determinable by the manual switch and are connected thereto in such a manner as to provide complete electrical isolation between a selected

2

contact member and the other members of any particular limit switch means. The effect is to provide electrical isolation of any switching circuit when the selectively isolated contact member of that circuit is engaged, which serves to interrupt current to its respective motor and to preclude leakage from any other switching circuits which may still be energized.

My invention will be more clearly understood from the following detailed description taken in conjunction with the appended drawings in which:

Fig. 1 is a diagrammatic disclosure showing the circuit arrangement and the basic structural elements for a system having three predeterminable cutoff points;

Fig. 2 is a modification of my invention showing the changes required to provide a system having four predeterminable cutoff points.

With reference to Fig. 1, an arrangement is shown for a plurality of motors 1 utilized in conjunction with a system having three predeterminable cutoff points and consisting of the selective switching device 2 comprising three integrally movable arms 3a, 3b, and 3c which are selectively engageable with a switch point in each of the groups of switch points A, B, and C. A manually operable knob and pointer 4 is secured to the switch arms for positioning them in accordance with indices associated with the groups A, B and C and shown as the encircled reference characters A, B, and C on the drawing. It will be noted that in each of the switch point groups one of the switch points is electrically isolated, i. e., it is not electrically connected to any other part of the circuit whereas in each group the other switch points are electrically connected to each other. The spacing arrangement of the electrically isolated switch points is such that rotation of the knob 4 to an extent equal to the angular spacing between any two switch points will result in one switch arm at any particular time being in engagement with one of the electrically isolated switch points. In the specific illustration of the drawing, engagement of switch arm 3b with the electrically isolated switch point in group B may be noted, while the switch arms 3a and 3c engage electrically connected switch points in groups A and C. Accordingly, it will be seen that if the switch arms were rotated clockwise from the position shown in Fig. 1 engagement of one of the arms, 3a, with the isolated switch point would then take place in group A while groups B and C would have conductive engagement with their associated switch arms. Similar-

ly, counterclockwise rotation of the switch arms would result in nonconductive engagement of switch arm 3c associated with group C and conductive engagement of the switch arms associated with groups A and B. It will be obvious that the spacing pattern of the several groups of switch points is such that the isolated point is located progressively one angular spacing farther in a counterclockwise sense, as between groups, starting with group A and progressing through group B to group C. Groups A, B, and C are connected to corresponding metallic conductive segments A', B' and C' of three sets of conductor means cylindrically arranged and dielectrically separated by being secured on suitable insulating rings 6 as shown on the drawing. Segments A' have a common connection as do segments B' and also segments C', as shown. The segments are secured to the rings 6 in any suitable manner, being so arranged that they overlap at their extremities by virtue of undercut steps 7 formed in the material of rings 6. The cylindrical arrangement of the segments A', B' and C' in each set is adapted to provide successive engagement with a spring brush 9 associated with each set which is secured to a metallic disc 10 keyed to a shaft 11, in each case. Brushes 9 are adapted to rotate about the relatively fixed segments by virtue of rotation of shaft 11. A second brush 15 is provided in each set which slidably engages the periphery of the disc 10 when the disc is rotated by virtue of rotation of shaft 11 through reduction gear arrangements 16 driven by the motors. The shafts 11 are shown as extending through the segment holding rings and are provided at their extremities with bush wheels 20 having pins 21 mechanically linked to a mechanism to be actuated, e. g., the iris type diaphragms of a plurality of cameras. One such iris diaphragm 22 is shown for illustrative purposes. It will be noted that each motor has a terminal connected to a common source of current supply such as a battery 23 and that one side of the current supply is connected to the switch arms 3a, 3b, and 3c. The operation of the device is as follows:

Assuming selector 2 is positioned as shown so that the current path through the switch arm 3b is broken by virtue of engagement with the electrically isolated switch point in group B, no current can flow in the common connection provided between the segments B' since they are electrically isolated from the line and therefore no current can flow through the brushes 9, discs 10 and brushes 15 to the motors. If, however, the knob 4 be positioned so that the pointer is aligned with the encircled reference character A, group A and segments A' become disconnected from the line due to engagement of switch arm 3a with the electrically isolated switch point in group A. However, arms 3b and 3c provide continuous connection from the line through engagement with electrically connected switch points in the respective groups to the common connection of segments B' and C'. In such case, current begins to flow through the segments B' and thence through the brushes 9, discs 10, brushes 15 and thence to the associated motors causing rotation thereof. Rotation of the motors causes rotation of the shafts 11, continuous contact of the brushes 15 and discs 10 being maintained. However, after brushes 9 pass segments B' they subsequently engage segments A', which are electrically isolated and the motors stop. Brushes 9 are provided with abrupt disengagement in passing from

one segment to another due to the stepped arrangement of rings 6, and the overlapping of the segments ensures continuity of connection with the foreportion of the segments A' in readiness for the next selective operation. The iris diaphragm has then been actuated to the position shown at A' and may be similarly actuated back to B' or to C' by selective manipulation of the knob 4. For example, if it now be desired to actuate the diaphragms back to positions B', knob 4 is aligned with encircled reference character B, thereby isolating segments B' but connecting segments A' and C' to the line through arms 3a and 3c, respectively. Accordingly, the motors are energized due to the existing engagement of brushes 9 with segments A' and rotation takes place, brushes 9 passing the A' segments and successively engaging the C' segments and thence coming to rest on the foreportions of the electrically isolated B' segments, rotation of the motors ceasing at that time. It will be noted that any number of motors may be controlled by the system shown in Fig. 1, it being merely necessary to provide an additional switching arrangement of segments A', B' and C' for each motor added to the system, by appropriate connections to leads 23, 24, and 25.

In general, the number of cutoff points corresponds to the number of positions to which the switch arms of the selector may be moved and requires the number of switch arms to be equal to the number of groups of switch points and to the number of switch points in each group. In other words, a system having, say, four predetermined cutoff points requires four switch arms associated with four groups of switch points, having four switch points in each group. Such a system is illustrated in Fig. 2 which differs from Fig. 1 essentially in the provision of four metallic contact bars A, B, C, and D associated with four integrally movable switch arms 26a, 26b, 26c, and 26d and four conductor segments A', B', C' and D'. The contact bars A, B, C, and D are the equivalent of four groups of switch points, having an electrically isolated point and three conductive points in each group. The isolated point is provided, in equivalence, by means of notches 30 cut out of the material of the contact bars which have a length equal to the width of four notches. The notches are progressively spaced relative to the bars in such a manner that moving the switch arms so that pointer 31 is in alignment with one of the encircled indices A, B, C, or D will selectively isolate the segments A', B', C' or D', respectively. Accordingly, any one of four cutoff points may be utilized, operation of the system taking place in the same manner as described for Fig. 1, i. e., by successive engagement of brush 9 with segments A', B', C' and D' with rotation ceasing at the time of engagement of the brush with the selectively isolated segment. Any number of motors may be controlled by providing duplication of the segment arrangement for each additional motor, tie-in with the wires 41, 42, 43 and 44 being made as desired.

Having thus described my invention, I claim:

1. An electric motor-operated device comprising a plurality of separately rotatable units all adapted to have rotation arrested at the same selected one of a plurality of positions, each unit comprising a rotatable member and a nonrotatable cylinder coaxial with said rotatable member, the cylinder of each unit carrying a series of cylindrically positioned insulated spaced conductive segments, like segments of the cylinders

5

of the several units being electrically joined together, a brush holder for each unit supported on and rotatable in unison with the rotatable member of said unit, a brush carried by each brush holder in continuous engagement upon rotation of the rotatable member of the unit with one after the other of the segments of the unit, a source of electrical energy, an electric motor for each unit having its windings electrically connected between the brush of the unit and one terminal of said source of electrical energy, a control switch for all of the units, said control switch comprising a number of insulatedly spaced stationary contacts at least one being electrically connected to each conductive segment of a unit, and a movable conductive switch member electrically connected to the other terminal of the source of electrical energy and adapted to make electrical connection at the same time to all except any selected one of the stationary contacts of said control switch.

2. The device defined in claim 1 wherein the segments are spiral surfaces with the trailing end farthest from the axis and having as many teeth as there are arresting positions on the switch, whereby, upon rotation, the brush drops off the trailing end of a segment onto the leading end of the next, thereby providing a quick break and being prevented making contact with more than one segment at a time.

3. An electric motor-operated device comprising a plurality of separately rotatable units all adapted to have rotation arrested at the same selected one of a plurality of positions, each unit comprising a rotatable member and a non-rotatable member coaxial with said rotatable member, the nonrotatable member carrying a series of circumferentially spaced insulatedly separated conductive members, like insulatedly spaced conductive members of the nonrotatable members of the several units being electrically joined together, a single conductive member for each unit supported on and rotatable in unison with the rotatable member of said unit, said single conductive member being in continuous engagement upon rotation of said rotatable member of the unit with one after the other of said insulatedly spaced conductive members of the unit, a source of electrical energy, an electric motor for each unit having its windings electrically connected between the single conductive member of the unit and one terminal of said source of electrical energy, a control switch for all of the units comprising a number of insulatedly spaced stationary contacts at least one being electrically

6

connected to each of said insulatedly separated conductive members of a unit, and a movable conductive switch member electrically connected to the other terminal of the source of electrical energy and adapted to make electrical connection at the same time to all except any selected one of the stationary contacts of said control switch.

4. An electric motor-operated device comprising a plurality of separately rotatable units all adapted to have rotation arrested at the same selected one of a plurality of positions, each unit comprising a rotatable member, and a non-rotatable member coaxial with said rotatable member, the nonrotatable member carrying a series of circumferentially spaced insulatedly separated conductive members, like insulatedly spaced conductive members of the several units being electrically joined together, a single conductive member for each unit supported on and rotatable in unison with the rotatable member of the unit, said single conductive member being in continuous engagement upon rotation of said rotatable member of the unit with one after the other of said insulatedly spaced conductive members of the unit, a source of electrical energy, an electric motor for each unit having its windings electrically connected between the single conductive member of the unit and one terminal of said source of electrical energy, a single control switch for all of the units comprising one common contact connected to the other terminal of the source of electrical energy and means to connect said common contact with all except a selected one of the circumferentially spaced insulatedly separated conductive members of a unit.

WILLIAM MUNGALL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
811,539	Bates	Feb. 6, 1906
1,564,872	McMullen	Dec. 8, 1925
2,098,587	Markowitz	Nov. 9, 1937
2,253,654	Schroder	Aug. 26, 1941
2,297,876	Crafts et al.	Oct. 6, 1942

FOREIGN PATENTS

Number	Country	Date
313,130	Great Britain	Apr. 17, 1930