H. A. STEEN.

LIMIT SWITCH FOR MOTOR OPERATED DEVICES.

APPLICATION FILED DEC. 2, 1909.

963,825. **Patented July 12, 1910.**

Fig. 1.

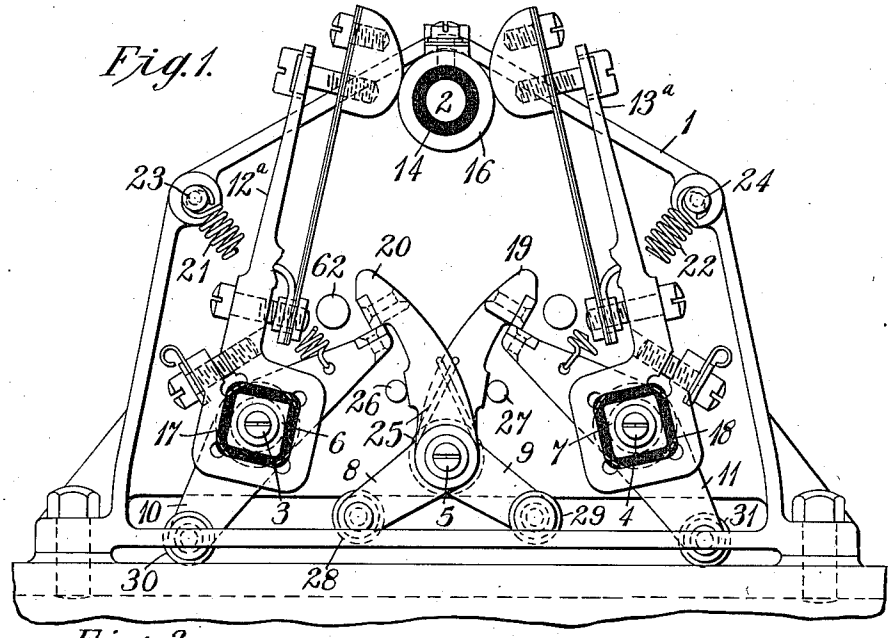


Fig. 3.

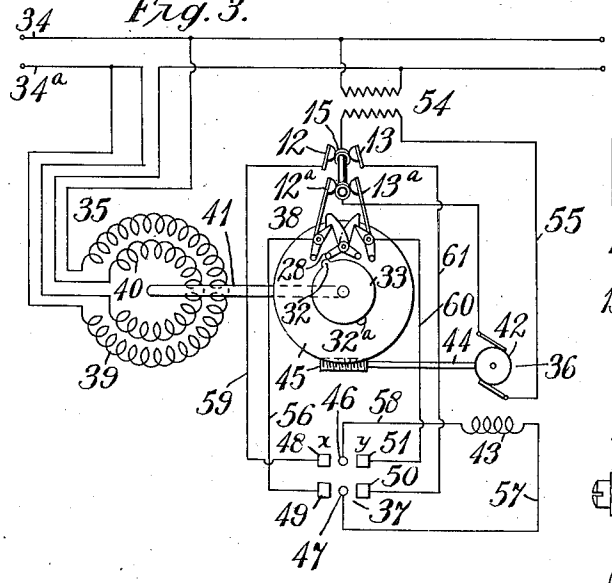
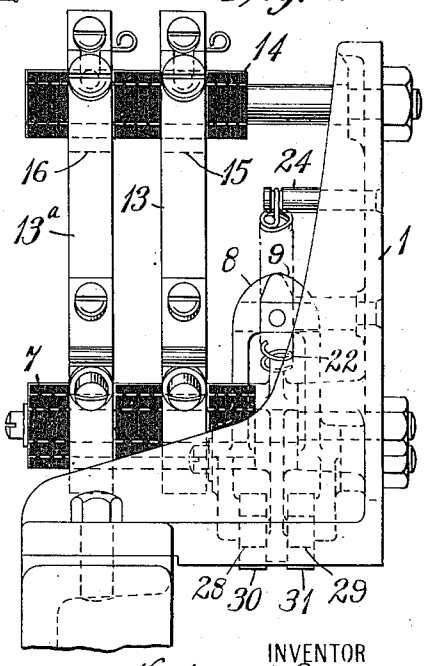


Fig. 2.



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LIMIT-SWITCH FOR MOTOR-OPERATED DEVICES.

963,825. Specification of Letters Patent. Patented July 12, 1910.

Application filed December 2, 1909. Serial No. 531,058.

To all whom it may concern:

Be it known that I, HALFDAN A. STEEN, a subject of the King of Norway, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Limit-Switches for Motor-Operated Devices, of which the following is a specification.

My invention relates to switching devices for electric circuits and it has for its object to provide a simple and durable limit switch for restricting the operation of electric motor-driven apparatus by interrupting the motor circuit at predetermined points in either direction of the motor travel.

Induction regulators of large size, controllers and other devices are frequently driven by small electric motors which operate in either direction, but are necessarily limited by the permissible travel of the movable element of the device and must be brought to rest in such a way that they may be automatically operated in the opposite direction in returning the device to an intermediate position.

According to my present invention, I provide a switch which is relatively simple and inexpensive in construction and which is particularly well adapted for the service to which reference has just been made.

Figure 1 of the accompanying drawings is a front elevation and Fig. 2 is a view at right angles thereto of a limit switch constructed in accordance with my invention. Fig. 3 is a diagrammatic view showing the circuit connections of a system of regulation embodying the switch of Figs. 1 and 2.

Referring to Figs. 1 and 2 of the drawings, the structure here shown comprises a cast iron base or bracket 1 from which a plurality of studs 2, 3, 4 and 5 project laterally outward, sleeves 6 and 7 which are rotatably mounted on the studs 3 and 4, a pair of bell crank levers 8 and 9 which are rotatably mounted on the stud 5, pawls 10 and 11 that are respectively secured to corresponding ends of the sleeves 6 and 7 and contact fingers 12 and 13 which are secured to and are insulated from the sleeves 6 and 7. The stud 2 is provided with an insulating sleeve 14 on which a pair of contact rings 15 and 16 are mounted and the sleeves 6 and 7 are provided with insulating bushings 17 and 18 over which the bases of the contact fingers are fitted. The bell crank levers 8 and 9 are oppositely mounted on the stud 5 and are provided with latch projections 19 and 20 which are respectively adapted to engage the extremities of the pawls 10 and 11. Helical tension springs 21 and 22 tend to cause the contact fingers to move out of engagement with the contact members 15 and 16, but their action is opposed by the bell crank levers except when the limit switch is actuated as hereinafter pointed out. Corresponding ends of the above mentioned springs are respectively secured to the pawls 10 and 11 near their points of engagement with the latches and the opposite ends of said springs are attached to stationary pins 23 and 24 which extend outwardly from the bracket 1, as shown in the drawings. The bell crank levers 8 and 9 are provided with a single spring 25 which tends to rotate them oppositely and which normally holds them in engagement with stops 26 and 27. The free ends of the levers 8 and 9 and the pawls 10 and 11 are severally provided with rollers 28, 29, 30 and 31 which are engaged by actuating projections 32 and 32^a of a cam 33, as shown in Fig. 3, to which reference may now be had. The system here shown comprises a supply circuit 34—34^a, an induction regulator 35, a driving motor 36 therefor, a manually-operated reversing switch 37 and the limit switch which is illustrated in the other figures. The regulator 35 is intended to be illustrative of any driven mechanism having a limited range of movement, and it comprises a stationary coil 39, a movable coil 40 and a driving shaft 41, the stationary coil being connected across the circuit 34—34^a and the movable coil having a series connection with the same circuit. The motor 36 comprises an armature 42, a field magnet winding 43 and a shaft 44 that is connected to the shaft 41 of the regulator by reducing gears 45. The reversing switch 37 is adapted to occupy two motor-operating positions x and y, and comprises stationary contact fingers 46 and 47 and movable contact members 48, 49, 50 and 51. The limit switch is actuated by pawl projections 32 and 32^a upon the cam 33 that is driven by the shaft 41.

The circuit connections for the system are as follows: As pointed out in the preceding

paragraph, the limit switch is normally closed and the operation of the regulator 35 is entirely governed by the position of the reversing switch 37. The reversing switch 37 may be manually operated, as shown, or automatically dependent for its operation upon the electromotive force of the circuit 34—34ª or upon some other element for which correction is made by the regulator. The travel of the movable member of the regulator is, of course, limited to a predetermined extent in either direction from its mid-position, in which its effect is *nil*, on account of the design of the regulator itself, and the limit switch 38 is intended to bring the motor 36 to rest whenever either one of these limits is reached. This is accomplished without interfering in any way with the subsequent operation of the motor in the reverse direction. If the reversing switch 37 is moved to the position *x*, circuit connections will be established from the transformer 54, through conductor 55, armature 42 of the motor 36, contact member 16 of the limit switch, contact finger 12ª, conductor 56, contact members 49 and 47, conductor 57, field magnet winding 43, conductor 58, contact members 46 and 48, conductor 59, contact finger 12 and contact member 15 to the opposite terminal of the transformer 54. Thus the motor circuit will be established and the regulator will be operated in one direction, which, for convenience, I assume to be clockwise. If the reversing switch is moved to occupy the position *y*, a circuit will be established from the transformer 54, through conductor 55, armature 42, contact member 16, contact finger 13ª, conductor 60, contact members 51 and 46, conductor 58, field magnet winding 43, conductor 57, contact members 47 and 50, conductor 61 finger 13 and contact member 15 to the opposite terminal of the transformer. The motor is now reversed since a circuit is established through its field magnet winding in the reverse direction and the regulator will be operated in a counter-clockwise direction. Should the reversing switch continue to occupy the position *x* until the projection 32 engages the roller 28 of the bell crank lever 8, the bell crank lever will be rotated in opposition to the contact spring 25 and the pawl 10 will be released. The contact fingers 12 and 12ª are now separated from the contact members 15 and 16 by the spring 21 which rotates the sleeve 6 in a counter-clockwise direction until the pawl 10 engages the stop 62. The motor circuit is in this way interrupted and the motor will be brought to rest, but it is evident that if the reversing switch is afterward thrown to position *y*, the motor will nevertheless be operated in the reverse direction. Assuming that this is the case, the projection 32 will engage the roller 30 of the pawl 10 and the limit switch will be closed by the rotation of the sleeve 6. The projection 32ª is adapted to similarly engage the rollers 29 and 31 to operate the limit switch at the other extreme position of the regulator. The rollers 28 and 30 are in the same plane and the rollers 29 and 31 are in another plane parallel to the first, in order that the projection 32 may not interfere with the rollers 29 and 31 if the motor overruns after its circuit is interrupted by the fingers 12 and 12ª, the projections 32 and 32ª being arranged to rotate in the planes of the rollers with which they are adapted to engage.

It is evident that the limit switch illustrated may be employed for various purposes and it is shown and described in connection with the system of Fig. 3 merely to make its method of operation clear.

Structural modifications may, of course, be effected within the spirit and scope of my invention and I desire that only such limitations shall be imposed as are indicated in the appended claims.

I claim as my invention:

1. An electric circuit switching device comprising a stationary shaft, a sleeve rotatable thereon, a plurality of contact fingers secured to and insulated from the sleeve, a spring tending to rotate the sleeve in one direction, and a latch for holding the sleeve in opposition to the spring.

2. An electric circuit switching device comprising a stationary base or supporting bracket, a shaft or stud projecting outwardly therefrom, a sleeve rotatable on said shaft, contact fingers affixed to and insulated from the sleeve, a pawl secured to the sleeve, an interposed spring tending to open the circuit and secured to one arm of the pawl and to the bracket, and a latch for opposing the spring.

3. In a switching device for electric circuits, the combination with a stationary base or bracket, a pair of stud projections extending outwardly therefrom, sleeves rotatable on said studs and contact fingers secured to and insulated from said sleeves, of stationary contact members between the fingers, springs tending to rotate the sleeve oppositely to separate the movable from the stationary contact members, and a pair of latches for holding the switch closed.

4. In a switching device for electric circuits, the combination with a stationary base or bracket having three stud projections extending outwardly therefrom, sleeves rotatably mounted on two of the studs and stationary contact rings secured to and insulated from the third, contact fingers secured to and insulated from the sleeves and adapted to engage the stationary contact rings, pawls secured to the sleeves and springs connected to the pawls at one end and to the

stationary bracket at the other for separating the fingers from the stationary contact members, of bell crank levers rotatable on the same shaft and provided with latch projections for holding the fingers in engagement with the contact members in opposition to the springs and means adapted to engage the bell crank lever for tripping the latch when the switch is closed and to engage the corresponding pawl for closing the switch when it is open.

In testimony whereof, I have hereunto subscribed my name this 17th day of November, 1909.

HALFDAN A. STEEN.

Witnesses:
R. S. MILLS,
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