Aug. 8, 1961 G. E. LUSK ET AL 2,995,043

TWO POSITION SNAP ACTION OPERATOR

Filed June 20, 1960 3 Sheets-Sheet 1

Fig. 1

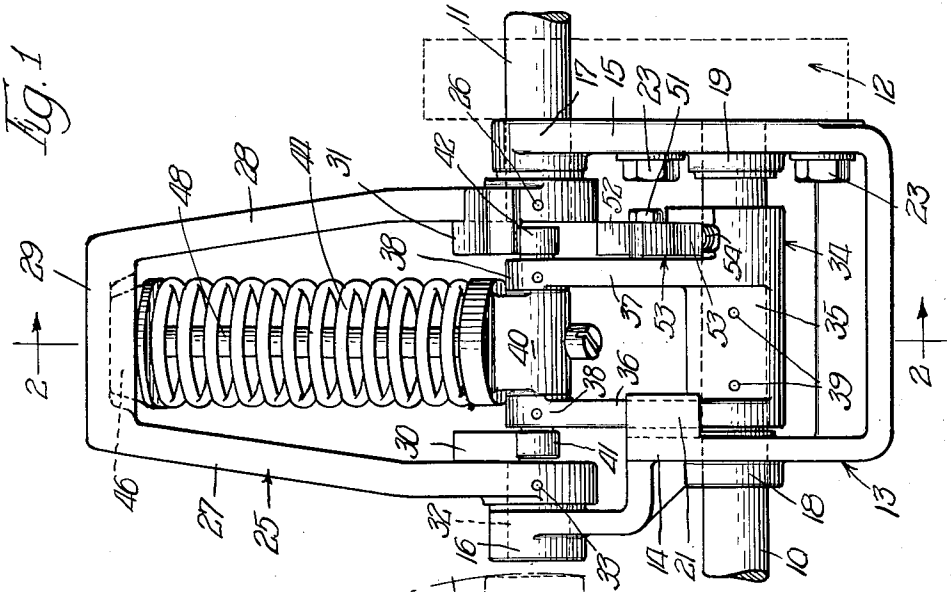
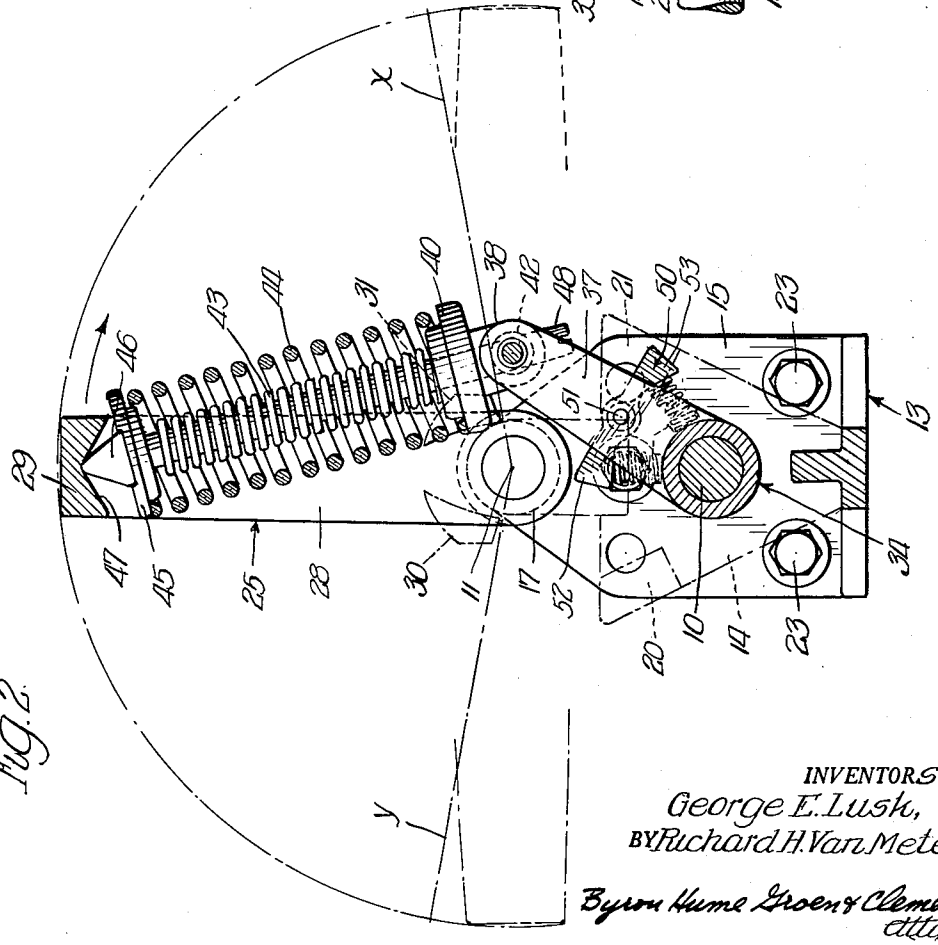


Fig. 2



INVENTORS.
George E. Lusk,
BY Richard H. Van Meter,
Byron Hume Groen & Clement
attys.

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Fig. 4

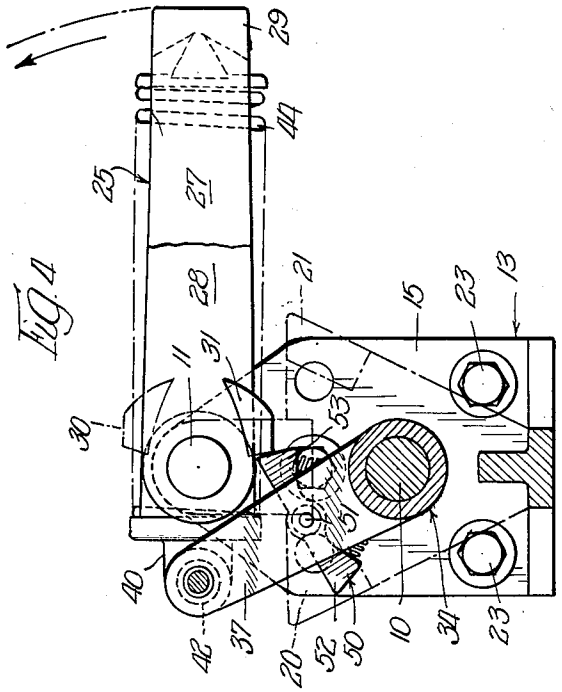


Fig. 5

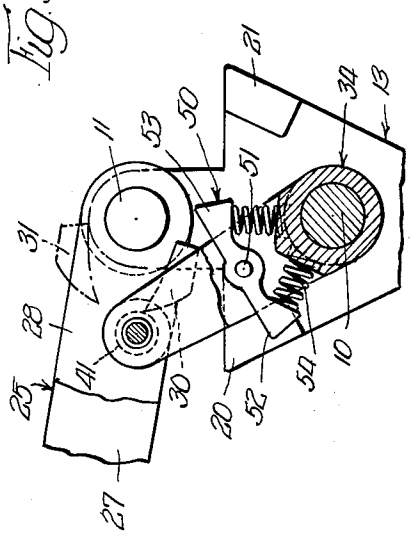
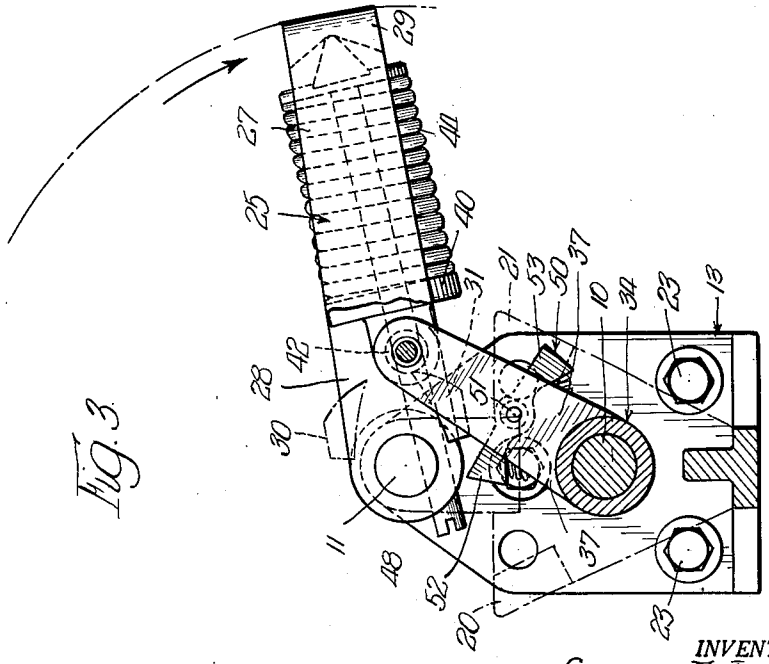


Fig. 3



INVENTORS.
George E. Lusk
BY Richard H. Van Meter,

Byron Hume Groen & Clement
Attys.

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Fig. 6.

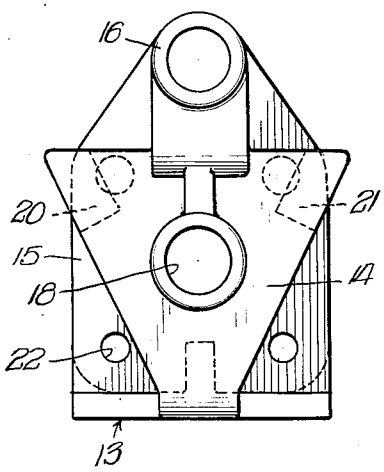


Fig. 7.

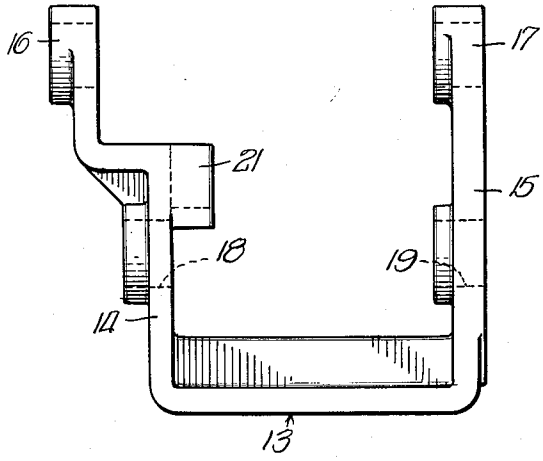


Fig. 8.

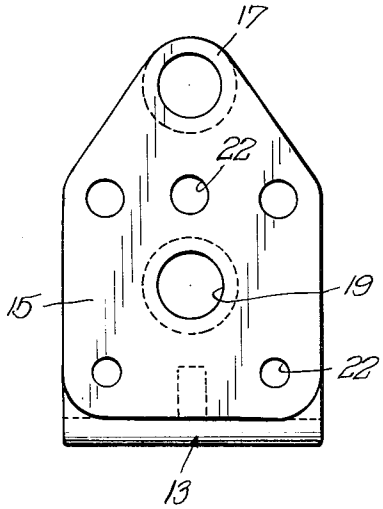
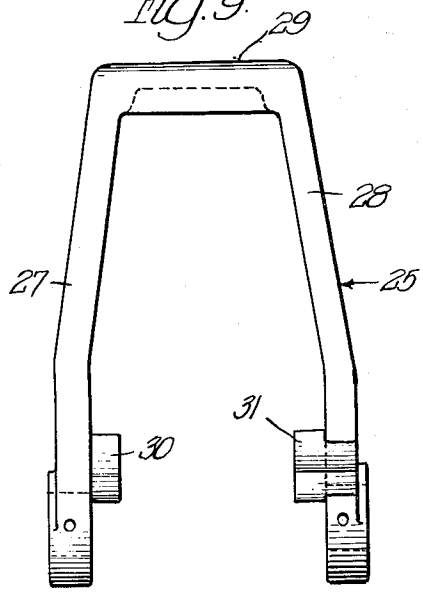


Fig. 9.



INVENTORS.
George E. Lusk,
BY Richard H Van Meter,
Byron Hume Green & Clement
Attys.

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2,995,043

TWO POSITION SNAP ACTION OPERATOR

George Edward Lusk, Downers Grove, and Richard H. Van Meter, South Holland, Ill., assignors to G & W Electric Specialty Company, Blue Island, Ill., a corporation of Illinois

Filed June 20, 1960, Ser. No. 37,475
9 Claims. (Cl. 74—97)

The invention relates to mechanical operators for electric switches and has reference in particular to a switch operator of the toggle type having oscillating snap action for performing the switching operation.

It is desirable from the standpoint of safety of the switchman to provide a mechanical operator for actuating electric switches, and this is especially so as regards large switches which handle electric currents of high amperage. Once the switchman has provided the necessary energy for the device to perform a switching operation, the mechanical device completes the actual current interruption and at the desired rate of speed regardless of any additional action on the part of the switchman. Furthermore, once the device takes over the switching operation, the switchman cannot slow down, stop or reverse the action. A switch operator capable of providing this type of function is said to be trip free.

The invention has for its main objective the provision of a mechanical switch operator of the toggle type which will be trip free and wherein the coil springs for the toggle structure will be fully compressed for storing energy therein to the maximum extent before tripping takes place to actuate the operating shaft of the switch.

A more particular object is to provide a switch operator of the toggle action type and wherein respective parts of the toggle are provided with cams which coact in a manner to prevent switch operation until the coil springs of the toggle are fully compressed. Accordingly, the switch operator of the invention stores the maximum amount of energy in the coil springs of the toggle arrangement so that when released it will rotate the switch operating shaft in a positive manner and at a high rate of speed.

A further object is to provide a mechanical switch operator of the toggle type wherein latch means carried by one part of the toggle coact with cam elements carried by the other part of the toggle in a manner to prevent unintentional or accidental rotation of the switch operating shaft.

Another object of the invention is to provide a two position snap action switch operator which will be relatively simple in design embodying a minimum of parts and which can be economically manufactured.

With these and various other objects in view, the invention may consist of certain novel features of construction and operation, as will be more fully described and particularly pointed out in the specification, drawings and claims appended thereto.

In the drawings which illustrate an embodiment of the device and wherein like reference characters are used to designate like parts—

FIGURE 1 is a front elevational view illustrating the mechanical switch operator of the invention in a mid-position as regards the carriage yoke of the toggle structure;

FIGURE 2 is a vertical sectional view taken substantially along line 2—2 of FIGURE 1;

FIGURE 3 is a fragmentary sectional view similar to FIGURE 2 but showing the carriage yoke in a position where the fully compressed coil spring structure is about to be released for tripping the toggle and rotating the operating shaft of the switch device;

FIGURE 4 is a fragmentary sectional view similar to

FIGURE 3 but showing the position of the toggle parts following release and which has produced rotation of the switch operating shaft in a counterclockwise direction;

FIGURE 5 is a fragmentary sectional view similar to FIGURE 4 but showing the position of the toggle parts just before release for producing clockwise rotation of the switch operating shaft;

FIGURE 6 is an end elevational view of the supporting frame shown in FIGURE 7;

FIGURE 7 is a front elevational view of the supporting frame for the switch operator;

FIGURE 8 is a view of the right hand end of the supporting frame; and

FIGURE 9 is a front elevational view of the carriage yoke.

Referring in particular to FIGURE 1, it will be seen that the operating shaft of the electric switch mechanism is indicated by numeral **10** and that the operating shaft of the switch operator is indicated by numeral **11**, said shaft **11** extending through and beyond the supporting structure **12** to which the supporting frame **13** of the operator is secured. The construction and shape of frame **13** is best shown in FIGURE 7 wherein it will be observed that the same is substantially a yoke including a pair of upstanding supports **14** and **15**, having journalling portions **16** and **17** at their respective ends and intermediate journalling openings **18** and **19**. The support **14** is wider at an intermediate location than at its base and the spaced extremities of said intermediate part are formed to provide the spaced stops **20** and **21**. Upright support **15** has the openings **22** therein, and this support is bolted to the structure **12** by the bolts **23**.

The operating shaft **11** is journalled in the fixed supporting frame **13** by the journalling portion **17**, and said end of the shaft **11** is fixed to the carriage yoke **25** as at **26**. The yoke essentially includes the arms **27** and **28**, a top connecting part **29** and the cams **30** and **31** which are formed integrally with the yoke adjacent the lower end of the arms. Cam **30** is formed on arm **27** and the same faces in one direction, whereas cam **31** is formed on arm **28** and the same faces in an opposite direction. A stud shaft **32** is fixed to arm **27** at **33** and the stud shaft extends into and is journalled by the portion **16**.

The base toggle member **34** is also in the form of a yoke having a base **35**, a pair of arms **36** and **37** each terminating in a journalling portion such as **38**. The base **35** is fixed at **39** to the switch operating shaft **10**, the said shaft being journalled in the intermediate journalling openings **18** and **19** of the frame structure. The spring supporting base member **40** is carried by the base toggle member **34** by means of laterally extending stud shafts integral with the base member **40** and which are respectively mounted in the portions **38** so as to extend through and project beyond the same. The projecting ends of the stud shafts provide the cam followers **41** and **42**.

The coil spring structure of the toggle arrangement includes a pair of coil springs **43** and **44**, each being supported at their base by the member **40**. The upper end of each coil spring engages the toggle plate **45** having the nose portion **46**, and which is mounted in the connecting part **29** of the carriage yoke, the said connecting part on its underside is shaped at **47** to anchor the nose portion and thus the plate for pivotal movement. Said toggle plate **45** is integral with a rod **48** extending centrally through the coil springs and said rod also extends centrally through an opening in the base support member **40** to project a predetermined distance below the same. The construction of the carriage yoke and base supporting member is such as to locate the cam followers **41** and **42** in operative relation with the cams

30 and 31. Also, it will be observed that the base toggle member 34 is limited in its oscillating movements by the stops 20 and 21 which are located in the path of the arm 36.

In order to prevent a torque being applied to the switch operating shaft 10 such as might rotate the shaft and override the toggle switch operator, the invention includes a spring loaded blocking lever, the same being carried by the base toggle member. The lever 50 is pivoted to arm 37 by the threaded pivot member 51 and the respective ends 52 and 53 of the member, FIGURES 3 and 5, are engaged by the coil springs 54 which seat at their base in recesses provided for the purpose in the base toggle member.

The carriage yoke 25 has oscillating movement through an arc of approximately 170 degrees which compresses the coil springs 43 and 44 of the toggle arrangement by eccentric pivot action. The carriage yoke 25 is shown in FIGURE 2 as being rotated in a clockwise direction and the action of the coil springs at this point in the rotative movement is to maintain the base toggle member 34 positioned to the right and in contact with stop 21. As clockwise rotation of the carriage yoke continues, the base toggle member will be yieldingly biased in a direction towards the left which causes the cam follower 42 to engage the cam 31. This position of the parts is clearly shown in FIGURE 3 and it will be observed that the coil springs have been compressed to the maximum extent. Due to engagement of the cam follower 42 with the cam 31, movement of the base toggle member 34 is prevented and said member is held against movement until the carriage yoke reaches a release position indicated by line X in FIGURE 2. When the release position is reached the cam 31 will be positioned just sufficiently below the cam follower 42 as to free the toggle arrangement, and accordingly the full compressive force of the coil springs 43 and 44 is effective to oscillate the base toggle member 34 with a snap motion into its left hand position, thus rotating the switch operating shaft 10 in a counterclockwise direction. The parts will thereupon assume the position as shown in FIGURE 4 and wherein the member 34 is now in contact with the stop 20.

For returning the base toggle member to a right hand position, the carriage yoke is rotated in a counterclockwise direction from its position as shown in FIGURE 4. After the carriage yoke has reached and passed a vertical dead center position, the action of the coil springs will be to resiliently bias the base toggle member in a right hand direction. However, the cam 30 will now be positioned in the path of the cam follower 41 and movement of the base toggle member will be prevented as clearly illustrated in FIGURE 5. As counterclockwise rotation of the yoke continues the coil springs will be additionally compressed and when the release position is reached as indicated by line Y of FIGURE 2, the base toggle member will snap into its right hand position and return rotation of the switch operating shaft takes place.

Referring again to FIGURE 4 it will be seen that with the parts in the position as shown, the end 53 of the blocking lever 50 is positioned immediately adjacent the cam 31. As long as the parts remain as shown in FIGURE 4, the cam 31 accordingly provides a stop preventing movement of the base toggle member in a clockwise direction towards the right. Thus it is impossible to inadvertently or accidentally rotate the switch operating shaft and over-ride the toggle switch operator. In the opposite horizontal position of the carriage yoke similar action will not take place, since the cam 30 is on the wrong side with respect to the blocking lever for coaction therewith. However, in order to have blocking action between the parts when the switch operator is in a position opposite to that of FIGURE 4, it is only necessary to add a second cam such as 30 to the arm 28 of the carriage yoke. This second cam will thus be located on the same side as cam 31 and the two cams will coact with the ends respectively, of the blocking lever in a manner as described. Since the blocking lever is pivoted it is thus capable of oscillation. However, the coil springs 54 tension each end and resiliently maintain the lever in equilibrium. The switchman automatically disengages the blocking device when he rotates the shaft 11 for another operation of the switch.

The invention is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawings, as various other forms of the device will, of course, be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

What is claimed is:

1. In a device of the character described, the combination with a switch operator shaft and an operating shaft for switch mechanism, of a toggle arrangement including a base toggle member fixed to the operating shaft of the switch mechanism and a rotatable carriage yoke fixed to the operator shaft, coil spring structure forming part of said toggle arrangement and which is compressed by eccentric pivot action resulting from oscillating movement of the carriage yoke, at least one cam on the carriage yoke, and at least one cam follower provided by the base toggle member and so located as to have operative coaction with the cam, said cam follower engaging the cam when the yoke is oscillated in a certain direction to prevent oscillating movement of the base toggle member until the coil spring structure is compressed to substantially a maximum extent.

2. A device of the character as defined by claim 1, additionally including a supporting frame which journals the operator shaft and the switch operating shaft so as to permit rotation thereof, and wherein the supporting frame provides a pair of spaced stops for limiting the oscillating movement of the base toggle member.

3. A device of the character as defined by claim 1, wherein two cams are located on the carriage yoke, one on each side member of the yoke, and wherein two cam followers are provided by the base toggle member for coaction with the cams respectively.

4. A device of the character as defined by claim 1, additionally including a supporting base member for the coil spring structure, means pivotally mounting the said supporting base member on the base toggle member, and wherein said cam follower is located on the base toggle member at the pivot connection therewith of the supporting base member for the coil spring structure.

5. In a device of the character described, the combination with a switch operator shaft and an operating shaft for switch mechanism, of a supporting frame having journalling portions, certain of said portions mounting the operating shaft of the switch mechanism in a rotatable manner, a base toggle member fixed to said operating shaft, a carriage yoke journalled by certain other portions of the supporting frame and being fixed to the switch operator shaft which assists in journalling the carriage yoke, a spring supporting base member carried by the base toggle member, coil spring structure confined between the supporting base member and the carriage yoke to form a toggle arrangement with the base toggle member, a pair of cams on the carriage yoke being located on respective side members of the same, and cam followers provided by the base toggle member at the connection therewith of the spring supporting base member, at least one cam follower engaging one of the cams during oscillating movement of the carriage yoke in either direction to prevent oscillating movement of the base toggle member until the coil spring structure is compressed to substantially a maximum extent by eccentric pivot action resulting from said oscillating movement of the carriage yoke.

6. In a mechanical operator for electric switch mechanism, the combination with a switch operator shaft and an operating shaft for switch mechanism, of a support-

ing frame providing upright supports having journalling portions, certain of said portions mounting the operating shaft of the switch mechanism in a rotatable manner, a base toggle member fixed to said operating shaft and upon oscillating movement thereof producing rotation of the shaft, said operator shaft being mounted by another journalling portion for rotation, a carriage yoke supported for oscillating movements by the supporting frame and being fixed to the switch operator shaft which assists in journalling the carriage yoke, a spring supporting base member pivotally carried by the base toggle member, coil spring structure confined between the supporting base member and the carriage yoke to form a toggle arrangement with the base toggle member, whereby the coil spring structure is compressed by eccentric action resulting from the oscillating movement of the carriage yoke, at least one cam on the carriage yoke, and at least one cam follower provided by the base toggle member and located in alignment with the pivot axis of the spring supporting base member, said cam follower engaging the cam when the yoke is oscillated in a certain direction to prevent oscillating movement of the base toggle member until the coil spring structure is compressed to substantially a maximum extent.

7. A device of the character as defined by claim 6, additionally including a pair of spaced stops on the supporting frame and located in the path of the base toggle member for limiting the degree of oscillating movement of said base toggle member.

8. A device of the character as defined by claim 6, additionally including a pair of spaced stops on the supporting frame and located in the path of the base toggle member for limiting the degree of oscillating movement of said base toggle member, and a blocking lever pivoted to the supporting frame and adapted to coact with said cam, when the base toggle member is located in an oscillated position in contact with one of said stops, to prevent accidental or inadvertent rotation of the operating shaft for the switch mechanism, said blocking lever and cam automatically disengaging when the operator shaft is rotated for effecting a switch operation.

9. In a mechanical operator for electric switch mechanism, the combination with a switch operator shaft and an operating shaft for switch mechanism, of a toggle arrangement including a base toggle member fixed to the operating shaft of the switch mechanism and a rotatable carriage yoke fixed to the operator shaft, a supporting frame for the toggle arrangement and which mounts the operator shaft and the switch operating shaft permitting rotation, coil spring structure forming part of said toggle arrangement and which is compressed by eccentric pivot action resulting from oscillating movement of the carriage yoke, at least one cam on the carriage yoke, at least one cam follower provided by the base toggle member and so located as to have operative coaction with the cam, said cam follower engaging the cam when the yoke is oscillated in a certain direction to prevent oscillating movement of the base toggle member until the coil spring structure is compressed to substantially a maximum extent, a pair of spaced stops on the supporting frame for limiting the oscillating movement of the base toggle member in both directions, and a blocking lever pivoted to the supporting frame and adapted to coact with said cam when the base toggle member is located in an oscillated position in contact with one of said stops, to prevent rotation of the operating shaft for the switch mechanism except by actuation of the operator shaft.

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