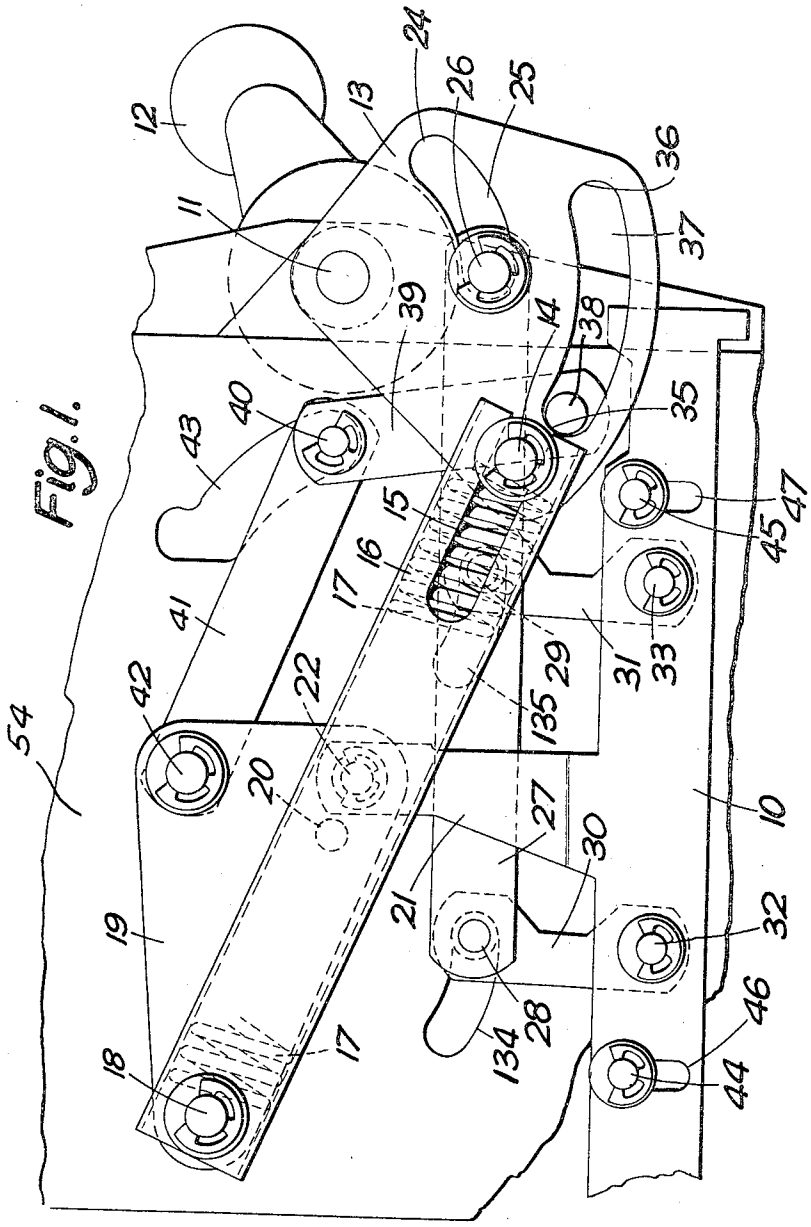
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TOGGLE MECHANISM

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Fig. 1.



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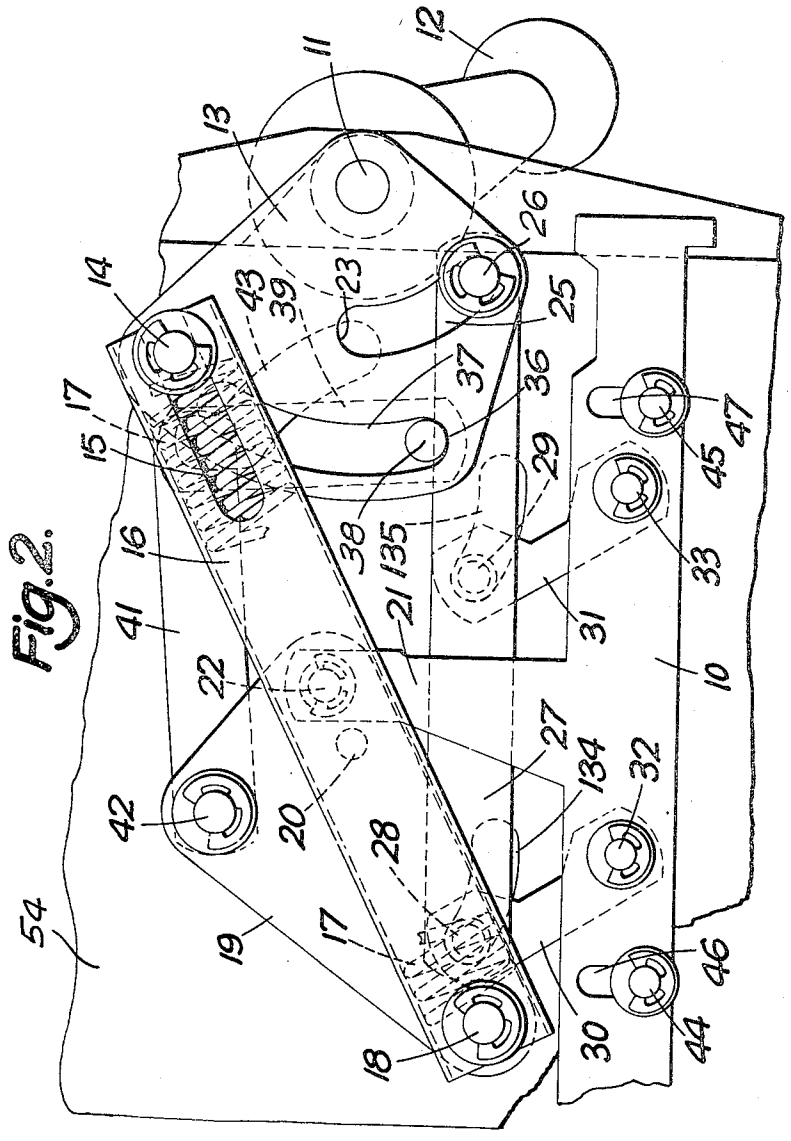


Fig. 2.

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TOGGLE MECHANISM

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ABSTRACT OF THE DISCLOSURE

A toggle mechanism in which the toggle action is controlled by a spring link coupled to a rotatable operating shaft and to a rotatable link plate so as to be compressed and released during initial and final parts of the toggle action; the operating shaft carries a slotted plate and a link system is coupled between the slotted plate and the link plate such that a "dead centre" position is reached before maximum compression of the spring in the link. Accordingly, there is no equilibrium position and the toggle mechanism cannot "stick" in a true dead centre position.

The invention relates to toggle mechanisms. Such mechanisms, which may be operated manually, are particularly useful in electrical switch gear where a positive drive to one of two switch positions is desirable and in similar applications.

The object of the present invention is to provide a simple and yet versatile toggle mechanism.

One embodiment of the invention will be more particularly described hereinafter with reference to the accompanying drawings in which:

FIGURE 1 illustrates a toggle mechanism in one of its end positions; and

FIGURE 2 illustrates the toggle mechanism in its other end position—i.e. the element moved by the mechanism is in its other end position.

Referring to FIGURES 1 and 2; an element **10** is required to move with a toggle action between two end positions; the two end positions may correspond to the two positions of a switch or the movement of the element **10** may be positively transmitted to operate the switch.

An operating shaft **11** on which is shown a handle **12** has rigidly mounted on it a plate **13** having an anchor pin **14**. The pin **14** extends through slots **15** in the rigid cylindrical tube **16**, and forms a movable anchor pin for the spring **17** which is anchored to the tube **16** at its other end by the fixed anchor pin **18**. The pin **18** also constitutes the other wearing end connection for the tube **16**, being mounted on a link plate **19** constituting a crank. The link plate **19** is rotatable about the fixed pin **20** and transmits movement via pin **22** to the arm **21** which is integral with element **10**. Rotation of the shaft **11** compresses the spring **17** which releases abruptly after dead centre is reached; consequently, the element **10** is movable with an over-centre toggle action from one end position to the other. FIGURE 1 shows one end position and FIGURE 2 shows the other end position. The element **10** is slidable between its two end positions, pins **44** and **45** on plate **54** engaging slots **46** and **47** in element **10**.

The plate **13** has two slot end abutment **23**, **24** disposed at a fixed distance from one another; in the embodiment shown in FIGURES 1 and 2 the abutments **23** and **24** are sides at opposite ends of a slot **25**. Clockwise rotation of the shaft **11** in FIGURE 1 causes slot **25** to slide along pin **26** of link bar **27** until end **24** bears on the pin **26**; further rotation causes the link bar **27** to move to the position shown in FIGURE 2. The reverse rotation moves the bar **27** back to its initial position. The bar **27** is pinned by pins **28** and **29** to links **30** and **31**

which are themselves pinner by pins **32** and **33** to element **10**. The pins **28** and **29** are slidable in the arcuate slots **134** and **135** in the support plate **54**, which also acts as a rigid support for the fixed pivots and shafts of the mechanism. The bar **27** can thus move the element even if spring **17** fails.

When the shaft **11** and therefore the plate **13** are rotated so that the anchor pins **14**, **18** of the spring **17** form a straight line with the shaft **11**, the spring **17** is at maximum compression. Further rotation of the plate **13** beyond this position allows the spring to expand and cause the element **10** via the link plate **19**, to snap into its other end position and complete its toggle action. To ensure that there is no chance of the shaft **11** and therefore the plate **13** sticking or easily balancing in the in line position reached when the anchor pins **14**, **18** form a straight line with the shaft **11**, the abutments **23** and **24** of the arcuate slots **25** are adapted to start to push the link bar **27** when shaft **11** is between 2° and 5° before its angular position at dead centre of the toggle movement. Upon further rotation of the shaft **11**, the bar **27** pushes the links **30** and **31** out of their respective locking positions and acts on the element **10** with less movement and in the same direction as the toggle movement initiated by the spring. The link plate **19** turns in the opposite direction to the shaft **11** and so the anchor pin **18** tends to "meet" the other anchor pin **14** so that the anchor pins and the shaft **11** lie on a straight line formed a few degrees of rotation before that angular position of the shaft **11** which, with the same mechanism dimensions, would have given the in-line position.

An analogous operation occurs when the mechanism is operated in the reverse direction.

At the position when one of the slot-end-abutments **23** or **24** bears against pin **26**, the corresponding end **35** or **36** of arcuate slot **37** bears against pin **38** on link **39**, which is pivoted at the pin **40** to link **41**, itself pivotally attached to link plate **19** at the pin **42**. The pin **40** is slidable in arcuate slot **43** in plate **54**. This arrangement transmits the further rotation of shaft **11** to link plate **19** to ensure that the link plate **19** does not stay in the dead centre position.

The mechanism described above fulfills certain operating conditions, namely:

(a) A single operating spring assists a toggle movement in two opposite directions;

(b) The operating shaft cannot be balanced so as to remain in a position corresponding to the unstable position of the operating spring—i.e. where the spring is at maximum compression: the position of the operating shaft therefore gives an accurate indication of the position of the element;

(c) The element **10** can be mechanically locked in one of its end positions by the links **30**, **31**;

Two further important requirements are:

(d) The toggle movements cannot be retarded by the operating shaft; and

(e) The element **10** can always be brought to one or the other of its end positions by rotation of the operating shaft even if the operating spring or its associated links are missing owing to spring breakage or the like.

To meet these two latter requirements, the abutments **23**, **24** (and abutments **35** and **36**) must be in such an angular relationship to one another that before the bar **27** starts to be moved, which is before the spring reaches its position of maximum compression, the abutments must be so positioned as to act on the bar **27** even when the mechanism is in its two end positions. Consequently, the element **10** may then be moved between its two end positions without the operation of the spring **17**. Of course, this movement without the spring **17** is not a toggle action.

The distances between the abutments **23** and **24** and between abutments **35** and **36** in the plate **13** are, in relation to the other dimensions of the mechanism, arranged so that, when the anchor pins **14, 18** are on a straight line with the shaft **11**, the mechanism can snap into its other end position, even though shaft **11** and the plate **13** be forcibly retained in the position associated with the beginning of the toggle movement.

The mechanism described above has the additional useful feature that less than 90° of rotation of shaft **11** is required to operate it.

I claim:

1. A toggle mechanism comprising an element movable between two end positions; a drive member rigidly mounted on a rotatable operating shaft and slidably engaging one end of a spring linkage; an operating link constituting a crank which is pivotally coupled to the spring link and is movable between two end positions, the element being coupled to the crank, the pivot point of the brank being separate from the operating shaft wherein rotation transmitted from the operating shaft to the drive member is transmitted to the crank via the spring link, and further comprising linking means coupled in parallel with the spring link and arranged, during some of the movement against the spring action of the spring link, to tend to turn the crank in the opposite direction in relation to the drive member, and during the releasing movement only of the spring link, to be released from driving engagement with the drive member.

2. A mechanism as set forth in claim **1**, wherein said linking means comprises an intermediate link carrying pivotally mounted locking links pivotally mounted at their other ends to said element, which is slidable between its

two end positions, said intermediate link being moved by engagement with one of two slot end abutments of said drive member.

3. A mechanism as set forth in claim **2**, wherein said slot and abutments are spaced angularly on said drive member so that in the two end positions a portion of said intermediate link rests against a respective slot end abutment of said drive member which is moved to cause the turning of said crank by the other slot end abutment.

4. A mechanism as set forth in claim **3**, wherein said intermediate link moves along an arcuate path and said element, locking link and intermediate link form a locking arrangement when said element is in one end position, there being provided a further intermediate link, a fixed member defining an arcuate slot, said further intermediate link engaging said arcuate slot and being pivotally coupled to the crank to form thereby a locking arrangement for the other end position of the element.

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