Feb. 12, 1957 O. LARDELLI 2,781,426

DISCONNECT SWITCH

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Fig. 1.

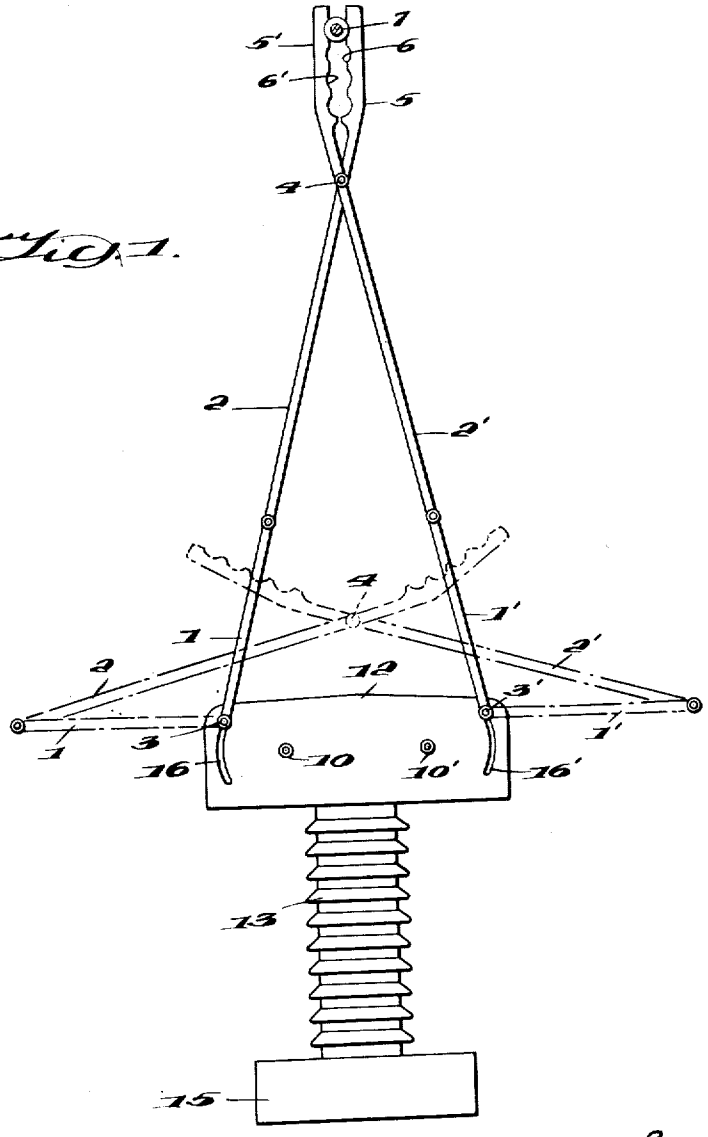

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Fig. 2.

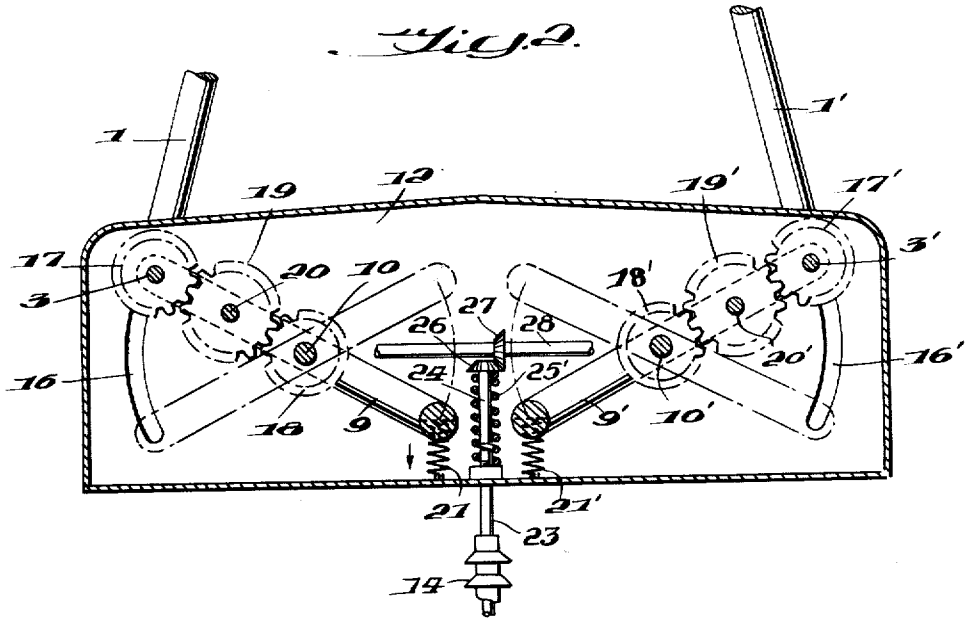
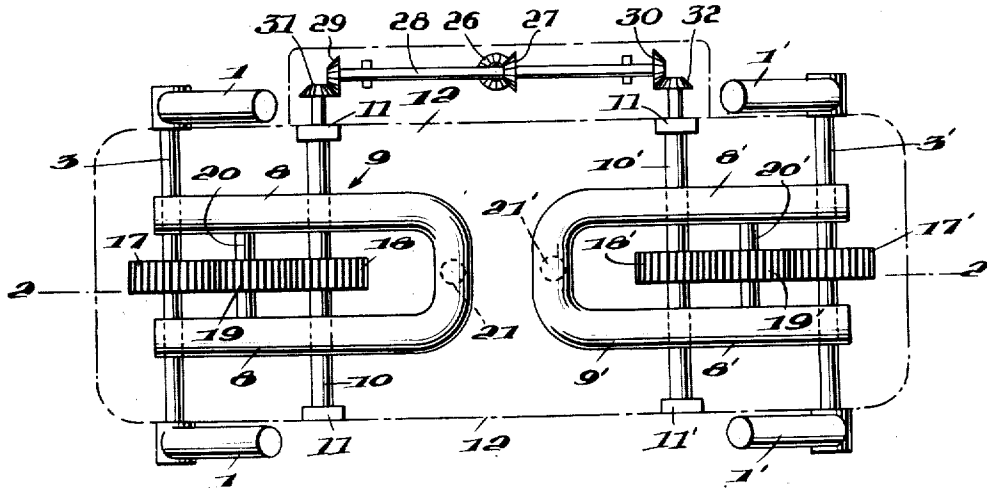


Fig. 3.



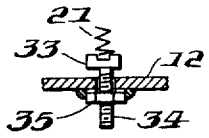


Fig. 4.

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DISCONNECT SWITCH

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Application June 9, 1955, Serial No. 514,189

8 Claims. (Cl. 200—48)

This invention relates in general to disconnect switches for use on high voltage systems and more particularly to switches of the type adapted to be mounted upon insulating pillars and having a movement from a lower, retracted "open" position on the pillar, to a raised, extended "closed" position wherein electrical contact is made by the upper end of the extendable switch mechanism with an overhead conductor or bus-bar. Such switches permit the connection of vertically intersecting bus-bars at the point of least distance between the conductors. In order to obtain maximum savings of space, it is desirable to keep the overall height of the contact elements of the disconnect switch at a minimum. However, the elements need to be constructed in such manner that the contacts will be certain to close in a positive manner. This involves the contact pressure as well as the various possible positions of the overhead contact which may shift due to various causes such as wind, etc.

One known construction for such a disconnect switch comprises a pair of parallel spaced scissors, each consisting of one or several links, and operated by pivotal movement of the lower links of each scissors about their lower ends. In an embodiment where the twin scissors are arranged symmetrically, the upper ends thereof carrying the movable contact parts usually move up vertically in the plane of the pillar on which the mechanism is supported. In an embodiment wherein the twin scissors are arranged asymmetrically, the path of the movable contact parts follows a curve. The movable contact parts may also move in a plane other than that containing the axis of the support pillar.

The object of this invention is to provide a disconnect switch having twin, i. e. spaced parallel scissors carrying the movable contact element at the upper ends thereof, each scissors comprising one or several articulated links, and wherein the lower ends of the lowermost links of each scissors are mounted for rotation on horizontal axles which, in addition to rotation about their axes, are also arranged for movement in a plane vertical to those axes. In particular, these axles can be mounted on pivotally mounted levers, the pivot axes of these levers being arranged stationarily within the head of the support pillar. Such head contains the drive mechanisms for scissors operating axles which cause the scissors to be raised and lowered. According to one embodiment of the invention, two movable axles are provided, each being mounted on a pivotally mounted lever, and a spur gear on each said axle is coupled to another spur gear of the same diameter on the pivot axle of the corresponding lever through an intermediate spur gear which is mounted on the lever. The diameters of the outer spur gears being equal, it becomes possible to turn the lever about its pivot axis without materially affecting the position of the two spur gears if one of the two is being held in place.

The mechanism according to the invention has the following advantages: After the disconnect switch, through pivotal movement of the lowermost links of each scissors, has reached the "on" or "closed" position wherein the

outer ends of the scissors grasp the overhead stationary contact member, the two axles connected with the ends of the lowermost links can be lowered by movement of the pivotally mounted levers. The movable contact, at the outer ends of the scissors consists of at least two jaws which are connected with the upper links of the scissors and these jaws are provided with teeth-like projections which, when the scissors are raised, will clamp around the stationary contact and hang on the same, due to lowering of the axles, thus increasing the contact pressure. The clamping force of the scissor-type arrangement need now to be only strong enough to prevent the jaws from opening. The contact pressure can be made, to give an example, approximately equal to the weight of the scissor type arrangement. By the use of springs acting upon the pivotally mounted levers, it becomes possible to generate forces in the direction of movement of the scissors, thereby establishing the correct contact pressure. The free ends of the springs preferably are secured in such manner that the springs can be adjusted.

The foregoing method of producing an adjustable contact pressure results in a substantial simplification of the contact construction. It is possible to use the conductor wires of the bus-bar system as the opposed, i. e. stationary contacts, such contacts being structurally detached from the disconnect switch mechanism. It is expedient to protect the conductors within the area of contact by pieces of pipe. If the conductors and disconnect switch mechanism are subject to lateral stresses, for example, due to wind pressure, such stresses will be absorbed elastically by the springs acting upon the pivotally mounted levers without overburdening the scissors, the support pillar or the drive mechanism for the scissors. This also holds true for any vertical stresses which may be created by ice loads or expansion due to changes in temperature.

The flexibility of the disconnect switch according to the invention is further improved by the placing of at least one elastic unit between the spur gear mounted on each of the two movable axles and serving as the driving link, and the initial link to the mechanism driving the scissors, for example, a hand operated crank. When the disconnect switch is "closed," said elastic unit will be under tension and create the clamping force of the scissors. Since the magnitude of the clamping force can be kept relatively low, it is possible to utilize soft springs, with the result that the flexibility of the scissors mechanism will be greater than would be the case were strong contact springs to be used according to known constructions.

In the drawings which illustrate one practical embodiment of the invention:

Fig. 1 is a side view in elevation of the disconnect switch mechanism;

Fig. 2 is a vertical central longitudinal section on line 2—2 of Fig. 3 through the head portion of the support pillar drawn to a somewhat larger scale, and showing the mechanism for effecting movement of the scissors;

Fig. 3 is a plan view of the mechanism within the head of the support pillar; and

Fig. 4 is a fragmentary detail showing means for adjusting the springs which act on levers associated with the scissors links.

With reference now to the drawings and to Fig. 1 in particular, it will be seen that the twin scissors disconnect switch is comprised of a pair of scissors, only one being seen in this view, the other being directly behind and in line with the one which is visible. Each leg of each scissors is comprised of a plurality of links articulated in end-to-end relation. One leg consists of the articulated links 1, 2 and the other leg consists of the articulated links 1', 2'. The lower ends of the lowermost links 1 and 1' are secured to axles 3 and 3' and, as these axles are rotated in counterdirections, the links will cause the scis-

sors to move vertically from a retracted position indicated in dash-dot lines to an extended position shown in full lines. Links 2 and 2' are pivotally connected together at 4 and the upper ends of these links terminate in jaws 5, 5' having confronting sets of projections or teeth 6, 6' between which the overhead contact member 7 is grasped as the scissors close.

As is more clear from Figs. 2 and 3, axle 3 is mounted for rotation in the outer portions of the legs 8 of a U-type lever 9, the legs of the U being mounted for rotation on a stationary axle 10 which is journalled in bearings 11 at the opposite sides of a casing 12 located atop an insulating support column 13. Parallel with column 13 is a second insulator column 14 in which is mounted a shaft 23 driven by mechanism located in the base 15 upon which the insulators 13 and 14 rest. Opposite sides of the casing 12 are provided with aligned slots 16 within which the axle 3 can move vertically as the pivotally mounted lever 9 is caused to move. In a similar manner, the other axle 3' is mounted in the legs 8' of a U-type lever 9' mounted for rotation on a stationary axle 10'.

Secured upon axle 3 intermediate the U legs 8 is a spur gear 17 which acts upon a spur gear 18 that is mounted for rotation with axle 10 also intermediate the U legs 8, through an intermediate spur gear 19 that is mounted on an axle 20 carried by the U legs 8. Spur gears 17 and 18 have the same diameter. In a similar manner a spur gear 17' secured upon axle 3' acts upon a spur gear 18' mounted for rotation with axle 10' through an intermediate spur gear 19' mounted on axle 20' carried by U legs 8'.

A spring 21 having one end fixed to the casing 12 and the other end attached to the closed end of the U lever 9 exerts a force in the direction of the axis of movement of the scissors. In a similar manner, a spring 21' has one end fixed to casing 12 and the other end secured to the closed end of U lever 9'. If desired, the force exerted by springs 21, 21' may be adjusted. Fig. 4 shows an arrangement for effecting this result, it being noted that the rest point for the lower end of spring 21 is constituted by the upper headed end of a threaded bolt 33, the shank 34 of which extends through an opening in the bottom wall of casing 12 and is threaded into a stationary nut 35 secured as by welding to the underface of such bottom wall. By turning the bolt 33, it may thus be raised or lowered thus raising or lowering the rest point for the lower end of spring 21 and adjusting its force accordingly.

The drive mechanism for rotating the axles 3—3' is comprised of the vertical shaft 23 which constitutes the initial drive unit of the mechanism driving the scissors, said shaft extending upwardly through insulator column 14 into the casing 12. The upper end of shaft 23 is elastically coupled to a shaft 24 coaxial with shaft 23 by means of a helical spring 25 which encloses the end portions of both shafts 23, 24 and is connected to each shaft so that as the shaft 23 is rotated, the shaft 24 will likewise be rotated through the torsional effect produced in the spring 25. A bevel gear 26 secured to the upper end of shaft 24 is meshed with a bevel gear 27 secured upon a horizontal shaft 28 and bevel gears 29, 30 secured at the outer ends of shaft 28 mesh respectively with bevel gears 31, 32 secured respectively upon the outer ends of shafts 10 and 10'. Rotation of shafts 10 and 10' effect

rotation of gears 18, 18' and hence bring about rotation of axles 3, 3'.

In conclusion, it will be evident that various minor changes in the construction and arrangement of component parts may be made without, however, departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. In a disconnect switch adapted for use on high voltage the combination comprising twin scissors each having at least one link, said scissors carrying the movable contact, the two lower links of each scissors being mounted upon movable axles for rotation about the axle axes and means for effecting movement of said axles vertically to the plane of the axles.

2. In a disconnect switch adapted for use on high voltage the combination comprising twin scissors each having at least one link, said scissors carrying the movable contact, the two lower links of each scissors being mounted on movable axles for rotation about the axle axes, pivotally mounted levers arranged for rotation about stationary axles, said levers carrying said movable axles, and means for moving said levers and simultaneously rotating said movable axles about their respective axes, said levers being arranged within the head of a support pillar for the scissors.

3. A disconnect switch as defined in claim 2 wherein said means for moving said levers and rotating said movable axles comprises a spur gear mounted on each of said movable axles is coupled to a spur gear of like diameter mounted on the corresponding lever axle through an intermediate gear also mounted on the corresponding lever.

4. A disconnect switch as defined in claim 2 and which further includes springs acting respectively on said levers and exerting forces on said scissors in the plane of the scissor axis.

5. A disconnect switch as defined in claim 4 and which further includes adjustable mounting means for said springs whereby to enable adjustment of the spring force acting on said levers.

6. A disconnect switch as defined in claim 2 and which further includes at least one elastic unit arranged between said lower links located on said movable axles and the initial driving unit of the mechanism driving said scissors, said elastic unit being under tension when said disconnect swtch occupies its closed position.

7. A disconnect switch as defined in claim 1 wherein the movable contact embodied in each of said scissors comprises a pair of jaws connected to the upper links of the scissors and which clamp around the stationary contact when said scissors are raised.

8. A disconnect switch as defined in claim 7 wherein said jaws are provided with hook-like projections which are adapted to hook into said stationary contact as soon as said movable axles move downward subsequent to raising of the scissors.

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