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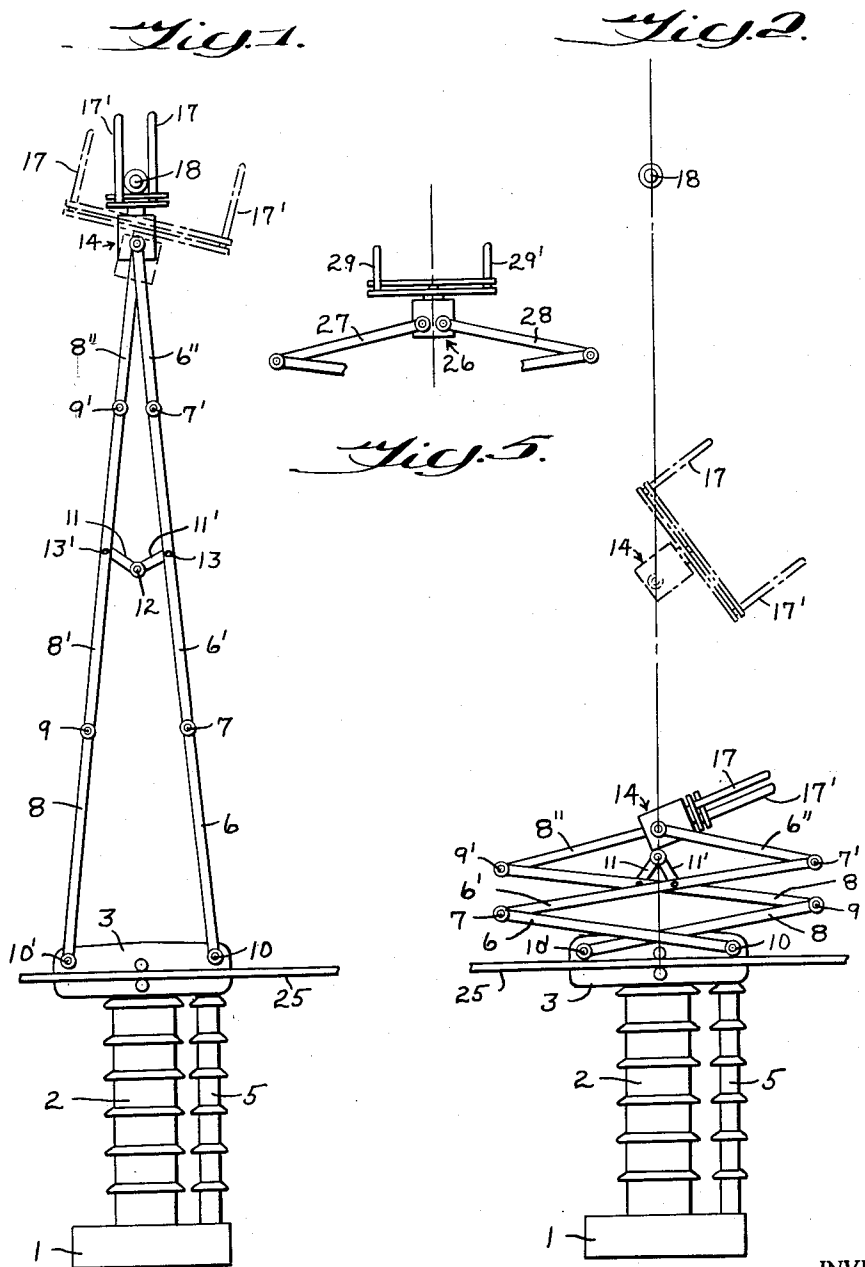
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2,748,211

DISCONNECTING SWITCH

Filed June 7, 1955

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

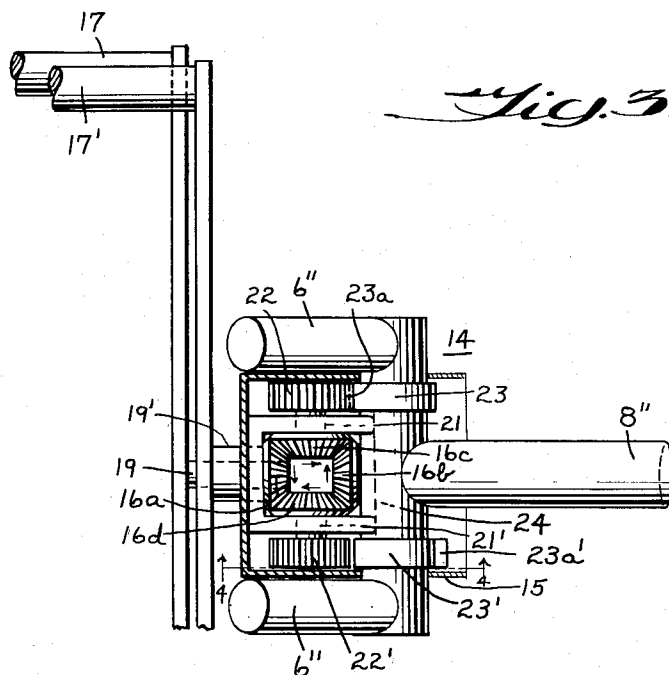
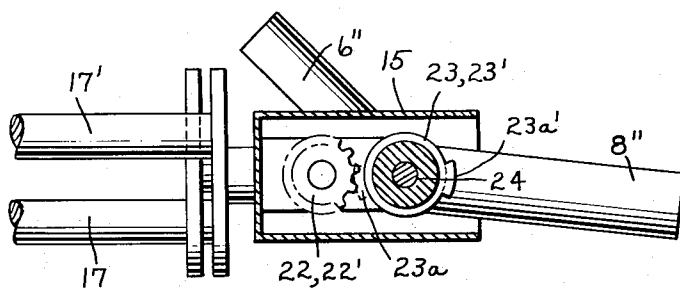


Fig. 3.



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DISCONNECTING SWITCH

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7 Claims. (Cl. 200—48)

This invention relates to electrical disconnecting switches of the pole type and particularly to those wherein the movable contact piece is mounted upon the outer end of a system of jointed levers capable of great extension commonly referred to as a lazy-tongs or extensible lever system. The extensible lever system is mounted upon an insulating support and the contact piece at the outer end of the lever system is adapted to move into engagement with a stationary contact member when the lever system is extended. This type of disconnect switch has been developed for use with very high voltage systems and is commonly applied in situations where the stationary contact member is constituted by an overhead line or bus bar itself or to a contact member fastened to the line or bus bar. The extensible lever system is mounted upon a pedestal type of insulating support, and the other electrical line with which electrical contact is established through the stationary and movable contact pieces and the extensible lever system, is secured to the insulating support, there being an electrical connection made between the base of the extensible lever system and said other electrical line. The advantage of this type of disconnect switch is its space saving factor and the reduction made possible in the distance between adjacent lines or bus bars.

In the design of this type of disconnect switch one encounters certain problems. For example, it is difficult to attain proper pressure between the stationary and movable contact pieces. Also, it is necessary to construct the movable contact piece in such manner that it will be certain to engage the stationary contact piece. With overhead bus bars which are rigidly fixed as to position this poses no great difficulty. However, when the stationary contact piece is either an overhead line itself or a contact piece attached to such line much difficulty is encountered as the line swings due to pressure from the wind, temperature changes, ice formation, etc., which can prevent the switch contacts from closing.

One known arrangement for obtaining proper contact pressure is by constructing the movable contact at the end of the extensible lever system in the form of a gripper having jaws which are adapted to grasp between them the stationary contact element. However, a gripper type of contact suffers from the disadvantage that it requires an unnecessarily large spacing between adjacent overhead lines. This is due to the fact that when the overhead line or bus bar runs parallel to the lower branch line fastened to the insulator pedestal which supports the extensible lever system it is necessary to arrange the switching mechanism such that the arms of the gripper or the lever elements of the extensible lever system move in a plane normal to the plane of the lines so that the gripper may grasp the opposite, i. e. stationary contact. This is essential, since the gripper, being a continuation of the extensible lever system must move in the same plane as the latter. Hence, the

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need for wide spacing between adjacent lines. As a remedy it has been proposed to use a rather expensive contact arrangement employing suspension insulators or some similar auxiliary construction.

Another known arrangement for assuring proper contact pressure is to construct the stationary contact member in the form of an open cup or tulip-shape. The movable contact member at the end of the extensible lever system is so constructed as to enter the cup or tulip shaped contact and spread after insertion thus establishing good contact pressure inside the cup. A contact arrangement of this type is, however, satisfactory only on lines where the line space between adjacent supports is relatively short and swinging motion of the line is inconsequential. This for the obvious reason that otherwise the movable contact member might miss the opposite, tulip contact entirely and hence fail to close the electrical circuit between the contacts. Of course, the diameter of the tulip shaped contact could be made disproportionately larger so as to ensure entry of the movable contact but this has its limitations from a practical point of view.

The object of this invention is to provide an improved construction for the movable contact member at the end of an extensible lever system type of disconnect switch which will accomplish the necessary contact pressure in a simple and reliable manner when the switch is closed, and also require a minimum of spacing.

This objective is obtained by constructing the movable contact member in the form of a yoke and wherein the arms of the yoke are adapted to rotate toward each other after the yoke has embraced the stationary conductor thus establishing adequate contact pressure with the stationary conductor. Movement of the arms of the yoke is effected by means of a gearing arrangement actuated by movement of the extensible levers themselves.

In the accompanying drawings which illustrate a preferred embodiment of the invention:

Fig. 1 is a view in side elevation of the disconnecting switch, the extensible lever system being shown in its raised, extended position and with the yoke engaged with the stationary overhead conductor. This view also shows the yoke in dot-dash lines in the position which it occupies just prior to closing of the yoke arms into contact with the overhead conductor.

Fig. 2 shows the extensible lever system in the lowered, retracted position on its pillar type insulating support, this view also showing the position of the yoke at an intermediate point between the fully retracted and fully extended positions of the extensible lever system.

Fig. 3 is a sectional view drawn to a larger scale of the yoke, its supporting structure and the gearing by which the yoke arms are shifted between their outstretched position and the position contacting opposite sides of the overhead conductor.

Fig. 4 is a section taken on line 4—4 of Fig. 3; and

Fig. 5 is a view showing a modified construction for actuating the arms of the yoke.

With reference now to the drawings and Figs. 1 and 2 in particular, it will be seen that the improved disconnect switch includes a base 1 on which is supported a pillar type insulator 2. Carried at the top of insulator 2 is a housing 3 in which is contained gearing (not shown) by which the extensible lever system is raised and lowered. For driving the gearing, a drive shaft (not shown) extends upwardly from the interior of base 1 through a separate insulator column 5, parallel to pillar insulator 2, into gear housing 3. The upper end of the drive shaft is coupled to the gearing in this

housing and the lower end is coupled to motor means (not shown) located in the base 1.

The extensible lever systems includes two sets of levers, the levers of each set being pivotally connected in end-to-end relation. One set comprises the levers 6, 6' and 6'' pivotally connected at their ends by pivots 7 and 7'. The other set comprises levers 8, 8' and 8'' pivotally connected at their ends by pivots 9 and 9'. The lower ends of levers 6 and 8 are pivotally mounted at 10, 10' on the gear housing 3 and are rotated about such pivots by the gearing in such housing. It will be noted that a pivoted link system consisting of two short links 11, 11' interconnects intermediate points of levers 6' and 8', the links being pivotally connected together at their adjoining ends by pivot 12 and the outer ends of the links being connected pivotally at 13, 13' respectively to levers 8' and 6'. Consequently, when levers 6 and 8 are rotated respectively about their pivots 10, 10' from the lowered or retracted position shown in Fig. 2, the two sets of levers 6, 6', 6'' and 8, 8', 8'' will extend upwardly to the position shown in Fig. 1 wherein the levers of each set are in end-to-end alignment.

The "movable" contact assembly of the disconnect switch is carried by the outer ends of levers 6'' and 8'' and is indicated generally by reference numeral 14. The assembly 14 comprises a housing 15 to which the outer end of lever 8'' is rigidly secured, a set of four intermeshed bevel gears 16a—16d and a pair of arms 17, 17' forming a yoke which are adapted to move between an out-stretched position and a position contacting opposite sides of the overhead conductor 18. The arms 17, 17' are mounted on concentric shafts 19, 19' respectively; the inner shaft 19 extending through gear 16a and being connected to an oppositely disposed coaxial gear 16b. The outer shaft 19' is connected to gear 16a. Consequently, gears 16a, 16b constitute the output gears. The two other bevel gears 16c, 16d which are oppositely disposed and coaxially arranged and meshed with gears 16a, 16b constitute input gears and are mounted respectively on shafts 21, 21'. A spur gear 22 secured upon shaft 21 drives the latter, and a spur gear 22' is secured upon shaft 21' to drive it. Gears 22, 22' are provided with teeth around their entire periphery and are adapted to mesh respectively with drive gears 23, 23' secured upon a shaft 24 that is rotated by lever 6''. As shown in Fig. 4, the teeth of the drive gears 23, 23' extend over only a portion of their peripheries, and the toothed portions 23a, 23a' lie about 180° apart as related to the axis of drive shaft 24. Consequently, the teeth 23a on gear 23 never mesh with the teeth on gear 22 at the same time teeth 23a' on gear 23' mesh with the teeth on gear 22'.

Fig. 3 shows the position of the outer ends of levers 6'', 8'' when the lever system is retracted according to the position of Fig. 2 and the corresponding positions of the yoke arms 17, 17' and gearing 16a—16d, 22, 22' and 23, 23'. In this position it will be observed that the teeth 23a on gear 23 are in mesh with the teeth on gear 22. As the lever system begins its extension, lever 6, rotating shaft 24 and gears 23, 23' effects rotation of gear 22 and shaft 21 and gear 16c. In this condition gear 22' being out of mesh with gear 23' and hence also shaft 21' and bevel gear 16d are free, and gear 16d functions as an intermediate gear. The gears 16a—16d are thus caused to rotate in the directions indicated by the arrows with the result that shafts 19, 19' and hence yoke arms 17, 17' are each caused to rotate approximately 90° in counterdirections until the latter reach an outstretched position substantially 180° apart at the intermediate position of extension of the lever system, indicated by the dash-dot lines in Fig. 2.

As the lever system continues to rise, the head of the movable contact assembly 14 turns in a counter-clockwise direction reaching the position indicated by the dash-dot lines in Fig. 1 wherein it will be noted that the yoke arms 17, 17' embrace the overhead conductor 18. Finally, as

the extensible lever system nears the end of its upward stroke, the teeth 23a' mesh with the teeth on gear 22' (the teeth 23a have at this time now disengaged from the teeth on gear 22) thus causing bevel gear 16d to be driven, which drives bevel gears 16a, 16b and hence shafts 19, 19' and yoke arms 17, 17' through a further angle of approximately 90° to the position indicated by full lines in Fig. 1 wherein it will be noted that the overhead line 18 is grasped between by the yoke arms 17, 17'. This is the "on" position of the disconnect switch. The levers which make up the extensible lever system are made from electrically conductive metallic material and hence complete an electrical circuit from the overhead line contact 18 to the other side of the line, conductor 25, which is supported by gear housing 3 at the top of insulator pillar 2. When the disconnect switch is opened, the sequence of operations above described for closing the circuit, is simply reversed, the final position of the lever system being as indicated in Fig. 2.

Fig. 5 shows a slightly modified construction wherein the movable contact assembly 26 performs only one turning motion, and such motion takes place at the end of the closing movement for the purpose of securely engaging the overhead contact member. The gearing of the contact assembly 26 is altered from that described for contact assembly 14 to meet the different operating arrangement, and both sets of levers 27, 28 are pivotally connected to the contact assembly 26. The double yoke, arms 29, 29' always move in line with the axis of the insulator support pillar, and a somewhat shorter yoke can therefore be used than is required for the embodiment shown in Figs. 1—4. On the other hand, the height of the extensible lever system 27, 28 will be shorter when in the retracted, open circuit position.

As to both of the described embodiments, the movable contact assembly is in the form of a double yoke. However, in cases of multiple conductors it is possible to construct the movable contact assembly as a single yoke because the yoke will be positioned between two double bars when the switch is being closed, and the yoke, when turning, will be able to exert sufficient contact pressure against the overhead conductor without difficulties.

In conclusion, a disconnect switch with the movable contact assembly as above described has the added great advantage in that the switch can be arranged within the switchboard assembly without regard to the relative position of the conductors which are to be connected by the switch. Furthermore, the space requirement of the switch is reduced to a minimum.

I claim:

1. In a disconnecting switch the combination comprising an extensible lever system mounted upon an insulating support and movable between a retracted open circuit position to an extended closed circuit position, a movable contact assembly carried by the upper end of said lever system, said assembly including a yoke mounted for rotation thereon to make and break contact with an overhead conductor, gearing means for effecting rotation of said yoke, and means controlled by movement of said lever system for actuating said gearing means and hence also said yoke.

2. A disconnecting switch as defined in claim 1 wherein said yoke is a single yoke.

3. A disconnecting switch as defined in claim 1 wherein said yoke is a double yoke.

4. A disconnecting switch as defined in claim 1 wherein said gearing means effects movement of said yoke only during part of the extension movement of said lever system.

5. A disconnecting switch as defined in claim 1 wherein said extensible lever system includes two sets of levers, and said movable contact assembly includes a housing in which said gearing means is journaled, one lever of one set being secured rigidly to said housing and one lever of the other set being pivotally connected to said hous-

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ing and coupled to said gearing means for actuating the same.

6. A disconnecting switch as defined in claim 5 wherein said yoke is a double yoke having a pair of arms and said gearing means comprises first and second pairs of bevelled intermeshed gears, the gears of each pair being coaxial and opposite disposed, the gears of said first pair being alternate driving gears and each gear thereof being adapted to be meshed at different times with gears rotated by the lever pivotally connected to the housing of said movable contact assembly, and the gears of said

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second pair being secured to drive shafts to which the arms of said yoke are secured respectively.

7. A disconnecting switch as defined in claim 1 wherein said extensible lever system includes two sets of levers and said movable contact assembly includes a housing in which said gearing means is journaled, one lever of each set being pivotally connected to said housing and coupled to said gearing means.

No references cited.

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