Jan. 15, 1952 W. A. GUSSOW 2,582,326

ELECTRIC SWITCH

Filed Aug. 21, 1950 2 SHEETS—SHEET 1

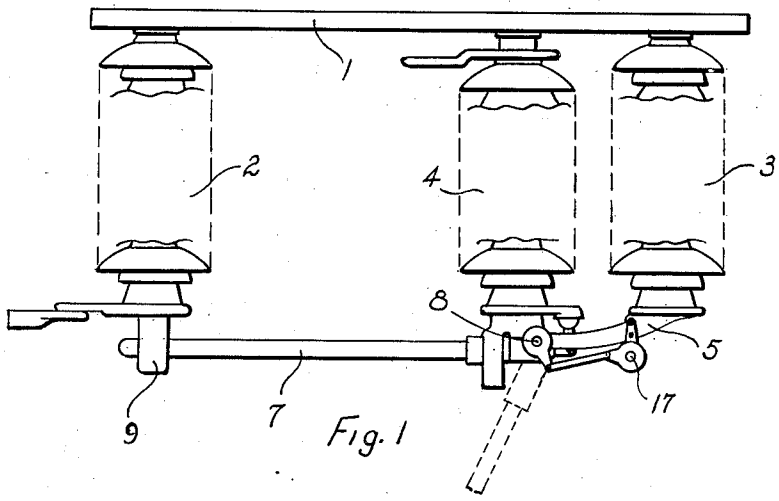

Fig. 1

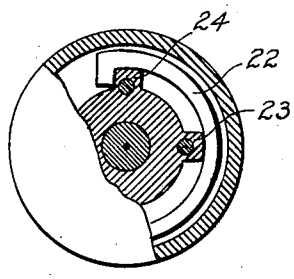

Fig. 2

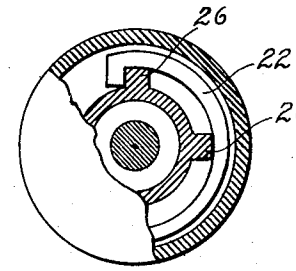

Fig. 3

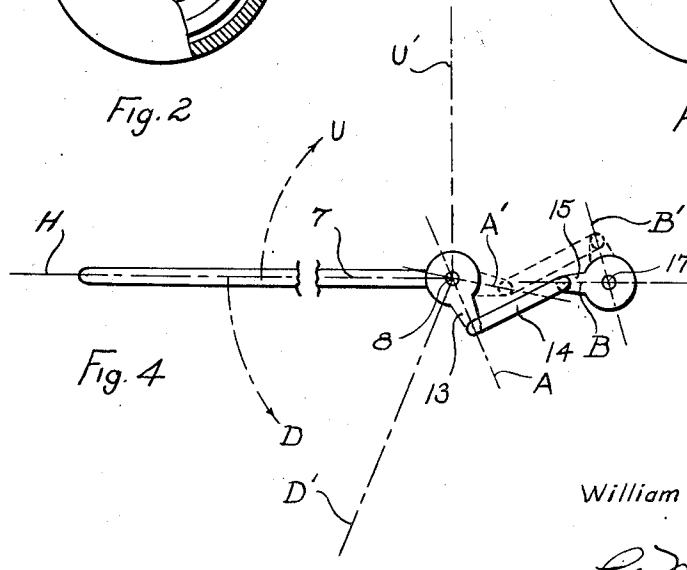

Fig. 4

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Jan. 15, 1952 W. A. GUSSOW 2,582,326

ELECTRIC SWITCH

Filed Aug. 21, 1950 2 SHEETS—SHEET 2

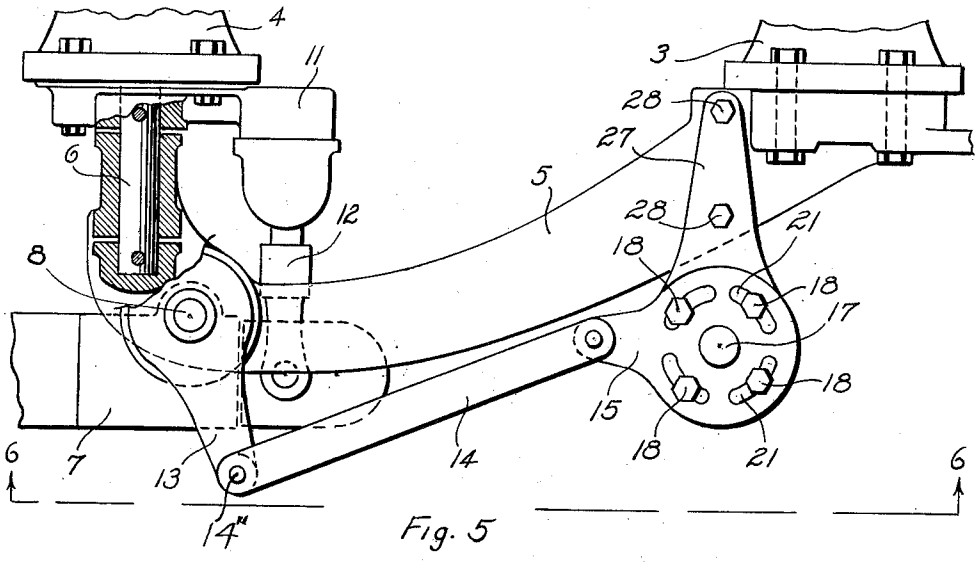

Fig. 5

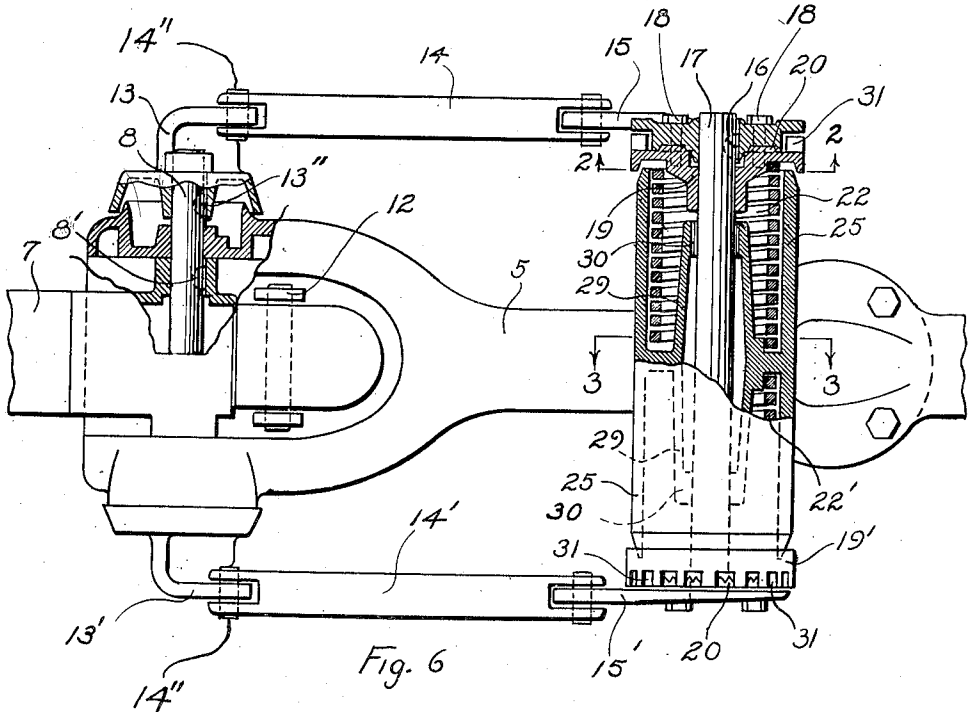

Fig. 6

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ELECTRIC SWITCH

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6 Claims. (Cl. 200—48)

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This invention relates to high voltage electric switches, and particularly to counterbalancing a pivotally mounted switch arm which is movable from its open to its closed position. To counterbalance the arms of both vertically mounted and upright mounted switches, springs can be directly applied. But this cannot be done effectively on underhung switches.

One purpose of this invention is to produce a switch arm correctly counterbalanced for underhung mounting; another purpose is to produce in such a mechanism a counterbalancing device which does not interfere with the members which operate the switch, which is readily applied or removed, which is compact, which can be assembled without having any strain on the spring or springs, which can readily be tensed after assembly, and which can easily be adjusted or modified after trial.

Referring to the drawings, Figure 1 shows in small scale an underhung switch which includes this invention; Figure 2 is a larger scale sectional view on line 2—2 in Figure 6, Figure 3 is a similar view on line 3—3 in Figure 6, and these show how the two ends of one of the counterbalancing springs are held; Figure 4 is a chart diagrammatically showing the principles of operation; Figure 5 shows in large scale a side view of the counterbalancing mechanism; and Figure 6 in the same scale shows a view on the line 6—6 in Figure 5, but with some members sectionized at two locations.

Condiitons in an underhung switch are radically different from conditions when a similar switch is mounted in a vertical or in an upright position, as shown in Figure 4. Referring to this chart, 8 represents the hinge pivot about which the switch arm 7 rotates. From the horizontal position H, the arm moves upwardly in direction U to position U', or it moves from position H downwardly in direction D to position D'. In an upright switch H is the closed position and U' the open position; in a vertical switch H is the open position and U' is the closed position; and in an underhung switch H is the closed position and D' is the open position.

On all large switches the force of gravity is considerable and the switch arm has to be counterbalanced; the rotative effect of gravity is greatest at position H and it is least at position U' or D'. When the switch arm travels from H to U', a counterbalancing spring can be connected directly to the arm and stressed to bias the arm upwardly against the force of gravity. As the arm moves in direction U it is moving in the

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direction of the bias caused by the spring, and so the stress of the spring relaxes. Also the rotative effect of gravity becomes continuously lessened as the arm approaches position U'. It is relatively simple to coordinate these two forces closely enough to make the switch operable manually.

But on an underhung switch the motion of the arm from H in direction D is with gravity, not against it, and therefore as the arm makes this motion it is moving against the bias of the counterbalancing spring, not with it. And any motion against the bias of the spring tends to increase the pressure developed by the spring. Therefore, to counterbalance an underhung switch arm correctly the spring mechanism must produce maximum rotative bias at H, and then as the arm moves from H towards D' the rotative effect must be continuously reduced, even though this motion is against the bias caused by the spring. This invention meets these requirements.

Referring to the drawings, the support 1 carries two stationary insulators 2, 3 and one rotatable insulator 4; the base 5 is bolted to insulator 3 and it is movably secured to insulator 4 by pivotal bearing 6 which allows insulator 4 to rotate. The switch arm 7 is pivotally mounted on base 5 by the long hinge pivot 8. The switch arm assembly 7 includes the long extension which engages with the jaw contact 9, and also the associated members which rotate with this long extension about the same axis. Jaw contact 9 is secured to insulator 2. Crank 11 is fixed to insulator 4 and rotates with it. Link 12 connects crank 11 with the rear extension of switch arm 7. Rotation of insualtor 4 thereby operates the switch as explained in Patent No. 2,520,036.

Crank 13 is secured by key 13'' to the end of hinge pivot 8, and switch arm assembly 7 is secured to hinge pivot 8 by key 8', therefore switch arm 7 and switch crank 13 rotate together with hinge pivot 8. In the end of crank 13 is the pivot pin 14'', which is thus held in fixed relation to switch arm 7 and rotates with switch arm 7 about the axis of switch pivot 8. Rod 14 is pivotally held at one end by pivot pin 14'', and at the other end rod 14 is pivotally connected to spring crank 15. These parts move as shown in Figure 4 from closed positions A and B to open positions A' and B' which are shown by dotted lines. Similar members, opposite hand, marked 13', 14' and 15', are on the other side of the switch. Crank 15 is secured by key 16 to spring pivot 17. Bolts 18—18 hold crank 15 to collar 19 which makes a slip fit over spring pivot 17,

while radial corrugations 20—20 and slots 21—21 allow non-slipping adjustments to be made between crank 15 and collar 19. A long coil spring 22 engages with projections 23, 24 on collar 19, as shown in Figure 2. Housing 25 surrounds spring 22, and projections 26, 26 engage the inner end of spring 22 as shown in Figure 3. The other end of housing 25 surrounds a similar spring 22', and all members on the two sides of the switch are similar but opposite hand. The two springs 22 and 22' act similarly to counterbalance switch arm 7, each doing half of the work.

Lug 27 and a similar lug on the opposite side of the switch are integral with housing 25 which is thus rigidly secured by bolts 28—28 to base 5. Inside housing 25 two conical sleeves 29, 29 provide two spaced bearings 30, 30 which support spring pivot 17 and allow it to rotate.

Collars 19 and 19' have short radially disposed slots 31—31 into which a bar may be inserted to turn collar 19 or 19'. The spring 22, being held at the ends as shown in Figures 2 and 3, has its entire central portion free to contract and expand as stress is increased or reduced. In assembling, all parts are put together without any stress being applied to springs 22, 22'. Then with bolts 18—18 loosened or removed and a bar inserted in a slot 31, collar 19 is turned until the desired stress is developed in spring 22. Bolts 18—18 are then tightened, and a similar adjustment is made at collar 19', so that springs 22 and 22' together bias switch arm 7 upwardly towards position H. See Figure 4.

When at position H, arm 13 is at the position A; and arm 15 is at the position B, thereby forming with rod 14 a very obtuse angle. Meanwhile crank 13 and rod 14 form an angle that is close to 90°. In these positions, the rotative effect on switch arm 7 is stronger than the direct rotative effect of spring 22. As switch arm 7 is lowered in direction D the angles formed by rod 14 with cranks 13 and 15 change continuously; and when switch arm 7 has reached the fully open position at D', the crank 13 is at position A' and forms an obtuse angle with rod 14, while crank 15 at position B' forms a right angle, approximately, with rod 14. And in these positions the torsional bias on switch arm 7 is much less than the torsional effect directly exerted by spring 22 against crank 15.

Springs 22, 22' are quite long and they are operated over only a small part of their elastic range, and the changes in the torque exerted by each spring is much less than the changes in leverage developed between the spring cranks, the rods and the switch cranks. Therefore when all members are properly proportioned, springs 22, 22' will exert maximum torque on switch arm 7 when at its horizontal position H, and a minimum torque when switch arm 7 is at its open position D', even though the torque exerted by springs 22 and 22' against collars 19 and 19' is just the opposite. These results are achieved by a combination of several features.

In assembling, the switch itself is put together and adjusted, with housing 25 and rods 14, 14' omitted. Then lug 27 and the similar lug on the other side of housing 25 are rigidly bolted to base 5, base 5 also provides the journals in which hinge pivot 8 rotates. Thereby spring pivot 17 is held in fixed relation to hinge pivot 8 and all stresses due to tension on springs 22, 22' are contained by base 5. Housing 25 being entirely below base 5 does not interfere in any way with operation of the switch. After complete assembly, springs 22, 22' are stressed to the proper tension as described above, and all tension developed between pivots 8 and 17 is absorbed by base 5, without imposing any undesirable strains on any of the insulators. And if it should be desired to change the total counterbalancing effect of springs 22, 22' then bolts 18—18 can be loosened enough to allow corrugations 20—20 to slip past one another as collar 19 is rotated the desired amount, by means of a bar inserted in one of the slots 31. Then bolts 18—18 are tightened again.

The inner ends of springs 22, 22' are close together, and the outer ends are close to cranks 15, 15' thereby housing two long lengths of spring wire in a compact space. But having sleeves 29, 29 and bearings 30, 30 located inside the coiled springs, gives a wide spacing between bearings 30, 30 and supports pivot 17 close to collars 19, 19', which is where the stress of the springs is applied. This makes possible a very compact unit.

The hinge pivot assembly is also compact. The pivot 8' is journalled at two places by base 5, and between these journals the switch arm assembly 7 is keyed to pivot 8 by key 8', while crank 13 is also keyed to pivot 8 by key 13''. Thus the only torsion imposed on pivot 8 is between keys 13'' and 8'. A similar arrangement is provided at the other end of pivot 8.

The combination of the two cranks 13, 13' on the ends of pivot 8, two cranks 15, 15' on the ends of pivot 7 which are stressed by two springs 22, 22', and two rods, 14, 14' connecting the pairs of cranks together, form a complete and compact counterbalancing unit which is most efficient. In actual service it has been found that the device as here disclosed makes easy the manual operation of underhung three-pole switches of even the largest sizes.

I claim:

1. In an electric switch, a hinge pivot, a switch arm rotatable about the axis of the hinge pivot from a position that is approximately horizontal downwardly to a position more nearly vertical, a base which supports the hinge pivot and which also supports a spring pivot which is parallel with and spaced from the hinge pivot, a switch crank connected with the switch arm and rotatable with the switch arm about the axis of the hinge pivot, a spring crank rotatable about the axis of the spring pivot, a spring connected with the spring crank to bias it rotatively, a rod pivotally connected at its two ends, respectively, with the swing ends of the two said cranks, the rod and the switch crank defining an angle that is approximately a right angle when the switch arm is horizontal and that is an obtuse angle when the switch arm is more nearly vertical, and the rod and the spring crank defining an angle that is obtuse when the switch arm is horizontal and that is approximately a right angle when the switch arm is more nearly vertical; the said spring and its associated members thereby acting to counterbalance at least partially the switch arm.

2. In an electric switch similar to that described in claim 1, a switch crank on each end of the hinge pivot, a spring crank on each end of the spring pivot, two rods each of which pivotally connects together one switch crank with one spring crank, and two springs which bias the two spring cranks, and thereby act together to counterbalance the switch arm in a manner similar to that described in claim 1.

3. In an electric switch, a hinge pivot, a switch arm rotatable about the axis of the hinge pivot, a pair of pivot pins fixedly held one at each side of the switch arm to rotate with the switch arm about the axis of the hinge pivot; and fixedly spaced from the hinge pivot a switch arm counterbalancing mechanism which includes a spring pivot parallel with the hinge pivot, two spring cranks one at each end of the spring pivot and rotatable together about the axis of the spring pivot, and spring means to bias the two spring cranks rotatively in the same direction; and two rods each one pivotally connected at one end to one of pivot pins and pivotally connected, respectively, at the other end to the corresponding spring crank, whereby the spring means at least partly counterbalances the switch arm.

4. In an electric switch, a hinge pivot, a switch arm rotatable about the axis of the hinge pivot from a horizontal position downwardly to a position more nearly vertical, a pivot pin fixedly connected with the switch arm and rotatable with the switch arm about the axis of the hinge pivot, a spring pivot fixedly located in spaced relation to the switch pivot and parallel with it, a spring crank rotatable about the axis of the spring pivot, a rod pivotally connected at one end to the said pivot pin and at its other end pivotally connected to the swing end of the spring crank, the said rod defining with the spring crank an angle that is obtuse when the switch arm is in horizontal position and that is more nearly a right angle when the switch arm is more nearly vertical, together with a spring to bias the spring crank rotatively and thereby at least partly counterbalance the effect of gravity upon the switch arm.

5. In an electric switch, a hinge pivot, a switch arm rotatable about the hinge pivot, and connected with the switch arm a counterbalancing mechanism which comprises a pair of spaced bearings supporting a spring pivot that is fixedly spaced from and parallel with the hinge pivot, at each end of the spring pivot a spring crank

that is rotatable about the axis of the spring pivot, two coil springs each surrounding one of the said spaced bearings, the inner ends of the springs being fixedly held close to one another, and the outer end of each spring being connected with one of the spring cranks in a manner to bias both spring cranks in the same direction, and connecting means between the spring cranks and the switch arm whereby the two springs at least partially counterbalance the switch arm against gravity.

6. In an electric switch, a hinge pivot, a switch arm rotatable about the hinge pivot, and connected with the switch arm a counterbalancing device which comprises a housing held in fixed spaced relation to the switch pivot, two coil springs recessed, respectively, into each end of the housing and with the two inner ends of the springs close to one another and held against turning, two spaced bearings integral with the housing and each bearing being located inside the coil of one of said springs, a spring pivot within the said bearings, a collar on the spring pivot near each end of the spring pivot and engaged with the outer end of the coil spring, a spring crank on each end of the spring pivot, and adjustable means for connecting together each spring crank and the adjacent collar, together with means connecting each spring crank with the switch arm whereby the two springs act together to counterbalance the switch arm.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,863,405	Hoye	June 14, 1932
2,306,117	Dunlap	Dec. 22, 1942
2,316,844	Cornell et al.	Apr. 20. 1943