March 14, 1933. A. J. BOWIE 1,901,493

SWITCH CONTACT

Filed Nov. 20, 1929 2 Sheets-Sheet 1

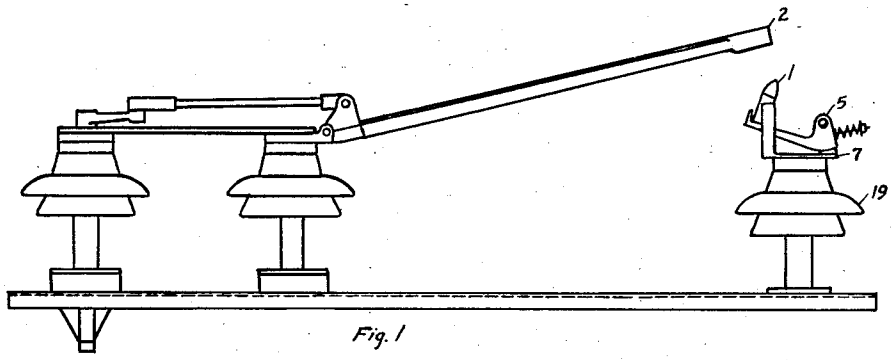


Fig. 1

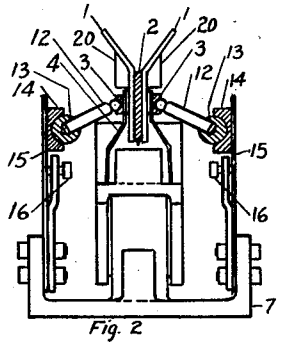


Fig. 2

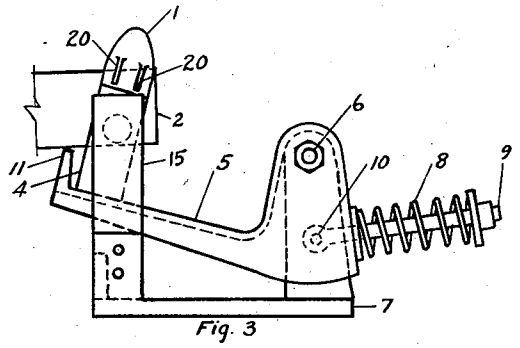


Fig. 3

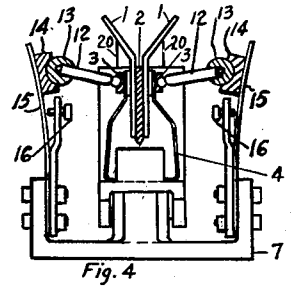


Fig. 4

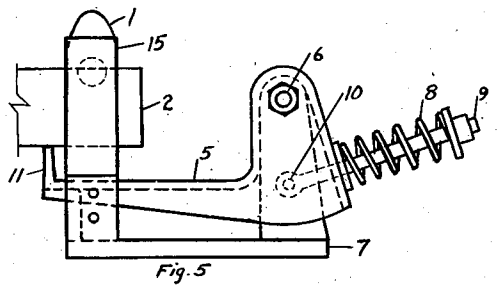


Fig. 5

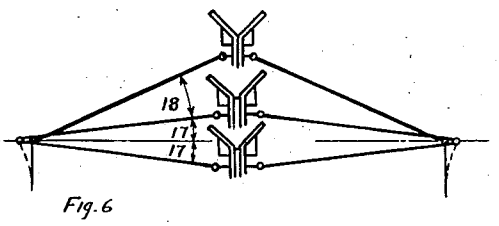


Fig. 6

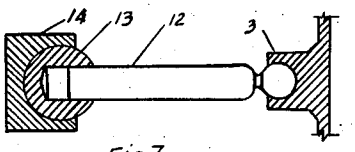


Fig. 7

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March 14, 1933. A. J. BOWIE 1,901,493

SWITCH CONTACT

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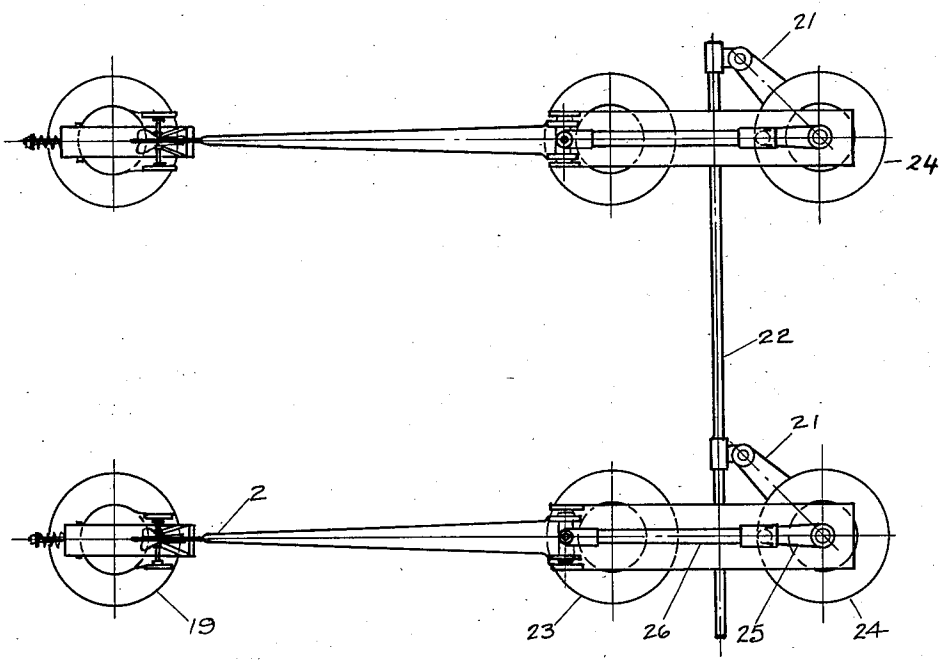


Fig. 8.

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UNITED STATES PATENT OFFICE

AUGUSTUS JESSE BOWIE, OF SAN FRANCISCO, CALIFORNIA

SWITCH CONTACT

Application filed November 20, 1929. Serial No. 408,486.

It is the object of this invention to provide a method of increasing the pressure between the relatively movable switch contacts without increasing the power required for switch operation. While this refers to any type of switch, either single pole or gang operated, it has particular reference to the gang operated switch.

The usual switch contact consists of a blade and a clip, movable relatively to each other the blade sliding into the clip surfaces and contacting therewith. The clip surfaces generally work against a spring pressure, which furnishes the necessary contact pressure between blade and clip. If this pressure is too great it will result in too high an effort to operate the switch, and also in abrasion of the contact surfaces.

It is the object of this invention to overcome these difficulties and to provide a clip with a greatly increased contact pressure, without the necessity of sliding the blade and clip against a high pressure with its consequent difficulties.

Other arrangements of contacts besides the clip and blade may be equally well used, such as any of the other common types in use and have the same principle applied to them. Therefore, the invention is not limited to the clip and blade type of contact.

In gang operated switches, even of the best design, there is always some difference between the exact blade and clip locations in the closed positions for the different poles, although in the good designs this difference of contact position is relatively small. However, no gang operated switch can be really satisfactory, unless allowing when closed variations of clip and blade relative positions, and therefore the proper operation must not be predicated upon exact contact positions.

I accomplish the increased pressure in the following manner:

The clip, which commonly consists of two shoes pressed together by spring pressure, is mounted on a movable carriage, which allows the clip to travel as a whole after the blade has properly contacted therewith. This travel is guided by the necessary mechanism, and in the course of the travel a materially increased pressure is applied generally transversely to the clip faces. This means that first the blade enters the clip, contacting properly therewith, and after so entering, the clip moves with its carriage. The motion of this clip will then increase the transverse pressure. This will not call for any material relative motion of the blade and clip after first contact is made, thus avoiding the power to move under high pressure and the abrasion of the surfaces. To accomplish this result satisfactorily in a gang switch requires a material motion of the clip carriage under which proper contact can be made and sufficient pressure obtained.

Figure 1 is a side elevation of a single pole of a gang operated switch showing the blade about to start to enter the clip.

Figure 2 is an end view of the blade which has fully entered the clip but has not moved the carriage on which the clip mounts.

Figure 3 is a side view of the details shown in Fig. 2.

Figure 4 is an end view with the blade fully entered into the clip and of the carriage depressed.

Figure 5 is an end view of the details of Fig. 4.

Figure 6 shows diagrammatically the motion in end view of the clip faces, blade, and toggle.

Figure 7 shows a cross sectional detail of the end connections of the link 12.

Figure 8 shows a plan view of the gang operated switch which is shown in side elevation in Figure 1.

1, 1, are clip faces contacting with blade 2. The clip faces are provided with hubs 3, 3, inserted in a U spring 4, which presses the clip faces firmly together. 5, is a rigid carriage mounted on pin 6, which trunnions in cap 7, which mounts on a switch insulator 19. 8, is a spring mounted on rod 9, connected by pin 10, to the clip cap 7.

Normally, when the blade is not in engagement the clip carriage stands up as in Figure 1. When the blade enters the clip, the spring 8, is of sufficient strength to allow the blade to force its way thru the clip faces

before depressing this spring 8 and the clip carriage 5. After the blade has forced its way thru the clip impinging on the stop 11, as shown in Figs. 2 and 3, further blade action depresses the carriage to the position shown in Figures 4 and 5. 12, 12, are connecting rods with a ball socket in hubs 3, 3, on one end and at the other end they slide in balls 13, 13, supported by socket and base 14, 14, attached to springs 15, 15. When the clip carriage is up in the position shown in Figures 2 and 3, the connecting rods 12, 12, are free and do not bottom on the balls 13, in which they have free play. As the clip carriage is depressed, the rods 12, 12, come into engagement with the bottoms of balls 13, 13. After this further action results in the pressure of the spring 15, being applied directly to the rod 12, and consequently to the clip faces. The maximum pressure will come when rods 12, 12, are perpendicular to the clip faces though a very material pressure will be exerted over a reasonable distance up and down from the central toggle position.

Stops 16, 16, allow the springs 15, 15, to be under material tension before the rods 12, 12, bottom in the balls 13, 13, and call into pressure the springs 15, 15. There is evidently considerable motion then of the clip faces wherein the springs 15, 15, will be in engagement resulting in a considerable variation of motion in the position of the blade end wherein high pressure may be obtained from springs 15, 15, with consequent good contact.

It is evident that very little pressure is necessary in the direction of the blade motion to cause the springs 15, 15, to come into operation resulting in a very small increase of operating strain on the mechanism and eliminating motion between the blade end 2, and clip faces 1, 1, except for a very small rotary motion under high pressure which may be made as great as desired, and in some cases may be of benefit in securing a better contact.

The motion of the clip carriage may be in a straight line or it may be pivoted as shown on pin 6, which being in line with the center of pressure on the clip faces approximates straight line motion. Thus it will be seen that the angle 17, 17, either above or below the center of clips of pressure, which rods 12, 12, take, will assure good contact with high pressure, altho the additional angle 18 may also be used to obtain some of the benefits of this invention.

It is evident that the difference between the sum of the lengths of the two connecting rods 12, 12, and the sum of the rod length times the cosine of angle 17, is a relatively very small quantity, insuring therefore practically the full pressure range over the angle 17, either above or below the center, in other words giving practically any of these positions with full spring pressure.

When the blade is out of the clip the faces 1, 1, come into close engagement, protecting them from the weather. The blade entering the clip will first force the faces 1, 1, sufficiently apart to allow the entrance of the blade with a resultant moderate pressure on the blade end. This causes an effort to depress the carriage 5, but the spring 8, is made sufficiently strong so that the blade 2, will be sure to force its face thru the clip faces 1, 1, impinging on the stop 11, before depressing the carriage. Further motion of the blade results in depressing the carriage 11, and brings the links 12, 12, into engagement with the bottom of the holes in the balls 13, 13, and consequently brings into play the spring pressure of springs 15, 15, against the clip faces, resulting in an increased pressure on the blade.

The blade does not as preferably arranged work against any increased spring pressure, until it has fully entered the clip faces and is in substantial contact therewith. Moreover the motion of the clip and the blade is very slight after first contacting, the only practical motion consisting of a possible slight rotation of the clip faces on the blade, which may be limited by limit stops on the clip faces to any degree desired.

In opening the switch if the blades and clips adhere strongly, the clip faces will tend to rotate about the hubs 3, 3. Lugs 20, 20 on clip faces will impinge on the top of spring 4. This allows a moderate angle of rotation with the clips adhering to the blade after which the lugs 20, 20, stop the clip rotation. When the motion is stopped there is a slight twisting of the clip face relative of the blade which breaks adhesions with moderate effort of operation.

The action is first to protect the clip faces against deterioration by contact with each other. Second, to allow the blade to enter into full contact with the clip with only moderate resisting pressure. Third, to depress the carriage against spring 8, requiring merely sufficient effort to overcome the spring 8. Fourth, as the position of the link 12, approaches the true toggle position to call into play the springs 15, 15, to give increased pressure between blade and clip. The stop 16 allows the carriage to be depressed till the toggle links 12, 12, move thru the angle 18. Up to this point the only operating effort is for the blade to overcome the spring 8. Then when springs 15, 15, are engaged full pressure comes on the clip contacts. The only increased effort at the end of the blade is to spread very slightly the springs 15, 15, calling for very small operating effort of the switch and insuring excellent contact. The material motion of the carriage 5 is essential in a practical gang operated switch to insure

adequate contacts for all poles. The flexibility of the spring 15, is an important essential in obtaining adequate pressure on all blades of a gang operated switch. This requires no adjustment and compensates for any wear.

In closing the switch blade after it has depressed the carriage beyond the full toggle position of the auxiliary pressure springs, their pressure will tend to keep the switch in closed position acting in opposition to the carriage spring. When starting to open after passing toggle center the pressure springs assist the carriage spring to start the switch open tending to overcome any blade and clip adhesions. These are both important advantages in my construction.

In the operation of an electric switch particularly for outdoor service, the arrangement of a clip with faces which come close to each other, when the blade is out of engagement results in very detrimental action on the contact surfaces of the clip. A narrow path between the clip faces which is free to the entrance of dirt and moisture invites destructive action. Therefore, to work properly the clip faces should come together when the blade is out of engagement. Under these circumstances proper action for the switch is for the blade to force apart these clip faces and to enter between them in such a position as to make surface contact. Under these conditions a high pressure at the entrance of the blade to the clip will cause the switch to work so hard it would be inoperative and, therefore, the pressure between the clip and blade, until the blade has fully entered the clip, should be moderate, and the high pressure should be applied after the blade movement between the jaws has ceased.

It is advisable that the motion of the blade when moving between the clip faces should not result in increasing the pressure between the blade and clip and for this reason in my invention the blade first enters the clip fully and then impinging on a limit stop calls into action means for increasing the pressure between the blade and clip.

The motion of the clip carriage is considerably less than that of the blade. Nevertheless the carriage must travel a material distance to insure adequate contact in all phases of a gang operated switch.

The pressure links 12, 12 where they attach to the clip faces terminate in ball ends. These are inserted in a ball cavity in the hubs of the clip faces and the outer edge of this cavity is then crimped over the balls. While this makes a flexible joint, however, all lost motion is eliminated.

The balls 13, 13 are similarly inserted in cavities in bases 14, 14, and these bases are then crimped over the balls so as to retain them without lost motion. There is preferably provided an endwise clearance in the seats for links 12, 12 in the balls 13, 13, so that the blade not only enters the clip fully but also moves the carriage downward then before the members 12, 12 bottom and bring into play the pressure of springs 15, 15.

Referring now to Figure 8, 23 is the hinge insulator on which the blade is pivoted. 24 is the rotating insulator which operates the switch blade through rod 26 and top crank 25, which is rigidly connected to the top of rotating insulator 24.

21, 21 are cranks connected to rotating insulators 24, 24, and 22 is the connecting rod which gives gang operation of the different poles of the switch, causing both insulators 24, 24 to operate simultaneously and to operate their respective blades.

What I claim is:

1. In an electric switch a plurality of independent switch poles, simultaneously operated by a common mechanism, each pole consisting of a pair of relatively movable contactors adapted to move into full engagement with each other, means for continued motion of said contactors while maintaining said full engagement, and a spring adapted to increase the pressure between said contactors during said continued motion.

2. In an electric switch a plurality of independent switch poles, simultaneously operated by a common mechanism, each pole consisting of a pair of relatively movable contactors adapted to move into full engagement with each other, means for continued motion of said contactors while maintaining said full engagement, and toggle links for increasing the pressure between said contactors, a spring acting on said toggle links during said continued motion thereby causing said toggle links to effect the increased pressure between said contactors.

3. In an electric switch a plurality of independent switch poles, simultaneously operated by a common mechanism, each pole consisting of a pair of relatively movable contactors adapted to move into full engagement with each other, means for moving both of these contactors while they are in full engagement without substantially relative motion of the faces of said contactors and a spring adapted to increase the pressure between said contactors when said movement in full engagement takes place.

4. In an electric switch a plurality of independent switch poles, simultaneously operated by a common mechanism, each pole consisting of a pair of relatively movable contactors adapted to move into full engagement with each other, means for continued motion of said contactors while maintaining said full engagement, a spring and a toggle link normally inoperative until said movable contactors come into full engagement, said toggle link being adapted by the above con-

tinued motion of said contactors after engagement, to increase the pressure between said contactors through said spring.

5. In an electric switch a plurality of independent switch poles, simultaneously operated by a common mechanism, each pole consisting of a pair of relatively movable contactors adapted to engage each other, one contactor consisting of a blade and the other contactor consisting of a clip, the first of said contactors being adapted to move into and out of engagement with the second contactor, the second contactor being adapted to relatively small movement after the first contact is engaged therewith, the second contactor being mounted on a movable carriage, said movement after full engagement maintaining the full contact of said members, and a spring adapted to increase the pressure between said contactors after engagement.

6. In an electric switch a plurality of independent switch poles, simultaneously operated by a common mechanism, each pole consisting of a pair of relatively movable contactors adapted to engage each other, one contactor consisting of a blade and the other contactor consisting of a clip, the first of said contactors being adapted to move into and out of engagement with the second contactor, the second contactor being adapted to a relatively small movement after the first contactor is engaged therewith, said second contactor being mounted on a movable carriage which allows the two said contactors to move together after full engagement with only a relatively small motion of surfaces of said contactors, said movement after full engagement maintaining the contact of said members, and a spring adapted to increase the pressure between said connectors after engagement.

7. In an electric switch a plurality of independent switch poles, simultaneously operated by a common mechanism, each pole consisting of a pair of relatively movable contactors adapted to engage each other, one of said contactors consisting of a blade and the other contactors consisting of a clip mounted on a carriage adapted to allow by its motion a further motion of said contactors after their first full engagement while maintaining the full contact, and a spring adapted to increase the pressure between said contactors after engagement.

8. In an electric switch a plurality of independent switch poles, simultaneously operated by a common mechanism, each pole consisting of a pair of relatively movable contactors adapted to engage each other, one of said contactors consisting of a blade and the other contactor consisting of a clip comprising contact shoes held in spring engagement with each other, a carriage on which the said clip mounts adapted to allow further motion of said clip after full engagement with said blade while maintaining the contact, means for holding the carriage until the blade has contacted with the clip, and then allowing further motion of the contactors by movement of the carriage, and a spring adapted to increase the pressure between said contactors after engagement.

9. In an electric switch a plurality of independent switch poles, simultaneously operated by a common mechanism, each pole consisting of a pair of relatively movable contactors adapted to engage each other, one of said contactors consisting of a blade and the other contactor consisting of a clip mounted on a carriage which moves so that the center line of the blade and of the clip when in contact allows practically a straight line motion without material longitudinal motion of said blade and said clip along the axis of said blade after the engagement between said contactors, said carriage being adapted by its motion to allow further motion of the contactors after first engagement while maintaining the contact, and a spring adapted to increase the pressure of said contact after engagement.

10. In an electric switch a plurality of independent switch poles, simultaneously operated by a common mechanism, each pole consisting of a pair of relatively movable contactors adapted to engage each other, one of said contactors consisting of a blade and the other consisting of a clip mounted on a carriage adapted to allow by its motion further motion of said contactors after first engagement while maintaining the contact, a toggle link and spring acting on said toggle link adapted to increase the pressure between said contactors after engagement.

11. In an electric switch a plurality of independent switch poles, simultaneously operated by a common mechanism, each pole consisting of a pair of relatively movable contactors adapted to engage each other, one of said contactors consisting of a blade and the other contactor consisting of a clip mounted on a carriage adapted to allow by its motion further motion of said contactors after first engagement while maintaining their contact, a spring and a pair of toggle links adapted to increase through said spring the pressure between said clip faces and said blade after engagement.

12. In an electric switch a plurality of independent switch poles, simultaneously operated by a common mechanism, each pole consisting of a pair of relatively movable contactors adapted to engage each other, one of said contactors consisting of a blade and the other contactor consisting of a clip mounted on a carriage adapted to allow by its motion further motion of said contactors after first engagement while maintaining the contact, a spring, and a pair of toggle links, said toggle links not being in engagement until said con-

tacts have come into engagement, the motion of said carriage being adapted to bring into engagement said toggle links and to increase through said spring the pressure between said contactors.

13. In an electric switch a plurality of independent switch poles, simultaneously operated by a common mechanism, each pole consisting of a pair of relatively movable contactors adapted to engage each other, one of said contactors consisting of a blade and the other contactor consisting of a clip mounted on a carriage, means for moving said clip and carriage after engagement of said blade and clip and for keeping said contactors in cooperation during said last mentioned movement, and a toggle adapted to increase the pressure between said contactors during said last mentioned movement, a spring adapted to press against said toggle, said spring acting to hold the switch closed when the switch is in fully closed position.

14. In an electric switch a plurality of independent switch poles, simultaneously operated by a common mechanism, each pole consisting of a pair of relatively movable contactors adapted to engage each other, one of said contactors consisting of a blade and the other contactor consisting of a clip mounted on a carriage, means for moving said clip and carriage after engagement of said blade and clip and for keeping said contactors in cooperation during said last mentioned movement, a toggle adapted to increase the pressure between said contactors during said last mentioned movement, a spring adapted to press against said toggle, said spring acting to hold the switch closed when the switch is in fully closed position, and to assist the said contactors to open after said toggle passes the center on the opening of the switch.

15. In an electric switch a pair of relatively movable contactors adapted to engage each other, one of said contactors consisting of a blade and the other consisting of a clip, and a toggle link and a spring acting on said toggle link adapted to increase the pressure between said contactors after engagement.

16. In an electric switch a pair of relatively movable contactors adapted to engage each other, one of said contactors consisting of a blade, and the other contactor consisting of a clip, and a toggle adapted to increase the pressure between said contactors when the switch is closed, a spring adapted to press against said toggle, said spring acting to hold the switch closed when the switch is in a fully closed position, and to assist said contactors to open after said toggle passes the center on the opening of the switch.

In witness whereof, I affix my signature.

AUGUSTUS JESSE BOWIE.