Feb. 11, 1941. J. L. SHROYER 2,231,598

ELECTRIC SWITCH

Filed Jan. 22, 1937

Fig. 1.

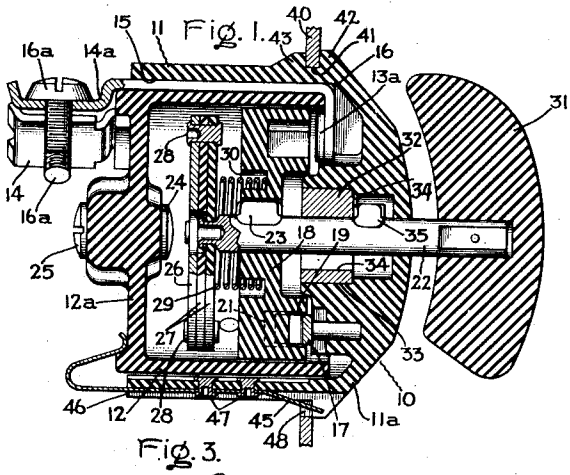


Fig. 2.

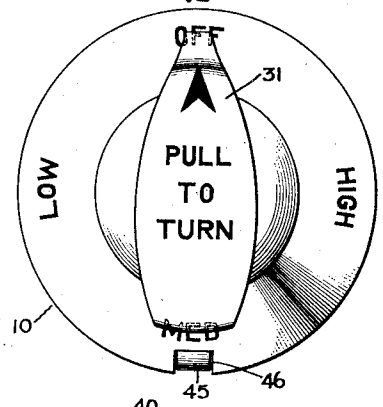


Fig. 3.

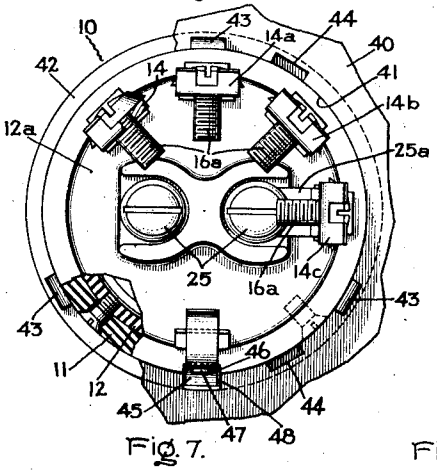


Fig. 4.

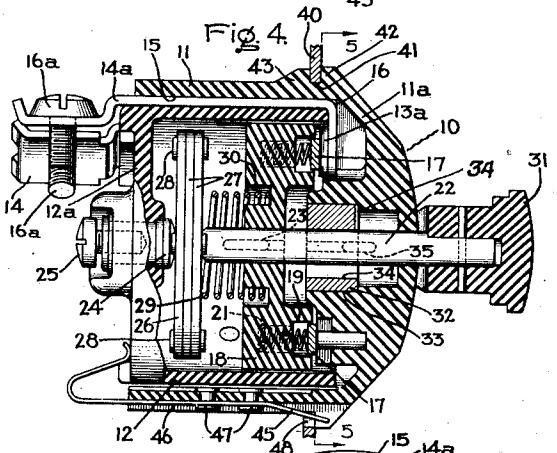


Fig. 5.

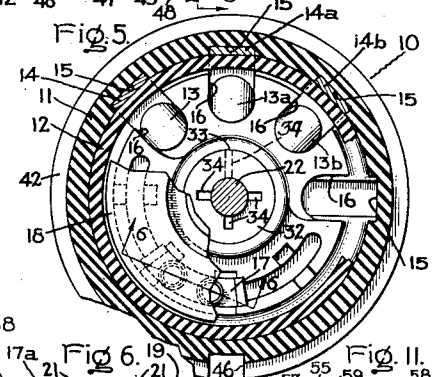


Fig. 7.

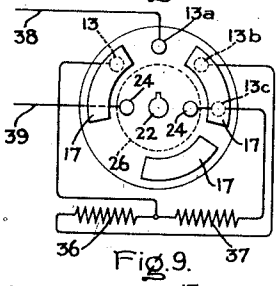


Fig. 8.

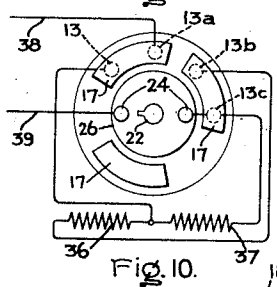


Fig. 9.

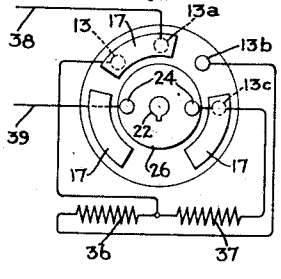


Fig. 10.

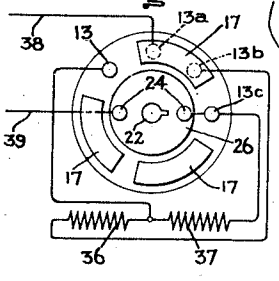


Fig. 6.

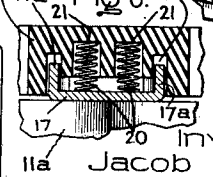
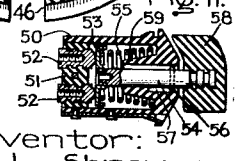


Fig. 11.



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His Attorney.

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UNITED STATES PATENT OFFICE

2,231,598

ELECTRIC SWITCH

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Application January 22, 1937, Serial No. 121,834

8 Claims. (Cl. 200—4)

This invention relates to electric switches, and it has for its object the provision of an improved switch of this character.

This invention has particular application to multiple-position electric switches, such as used in the control of the inter-connected circuits for a heating system having a plurality of heating resistances to connect the resistances in different ways to give different degrees of heat. The invention contemplates a switch of this character which is safer in its operation, improved in its electrical and mechanical characteristics, and one which is less expensive to make and which has a longer life than those heretofore generally used.

For a more complete understanding of this invention, reference should be had to the accompanying drawing in which Fig. 1 is a vertical sectional view illustrating a multiple-position electric switch arranged in accordance with this invention; Fig. 2 is a front elevation of the switch of Fig. 1; Fig. 3 is a rear elevation of the switch of Fig. 1, parts being broken away so as to illustrate certain details of construction; Fig. 4 is a sectional view similar to Fig. 1 but showing the switch in a different operative position; Fig. 5 is a sectional view taken through the line 5—5 of Fig. 4 and looking in the direction of the arrows; Fig. 6 is a sectional view taken through the line 6—6 of Fig. 5 and looking in the direction of the arrows; Figs. 7, 8, 9 and 10 are diagrammatic views illustrating the electric switch of this invention applied to control the inter-connected circuits of an electric heating system involving two resistance heating elements; and Fig. 11 is a sectional view of a line switch arranged in accordance with this invention.

Referring more particularly to Figs. 1 to 10, this invention has been shown in one form as applied to an electric switch intended to control the resistances of an electric heating system so as to connect them in different ways to give different degrees of heat such as high, low and medium heats.

As shown in the drawing, the electric switch comprises an electrically insulating casing 10. The casing 10, as shown, comprises two cup-shaped members 11 and 12 positioned in the reverse order. The casing member 12 is smaller than the casing member 11 and is inserted in it, as shown in Figs. 1 and 4. The casing members 11 and 12 are formed of a suitable mechanically strong, electrically insulating material, such as a suitable phenol condensation product. The front wall 11a of the outer casing member 11 constitutes the front of the switch. and this wall, as shown, is relatively massive in proportion. The end wall 12a of the inner casing member constitutes the rear end of the casing 10, that is, of the switch.

Mounted in the side of the front wall 11a of the outer casing are a plurality of circuit controlling contacts 13, 13a, 13b and 13c arranged in an arc of a circle and spaced at intervals along the arc, as shown diagrammatically in Figs. 7–10. Contacts 13, 13a, 13b and 13c are mounted on contact blades or leads 14, 14a, 14b and 14c respectively. The leads, as shown, fit into recesses 15 provided for them in the inner surface of the outer casing member 11 and extend from the rear to the front of the switch where they have portions turned inwardly at right angles to the main body of the leads, as clearly shown in Figs. 1 and 4. These latter portions are received in recesses 16 provided in the inner surface of the front wall 11a of the outer casing member. It will be observed that when the inner casing member 12 is inserted in the outer member 11, the walls of the inner casing cooperate with those of the outer casing to house the leads in closed channels so as to hold them rigidly in place in the switch casing. The contacts 13, 13a, 13b and 13c may be secured to their respective lead members in any suitable manner, as by welding, and the contacts may be formed of any suitable material, such as silver. The outer ends of the leads are provided with binding screws 16a by means of which the external connections are made.

Cooperating with the stationary contacts 13—13c are a plurality of movable contacts 17. The movable contacts 17 are mounted in a contact carrier 18 which is of disc form and which has an outer diameter substantially equal to the inner diameter of the inner casing member 12. The contacts 17 are mounted on the side of the disc facing the stationary contacts 13—13c and, as shown diagrammatically in Figs. 7–10, are arranged in a circle and spaced from each other circumferentially.

The contacts 17 are mounted in recesses 19 provided for them in the side of the disc. As shown (Fig. 6), each contact 17 is relatively elongated and has inturned ends 17a arranged substantially at right angles to the main body of the contact. These inturned ends are received in relatively deep end sections provided in the recesses 19. A pair of helical compression springs 20 are inserted in recesses 21 back of each contact, and bear directly on the contact to force it outwardly toward the front wall of the switch.

The carrier disc 18 is mounted on a shaft or

rod 22. It has a key-connection 23 with the shaft whereby the shaft is connected to rotate the disc, but can be slid freely axially relative to the disc.

Mounted on the inner surface of the rear wall 12a of the casing 12 opposite the stationary circuit contacts 13—13c are a pair of stationary spaced line contacts 24. As shown, these members are of relatively massive proportions, and are secured to the casing of the switch by molding them in the insulating material of which the inner casing 12 is made. The contacts 24 extend through the wall 12a and on the outside of this wall are provided with suitable binding screws 25 threaded in them. One contact 24, the right-hand one, as viewed in Fig. 3, is electrically connected with the stationary contact 13c by means of the lead 14c and a connector 25a.

Cooperating with the line contacts 24 is a bridging contact member 26. This member is arranged to abut the stationary line contacts 24 to complete the circuit through them. The bridging contact, as shown, is of disc form having a relatively large diameter, and it is connected to similarly shaped insulating supporting members 27 by means of rivets 28. The assembly of the bridging contact and supporting members is mounted directly on the end of shaft 22 which is peaned or riveted over, as clearly shown in Fig. 1, to secure the assembly.

Interposed between this assembly and the contact carrying disc 18 is a compression spring 29 having one end bearing on the assembly and its inner end received in and bearing on the bottom of a recess 30 provided in the adjacent side of the disc. This spring, it will be observed, biases the rod axially inwardly of the switch to cause the bridging contact 26 to abut the line contacts, and biases the carrier 18 outwardly toward the front of the switch against the front wall of the housing.

It will be observed that the rod 22 constitutes a common operating member both for the contact carrying disc 18 and for the bridging contact 26. It operates the former through the key-connection 23 when it is rotated, and the latter when it is moved axially. The front end of the rod protrudes through the front wall of the casing, and on the exposed portion there is mounted an operating knob 31 which may be grasped to rotate the rod or move it axially.

It is important that the bridging contact 26 be moved to break the line contacts 24 before the position of the disc 18 is changed. In other words, it is important that the knob 31 be pulled forwardly to break the line contacts before turning the disc 18 to change the controlled circuit connections. I insure this operation by providing an interlock between the rod 22 and the switch housing. This interlock comprises a cylindrical metallic member 32 mounted in a recess 33 provided for it in the front wall 11a of the outer casing member, as shown in Figs. 1, 4 and 5. This member, as shown, is provided with a centrally arranged aperture receiving the rod 22. On the outer face of this member are provided a series of slot-like depressions 34 arranged at proper intervals circumferentially of the central opening corresponding to the "off" and circuit controlling positions of the switch. Arranged to be fitted into these slots is a key 35 fixed on the rod 22. The slots are of such depth that when the knob is in the "off" position, that is, is in a position where the switch does not connect the controlled circuits with the line, it is held in its position shown in Fig. 1 wherein the line contacts 24 are open, but when it is in any of its circuit controlling positions, it can be moved inward sufficiently far to close the line contacts 24. However, before the switch can be moved from the "off" to any controlling position, or from any one of these to another or to the "off" position, it is necessary to pull the knob 31 forwardly to remove the key 35 from the slot in which it is in, whereupon the knob can be turned to another position.

In Figs. 7 to 10 inclusive, the switch has been shown as applied to a heating circuit having a pair of resistance heating elements 36 and 37. These resistance elements are energized from a two-wire source of supply having two supply conductors 38 and 39. In this particular system, the line wire 38 is connected with the lead member 14a and hence, with the stationary contact 13a, while the other line wire 39 is connected with one of the line contacts 24, the left-hand one, as viewed in Figs. 3 and 7 to 10. The opposite line contact is connected with the stationary contact 13c, as previously pointed out, and also with one end of the resistance heating element 37, which is connected to lead 14c. The other end of this resistance heating element, as well as one end of the resistance element 36, are connected directly with the stationary contact 13 through the lead 14. The other end of the resistance element 36 is connected with the stationary contact 13b through the lead 14b.

In the operation of the switch as applied to this system, it will be understood that in the "off" position, the parts are as shown in Fig. 7. Here the line is broken at the two contacts 24, because as previously explained the bridging contact 26 is held away from them by the interlock between the rod 22 and the switch housing. Moreover, the stationary contact 13a connected with the line 38 is disconnected from any of the circuit controlling contacts 13—13c.

When the knob 31 is pulled forwardly and moved from its "off" position of Fig. 7 a quarter turn in a clockwise direction, as viewed in Fig. 2, to its position of Fig. 8, the movable contacts 17 are turned to their positions shown in this figure, and also, as previously described, when the knob 31 is released in this position of the knob, the spring 29 moves the rod 22 axially to close the line contacts 24. This operation of the switch connects the resistances 36 and 37 in parallel across the supply source, and effects "high" heat.

To effect a "medium" heat the switch is moved a quarter turn from its position of Fig. 8 to its position of Fig. 9. As before, it is necessary to pull the knob 31 forwardly to break the line contacts 24 before it can be rotated to its "medium" position, and to release it in this position to close the line circuit. In this position, it will be observed, that the resistance conductor 37 only is connected to the supply source.

To provide "low" heat the knob 31 is pulled outwardly and moved a quarter turn to the position designated "low." Fig. 10 shows the circuits in this position; as here shown, the two resistance elements 36 and 37 are connected in series across the supply lines 38 and 39.

In order to conveniently mount the switch housing in a suitable supporting panel 40, such as in the front wall of the switch panel of an electric range, the panel is provided with a cylindrical aperture 41 having a diameter substantially equal to the outer diameter of the outer

casing member 11. This casing member is provided with an outwardly extending flange 42 about the front wall 11a arranged to abut against the front wall of the panel, as shown in Figs. 1 and 5. Arranged back of this flange and spaced from it a distance substantially equal to the thickness of the panel 40 are a plurality of peripherally spaced lugs 43. These lugs are arranged to be inserted through notches 44 spaced about the opening 41 and positioned with relation to each other as are the lugs 43, but angularly removed as a system from the system of lugs when the switch housing is in its normal operative position shown in Figs. 1 and 4. The switch housing is applied to the panel by inserting it through the opening 41 so that the lugs 43 pass through the notches 44, and then by rotating the switch to its proper operative position. In this position, the switch housing is locked against axial movement relative to the panel by the flange 42 and lugs 43 which sandwich the panel between them. It is locked against rotary movement in the panel by means of a spring latch 45. This latch, as shown, is mounted in a recess 46 provided in the bottom of the switch housing and is secured to the housing by means of rivets 47. The latch, as shown, protrudes from the recess, and when the switch housing is rotated to its normal operative position after being mounted in the panel springs into a notch 48 provided for it in the panel. The latch is forced into the recess 46 when the housing is applied to the panel and while being rotated to its normal operative position.

A very important feature of this invention is the arrangement of the insulating disc 18 between the stationary contacts 13—13c and their associated movable contacts 17, and the cooperating line contacts 24 and 26. The disc 18 in effect divides the switch housing into two electrically insulating chambers in which these two sets of contacts are housed respectively.

Another very important feature is that there is only one set of contacts, namely, the bridging contact 26 and spaced stationary contacts 24, which actually make and break the live line circuit.

A further important feature is that the bridging contact 26 makes butt contact with the line contacts 24, rather than a sliding contact, and also that these contacts are relatively large and massive. These features are of material importance where large wattages are encountered, such as those found in electric ranges and heavy duty heating equipment. Here the wattages may be for example two to four thousand and in some instances many more, and the voltages as high as 250. They are important because they do not permit an arc to be drawn out from the line contacts when the circuit is broken having sufficient energy to detrimentally affect the contacts. On the contrary, the energy of any arc that might be formed is negligible. And this is true whether the knob be pulled out slowly or quickly, because the length of the arc that can be formed is definitely limited. The length of the arc, and therefore the energy generated in the arc is definitely limited by limiting the distance that the bridging contact can be separated from the contacts 24. It will be observed that this distance is determined by the key 35 engaging the front wall of the switch in the outward movement of the knob 31. The distance that the key, and hence the contact 26, can be moved outwardly is such that even though the knob 31 be drawn outwardly at an unusually rapid rate, and an arc thereby set up, the arc will be so short that the energy developed in it is not great enough to burn or pit the contacts. The distance that the contact 26 is moved outwardly need only be from $\frac{1}{32}$ of an inch to $\frac{1}{16}$ of an inch for voltages as high as 250. I have discovered that this very short butt break of the large massive contacts 24 disrupts the circuit with practically no deteriorating arcing energy. This, of course, materially increases the life of the switch.

Moreover, the operating parts of the switch mechanism are fully enclosed in the housing 11, which excludes dust and dirt from the mechanism. No lubrication for the moving parts is required. There are no sliding live contacts. In addition, the switch formed as it is of simple parts has a very low manufacturing cost. Furthermore, each switch can be readily applied to and removed from its control panel independently of the rest by a simple mechanical operation:

Certain of the advantageous characteristics of this invention referred to above may also be used in a single pole switch. Such a switch is shown in Fig. 11. This switch comprises a cup-shaped casing 50 having its end closed by a wall 51. Mounted in this wall are a pair of relatively large massive spaced contacts 52. Cooperating with these contacts is a large disc-shaped bridging contact 53. This contact is mounted on an operating rod 54 mounted for axial movement in the front wall of the casing 50, as shown. The bridging contact is biased to engage the spaced contacts 52 by means of a compression spring 55. The rod 54 carries a key 56 received in a slot 57 in the front wall of the casing. The switch may be moved from its open or off position by moving the rod 54 forwardly until the key clears the passageway 57, whereupon the rod may be turned to cause the key to engage an outer portion of the front wall to hold the rod in its withdrawn or open position against the bias of the spring 55. The outer end of the rod is provided with a knob 58 whereby it may be conveniently operated. Here the contacts are relatively massive, as in the first case, and here also, the contacts are made and broken by a relatively slow movement. In addition to this, the distance that the bridging contact 53 can be moved away from the fixed contacts 52 is definitely limited by an extension 59 provided on the front wall of the casing.

While I have shown particular embodiments of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A switch comprising a housing, a contact supporting member between the ends of said housing dividing it into two aligned chambers, a plurality of spaced contacts in one of said chambers, contacts on said supporting member moved into and out of engagement with said stationary contacts by rotation of the supporting member, an operating member connected to said supporting member to rotate it to move the contacts thereon into engagement with said stationary contacts and having sliding movement axially of said supporting member, a pair of contacts in the other of said chambers, and a bridg-

ing contact carried by said supporting member movable into and out of abutting relation with said pair of contacts by axial movement of said member.

2. A switch comprising an electrically insulating enclosed cylindrical casing, an insulating disc mounted in said casing having a diameter substantially equal to the internal diameter of said casing, a rod connected to said disc arranged to rotate it in said casing and having free sliding movement axially of said disc, a plurality of spaced circuit contacts mounted in an end wall of said casing, contacts on said disc facing said circuit contacts and arranged to selectively engage them by rotation of said disc, a spring on said rod biasing said disc toward said one end wall, a plurality of line contacts in the opposite end wall on the other side of said disc, and a bridging contact carried by said rod and movable into and out of abutting relation with said line contacts by axial movement of said rod.

3. A switch comprising an electrically insulating enclosed cylindrical casing, an insulating disc mounted in said casing between its ends dividing the casing into two chambers substantially separated from each other electrically, a rod connected to said disc arranged to rotate it in said casing and having free sliding movement axially of said disc, a plurality of spaced-circuit contacts mounted in one end wall of said casing in one of said chambers, contacts on said disc facing said circuit contacts and arranged to selectively engage them by rotation of said disc, a plurality of line contacts in the opposite end wall in the other of said chambers, and a bridging contact in the latter chamber on the end of said rod movable into and out of abutting relation with said line contacts by axial movement of said rod, a spring on said rod between said bridging contact and said disc biasing the disc toward said one end of said casing and permitting movement of said rod axially of the disc to carry said bridging contact into and out of abutting relation with said line contacts while holding said disc against said one end.

4. An electric switch comprising a casing, circuit contacts in said casing, a contact-carrying member in said casing having contacts thereon arranged to engage said circuit contacts selectively when said member is rotated, a rod arranged to rotate said member from an off to a plurality of circuit closing positions, but freely slidable axially relative to said member, line contacts in said casing, a contact operated by said rod into and out of engagement with said line contacts by axial movement of said rod, a spring biasing said rod axially to cause said contact to engage said line contacts, and interlocking means between said rod and said casing arranged to hold the rod from rotating when in each of said off and circuit-closing positions and holding said rod against axial movement by said spring to close said line contacts when the rod is in the off position.

5. An electric switch comprising a casing, circuit contacts in said casing, a contact-carrying member in said casing having contacts thereon arranged to engage said circuit contacts selectively when said member is rotated, a rod arranged to rotate said member from an off to a plurality of circuit closing positions, but freely slidable axially relative to said member, line contacts in said casing, a contact on said rod movable into and out of engagement with said line contacts by axial movement of said rod, a spring biasing said rod axially to cause said contact to engage said line contacts, a member surrounding said rod, a pin on said rod, a plurality of spaced slots in said member corresponding to the off and circuit controlling positions of said rod arranged to receive said pin in the various controlling positions of said rod to hold the rod from turning, the slot corresponding to the off position being of such depth as to hold the rod axially in such positions that said contact on said rod is held out of engagement with said line contacts, and the remaining slots being sufficiently deep to permit said rod to move to close said line contacts.

6. A switch comprising an electrically insulating housing having side walls and a wall closing the housing at one end, contacts mounted in said wall at the end, leads for said contacts extending from said contacts to the opposite end of said side walls and the side walls having longitudinally extending channels that receive said leads, and a closing cup-shaped sleeve formed of an electrically insulating material inserted in said casing closing said opposite end and cooperating with said channels to enclose and secure said leads.

7. In a switch, a cup-shaped electrically insulating casing having a plurality of longitudinally extending peripherally spaced recesses in the side wall terminating in recesses substantially at right angles thereto in the end wall, a plurality of contact leads in said recesses in said side wall, and having portions at right angles thereto fitted in said recesses in the end wall, a second cup-shaped electrically insulating member inserted in the first member in close fitting relation with the walls thereof so as to close said recesses, and so that its inner edge engages the portions of said leads in the end wall of said first member, and contacts secured to said portions.

8. An electric switch comprising an enclosing casing formed of an electrically insulating material, circuit controlling contacts arranged in one end wall of said casing, line contacts in the opposite end wall of said casing, a control rod entering said casing through said one end wall, a contact on the end of said rod arranged to make butt contact with said line contacts and controlled by axial movement of said rod, an electrically insulating disc within said casing separating the circuit controlling and line contacts from each other, and having a key connection with said rod whereby the disc is rotated by the rod and the rod can slide axially relative to said disc, a compression spring on said rod between the contact thereon and said disc biasing the disc toward said circuit contacts and the contact and rod toward said line contacts, contacts on said disc arranged to engage said circuit contacts selectively as said disc is rotated, and springs on said disc behind said contacts biasing them toward said circuit contacts.

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