Jan. 28, 1958 J. L. HARRIS 2,821,585

CONTROL DEVICE

Original Filed July 28, 1949 2 Sheets-Sheet 1

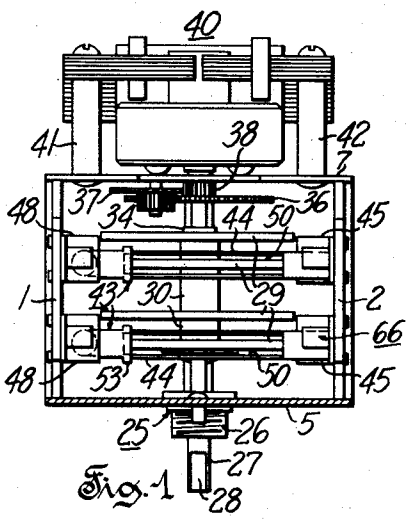


Fig. 1

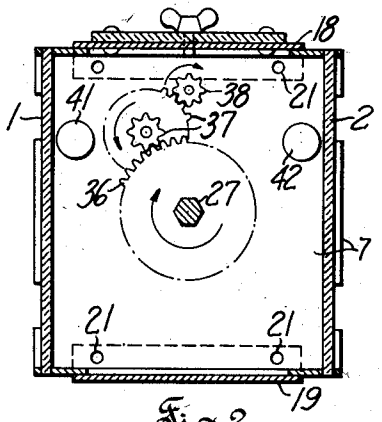


Fig. 2

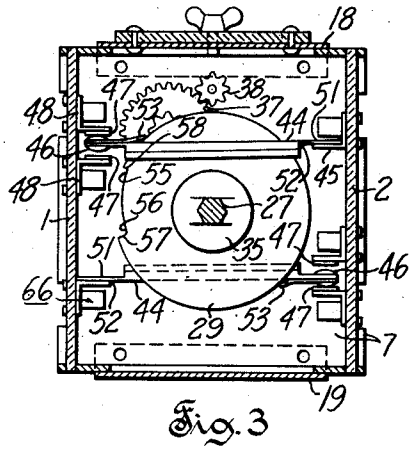


Fig. 3

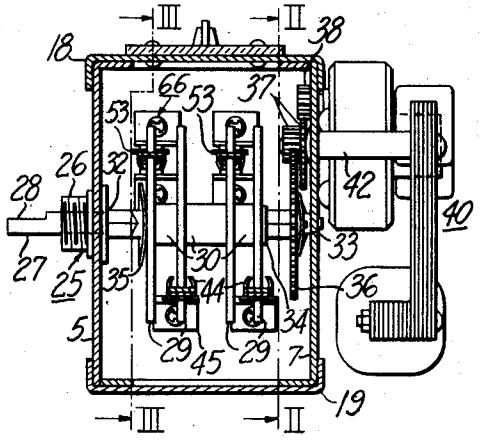


Fig. 4

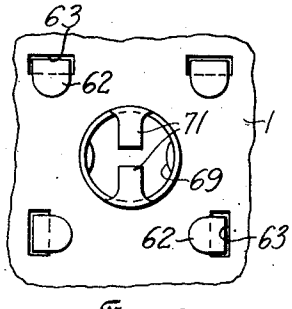


Fig. 5

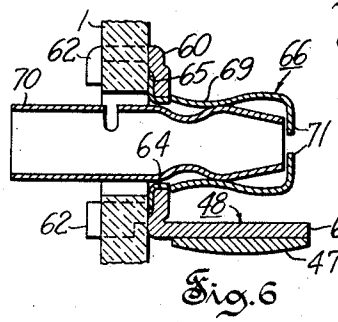


Fig. 6

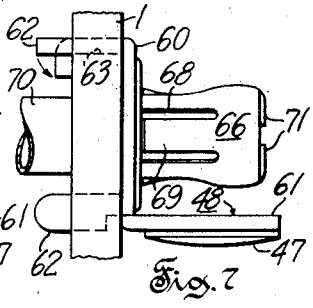


Fig. 7

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Jan. 28, 1958 J. L. HARRIS 2,821,585

CONTROL DEVICE

Original Filed July 28, 1949 2 Sheets-Sheet 2

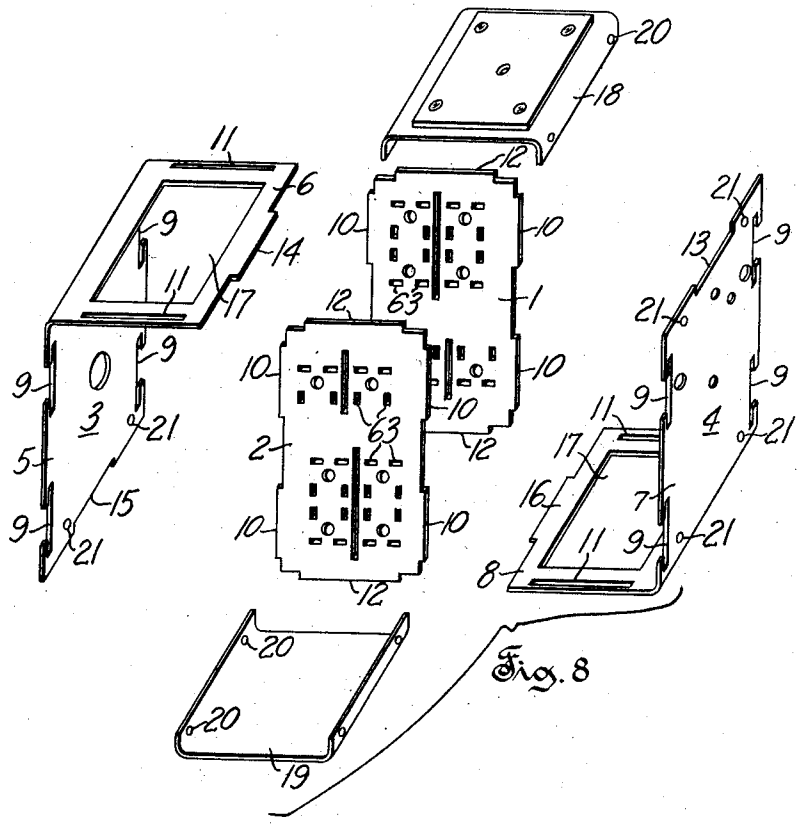


Fig. 8

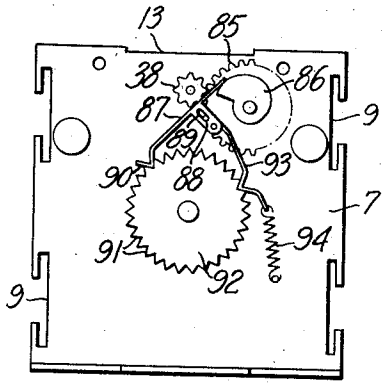


Fig. 11

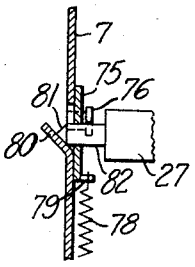


Fig. 9

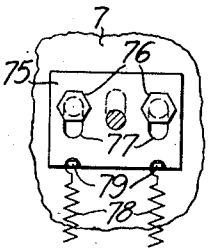


Fig. 10

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CONTROL DEVICE

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Original application July 28, 1949, Serial No. 107,219. Divided and this application June 24, 1954, Serial No. 439,014

9 Claims. (Cl. 200—38)

This application is a division of my copending application Serial No. 107,219, filed July 28, 1949.

This invention relates to switching mechanism and more particularly to switching mechanism adapted for use in motor driven timers.

One object of the invention is to provide a cam operated switch construction in which the switch blades are actuated directly by a drop off cam and in which reverse movement of the cam shaft will not harm the switch blades.

Another object of the invention is the provision of a cam operated switching mechanism in which the power required for operating a switch is reduced to a minimum.

A further object of the invention is the provision of a rotary switching mechanism which is simple and compact in construction and positive in operation.

A further object of the invention is to provide a simplified case construction for switching mechanism which holds non-metallic panels and metallic wall sections rigidly together without requiring spacer posts between wall sections.

Another object is the provision of a radial cam operated switch in which either rotary or linear motion of a cam shaft operates a single switch.

Other objects will appear from the following description and appended claims.

For a full disclosure of the invention, reference is made to the accompanying drawings in which,

Fig. 1 is a top view of the switching mechanism with the cover omitted to show the internal parts.

Fig. 2 is a sectional view taken on line 2—2 of Fig. 4.

Fig. 3 is a view similar to Fig. 2 but taken on line 3—3 of Fig. 4.

Fig. 4 is a side sectional view of the complete timer and switch mechanism.

Fig. 5 is an enlarged detail view of the bracket mounting.

Fig. 6 is an enlarged sectional view showing the bracket mounting and spring connector.

Fig. 7 is an external view of the construction shown in section in Fig. 6.

Fig. 8 is an exploded view showing the details of the case construction.

Fig. 9 is a sectional view of the cam shaft mounting which provides for manual operation of the switch by pushing or pulling the knob.

Fig. 10 is a front view of the construction shown in Fig. 9.

Fig. 11 is a view similar to Fig. 2 but showing a step-by-step drive mechanism for the cam shaft.

The switching mechanism is enclosed in a case formed of side panels 1 and 2 of insulation material. This construction is more clearly shown in Fig. 8. These side panels are supported by L shaped members 3 and 4. The L shaped member 3 includes a vertical section 5 which forms the front of the case and a horizontal section 6 which forms the bottom of the case. The member 4 consists of a vertical section 7 forming the rear of the case and a horizontal section 8 forming the top of the case.

The sections 5 and 7 are provided with notches 9 which receive projections 10 on the side panels 1 and 2. The horizontal sections 6 and 8 are similarly provided with slots 11 which receive projections 12 of the side panels 1 and 2. It will be apparent that when these members are assembled, the side panels are held in place in the metallic members on each side and also on their top and bottoms. The vertical section 5 is further provided with a notch 13 at its upper end which receives a tongue 14 on the horizontal or top section 8. The rear section 7 is provided with an identical notch 15 which receives a tongue or projection 16 on the bottom scetion 6. This internesting of the two parts prevents relative sidewise movement between the front and back sections. Thus the parts when assembled form a rigid case without requiring fasteners or spacers. If desired, the top and bottom sections 6 and 8 may be provided with access openings 17 for permitting inspection of the switching mechanism after the device is assembled. These access openings may be covered by channel shaped top and bottom members 18 and 19. Preferably, these members are provided with inwardly extending conical projections 20 which are received by holes 21 in the front and back members 5 and 7. The covers 18 and 19 are preferably of spring material so that they may be merely snapped into place after the unit has been assembled.

Referring particularly to Fig. 4, the front section 5 is provided with a bearing member 25 which is attached thereto preferably by a staking operation. The bearing member includes a threaded external portion 26 which provides a mounting for the device on a panel. This bearing member supports a cam shaft 27 which is supported at its other end in the back member 7. This cam shaft also extends beyond the bearing member 25 and is preferably provided with a flattened section 28 for mounting a manual adjusting knob (not shown). The cam shaft carries a series of cams 29, which are spaced apart by means of spacers 30. As more clearly shown in Fig. 3, the portion of the cam shaft which carries the cams is hexagonal and the holes in the cams through which the shaft passes are also hexagonal. This arrangement positively positions the cam on the shaft so that a definite relationship exists between the flat 28 on the shaft and the cams. Thus a knob attached to the shaft indicates the correct angular position of the cams on the shaft. The shaft 27 is additionally provided with shoulders 32 and 33 at the front and back ends of the shaft respectively. These shoulders hold the shaft in position in the case. The cams on the shaft are preferably held in place by means of a retainer ring 34 against which the rear cam abuts. The cams and spacers are pressed against this retainer ring by means of a spring clip 35 which is pressed over the hexagonal portion of the shaft. The rear end of the shaft carries a gear 36 which is frictionally mounted thereto in any suitable manner. This gear is shown as meshing with a gear and pinion 37 which is, in turn, driven by a pinion 38. The pinion 38 is driven by a synchronous motor 40 which is mounted to the rear section 7 by means of posts 41 and 42 (Fig. 1). The cam shaft is thus driven through a gear reduction by the synchronous motor and the friction drive between the cam shaft and its gear provides for manual adjustment of the cam shaft.

The cams 29 operate identical switching mechanisms generally indicated as 43. As shown in Figs. 1, 3, and 4, these switching mechanisms are four in number, two being located side by side in the upper portion of the case and the other two being located side by side in the lower portion of the case. Each of the switching mechanisms 43 consists of a switch blade 44 attached to a bracket 45 and carrying movable contacts 46. These contacts are located between stationary contacts 47 carried by brackets 48 mounted on the side panel opposite that at which the

bracket 45 is attached. Switch blade 44 consists of a generally channel shaped member which is open at its bottom as at 50 (Fig. 1) to permit the cam 43 to extend therethrough as shown in Fig. 3. The bottom of the channel member extends beyond the channel portion and is spot welded to the bracket 45 at 51. This leaves a flexible portion 52 between the bracket and the channel portion which acts as a pivot for the switch blade. The bottom of the channel also extends beyond the channelled section at the contact end so that the channel construction does not interfere with the contacts. On the outer side of the switch blade is a resilient cam follower member 53. This member is preferably riveted to the switch blade by the contact and extends inwardly to ride the cam. As shown in Fig. 1, the resilient blade 53 is somewhat wider than the channelled switch blade so that it is stopped or limited in its inward movement by the side members of the switch blade. The resilient member 53 before attaching is provided with a form to bias it against the outer edge of the switch blade. Thus normally there is a positive relationship between the spring member 53 and the switch blade so that the switch blade assumes a position in accordance with the position of the member 53 which is in turn determined by the cam 29 which it rides.

The cams 29, as shown in Fig. 2 are generally circular and are provided with recesses 55 and 56 which are determined by the particular sequence desired. When the cam follower 53 rides the periphery of the cam, the outer contacts, as seen in Fig. 3 are engaged. At this time the resilient cam follower member 53 deflects outwardly to relieve any strain and to provide overtravel for engagement of the contacts if necessary. As the cam shaft 43 is rotated clockwise, the cam follower portion 53 drops into the intermediate notch 55 at which time the movable contact will disengage both stationary contacts. On further rotation of the cam shaft, the cam follower blade 53 drops into the deeper recess 56 which permits the inner contacts to engage.

It should be noted that with the off center cam follower, the rise 57 in the cam provides a direct lift of the cam follower as the cam rotates. This arrangement reduces the power required to operate the switch to a minimum. It should also be noted that with the construction disclosed, in which the cam extends between the pivot of the cam follower and the portion riding the cam, there is no danger of harming the cam follower by backward rotation of the cam shaft. Thus if the cam follower portion 53 is in the notch on the cam and the cam is turned backwards, the drop off section 58 of the cam merely depresses the cam follower blade 53 inwardly against its positive stop. The backward rotation is resisted by the switch blade itself with a pure tension stress and thus the switch blade cannot be damaged by backward rotation of the cam shaft. This greatly simplifies the construction as it makes any provision against backward rotation unnecessary.

The channel portions 44 of the switch blades are preferably ribbed as shown in Fig. 4. This stiffens the blades and prevents them from moving laterally with any longitudinal movement of the cam shaft. This insures that the contacts will always remain in alignment.

Referring now to Figs. 5, 6 and 7, these figures show a preferred construction of the brackets and also show a method of connecting electrical lead wires to the switching mechanism. The bracket 48 is provided with a mounting portion 60 and a contact carrying portion 61. The mounting portion is formed with outwardly extending ears 62 which extend through holes 63 in the side panels (Fig. 8). These ears are formed inwardly after the bracket is assembled to the side panel and thus the bracket is rigidly secured to the panel without any separate fasteners. The mounting portion 60 is provided with a circular hole 64 and is offset around this hole to receive the flange 65 of a tubular spring connector generally indicated as 66. This spring connector consists of a barrel having a split section 68 running throughout its length. This connector is also provided with a series of tongues 69 which extend rearwardly toward the panel and also inwardly. These tongues are adapted to engage a pin type terminal 70 of a construction well known in the art. The tongues are proportioned so that they are deflected outwardly when the terminal pin 70 is inserted. These tongues are also of sufficient strength to cause the entire barrel to increase in diameter and forcefully engage the bracket. The end of the tubular spring clip is preferably closed by means of inwardly extending tongues 71. This prevents the terminal 70 from being inserted too far. It will be apparent to those skilled in the art that the arrangement just described provides a simple and positive mounting of a switch component and further provides a simple and compact arrangement for securing a lead wire to the switch component.

Where the device is used as a washing machine timer, it is desirable to be able to stop the machine by pushing the timer knob inwardly. In prior art devices this result is provided by using a separate switch which is actuated by linear movement of the cam shaft. Figs. 9 and 10 show an arrangement which eliminates the necessity of a separate switch. This arrangement opens the line switch irrespective of the angular position of the cam shaft when the cam shaft is pushed in from its normal position. This result is obtained by mounting the end of the cam shaft 27 in a movable plate 75. This plate is loosely secured to the back portion 7 of the case by means of studs 76. The plate 75 is provided with slots 77 so that this plate may move upwardly from the position shown. This plate is biased downwardly by means of springs 78 which are attached to outwardly extending tongues 79 formed on the plate 75. The plate 75 is provided with a tongue 80 which is struck out from the plate and which provides a cam surface which the conical end portion 81 of the shaft 27 abuts. When the parts are in the positions shown, that is with the shaft in its outer position, the cams operate the switches in a normal manner. However, when the shaft is pushed inwardly the conical portion 81 thereof cams against the tongue 80 and causes the rear end of the cam shaft to move upwardly. Thus, the rear cam on the shaft is moved bodily. By making the upward movement of the end of the cam shaft greater than the throw of the cams, the line switch of the timer will be opened irrespective of the angular position of the cam shaft. As the cam shaft is pushed inwardly, the conical portion 81 rides off the upper edge of the tongue 80 and thus the cylindrical portion 82 of the shaft rides on the end of tongue 80. This maintains the shaft in its inner or off position until it is pulled outwardly to its normal position. The shaft is normally held in its outer position due to the conical portion 81 abutting the tongue 80.

In some cases it is desirable to drive the cam shaft by the motor in an intermittent snap action motion instead of continuously. A construction for providing this result is shown in Fig. 11. In this figure the motor gear 38 drives a gear 85 which, in turn, drives a cam 86. This cam operates a cam follower 87 which is held in place by a pivot pin 88 mounted on the back member 7. The cam follower is provided with inwardly extending ears having slotted holes 89 through which the pin 88 extends. The cam follower 87 is also provided with a stop section 90 which is formed to fit into notches 91 in a ratchet wheel 92 which drives the cam shaft. The cam follower 87 is also pivotally attached to a pawl 93 which engages the ratchet wheel and which is biased by means of a spring 94. It will be apparent that the spring 94 pulls the pawl 93 into the ratchet wheel and also pulls the cam follower 87 in to engagement with the cam 85 and the ratchet wheel 92. In operation, the cam 86 is driven in a clockwise direction and gradually rotates the cam follower about its stop end 90 which bears against the

ratchet wheel. This holds the ratchet wheel and cam shaft stationary in a positive position. At this time the pawl moves backwards to engage the next notch in the ratchet wheel. When the cam follower drops off the cam, the spring 94 is free to pull the pawl 93 downwardly and thus rotate the ratchet wheel one notch. During the drop off movement of the cam follower, the reaction of the cam follower at its stop end is zero and thus there is no reactive force available at the stop end 90 of the cam follower. Thus the holding force of the cam follower on the ratchet wheel disappears during the turning movement of the ratchet wheel. However, when the cam follower strikes the bottom of the cam this reactive force immediately reappears and holds the cam shaft stationary.

From the foregoing description it will be apparent that the present invention provides a simple and compact switch assembly which is especially adapted for use as a sequence timer. While the invention has been described particularly as a sequence timer it will be apparent that certain features are of broader application. Inasmuch as many variations in form may be made without departing from the spirit and scope of the invention, it is desired to be limited only by the appended claims.

What is claimed is:

1. In a rotary control mechanism, the combination of, a shaft, a cam carried by said shaft, a movable member extending across said cam, said movable member being pivoted at one point and riding the cam at another point, said points being located on opposite sides of the cam and below the surface of at least a portion of the cam so that the cam is interposed between said points, and control means operated by said movable member.

2. In a rotary switch mechanism, the combination of, a shaft, a cam carried by said shaft, a movable switch arm extending across said cam, said switch arm being pivoted at one point and riding the cam at another point, said points being located on opposite sides of the cam and below the surface of at least a portion of the cam so that the cam is interposed between said points, a movable contact carried by said switch arm, and a cooperating stationary contact arranged for engagement by said movable contact.

3. In a rotary switch mechanism, the combination of, a shaft, a cam carried by said shaft, a movable switch arm extending across said cam, said switch arm being pivoted at one point and riding the cam at another point, said points being located on opposite sides of the cam and below the surface of at least a portion of the cam so that the cam is interposed between said points, a movable contact carried by said switch arm and facing away from said shaft, a stationary contact arranged for engagement by said movable contact, and strain relief means arranged to permit movement of at least a portion of the switch arm by said cam after the contacts are engaged.

4. In a rotary switch mechanism, the combination of, a shaft, a cam carried by said shaft, a movable switch arm extending across said cam, said switch arm being pivoted at one point and riding the cam at another point, said points being located on opposite sides of the cam and below the surface of at least a portion of the cam so that the cam is interposed between said points, a movable contact carried by said switch arm and facing away from said shaft, a stationary contact arranged for engagement by said movable contact, and strain relief means arranged to permit movement of at least a portion of the switch arm by said cam after the contacts are engaged, said strain relief means comprising a flexible blade forming part of the switch arm and arranged to ride said cam.

5. In a rotary switch mechanism, the combination of, a shaft, a cam carried by said shaft, a movable switch arm extending across said cam, said switch arm being pivoted at one point and riding the cam at another point, said points being located on opposite sides of the cam and below the surface of at least a portion of the cam so that the cam is interposed between said points, a movable contact carried by said switch arm and facing away from said shaft, a stationary contact arranged for engagement by said movable contact, and strain relief means arranged to permit movement of at least a portion of the switch arm by said cam after the contacts are engaged, said strain relief means comprising a flexible blade forming part of the switch arm and arranged to ride said cam, said flexible blade being biased toward said cam, and stop means between said flexible blade and another portion of said switch arm to limit movement of said flexible blade under its bias.

6. In a rotary switch mechanism, the combination of, a shaft, a cam carried by said shaft, a movable channel shaped switch arm extending across the cam, said switch arm being pivoted at one point and riding the cam at another point, said points being located on opposite sides of the cam and below the surface of at least a portion of the cam so that the cam is interposed between said points, said channel shaped switch arm being cut away at its bottom adjacent the cam so that the cam passes through the switch arm, a movable contact carried by said switch arm, and a cooperating stationary contact arranged for engagement by said movable contact.

7. In a rotary switch mechanism, the combination of, a shaft, a cam carried by said shaft, a movable channel shaped switch arm extending across the cam, said switch arm being pivoted at one point and riding the cam at another point, said points being located on opposite sides of the cam and below the surface of at least a portion of the cam so that the cam is interposed between said points, said channel shaped switch arm being cut away at its bottom adjacent the cam so that the cam passes through the switch arm, a movable contact carried by said switch arm and facing away from said shaft, a stationary contact arranged for engagement by said movable contact, and strain relief means arranged to permit movement of at least a portion of the switch arm by said cam after the contacts are engaged.

8. In a rotary switch mechanism, the combination of, a shaft, a cam carried by said shaft, a movable channel shaped switch arm extending across the cam, said switch arm being pivoted at one point and riding the cam at another point, said points being located on opposite sides of the cam and below the surface of at least a portion of the cam so that the cam is interposed between said points, said channel shaped switch arm being cut away at its bottom adjacent the cam so that the cam passes through the switch arm, and said strain relief means comprising a flexible blade forming part of the switch arm and arranged to ride said cam.

9. In a rotary switch mechanism, the combination of, a shaft, a cam carried by said shaft, a movable channel shaped switch arm extending across the cam, said switch arm being pivoted at one point and riding the cam at another point, said points being located on opposite sides of the cam and below the surface of at least a portion of the cam so that the cam is interposed between said points, said channel shaped switch arm being cut away at its bottom adjacent the cam so that the cam passes through the switch arm, and strain relief means comprising a flexible blade forming part of the switch arm and arranged to ride said cam, said flexible blade being biased toward said cam, and stop means between said flexible blade and another portion of said switch arm to limit movement of said flexible blade under its bias.

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