Feb. 13, 1940. W. F. MILLER 2,190,603

ELECTRICALLY OPERATED TIME SWITCH

Original Filed Dec. 1, 1933

Fig. 1.

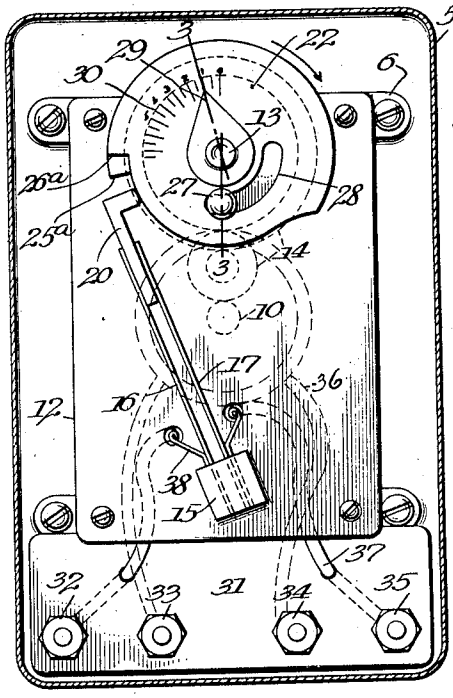



Fig. 2.

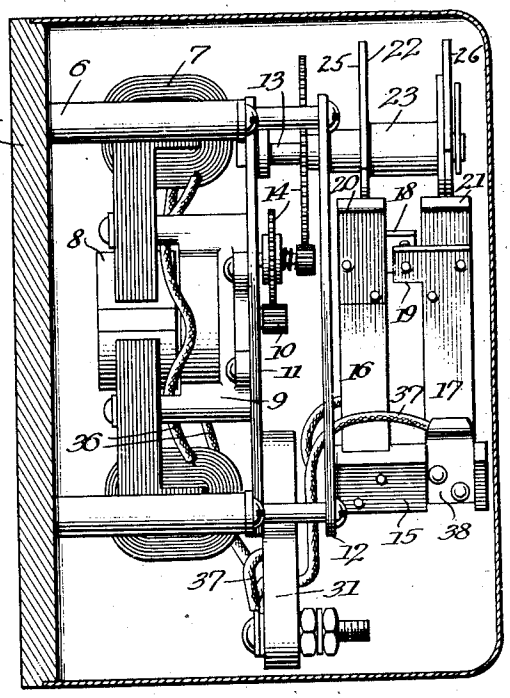



Fig. 3.

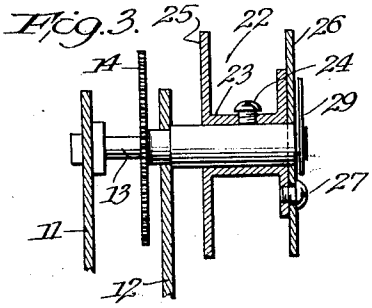



Fig. 5.

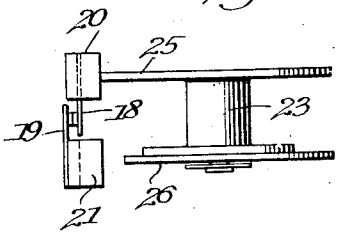
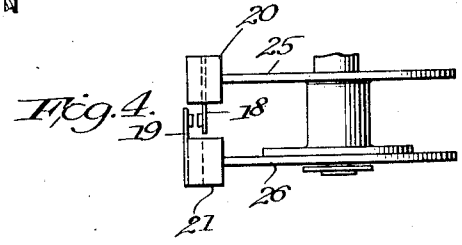



Fig. 4.




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His Attorneys

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# UNITED STATES PATENT OFFICE

2,190,603

## ELECTRICALLY OPERATED TIME SWITCH

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Refiled for abandoned application Serial No. 700,629, December 1, 1933. This application July 10, 1935, Serial No. 30,674

20 Claims. (Cl. 200—33)

The present invention relates to time controlled switches and more particularly those adapted to close circuits at regular predetermined intervals and to maintain the circuit closed for a definite predetermined time interval, and the invention aims generally to improve existing switches of that type.

The present application is a substitution for my prior application Serial No. 700,629, filed December 1, 1933.

In order that the nature of the invention, as well as its aims and objects, may be best understood, I will describe one preferred embodiment of the invention illustrated in the accompanying drawing, wherein

Fig. 1 is a front elevation of the switch;

Fig. 2 is a side elevation thereof, the casing being shown in section;

Fig. 3 is a detail sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary plan view showing the controlling cams, holding the switch arms open or apart; and

Fig. 5 is a similar view illustrating the switch arms in position to close the circuit.

According to the invention, my improved electrically operated switch comprises a supporting board or panel 5 upon which is mounted a frame 6 carrying a synchronous constant speed electric motor 7 of suitable construction. The armature 8 of the motor extends within a reducing gear box 9 adapted to contain a bath of oil to lubricate the reducing gears, the motor unit including a driving pinion 10 extending forwardly of the front panel 11 of the motor frame 6.

Mounted upon the front panel 11 but spaced therefrom is a support 12 in which is journalled a shaft 13. Suitable reduction gearing 14, preferably positioned between the supports 11 and 12, connects the pinion 10 and shaft 13 to rotate the shaft at a constant desired speed.

Secured to the support 12 adjacent one end thereof is a block 15 preferably of insulating material, in which is anchored spaced switch arms 16 and 17. The switch arms preferably are of resilient material, such as spring steel, and are provided with offset contacts 18 and 19 respectively, so as to overlie one another. The upper ends of the switch arms are preferably provided with insulating followers 20—21 respectively, adapted to engage a controller 22 to periodically close and separate the switch arms 16—17 to close and open the circuit.

The controller 22 for the switch arms 16—17 comprises in the illustrated embodiment, a two part cam fixed upon the rotatable shaft 13. This advantageously may be formed as a spool member 23, the hub of which is adapted to be secured to the shaft 13, as by set screw 24, the inner flange 25 of the spool being shaped as a cam, for example, of the contour shown in Fig. 1. A second cam disk 26, which may be of like contour as the flange 25 is loosely mounted upon the end of the shaft 13 but is adapted to be clamped in fixed position relative to the flange cam 25 by suitable means, as for example, a set screw 27 threaded in the adjacent end of the spool member 23 and passing through an arcuate slot 28 in the cam disk 26. Thus the disk is securely clamped to the spool member 23 so as to be rotatable therewith by the shaft 13.

The closed position of the switch is advantageously controlled by the relative adjusted positions of the cam flange 25 and the cam disk 26, and clearly may be effected by means of the clamping set screw 27 in the arcuate slot 28. In order to accurately control the duration of circuit closing time the shaft 13 carries a finger 29 adapted to register with time graduations 30 on the face of the cam disk 26.

Assuming that the shaft 13 and the controller is geared to make one revolution in 15 minutes and it is desired to close the circuit for exactly one minute during each revolution, the set screw 27 is loosened to permit adjustment of the cam disk 26 to a position that the pointer register with the numeral 1 of the graduations 30. The set screw 27 is then tightened. As the controller cams rotate in the direction of the arrow, both switch arms will be held in their normal open position during the major part of each revolution. As the shoulder 26a of the cam disk 26 reaches the follower 21, the latter drops off of the outer face of the cam, permitting the spring switch arm 17 to move to the right (Fig. 1) and quickly close the circuit as illustrated in Fig. 4. The circuit will remain closed for the one minute duration of the controller rotation, or until the follower 20 rides off of the shoulder 25a of the cam flange 25 when the spring arm will quickly move the contacts 18 away from the contact 19 and break the circuit, as illustrated in Fig. 5. The quick make and the quick break of the circuit is highly advantageous as it prevents sparking across the contacts 18—19.

The terminal panel 31, preferably of insulating material, is mounted upon a suitable part of the frame 6 advantageously between the panels 11 and 12 as illustrated in Fig. 2, and this terminal panel may be provided with a plurality of termi-

nals herein illustrated as 32, 33, 34 and 35. In the illustrated embodiment, the terminals 33 and 34 are connected to a source of power and have leads 36 connecting the power lines to the synchronous motor. The other terminals 32 and 35 are provided with leads 37 connected to terminal brackets 38 of the switch arms 16 and 17 and these terminals may in turn be connected to the wires of the circuit to be controlled.

Among the principal advantages of the invention is the provision of an electrically driven, constant speed switch adapted to close a circuit for a definite duration of time at regular predetermined intervals of time, the making and breaking of the circuit being advantageously effected quickly to avoid sparking of the current across the contacts of the switch. A further advantage is that by simple adjustment the duration of time that the circuit may be closed may be readily varied and precisely controlled. Furthermore the construction herein illustrated and described permits of a simple, compact, highly desirable and efficient switch that will give regular and satisfactory performance for long periods of time without the necessity of repair. As a unitary structure, it is small and compact and may be readily installed in a minimum of space where such time control electrical circuits are desired.

The invention has particular advantage in connection with the control of automatically controlled heating systems employing electrically controlled heating units wherein it is desirable to operate the heating unit at regular timed intervals throughout definite durations of time, as disclosed in my copending application Serial No. 30,675, filed July 10, 1935. Obviously the invention is applicable to other arrangements where an electrical circuit is to be controlled at regular timed intervals.

Although the construction illustrated and described herein is a preferred form of the invention and has proved highly satisfactory in operation, it is to be understood that many departures and variations may be effected without departing from the spirit of the invention.

I claim:

1. An electrically driven time switch comprising, in combination, a continuously rotating, constant speed, motor, a pair of switch contacts, and means comprising a pair of spaced cams geared to said motor and continuously engaging said switch contact for quickly effecting relative movement of said contacts toward and from each other at regular predetermined intervals of time to effect a quick make and break between said contacts, means for locking said cams together in variably adjustable positions for synchronous rotation, and a speed reducing spur gear drive connecting said motor and cams for constantly rotating said driven means.

2. An electrically driven time switch comprising, in combination, a continuously rotating, constant speed, motor, a pair of switch contacts, means comprising a pair of spaced cams geared to said electric motor and continuously engaging said switch contact for quickly effecting relative movement of said contacts toward and from each other at regular predetermined intervals of time to effect a quick make and break between said contacts, and means for locking said cams together in variably adjusted positions to provide for successive circuit closing periods of like duration according to the locked adjusted position of said cams.

3. An electrically controlled time switch comprising, in combination, a continuously rotating motor, a shaft geared thereto, a pair of switch contacts, movable switch arms, one for each contact, on which said contacts are mounted, and a controller unit comprising a pair of spaced cams mounted on said shaft and driven thereby, each of the cams engaging one of the switch arms, said controller being operative to first move one of the switch arms toward the other to close a circuit connected to said contacts and then to move the other arm away from the former to break the circuit.

4. An electrically controlled time switch comprising, in combination, a continuously rotating constant speed motor, a pair of switch contacts, movable switch arms, one for each contact, on which said contacts are mounted, a controller geared to the motor for rotation at a constant but reduced speed, a spur gear drive between and fixedly connected to said motor and controller, said controller being operative to first move one of the switch arms toward the other to close a circuit connected to said contacts and then to move the other arm away from the former to break the circuit, and means for variably controlling the duration of time between the making and breaking of the circuit.

5. An electrically driven time switch comprising a support, a frame mounted on said support, a constant speed motor mounted in said frame, a supplemental frame carried by said motor frame, electric switch mechanism mounted on said supplemental frame, a controller mounted on said supplemental frame and geared to a rotating part of said motor for operating said switch mechanism to close the circuit at regular predetermined intervals of time and throughout predetermined periods of duration, a speed reducing spur gear drive between the motor and controller.

6. An electrically driven time switch comprising a support, a frame mounted on said support, a motor mounted in said frame, a supplemental frame carried by said motor frame, electric switch mechanism mounted on said supplemental frame, a terminal panel mounted on said frame, a plurality of terminals on said panel connected in pairs respectively to said motor and said switch mechanism, and a controller mounted on said supplemental frame, a spur gear fast to the controller and disposed between the motor and supplemental frames, and a spur gear reducing gear connected to a rotating part of said motor for operating said spur gear to drive the switch mechanism to close the circuit at regular predetermined intervals of time and throughout predetermined periods of duration.

7. An electrically driven time switch as defined in claim 5 further characterized by a portion of the reducing gear being disposed between the motor frame and supplemental frame.

8. In a time controlled switch, a rotable controller having a pair of synchronously rotating cam surfaces, means including a shaft on which said controller is mounted for rotating said controller at a constant speed, a pair of switch arms mounted adjacent said controller for cooperation with the cam surfaces thereof, a contact carried by each switch arm, said controller being adapted with each revolution to actuate each of said switch arms to make and break the circuit, and means for rigidly connecting said cams together for limited relative adjustment therebetween.

9. In a time controlled switch, a rotatable controller having a pair of synchronously rotating cam surfaces, means for rotating said controller

at a constant speed, a pair of switch arms mounted adjacent said controller for cooperation with the cam surfaces thereof, a contact carried by each switch arm, said controller being adapted with each revolution to actuate each of said switch arms to make and break the circuit, and means adjustably connecting said cams together for rotation in unison to variably adjust the duration of the time interval the circuit is closed.

10. In a time controlled switch, a rotatable controller having a pair of cam surfaces adapted to be connected together for synchronous rotation, means for rotating said controller at a constant speed, a pair of flexible switch arms mounted adjacent said controller for cooperation with the cam surfaces thereof, a contact carried by each switch arm, said controller being adapted with each revolution to actuate each of said switch arms to make and break the circuit, and means for effecting limited adjustment of one of said cams relative to the other.

11. In a time controlled switch, a rotable controller having a pair of cam surfaces adapted to be connected together for synchronous rotation, means for rotating said controller at a constant speed, a pair of flexible switch arms mounted adjacent said controller for cooperation with the cam surfaces thereof, a contact carried by each switch arm, an insulated follower on said switch arms adapted to engage said controller, said controller acting to quickly move one of said switch arms relatively to the other to close the circuit and then to quickly move the other switch arm relative to the former to effect a quick make and break of the circuit connected to said switch arms.

12. In a time controlled switch, a rotatable controller, means for rotating said controller at a constant speed, a pair of flexible switch arms mounted adjacent said controller for cooperation therewith, a contact carried by each switch arm, an insulated follower on said switch arms adapted to engage said controller, said controller being provided with spaced cams acting upon said switch arms and means for locking one of the cams against accidental movement relative to the other, said cams being formed with abrupt shoulders to effect a quick make and break of a circuit connected to said switch arms.

13. In a time controlled switch, a rotatable controller, means for rotating said controller at a constant speed, a pair of flexible switch arms mounted adjacent said controller for cooperation therewith, a contact carried by each switch arm, an insulated follower on said switch arms adapted to engage said controller, said controller being provided with spaced cams acting upon said switch arms, said cams being formed with abrupt shoulders to effect a quick make and break of a circuit connected to said switch arms, said cams being relatively adjustable to variably adjust the duration of time interval that the circuit is closed and means for locking one of said cams against accidental movement relative to the other to insure that successive circuit closing intervals during successive revolutions of said cams are of like predetermined duration.

14. A circuit controlling device comprising a motor, a shaft driven thereby, a sleeve attached to the shaft, a cam disk connected to one end of the sleeve, a circular disk connected to the other end thereof, a second cam disk having an arcuate slot therein, a screw passing through the slot into the circular disk for adjustably connecting the second cam disk to the circular disk, said second cam disk having graduations thereon, a finger attached to the shaft for cooperating with said graduations, each cam disk having a segmental high part and a segmental low part and a shoulder at the junction at the rear of the high part and the front of the low part, a pair of spring arms, each formed with a laterally offset free end for engaging a cam disk, projections on the spring arms extending toward each other, a contact on each projection, said contacts engaging each other when one of the arms has its block engaging the high part of the first cam disk and the other arm has its block engaging the low part of the second cam disk, said blocks being of insulating material, and nonconducting means for supporting the spring arms.

15. A time switch comprising, in combination, a constant speed motor, a controller shaft fixedly geared thereto and adapted thereby to be rotated one revolution throughout a definite predetermined time interval, a pair of spaced switch members connected to opposite sides of a circuit to be controlled, and a pair of synchronously driven shouldered cams mounted on said controller shaft for rotation therewith and engaging the switch members, normally to hold said members in spaced circuit breaking position, but to establish circuit closing action between said switch members as one of the members rides off of the shoulder of its controlling cam, and means for locking one of said cams against accidental movement relative to the other to insure that successive circuit closing intervals during successive revolutions of said cams are of like predetermined duration.

16. A time switch comprising, in combination, a constant speed motor, a controller shaft fixedly geared thereto and adapted thereby to be rotated one revolution throughout a definite predetermined time interval, a pair of spaced switch members connected to opposite sides of a circuit to be controlled, and a pair of synchronously driven shouldered cams mounted on said controller shaft for rotation therewith and engaging the switch members, normally to hold said members in spaced circuit breaking position, but to establish circuit closing action between said switch members as one of the members rides off of the shoulder of its controlling cam, and means for adjusting the position of the last named cam on the shaft to vary the angular position of its shoulder with reference to the shoulder of the other cam whereby to variably control the duration of time interval that the circuit is maintained closed, and means for locking one of said cams against accidental movement relative to the other to insure that successive circuit closing intervals during successive revolutions of said cams are of like predetermined duration.

17. A time switch comprising, in combination, a constant speed motor, a controller shaft fixedly geared thereto and adapted thereby to be rotated one revolution throughout a definite predetermined time interval, a pair of spaced switch members connected to opposite sides of a circuit to be controlled, and a pair of synchronously driven shouldered cams mounted on said controller shaft for rotation therewith and engaging the switch members, normally to hold said members in spaced circuit breaking position, but to establish circuit closing action between said switch members as one of the members rides off of the shoulder of its controlling cam, means for adjusting the position of the last named cam on the shaft to vary the angular position of its shoulder with reference to the shoulder of the other cam where-

by to variably control the duration of time interval that the circuit is maintained closed, and means for locking one of said cams against accidental movement relative to the other to insure that successive circuit closing intervals during successive revolutions of said cams are of like predetermined duration, and means for insuring an adjustment of said last named cam such that it will release its control member in advance of the release by the other cam.

18. A time switch comprising, in combination, a constant speed motor, a controller shaft fixedly geared thereto and adapted thereby to be rotated one revolution throughout a definite predetermined time interval, a pair of spaced switch members connected to opposite sides of a circuit to be controlled, and a pair of synchronously driven shouldered cams mounted on said controller shaft for rotation therewith and engaging the switch members, normally to hold said members in spaced circuit breaking position, but to establish circuit closing action between said switch members as one of the members rides off of the shoulder of its controlling cam, means for adjusting the position of the last named cam on the shaft to vary the angular position of its shoulder with reference to the shoulder of the other cam whereby to variably control the duration of time interval that the circuit is maintained closed, a screw for locking said second named cam against unauthorized movement relative to the other cam to insure that the successive circuit closing periods during succeeding revolutions of the cams are of like predetermined duration, an index finger fixedly mounted on the forward end of said controller shaft and overlying the front face of the last named cam and to cooperatively register with time graduations thereon to indicate the time duration of circuit closing position of said switch members.

19. A time switch comprising, in combination, a constant speed motor, a controller shaft fixedly geared thereto and adapted thereby to be rotated one revolution throughout a definite predetermined time interval, a pair of spaced switch members connected to opposite sides of a circuit to be controlled, and a pair of synchronously driven shouldered cams mounted on said controller shaft for rotation therewith and engaging the switch members, normally to hold said members in spaced circuit breaking position, but to establish circuit closing action between said switch members as one of the members rides off of the shoulder of its controlling cam, and means connecting said cams together for limited relative adjustment, and means for locking one of said cams against accidental movement relative to the other to insure that successive circuit closing intervals during successive revolutions of said cams are of like predetermined duration.

20. A circuit controlling device comprising a motor, a timing shaft driven thereby, a controller fixedly attached to said shaft and comprising a flanged sleeve, a cam disk at one end thereof, a second cam disk movable relative to said shaft, means for locking said second cam disk to the sleeve flange, in spaced relation to the first named cam disk, a pair of switch arms mounted adjacent said controller and each having a portion engaging one of said cam disks, and movable thereby into circuit closing and opening position.

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