

Feb. 11, 1930.

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1,746,932

SWITCH CLOSING MECHANISM

Filed March 3, 1924

2 Sheets-Sheet 1

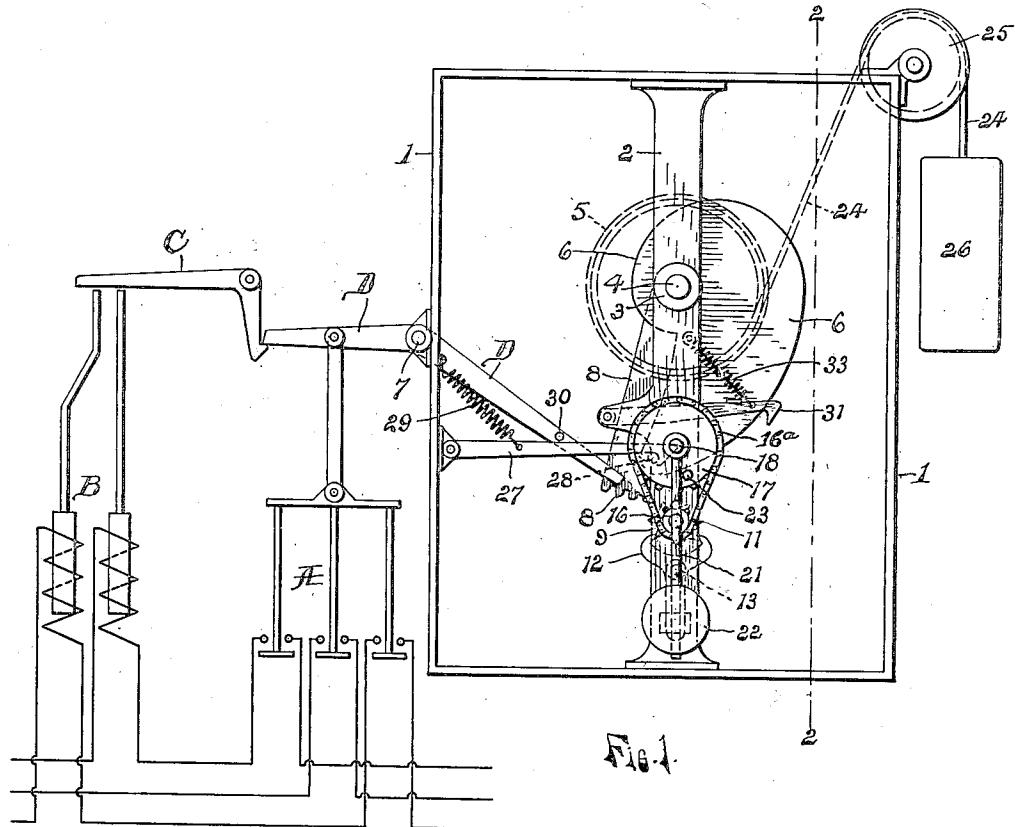
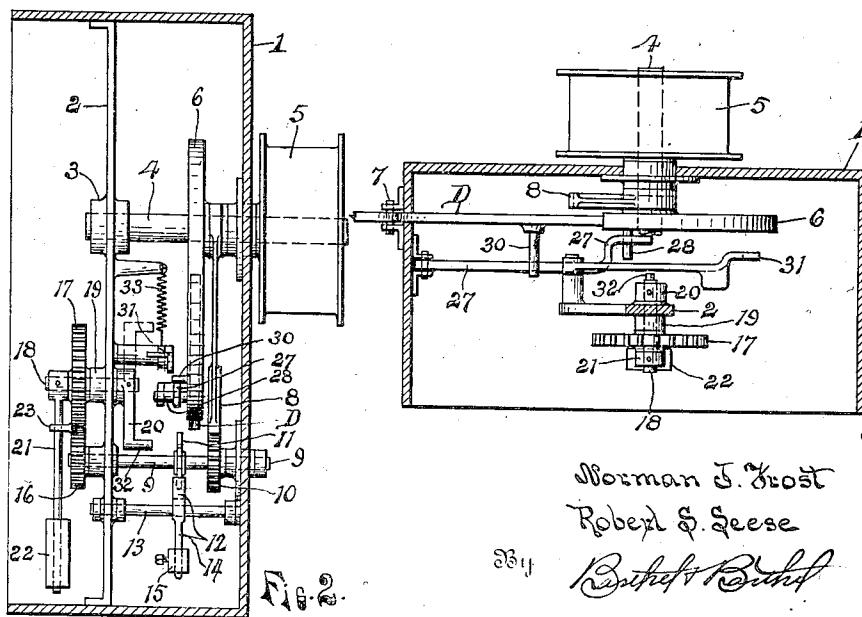


Fig. 1.



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2 Sheets-Sheet 2

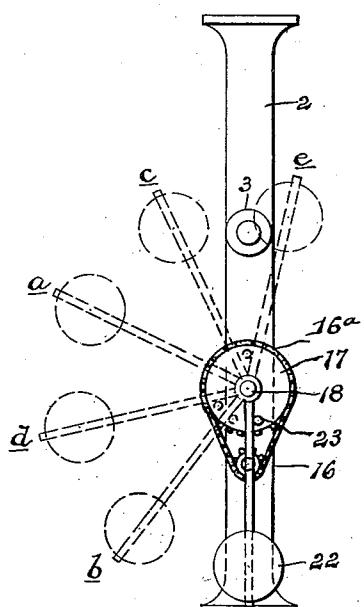


Fig. 6.

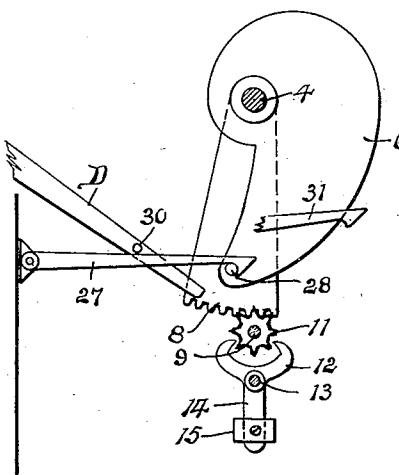
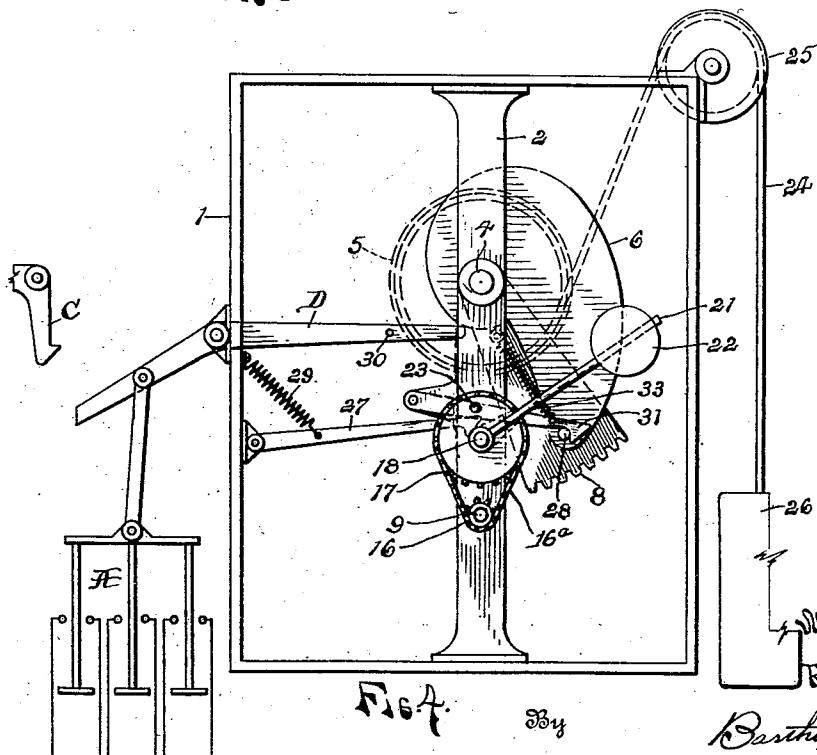


Fig. 5.



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SWITCH-CLOSING MECHANISM

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It is common practice to connect an automatic circuit breaker in a power circuit to protect other devices connected therein against overload or current surges in the line, and in certain instances it is particularly desirable that such automatically operating circuit breakers should be automatically reclosed after a certain period of time, thereby obviating the necessity for manual closing when the overload is of short duration, and further, it is most desirable that such reclosing mechanism be automatically operated several times at fixed intervals in order that the line may be automatically closed when the trouble is of comparatively short duration but persists for a longer period than that for which the mechanism is set to first operate. Further, it is desirable, after a certain number of reclosing operations, that the mechanism operate to lock the circuit breaker in open position to prevent the reclosing of the circuit until such time as the trouble on the line has been remedied and the circuit has been again closed by a manual closing of the circuit breaker and a resetting of the reclosing mechanism.

The present invention relates to automatic reclosing mechanism for circuit breakers, and more particularly to a mechanical device or mechanism operative to reclose a circuit breaker at certain successive intervals and to finally lock the breaker in open position and insure the inoperativeness of the mechanism until such time as the breaker is manually closed and the mechanism reset.

The object of the present invention is to provide a suitable and efficient, purely mechanical mechanism for the purpose, whereby the operation of the mechanism will not be dependent upon current supply and will operate immediately upon the opening of the circuit breaker. A further object is to provide a device or mechanism which is simple in construction and cheap to manufacture, and embodies certain other new and useful features, construction and arrangement of parts, all as hereinafter more fully set forth.

With the above and other ends in view, the invention consists in the matters here-

inafter set forth and more particularly pointed out in the appended claims, reference being had to the accompanying drawings, in which

Figure 1 is a side elevation of a mechanism ⁵⁵ illustrative of the invention applied to an automatic circuit breaker which is shown diagrammatically;

Fig. 2 is a section substantially upon the line 2—2 of Fig. 1;

Fig. 3 is a horizontal section showing the mechanism in plan view with parts broken away to more clearly show the construction;

Fig. 4 is a view similar to that of Fig. 1, and showing the operative parts in a different position to more clearly illustrate the operation;

Fig. 5 is a detail view of a portion of the mechanism showing a resetting cam, a sector and an escapement mechanism therefor, the ⁷⁰ parts being shown in the same position as shown in Fig. 1, and

Fig. 6 is a detail view showing mechanism for controlling the operation of the resetting cam, and illustrating in dotted lines the operation of this mechanism.

In the drawing an automatic circuit breaker of an old and well known construction is diagrammatically illustrated, the usual switch device being indicated at A and ⁸⁰ controlled by relays B which operate upon overload to move a latch C and release the operating lever D to which the switch A is connected. Any other suitable form of circuit breaker having an operating lever may ⁸⁵ be employed, and which circuit breaker is automatically opened upon overload on the line, thereby moving the operating lever to inoperative position.

The present invention relates to mechanism for operating the lever D of the circuit breaker, and as shown, may be mounted within a suitable casing 1, into which the projecting end portion of the lever D extends. Any suitable support 2 may be provided within the casing and provided with suitable bearings and supports for the parts of the mechanism hereinafter described, it being provided with a bearing 3 for one end of a shaft 4 which extends through the back of ⁹⁰ ⁹⁵ ¹⁰⁰

the casing and has a bearing thereon, with the rear end of the shaft extending through the back of the casing and provided with a suitable winding drum 5. Fixed upon the 5 shaft within the casing is a cam 6 arranged to turn in a vertical longitudinal plane of the lever D so that upon rotation of the shaft, the cam will be brought into engagement with the lever to turn the lever upon its pivotal support 7 and close the switch of the 10 circuit breaker. Also fixed upon the shaft 4 is a gear segment 8, and secured upon a shaft 9 directly below the shaft 4 and supported in bearings upon the support 2 and casing 1, 15 is a pinion 10 adapted to be engaged by the gear segment 8 upon rotation of the shaft 4. Also secured upon the shaft 9 is a star wheel 11 adapted to be engaged by the forked lever 12, said star wheel and lever forming an 20 escapement mechanism for retarding the rotation of the shaft 9, said lever 12 being pivotally supported by a shaft 13, with the lower end portion 14 of the lever swinging freely beneath the pivotal support and provided 25 with an adjustable weight 15, by means of which the operation of the escapement may be adjusted.

Secured upon the forward end of the shaft 9 is a sprocket 16, and motion is transmitted therefrom by a sprocket chain 16^a to a sprocket wheel 17 mounted upon a short shaft 18 to turn freely thereon independently of the turning of the shaft, this means for transmitting motion being old and well 30 known, and forming no part of the present invention, said shaft 18 being mounted within a suitable bearing 19 upon the support 2, with its rear end extending through the support and upon which rear end is fixed an arm 35 20. Fixed upon the forward end of the shaft 18 is a weight arm 21 provided with a weight 22 adjustable upon the arm.

On the sprocket wheel 17 is a lug or projection 23 extending forwardly from the face of the wheel and adapted to engage the arm 21 when motion is transmitted in one direction to the wheel from the shaft 9 by the chain 16^a.

Power is applied to turn the shaft 4, by means of a cable 24 wound upon the drum 5 50 and passing over a pulley 25 to support a weight 26 which is secured to the free end of the cable. The weight therefore acts to pull upon the cable and turn the drum, thereby exerting a constant torque on the shaft 4 to turn 55 the cam 6.

To lock the cam against turning, a locking dog 27 is pivotally supported at one end upon the casing 1 or other suitable support and extends inwardly parallel with the cam to engage a pin 28 extending laterally from the cam. This locking dog 27 is normally held in a raised position and out of engagement with the pin, by means of a spring 29, but is forced downwardly into engagement with the 60 35 pin against the action of the spring, by means

of a pin 30 on the lever D extending laterally therefrom, said pin being brought into engagement with the upper edge of the dog 27 whenever the cam 6 is rotated to force the lever D downwardly.

The normal position of the parts is that shown in Fig. 1, wherein the circuit breaker is closed, the arm D of which has been forced downwardly by the rotation of the cam and has in turn moved the dog 27 into locking engagement with the pin 28 on the cam.

A second locking dog or hooked lever 31 is pivotally supported at one end upon the support 2 or other suitable place of attachment, and is bent laterally adjacent its hooked end into the path of a laterally extending lug or end portion 32 on the arm 20. This hook 31 is normally held out of the path of travel of the pin 28 as said pin is carried around by the cam 6 by means of a spring 33, but is lowered against the action of said spring by the engagement of the projection 32 coming into contact with said hook when the shaft 18 is rotated a sufficient distance.

The parts being in the position shown in Fig. 1 with the circuit breaker closed, upon overload on the line and the release of the switch A by the disengagement of the hook C from the end of the lever D, the operation of the control mechanism will be as follows:

Upon release of the lever D by the latch C, the weight of the switch A will turn the lever on its pivotal support and swing the end portion thereof which extends into the casing 1, upwardly. The pin 30 carried by the lever D will therefore be moved out of contact with the dog 27, and said dog will then be free to rise, being turned upwardly by its spring 29, and thus being disengaged from the pin 28. The disengagement of the dog 27 from the pin 28 releases the cam 6, and the weight 26 will then at once act to turn the shaft 4. The turning of the shaft 4, carries the cam 6 and gear segment 8 with it, and as this gear segment comes into engagement with the pinion 10, the motion will be transmitted to the shaft 9. As the star wheel 11 of the escapement mechanism is secured upon the shaft 9, the rotation of this shaft will be retarded and will in turn retard the rotation of the gear segment and cam 6. The escapement mechanism therefore operates to retard or time the rotation of the cam, whereby there will be a certain predetermined time delay in the reclosing of the circuit breaker by the rotation of the cam.

As soon as the segment 8 passes out of engagement with the pinion 10, the turning force applied to the shaft 4 will impart a quick rotation to the cam, bringing its cam surface into contact with the lever D, and forcing said lever downwardly, the downward movement of the lever operating through the pin 30 to again lower the dog 27 into engagement with the pin 28 and thus

stop the rotation of the cam with the parts in the position shown in Fig. 1, except that the weighted arm 21 will not as yet have reached its original position, due to the retarding effect of the escapement. Upon the first rotation of the cam 6 and the resetting of the circuit breaker as just described, the motion imparted to the shaft 9 from the gear segment 8, and from said shaft 9 through the chain 16^a to the sprocket 17, will have turned the sprocket 17 and will have brought the lug 23 into engagement with the arm 21, thereby swinging said arm up to the position shown in dotted lines at *a* in Fig. 6.

When the gear segment 8 passes out of engagement with the pinion 10, the shaft 9 will be free to turn, and as the weighted arm 21 has been swung upwardly to position *a*, upon release of the shaft, said weight will reverse the rotation of said shaft 9 by swinging the arm downwardly, but the escapement mechanism acts upon the shaft in both directions to retard its rotation both when rotated by the segment and also when rotated in an opposite direction by the weighted arm 21, and therefore, while the cam is being turned from the point at which the segment leaves the pinion 10, to the original position shown in Fig. 1, with the circuit breaker in closed position, the weighted arm 21, due to such retardation by the escapement, will have fallen only part way back to its original position, or to position *b* shown in dotted lines in Fig. 6.

If the trouble on the line still persists, the arm D will not be engaged by the latch C when said arm is operated by the cam, and will, therefore again immediately swing upwardly when the point of the cam passes out of contact therewith, and the operation will be immediately repeated.

The weighted arm however, due to the retarding effect thereon of the escapement will not at the moment of the second opening of the circuit breaker, or upward swing of the lever D, be in its original position, but will be in position *b*, and therefore the second rotation of the cam and the bringing thereby of the segment 8 again into engagement with the pinion 10, will again swing the weighted arm 21 upwardly, this movement beginning at the position *b* and carrying the arm past the position *a*, from which advanced position *c* it will swing downwardly to position *d* during the time the cam is rotating from the point at which the segment leaves the pinion 10, back to original position. If the trouble still continues on the line so that the lever D is still free, a third rotation of the cam and third cycle of operation will immediately begin.

Due to the elevated or advanced position *d* of the weighted arm 21 at the beginning of the third operation of the cam 6, said arm will be swung during this operation to the point *e* beyond the vertical plane of the axis

of its pivot which is the shaft 18, and as the sprocket 17 is loose on said shaft and turns the arm by the engagement of the lug 23 with the rear side of the arm, as soon as said arm passes said vertical plane, gravity will cause the arm to fall away from said lug, turning its shaft 18 with it and also the arm 20 which is secured to the rear end of said shaft, the weighted arm 21 falling freely until arrested by the lateral projection 32 on the arm 20 coming into engagement with the upper side of the hook 31. The weight of the arm 21 being thus brought upon the hook which is held in raised position by the spring 33, will swing the hook downwardly against the action of said spring, bringing the hooked end of the hook into the path of the pin 28 on the cam 6, and thus locking said cam against rotation.

The mechanism is thus locked after a certain number of successive operations, in inoperative position and cannot again function to close the circuit breaker until said mechanism is reset manually.

A simple mechanical mechanism is thus provided for automatically closing the circuit breaker a definite number of times, each of the successive operations being delayed to give the desired lapse of time between the several operations of the switch lever D, and for finally locking the mechanism in an inoperative position so that the circuit breaker cannot be again closed until the mechanism is reset by the attendant. This mechanism is not dependent upon a supply of current for operating it, as power is supplied by the weight 26, and therefore is always operative independent of the electrical apparatus in conjunction with which it is used, is simple in construction and positive in its functioning. Obviously, the arrangement of gearing may be such as to secure any desired number of successive switch closing operations and the time delay in each operation may be regulated as desired not only by the arrangement of gearing but also by an adjustment of the speed of operation of the escapement. While a weight seems to be the preferable means for supplying motive power to operate the mechanism, due to its simplicity and reliability, it is obvious that such power may be secured through the employment of any other suitable means, and the means employed for finally locking the mechanism in inoperative position with the circuit breaker open, may also be modified within the scope of the appended claims, modification of the particular construction and arrangement of any or all of the parts being contemplated to suit the requirements of the particular installation and type of circuit breaker to be operated.

Having thus fully described our invention, what we claim is:—

1. A reclosing device for circuit breakers, including mechanically operated means for automatically operating a circuit breaker in-

dependently of current flow at successive intervals to close the breaker a plurality of times, an escapement for controlling the time of each successive operation of said operating means, and gravity actuated means operative to prevent further operation of said operating means after a predetermined number of circuit breaker closing operations.

2. Reclosing mechanism for circuit breakers, including a cam for directly engaging and operating a circuit breaker control member, means for locking said member with the breaker in closed position, electrically operated means for releasing said locking means upon overload, means for actuating the cam upon release of said member, and means for delaying the rotation of said cam.

3. Reclosing mechanism for circuit breakers, including mechanical means for operating a circuit breaker independently of current flow to reclose the breaker a number of times in succession, and locking mechanism to stop said operating means including pendulous means swung in one direction by said operating means and separate delaying means for delaying the return movement of said pendulous means.

4. Reclosing mechanism for circuit breakers including mechanical means for operating a circuit breaker independently of current flow to reclose the breaker a number of times in succession, and means for limiting the number of successive operations of the breaker operating means, said limiting means including a pendulous member swung in one direction by said operating means and delaying means for delaying the movement of said pendulous member in an opposite direction.

5. Reclosing mechanism for circuit breakers including mechanically operating means for operating a circuit breaker to close the breaker a number of times in succession independently of current flow, and limiting means for rendering said operating means inoperative after a predetermined number of operations of said operating means, said limiting means including a member operated in one direction by gravity and in the opposite direction by said operating means, and time delay mechanism for delaying the movement of said gravity member when operated by gravity.

6. Reclosing mechanism for circuit breakers including means for holding the breaker closed and for releasing the same upon overload, mechanism including driving means for operating a circuit breaker to close the breaker a number of times in succession independently of current flow, limiting means for rendering said operating mechanism inoperative after a predetermined number of operations, said limiting means including a gravity member operated in one direction by said operating mechanism, and time-delay mechanism operative to delay the gravity movement of

said member in an opposite direction and to delay each operation of said operating mechanism.

7. In combination with a circuit breaker and means for normally holding the breaker closed and for opening the breaker upon line overload, of reclosing mechanism including a cam for operating a reclosing member of the circuit breaker, dividing means for rotating said cam to close the breaker a number of times in succession, and means operated by said driving means for limiting the number of successive reclosing operations and including an escapement.

8. Reclosing mechanism for circuit breakers, having an operating member, and including a cam for operating said member, power means operative independently of current flow to turn said cam, means for limiting the number of times said cam may be turned in succession, an escapement for retarding rotation of the cam throughout a portion of its rotation, and means for locking said cam against turning, said locking means being released by the opening movement of the circuit breaker.

9. Reclosing mechanism for circuit breakers having an operating lever arm, said mechanism including a rotatable member to operate said lever arm and close the circuit breaker, means for rotating said member, an escapement for retarding the rotation of said member throughout a portion of its rotation, and means for limiting the number of successive rotations of said member and reclosing movements of said lever arm, said limiting means including a gravity member controlled in its movement by said escapement.

10. Reclosing mechanism for circuit breakers having an operating lever arm, said mechanism including a rotatable member to operate said lever arm and close the circuit breaker, locking means for locking said rotatable member against rotation, said locking means being unlocked by the opening movement of the circuit breaker, means for rotating said member, including a drum, a cable wound upon the drum, and a weight secured to the end of the cable, an escapement for retarding the rotation of said rotatable member throughout a portion of its rotation, and means for limiting the number of successive rotations of said rotatable member and closing movements of said lever arm, said limiting means including a gravity member operated intermittently against the action of gravity in timed relation to the rotation of said rotatable member and retarded in its gravity movement by said escapement.

In testimony whereof we affix our signatures.

NORMAN J. FROST.
ROBERT S. SEESE.

CERTIFICATE OF CORRECTION.**Patent No. 1,746,932.****Granted February 11, 1930, to****NORMAN J. FROST ET AL.**

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, line 74, claim 7, for "dividing" read driving; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of October, A. D. 1931.

**M. J. Moore,
Acting Commissioner of Patents.**

(Seal)