No. 769,228. PATENTED SEPT. 6, 1904.

J. K. NORSTROM & H. M. GRAIF.

ELECTRIC CIRCUIT CLOSER.

APPLICATION FILED MAY 20, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1

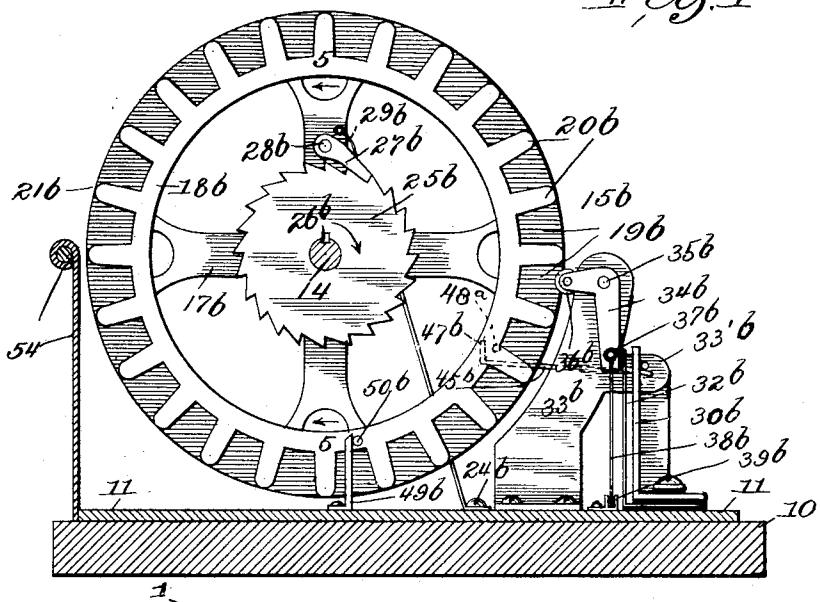
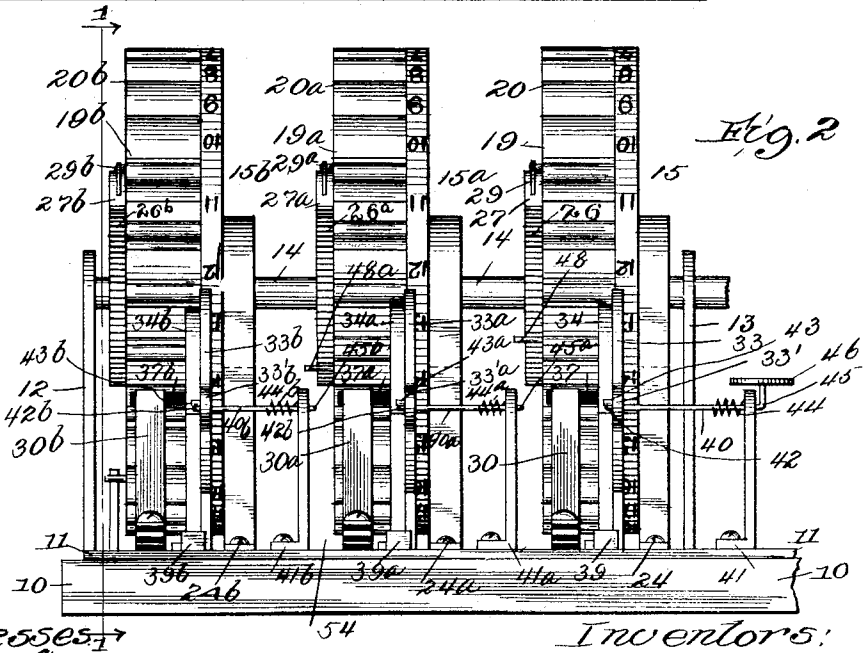


Fig. 2



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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3

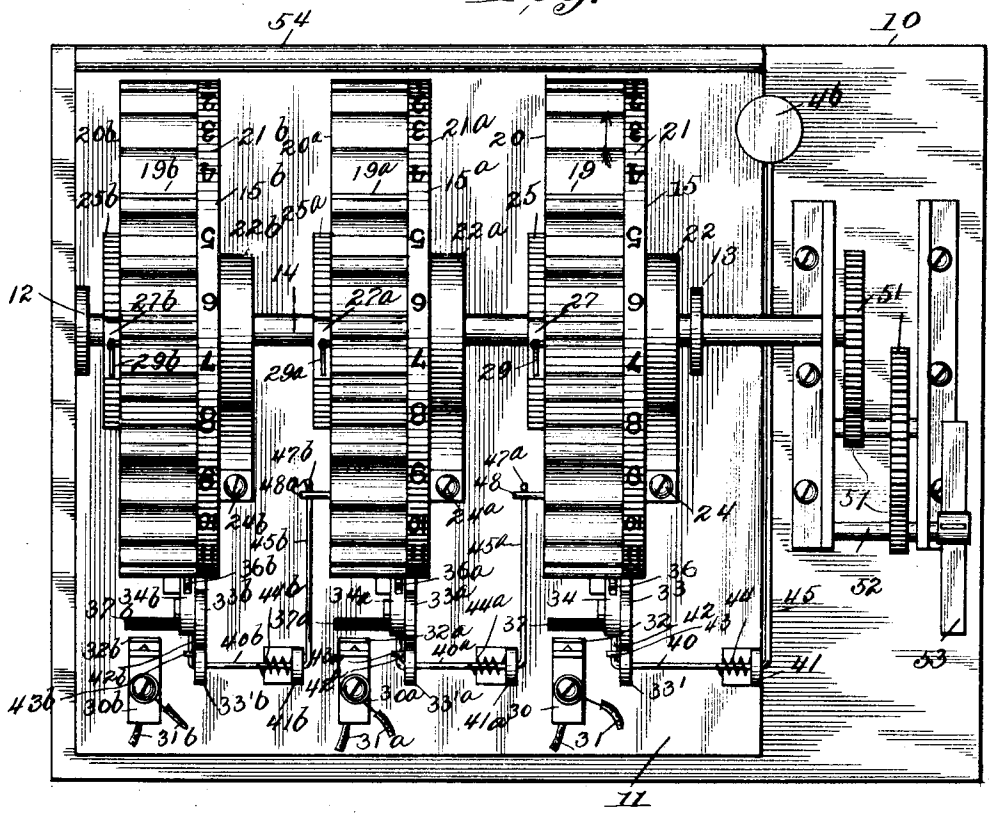


Fig. 4.

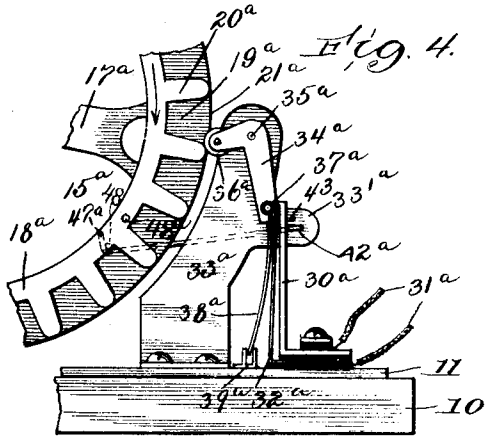
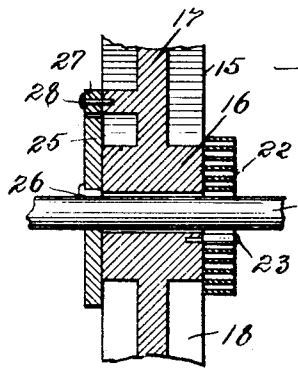


Fig. 5.



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UNITED STATES PATENT OFFICE.

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ELECTRIC-CIRCUIT CLOSER.

SPECIFICATION forming part of Letters Patent No. 769,228, dated September 6, 1904.

Application filed May 20, 1903. Serial No. 157,915. (No model.)

To all whom it may concern:

Be it known that we, JOHN K. NORSTROM and HENRY M. GRAIF, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric-Circuit Closers; and we hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form part of this specification.

Our invention relates to improvements in electric-circuit closers adapted to close one or more electric circuits a determinate number of times by the continuous movement of an actuating member.

The primary object of our invention is to provide a circuit-closer of the type described wherein the primary actuating member is adapted to be rotated manually in one direction without effecting the closing of the circuit controlled by the circuit-closer and wherein said primary member is adapted when released to return automatically to its initial position, in its return movement automatically closing the circuit a determinate number of times, dependent upon the extent of its initial manual movement.

A further object of our invention is to provide an arrangement of a plurality of rotatable primary actuating devices of the character described, each arranged to close a circuit, and instrumentalities auxiliary to the primary actuating devices, all so arranged that each primary actuating device when initially rotated is held in such position until all of the primary devices have been so set and that upon the release of one of said primary actuating devices the others are successively automatically released to permit them to perform their circuit-closing functions.

A further object of our invention is to provide an arrangement whereby the speed of return of the primary actuating devices is equalized.

A further object is to simplify and generally improve the construction of devices of the general character specified.

With a view to attaining these and other objects which will become apparent from the disclosure of our invention herein made our invention consists in the features of construction and the combinations and arrangements of parts hereinafter more fully described, and particularly specified in the claims.

In the drawings, wherein we have illustrated an operative embodiment of our invention, Figure 1 is a sectional elevation taken on line 1 1 of Fig. 2. Fig. 2 is a rear elevation of a portion of the circuit-closer. Fig. 3 is a top plan view of the circuit-closer. Fig. 4 is a detail in side elevation of a fragment of an actuating-wheel and its associated instrumentalities, illustrating the operation of the device in closing a circuit through its associated terminal contact-springs. Fig. 5 is a fragmentary section taken vertically through the hub of an actuating-wheel.

Referring now to the drawings, it will be seen that we have illustrated our invention as embodied in a circuit-closer arranged to control three separate circuits; but it will be understood that we do not desire to limit ourselves in any way to the number of circuits to be operated, as the number of circuits controlled and correspondingly the number of their actuating devices might be extended indefinitely, while certain features of our invention might be advantageously employed in a circuit-closer for a single circuit.

In the present illustrative construction, 10 indicates a suitable base-plate whereon the devices are mounted.

11 indicates a metal frame-plate superposed on the base and provided at suitable points with projecting standards 12 and 13, adapted to afford bearings for the freely-rotatable operating-shaft 14. Said shaft extends longitudinally almost the entire length of the machine and carries the primary actuating devices, herein illustrated as toothed wheels, three in number, each loosely mounted on said shaft. The wheels are respectively indicated by numerals 15, 15ª, and 15ᵇ and are substantially duplicates of each other. The structure of all of the wheels and their individual associated devices being generally

identical, it will suffice to describe wheel 15 and its associated instrumentalities, it being understood that similar parts are associated with each of wheels 15^a and 15^b, such parts being indicated by like numerals of reference, differentiated by exponent characters "a" and "b" throughout.

Referring now to the illustrated construction of the primary actuating-wheel, it will be seen that each wheel comprises a hub 16, spokes 17, and a wide rim 18. The rim 18 is provided with finger-recesses 19 of convenient size, separated by tooth-like walls 20. The notches 19 are preferably cut in from one side of the wheel and terminate between the edges thereof to leave along the other side of the wheel an uninterrupted peripheral zone 21, whereon may be suitably impressed numbers or other suitable indicia corresponding to the various finger-notches in the wheel periphery.

Associated with each wheel is a means tending to hold said wheel in a definite position and to return it to such position when moved therefrom, such means for each wheel in the illustrative embodiment comprising a coiled spring 22, having one end secured to a pin 23, projecting from the hub 16 of the wheel, and its other end secured, as at 24, to a relatively stationary part of the machine, such as the framework 11. Means are provided for securing the wheel 15 against movement in one direction relative to the common shaft 14, such means herein comprising a ratchet 25, secured to the shaft by a key 26 and operatively associated with a pawl 27, mounted on a stud 28, carried by the wheel and held, as by a spring 29, in constant contact with the ratchet. It will be apparent, therefore, that the shaft 14 and wheel 15 are freely relatively movable in one direction, but are connected for movement together in the opposite direction.

Associated with each primary actuating device is a pair of contact-springs adapted to form terminals of an electric circuit, and between the primary actuating-wheel and the contact-springs are arranged means for translating the rotary motion of the wheel into vibratory motion and when the wheel is moved in one direction only for transmitting the vibratory motion to the movable member of the circuit-closing springs to make and break the circuit therethrough a number of times, corresponding with the vibrations of the translating means occasioned by the movement of the wheel.

In the present illustrative embodiment of our invention, 30 indicates a relatively stationary vertically-disposed contact-spring to which one terminal of a circuit-wire 31 is connected, and 32 indicates a relatively movable spring arranged in front of the stationary spring in parallelism thereto. The other end of circuit-wire 31 is connected to coacting movable spring 32, the springs being suitably insulated from each other. 33 indicates a stationary bracket arranged between the springs and the wheel 15 and affording support for the translating device, which consists of a bell-crank lever 34, pivoted in the stationary bracket at 35. One arm of the bell-crank lever projects horizontally forward into the path of movement of the teeth 20 of the wheel 15, substantially radially to said wheel, so as to be movable in either direction by the passage of a tooth of said wheel in like direction. An antifriction-roller 36 is preferably mounted on the said end to receive the contact of the passing teeth. The depending end of the lever 34, remote from the actuating member, depends in parallelism to the contact-springs in proximity thereto and is provided with an insulated pin 37, arranged to overlie the spring 32 in front thereof. Thus the said spring is so related to the lever that rearward movement only of the depending end thereof serves to operatively move the spring. A damping-spring is preferably employed to yieldingly hold the lever in the position described, such spring being herein illustrated as a leaf 38, at its upper end secured to the lower extremity of the lever 34 and at its lower end arranged to freely play between guides 39, carried by the frame-piece 11.

The parts thus far described form an operative device for a single circuit or for a plurality of circuits where it is not necessary to make the operation of the various actuating devices interdependent.

In operation an actuating-wheel is initially rotated toward the operator—that is, in the direction of the arrow in Fig. 3—until a desired number of teeth have passed the roller 36 of the translating device. Each tooth in passing said device raises the projecting arm of the bell-crank lever and moves the depending arm away from the contact-springs. Accordingly the circuit is not closed during this initial movement. When, however, the actuating-wheel is released and allowed to return to initial position under tension of its spring 22, the teeth, repassing the lever 34 in the direction indicated by the arrow in Fig. 4 and contacting therewith, alternately move the projecting arm of said lever downward against the tension of its spring until the contacting tooth escapes roller 36 and permits said arm to escape into the finger-recesses, resuming thereby its normal position. The vertical vibration of the projecting arm causes a corresponding lateral vibration of the depending arm from vertical position toward the rear, and the latter arm is moved to alternately bring the movable spring 32 into contact with its coacting stationary spring 30 and permit said springs to separate. Obviously, therefore, the circuit 31 is made and broken a number of times, corresponding with the number of teeth of the actuating-wheel caused to pass the lever-arm of the translating device. It is often advan-

tageous, however, to employ several such circuit-closers and arrange them for interaction, so that each may be given its initial movement and held in set position until all have been set, and so that upon the manual release of one actuating-wheel the remaining actuating-wheels will be automatically and successively released each at a predetermined time with relation to the movement of the other.

In the present illustrative embodiment of our invention, 40 indicates a rock-shaft journaled for oscillation in bearings provided near its opposite ends in an offset 33′ of the bracket 33 and a bracket 41, respectively. These parts are so disposed that the shaft 40 extends from directly in rear of the bell-crank lever 34 to a point in proximity to the next adjacent wheel.

At one end of the shaft 40 is an arm 42, arranged when raised into contact with the stop 43, carried by the lug 33′, to lie behind the depending arm of the bell-crank lever 34, as illustrated in Fig. 1, so as to prevent rearward movement of said arm. A coiled spring 44, surrounding the rock-shaft 40 and secured at its opposite ends, respectively, to said shaft and to a fixed bearing, as the standard 41, serves to normally maintain the arm 42 in such elevated position. A releasing-arm 45 is arranged to project forward from the opposite end of the rock-shaft 40 and serves when depressed to remove said arm from the path of movement of the bell-crank lever.

It will be apparent now that when the arm 42 is in its normal or elevated position, preventing rearward movement of the depending arm of the rock-shaft, while the actuating-wheel may be freely moved in its forward or initial direction, its return from such position will be prevented by the engagement of the roller 36 with the then-adjacent tooth 20 of the wheel, the bell-crank lever being positively held against rearward movement by the said rock-shaft arm 42. If, however, the releasing-arm 45 is depressed, withdrawing the arm 42 from its position in the rear of the depending arm of the bell-crank lever 34, the latter instrumentality is released for operation, permitting the actuating-wheel 15 to return to its initial position, in its movement actuating the movable spring-arm 32 to close the circuit 31, as heretofore described.

Where interdependence of the releasing mechanism is to be provided for, one only of the releasing-levers 45 is extended forward into position convenient for use and is provided with a suitable head 46. Each of the other levers extend forward to overlie the next adjacent actuating-wheel and is provided with an upturned end 47. In the present illustration the releasing mechanism for the wheel 15 is adapted for manual actuation, while the wheels 15^a and 15^b are made dependent upon the movement of the wheels 15 and 15^a, respectively. The wheel 15 is accordingly provided with a pin 48, arranged when the wheel is in initial position to engage the hook 47^a of the releasing-arm 45^a, while the wheel 15^a is similarly equipped with reference to the release mechanism of wheel 15^b. It will be seen that the hooks 47^a and 47^b form positive stops to limit the range of movement of the wheels 15 and 15^a, respectively, in one direction and that when said wheels are at their respective limits of movement the releasing-arms 45^a and 45^b, respectively, are depressed. A suitable stop for wheel 15^b is provided, such stop being herein indicated as a fixed bracket 49^b, adapted to engage a pin 50^b, affixed to the wheel.

To regulate the rotative speed of the actuating-wheels when returning to their initial position after a primary or forward movement, we prefer to provide a speed-increasing gear (generally indicated at 51) adapted to transmit rotation from the main shaft 14 to an arbor 52, which carries a fan 53.

54 indicates a rail or casing member arranged immediately in front of the actuating-wheels to serve as a stop for the finger of the operator, each wheel being so arranged that a certain one of the finger-notches thereof appears above such rail when the wheel is in normal position.

The operation of our device when so constructed will be as follows: The operator, desiring to close each of the three circuits illustrated a determinate number of times, inserts his finger in the proper finger-recess of wheel 15 corresponding with the number of times he desires to close the corresponding circuit. The wheel is then drawn down until the finger of the operator contacts with the rail 54, the lever 34, as heretofore described, permitting the wheel to move freely in the direction specified. The arm 42 under tension of the spring 44, now elevated in rear of the bell-crank lever, prevents the return of the wheel, as heretofore described. It will be noted that during this initial or forward movement of the actuating-wheel the shaft 14 is not rotated, the wheel 15 being loosely mounted thereon and the pawl 27 slipping freely over the ratchet 25, keyed to the said shaft. It will be noted, further, that a forward movement of the wheel 15 removes the pin 48 from position of engagement with the hook 47^a upon the end of releasing-arm 45^a of the mechanism associated with the adjacent wheel 15^a. Now said wheel 15^a may be primarily rotated in like manner to the first-actuated wheel, it in its turn removing its pin 48^a from the hook 47^b of the releasing mechanism of wheel 15^b. The wheel 15^b may therefore be likewise rotated and will be held by its retaining mechanism. If, now, the head 46, carried by the releasing-arm 45 of the first-actuated wheel 15, be depressed, removing the arm 42 from its position of engagement with the lever-arm 34 of the translating device, the wheel 15 is allowed to re-

turn to its initial position. During this movement it will be noted that the pawl 27 operatively engages the ratchet 25, keyed to the shaft 14, and imparts its motion to said shaft 14, rotating it in the direction indicated by the arrow in Fig. 1. The speed of rotation of the shaft 15 is regulated or governed by the fan 53, as will be well understood, thereby causing the wheel 15 to return at a regulated speed. During the return movement of the wheel, the arm 45 being maintained depressed, the translating device is actuated to close the springs 30 and 32 a number of times, dependent upon the number of teeth 20 passing thereby. As the wheel 15 approaches its normal position the pin 48, carried by said wheel, engages the releasing-arm 45^a of the wheel 15^a, depressing said arm until the pin 48 engages the hook 47^a thereof, positively stopping the movement of the first actuating-wheel 15. The depression of the release-arm 45^a, however, removes from the path of vibration of the depending arm of lever 34^a the detent-arm 42^a, and so releases the wheel 15^a. In a similar manner the wheel 15^a actuates the release mechanism of wheel 15^b for permitting the latter to return to its initial position. It will be noted that each of the wheels is provided with its own return spring and that only one spring acts upon the common shaft 14 at a time. Consequently the speed of movement of the shaft may be made much more uniform than if a single spring were employed for all of the wheels.

While we have herein described in some detail an operative embodiment of our invention, we do not desire to be understood as limiting ourselves thereto in all of its details; but

What we claim, and desire to secure by Letters Patent of the United States, is—

1. In a device of the character described, a pivoted, primary actuating member having a tooth, a relatively stationary support, a lever pivoted in said support, having its end projecting substantially radially into the path of movement of the tooth of said member, and a pair of contact-springs, one of which is operatively associated with said lever to be moved into contact with its fellow spring by movement of the lever in one direction only.

2. In a device of the character described, a rotatable primary actuating member, having a tooth, a lever pivotally mounted between its ends disposed with one end in the path of the tooth of the actuating member and arranged for movement in either direction by the passage of the said tooth in like direction, and contact-springs including a spring movable in operation, said movable spring being related to the end of the lever remote from the actuating member to be operatively moved by the movement of said end in one direction.

3. In a device of the character described, a rotatable toothed actuating member, a stationary support, a lever pivoted in said support, and disposed with one end in the path of a tooth of the actuating member to be moved in either direction by the passage of said tooth in like direction, and contact-springs, including a spring movable in operation, arranged in the path traversed by a moving part of the lever when moving in one direction only.

4. In a device of the character described, a rotatable, toothed actuating member, a pair of contact-springs one of which is movable in operation, a stationary support, a lever pivoted on said support, said lever having a portion arranged for coaction with the movable contact-spring, and an arm lying substantially in the line intersecting the pivotal centers of the lever and the actuating member and projecting into the path of movement of a tooth of said member, whereby movement of said actuating member in one direction only serves through the lever to move the movable spring into contact with its fellow.

5. In a device of the character described, the combination with a rotatable, toothed member, and means for normally maintaining said member in definite position and returning it to such position when moved therefrom, of a pair of circuit-closing contact-springs one of which is movable in operation, a support stationary relative to the springs, a bell-crank lever pivotally mounted on said support intermediate the toothed member and the springs, with one arm projecting substantially radially into the path of the tooth of the rotatable member for movement in either direction by the passage of the tooth in like direction, and its other arm operatively associated with the contact-springs to operate the same when the tooth-engaging end of the lever is moved in one direction.

6. In a device of the character described, the combination of a rotatable primary actuating-wheel, a pair of contact-springs, one of which is adapted for movement in operation, a translating device arranged in operative relation to the actuating-wheel and the springs, to be actuated by the wheel and transmit motion to the movable spring, a member adapted and arranged when in operative position to prevent operative movement of the wheel in one direction from any position, and means for moving said member to inoperative position.

7. In a device of the character described, a primary actuating member, movable in two directions, a pair of circuit-closing contact-springs, one of which is movable in operation, a motion-transmitting instrumentality interposed between the movable spring and the actuating member, adapted and arranged to transmit motion from the actuating member to the movable spring when said actuating member is moved in one direction only, a movable holding device associated with said transmitting instrumentality adapted, when in operative position to prevent movement of

said transmitting instrumentality to move the spring to operating position, and means for moving said holding device to inoperative position.

8. In a device of the character described, a rotatable toothed wheel, a pair of contact members, a pivoted lever having one end arranged in the path of movement of the teeth of the wheel, and its other end disposed relative to the contact members so that when moved in one direction said lever brings said contact members into electrical connection, a movable holding device adapted when in operative position to engage said lever to prevent its movement in the said direction, and means for normally maintaining said holding device in operative position.

9. In a multiple circuit-closer, a frame, a shaft journaled therein for rotation, a speed-governing device operatively associated with said shaft, a series of wheels loosely mounted on said shaft, means associated with each wheel for securing it against rotation relative to the shaft in one direction, and permitting its free rotation relative thereto in the other direction, means associated with each wheel tending to move it in the first said direction, and circuit-closing devices operatively associated with each wheel for actuation thereby.

10. In a multiple circuit-closer, the combination with a frame, of a series of toothed actuating-wheels mounted therein for independent movement, means associated with each wheel for normally holding it at one limit of movement and returning it to said limit when removed therefrom, circuit-closing springs associated with each wheel, a pivoted lever interposed between each wheel and its contact-springs arranged to operate said springs during the return of the wheel to normal position after an initial movement therefrom, a movable holding device associated with each lever and arranged to normally prevent movement thereof in the spring-operating direction, a releasing means for each holding device, and means carried by each wheel for actuating during its return movement the releasing device associated with the next succeeding wheel, whereby, upon the setting of the wheels and actuation of a first releasing device to permit the return of the corresponding wheel, the remaining wheels will be automatically and successively released.

11. In a multiple circuit-closer, the combination of two rotatable, toothed wheels, circuit-closing springs associated with each wheel, a movable transmitting instrumentality interposed between each wheel and its contact-springs normally arranged to intercept the path of movement of the wheel-teeth and to be moved therefrom by the teeth in operation, a holding device associated with each transmitting instrumentality adapted to prevent movement thereof from the path of the teeth of the wheel, and means carried by one wheel arranged and adapted to move the holding device of the transmitting instrumentality associated with the other wheel, into inoperative position.

In testimony that we claim the foregoing as our own we affix our signatures in presence of two witnesses.

JOHN K. NORSTROM.
HENRY M. GRAIF.

Witnesses:
MARY F. ALLEN,
GEO. T. MAY, JR.