C. C. BADEAU.

SWITCH OR CIRCUIT OPENER FOR HIGH POTENTIAL CIRCUITS.

APPLICATION FILED AUG. 8, 1908.

996,394.

Patented June 27, 1911.

2 SHEETS—SHEET 1.

Fig. 1

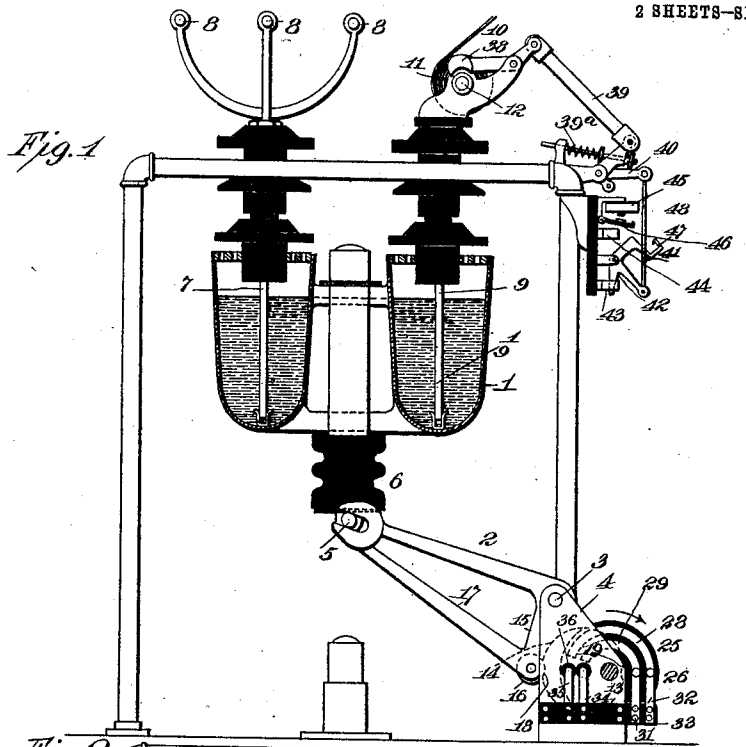
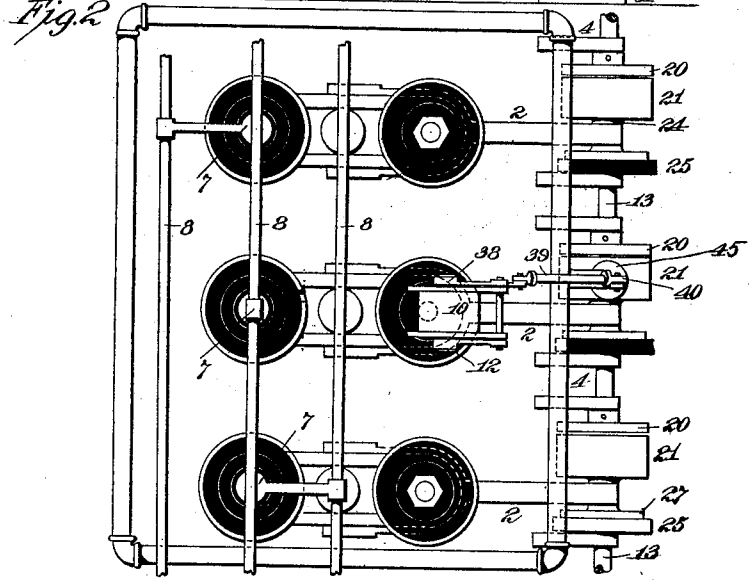


Fig. 2



Witnesses:

Jas. F. Coleman

John L. Folsch

Inventor

Charles C. Badeau

By Dyer & Dyer

Attorneys.

C. C. BADEAU.

SWITCH OR CIRCUIT OPENER FOR HIGH POTENTIAL CIRCUITS.

APPLICATION FILED AUG. 8, 1908.

996,394.

Patented June 27, 1911.

2 SHEETS—SHEET 2.

Fig. 3

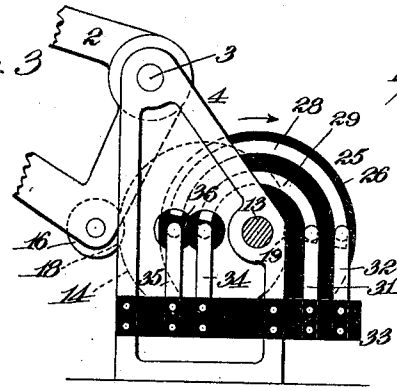


Fig. 4

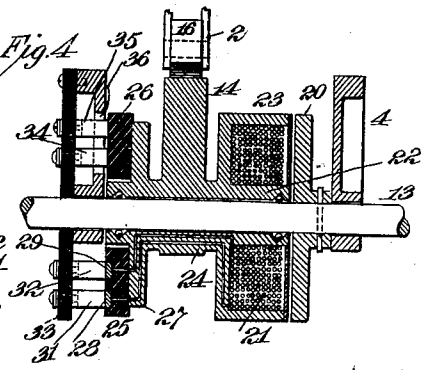


Fig. 5

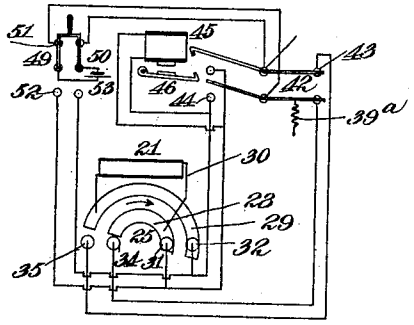


Fig. 6

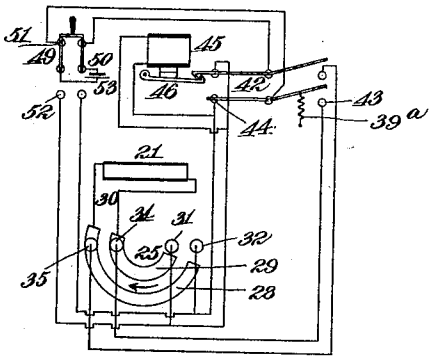


Fig. 7

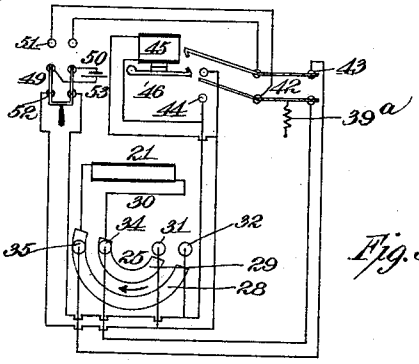


Fig. 8

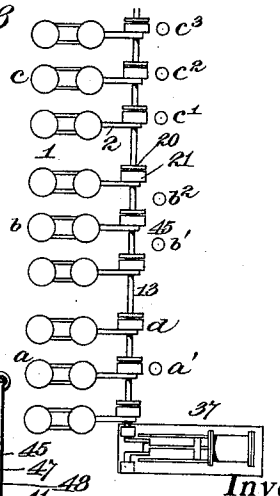
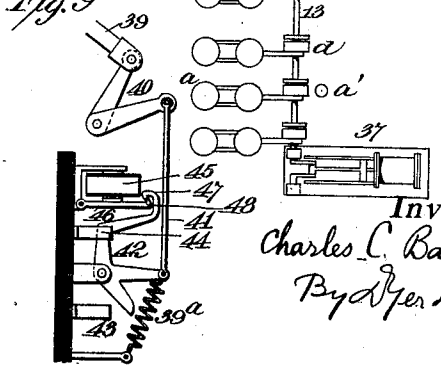


Fig. 9



Witnesses:

Jas. F. Coleman

John Lobach

Inventor

Charles C. Badeau

By Dyer & Dyer

Attorneys.

UNITED STATES PATENT OFFICE.

CHARLES C. BADEAU, OF BETHLEHEM, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO ROLLER-SMITH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

SWITCH OR CIRCUIT-OPENER FOR HIGH-POTENTIAL CIRCUITS.

996,394. Specification of Letters Patent. Patented June 27, 1911.

Application filed August 8, 1908. Serial No. 447,655.

To all whom it may concern:

Be it known that I, CHARLES C. BADEAU, a citizen of the United States, residing in Bethlehem, county of Northampton, State of Pennsylvania, have invented a certain new and useful Improvement in Switches or Circuit-Openers for High-Potential Circuits, of which the following is a specification.

This invention relates to improvements in switches or circuit openers for high potential circuits.

The general object of my invention is the production of a new and improved switch or circuit breaker for opening and closing circuits carrying large currents at high potential.

More explicitly stated among the objects of my invention is the production of an electrically controlled circuit breaker which opens upon occurrence of overload in the circuit controlled by it, and which may also be closed and opened at will from any desired point.

A further object of my invention is to produce a new and improved circuit breaker which may be closed and opened, irrespective of the existence of current in the circuit in which the breaker is located.

Other objects of my invention will appear from the following description thereof, taken in connection with the accompanying drawings.

In the drawings, Figure 1 is an end elevation, partly in section, of a portion of an apparatus embodying my invention, showing the openers closed, but with the overload switch coil deënergized. Fig. 2 is a plan view of such apparatus. Fig. 3 is an enlarged end view of a portion of the operating mechanism. Fig. 4 is a longitudinal sectional view of the shaft and clutch. Fig. 5 is a diagrammatical view showing the circuits of the circuit opener when the parts are in closed position. Fig. 6 is a similar view showing the parts when opened by overload. Fig. 7 is a similar view when the parts are opened by hand. Fig. 8 is a plan view of a number of elements and one operating shaft with a prime mover therefor; and Fig. 9 is a detail view of a modified form of holding coil and its operating parts.

In all of the views like parts are designated by the same reference characters.

The numeral 1 indicates the oil containing receptacles in which the make and break of the circuit occurs. These receptacles are illustrated in the co-pending application filed by me June 16, 1906, Serial No. 321,996. They are shown as arranged in pairs, the two elements communicating through passages which permit the free equalization of pressures in the two receptacles. These receptacles are elevated to close the circuit, or depressed to break the circuit by means of a lever 2, pivoted at 3, to a bracket 4. The free end of the lever 2 is forked, as shown, the tines of the fork passing on each side of a pin 5, which pin is connected by means of an insulator 6 to the receptacles 1. One terminal 7 of the circuit opener is shown as connected to one of the three bus bars 8. The other terminal 9 is connected to a flexible conductor 10. This flexible conductor may be made in the manner illustrated in my Patent No. 752,192, dated February 16, 1904. This conductor 10 is formed of conducting material made in a coil 11, the convolutions of the coil being separated by insulation, as shown. In the center of the coil is a core 12, such core and coil constituting an electro-magnet.

The means for operating the lever 2 for opening and closing the circuit breaker comprises a shaft 13, which is rotated by suitable mechanism, and carries a cam, which engages with the lever 2, and raises or lowers the latter. The cam, as shown in Fig. 3, is indicated by the character 14. An arm 15 on the lever 2 carries at its free end a roller 16, which is adapted to engage with the periphery of the cam 14. A brace 17 connects the free end of the arm 15 with the free end of the arm 2. The cam 14 is provided with notches 18—19, arranged upon opposite sides of its periphery, and adapted to the purpose of engaging with the roller 16 when the cam has made a half revolution, and preventing the cam moving too far should it have a tendency to do so. The cam is so mounted as to permit the shaft 13 to turn freely within it until it is connected thereto temporarily, whereupon it will turn with the shaft. Means for securing it temporarily to the shaft may be the magnetic clutch illustrated in Fig. 4. This clutch comprises an armature 20, which is secured to the shaft 13 to turn with it.

This armature is in the form of a plate of magnetic material. A coil 21 surrounding a sleeve 22, and lying within a casing 23, completes the magnetic portion of the clutch. The sleeve 22 and casing 23 are made of magnetic material. The sleeve 22 may be a continuation of a sleeve 24 upon which the cam 14 is carried, and both sleeves are carried upon ball bearings, as shown, so that there will be no tendency for the sleeves to turn when the coil is de-magnetized. The sleeve 24 carries a commutator 25. The commutator is shown as formed of a disk 26 of insulating material carried upon a supporting flange 27. The disk 26 is provided with semi-circular contact strips 28 and 29. These contact strips, by means of the wires 30, serve to complete the circuit through the coil 21. Contact with the strips 28 and 29 is made by means of the brushes 31 and 32. These brushes are carried upon a strip 33 of insulating material connected to and supported by the bracket 4. Contact is made also with the strips 28 and 29 through the agency of brushes 34 and 35, which are also shown as carried upon the strip 33. The ends of these brushes 34 and 35 pass through an opening 36 formed in the bracket 4. It is to be noted that the contact strips 28 and 29 are so arranged that when either of the notches 18 or 19 is in engagement with the roller 16, but one set of brushes 31—32 or 34—35 will be in contact with the strips 28 and 29. It will also be apparent that one set of brushes will always be in contact with these strips irrespective of whether the notch 18 or 19 is in engagement with the roller 16.

The shaft 13 may be connected through the agency of the lever, cams and clutches already described to any number of switch elements 1, as desired. Fig. 8 shows an arrangement with three sets of three elements. The shaft 13 is adapted to be constantly rotated; any suitable motor may be used for that purpose; in Fig. 8 an expansion engine 37 being employed. Any other form of engine may be used, but the expansion engine or motor of similar type is preferred in place of an electric motor, as it can be relied upon to be continually moving in the event of a breakage occurring in the electric system at a time that it would be desirable to close or open the breakers.

I provide means for energizing the electric clutches, and illustrate two means for that purpose; one of these means is manually controlled and the other is automatic, operating by any abnormal change in the current, such as overload or underload. The specific illustration is for an overload condition.

Referring to Fig. 1, the electro-magnet, comprising the coil 11 and core 12, is adapted, when an overload occurs, to attract the armature 38. This armature is connected by means of a link 39, a bell crank lever 40, link 41, to a switch 42. This switch is provided with contact points 43 and 44. When in the normal position the contact points 43 are closed and the contact points 44 are open. The switch is normally held in contact with the points 43 by means of a spring 39^a, which is a spring that acts by expansion. In the modification illustrated in Fig. 9 the spring 39^a acts by contraction. In addition to the switch arm described, there is a holding coil 45, such holding coil being adapted to attract an armature 46, the said armature having a hook 48 which may be engaged with a hook 47 on the switch 42. When the armature 46 is unattracted, the hooks 47 and 48 will be separated; when the armature is attracted to the coil 45, the hook 48 will be in the path of the hook 47, and should the switch 42 be then moved away from engagement with the contact points 43 to engagement with the contact points 44, the two hooks 47 and 48 will engage together and the switch 42 will be locked against opposite movement unless it is released by the dropping of the armature 46, which will occur only by the deënergization of the coil 45.

In connection with the switch 42, already described, I use a hand switch 49 (see Fig. 5). This switch is connected to a source of current such as a battery 53, and is adapted to engage with the contact points 51 or 52. The contact points 51 are connected, as shown, in Figs. 5, 6 and 7 to the switch 42; contact points 52 are connected to the brushes 31 and 32. The brushes 34 and 35 are connected to the contact points 43, while the contact points 44 are connected to the brushes 31 and 32. The coil 45 is arranged to be in shunt with the brushes 31 and 32.

The overload switch coil 11 of the control magnet is in series with the main circuit, and therefore this magnet is deënergized as soon as the main circuit is opened. If the holding coil 45 and its armature 46 were not provided, and an overload should occur, the controlling switch 42 would be moved to the position in which its movable member engages with the contacts 44, thereby energizing the coil 21 and causing rotation of the cam 14 and opening of the circuit breaker. Immediately on opening of the circuit breaker, the overload coil 11 would be deenergized and the switch 42 would be thrown back to its normal position by the spring 39^a, with the result that the circuit through the coil 21 would be again completed through the contacts 43, and the cam 14 would be caused to revolve another one-half revolution, thereby causing the circuit breaker to close. The closing of the circuit breaker would at once reënergize the overload coil 11, and if overload condition still existed,

the circuit breaker would be again opened, with the result that the sequence of operations just described might be indefinitely repeated. Any such objectionable mode of operation is, however, prevented by the holding coil 45 and its coöperating armature 46 which holds the movable member of the controlling switch 42 in engagement with contacts 44 after being once moved to that position, until the controlling switch 49 has been moved.

When the circuit breaker is closed, the parts are in the position illustrated in Fig. 5, the switch 42 being in engagement with the contact points 43, and the switch 49 in contact with the contact points 51. The cam 14 will be in such a position that the notch 18 is in engagement with the roller 16, and the lever 2 will be in the elevated position.

Fig. 6 illustrates the position of the parts after the switch has been opened by overload. An overload will attract the armature 38, and by means of the mechanism described, will move the switch 42 from engagement with the contact points 43 to engagement with the contact points 44. The current will then flow from the battery 53 through the switch 49 to contact points 51, to the switch 42 and through the contact points 44, through the brushes 31—32 to the contact plates 28—29, energizing the coil 21. The holding coil 45 being in parallel will also be energized. The coil 21 being energized, the clutch will be actuated, and the shaft 13 being constantly rotated, the cam 14 will be turned in the direction of the arrow illustrated in Figs. 5, 6 and 7. The coil 21 will remain energized so long as the brushes 31—32 are in engagement with the contact strips 28—29. They will remain in engagement with such strips until the brushes pass over the ends of the latter, which will occur after the cam 14 has made a half revolution and the notch 19 is in engagement with the roller 16. The notch 19 being located at the smallest radius of the cam, the lever 2 will be in its lowermost position and the circuit breaker will be opened. After the brushes 31 and 32 cease to be in contact with the contact strips 28 and 29, the parts will be in the position shown in Fig. 6, the coil 21 being deënergized, the coil 45, however, will remain energized, as that coil will not be cut out. There will, therefore, be no possibility of the switch 42 being moved backward, because this switch 42 will be held in this position by the engagement of the hooks 47 and 48. This position will be retained so long as the coil 45 is energized.

Fig. 7 shows the position of the parts after the circuit opener has been opened by hand. In this situation the switch 49 is moved to disengage the contact points 51 and causing them to engage with the contact points 52. When they are in this position the circuit will be from the battery 53 through the brushes 31—32, and the coil 21 will be energized in the manner already described, as also will be the holding coil 45. When the switch has been opened by overload and is to be closed, the hand switch 49 is first moved away from engagement with the contact points 51. The holding coil 45 will then be deënergized, and the switch 42 will be moved back to its normal position by means of the spring 39^a. The hand switch 49 being now moved back to engagement with the contact points 51, the circuit from the battery 53 will pass through the contact points 43 and brushes 34—35, and will energize the coil 21 of the clutch, which will result in turning the cam 14 a half revolution, thus closing the main breaker.

Fig. 8 illustrates several arrangements of tripping switches in connection with a circuit opener. The group a of openers is controlled by a single tripping switch a'. The group b is controlled by the two tripping switches b', b^2, while the group c is controlled by the three tripping switches c', c^2 and c^3. All switches control clutches d, mounted on the common shaft 13, which is continually rotated by the prime mover 37, which is shown as a non-electrical device.

In accordance with the provisions of the patent statutes, I have described the principle of my invention, together with the apparatus, which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is merely illustrative, and that the invention can be carried out in other ways.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A circuit opener having a breaker, a constantly rotating shaft and a magnetic clutch thereon; connections between the clutch and breaker for controlling the latter, an electric circuit connected with said clutch and a two-station control for such circuit, one of such stations being responsive to abnormal current conditions in the mains, a switch in the circuit at that station, and means operatively controlled by said switch for holding the switch in closed condition after the breaker is opened.

2. A circuit opener having a breaker, a constantly rotating shaft and a magnetic clutch thereon; connections between the clutch and breaker for controlling the latter, an electric circuit connected with said clutch, and a control for such circuit, such control being responsive to abnormal current conditions in the mains, a switch in the circuit, and means operatively controlled by said switch for holding the switch in closed condition after the breaker is opened.

3. A circuit breaker comprising a stationary contact member, a movable contact member coöperating therewith, a constantly rotating shaft, an operating connection between said shaft and said movable contact member including a magnetic clutch, control circuits connected with said clutch, switch contacts in said circuits biased to closed position, other switch contacts in said circuits biased to open position, means responsive to current through the circuit breaker for opening the first named switch contacts and closing the last named switch contacts, electrically operated means made operative by the closing of the last named switch contacts for holding said contacts in their closed position, and a hand operated switch for opening and closing said control circuits.

This specification signed and witnessed this twenty-fourth day of April, 1908.

CHARLES C. BADEAU.

Witnesses:
M. A. TRANSUE,
D. H. SMITH.