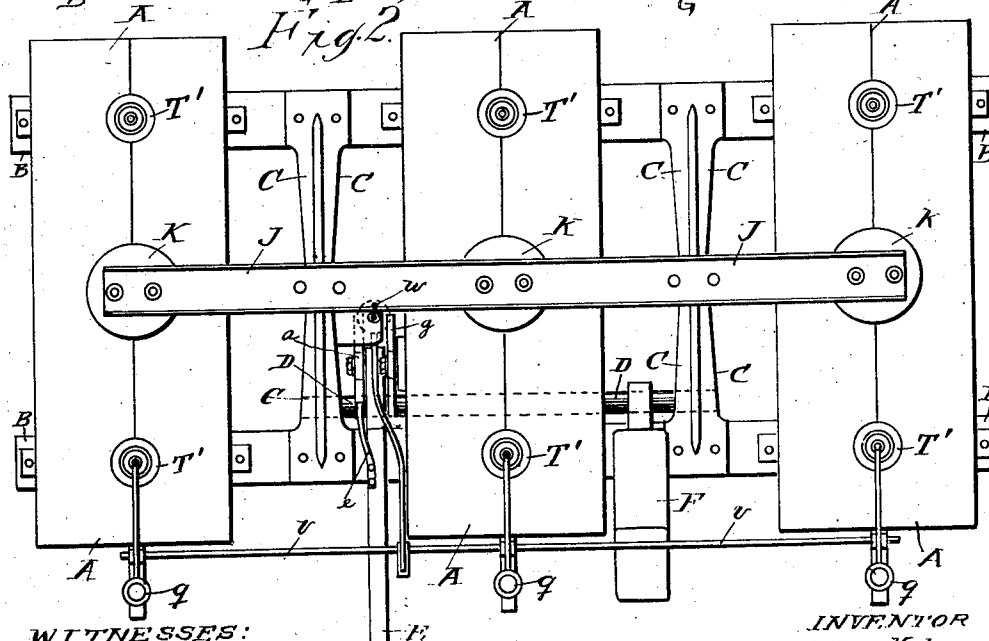
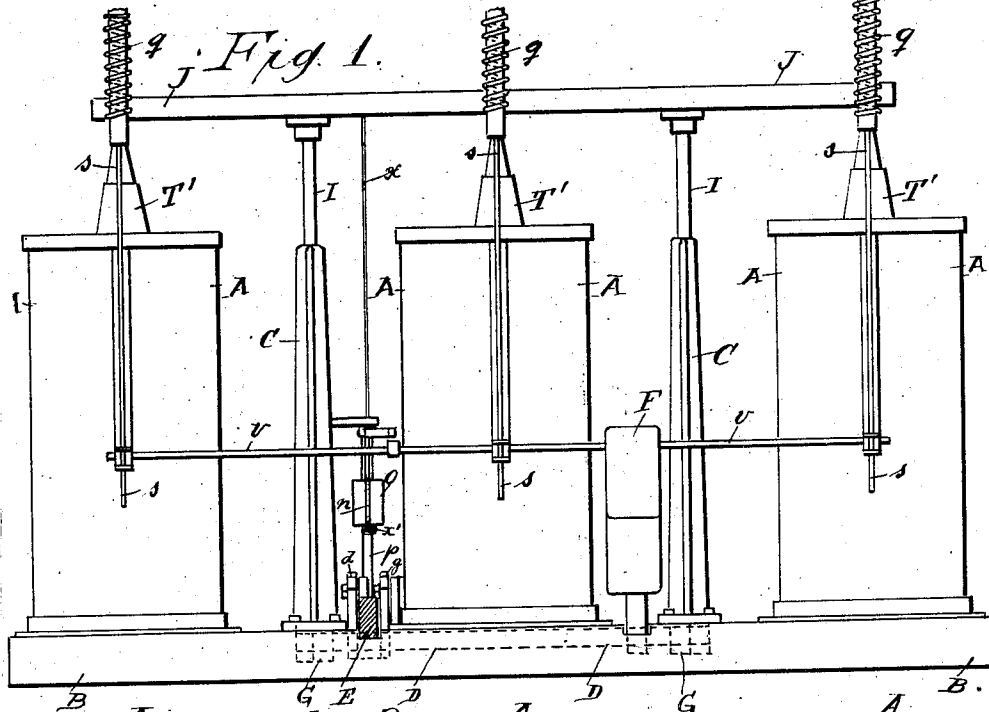


J. N. KELMAN.
AUTOMATIC CIRCUIT BREAKER.
APPLICATION FILED APR. 22, 1907.

Patented Oct. 26, 1909.

4 SHEETS—SHEET 1.

938,324.



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Ida M. Daskam

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Joseph Nelson Kelman

BY *John Day*
ATTORNEY

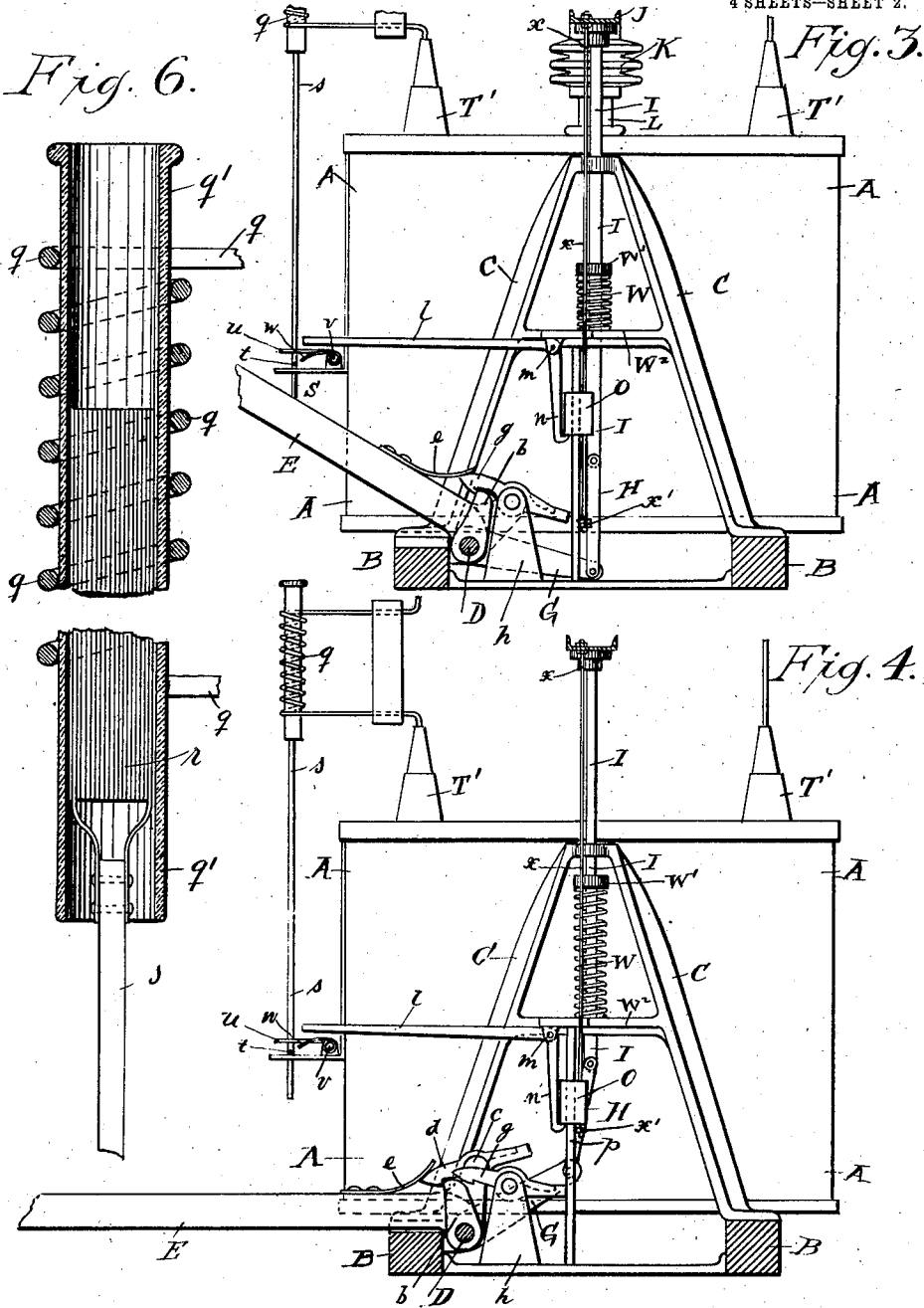
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4 SHEETS—SHEET 2.

Fig. 6.



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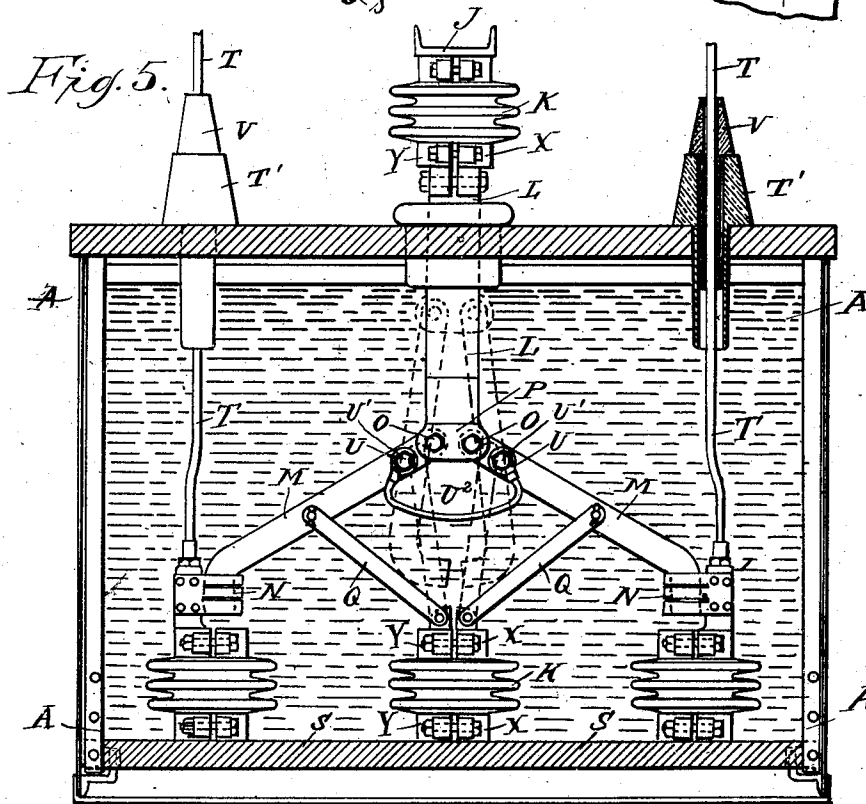
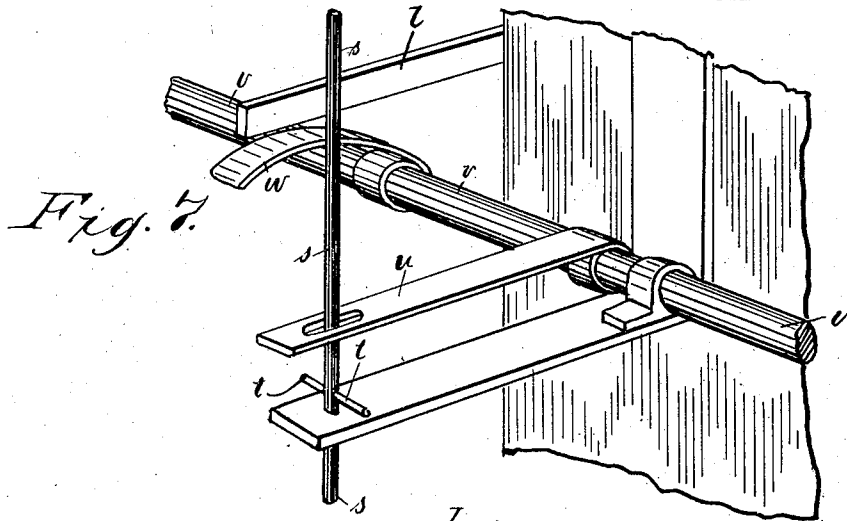
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 4 SHEETS—SHEET 3.



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4 SHEETS—SHEET 4

Fig. 8

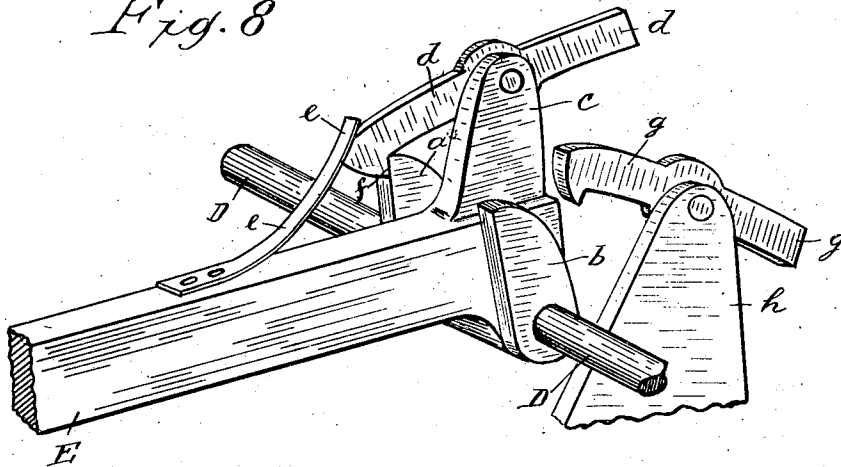
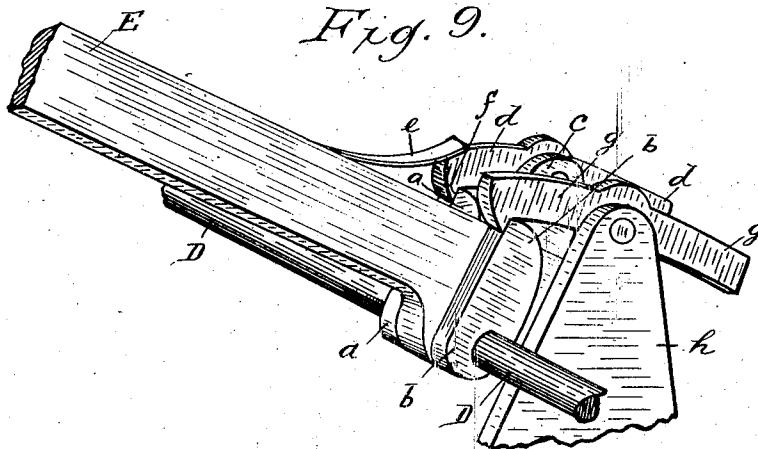


Fig. 9.



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UNITED STATES PATENT OFFICE.

JOSEPH NELSON KELMAN, OF LOS ANGELES, CALIFORNIA.

AUTOMATIC CIRCUIT-BREAKER.

938,324.

Specification of Letters Patent.

Patented Oct. 26, 1909.

Application filed April 22, 1907. Serial No. 370,091.

To all whom it may concern:

Be it known that I, JOSEPH NELSON KELMAN, of the city of Los Angeles, in the county of Los Angeles, in the State of California, have invented an Automatic Circuit-Breaker, of which the following is a full, clear, and exact specification, reference being had to the annexed drawings and to the figures and letters marked thereon.

The improved switch and circuit breaker for high potential circuits, constituting my present invention, is in part the same as the switch and circuit breaker for which I have filed an application for Letters Patent, Serial Number 367,124, and having the following filing date, namely April 8th, 1907. The essential difference in the apparatus constituting my present invention is that the additions which my present invention consists of, being applied to the switch and circuit breaker described in my aforesaid application for Letters Patent, render it automatic in the opening of high potential circuits instead of being wholly opened and closed by hand as in the apparatus described in my aforesaid application for Letters Patent.

The apparatus constituting my present invention is of that type wherein the circuit is opened or closed under oil, and is not only safe and effective in operation, but consequently can be depended upon at all times to automatically open the circuit under any conditions of overload or short circuit. I have tested my said improvements as applied to switches and circuit breakers on electric circuits wherein there have been carried voltages ranging from 15,000 to 60,000 volts under all conditions of overload and short circuit.

My new or improved switches or circuit breakers are made up with any desired number of pairs of poles, each pair of poles and corresponding contact makers or switch blades being in a separate oil tank. The poles and contact makers being of the double type having two fixed poles, and the two contact pieces arranged to move horizontally or as near horizontally as may be.

The tanks of the apparatus are made of iron or other suitable material, the top or cover of each of which is of marble and preferably made in two pieces, so that either or both of these pieces of marble can be readily taken off to admit of inspection of the switch in the interior of the tank, for the reason that the pieces of marble constitute

a cover only for the tank, none of the working parts being fixed to, or supported by the covers in any respect.

The fixed contacts of the switches are mounted on porcelain insulators, and are of the kind described in the specification of my aforesaid application for Letters Patent, their construction being such as to provide very high insulation and considerable mechanical strength. These insulators are mounted upon a wooden or equivalent insulating support placed deep down in the oil tanks. The movable contacts of the switches are attached to a rod of wood, while between this rod and the operating mechanism is a porcelain insulator of the same special design, and construction, providing very high potential insulation, and the requisite strength at this part of my device.

In connection with my said device there is provided a solenoid coil which is part of the main circuit and therefore operated by the current in the main circuit. During the time that the circuit is in normal or proper operation, the weight of the longer arm of a pivoted lever presses the shorter arm of that lever, having a hook at its lower extremity, beneath a weight carried slidably upon a vertical guide bar. This hook maintains the weight from falling, but the instant when the circuit becomes overloaded or short circuited, the solenoid coil part of the circuit being then abnormally excited, excites the soft iron core of the solenoid to such an intensity that the solenoid coil part of the circuit then pulls upward the soft iron core, and a cross bar or pin, attached to the lower part of a rod extending downward from the soft iron core, which as the solenoid coil continues to pull the soft iron core upward, causes a cam carried upon a revolvable shaft to operate upon the long end of the aforesaid pivoted lever, thereby pulling the catch of the short arm of the aforesaid pivoted lever outward from beneath, and therefore from supporting the aforesaid weight. In consequence of this, the weight falls, and in falling strikes upon a pivoted detent, which on being released frees the mechanism to automatically open the switch or circuit breaker, while the upward movement of the parts which open the switch or circuit breaker lift and return the weight to be again held up by the hook or catch of the said pivoted lever, in readiness to fall and perform the same functions of automatically

opening the switch or circuit breaker when the load in the circuit shall again become excessive, or the circuit short circuited.

Upon the annexed drawings, Figure 1, is a front elevation of a three tank automatically opening switch apparatus for high potential circuits, constructed according to my present invention. Fig. 2, is a plan corresponding to Fig. 1. Fig. 3, is an end elevation of one of the oil tanks showing the automatic apparatus constituting my invention as situated between two of the tanks, and with the parts of the apparatus in the position they occupy when the circuit is in its closed condition. Fig. 4, is another end elevation of one of the oil tanks, corresponding to Fig. 3, but showing the automatically operated parts of my apparatus in the position they occupy when the circuit has been opened or broken by the falling of the weight having operated the part of the apparatus upon which it strikes. Fig. 5, is a transverse section of the tank, showing the switch contained therein, and submerged in oil. Fig. 6, is an enlarged view of the solenoid part of the circuit and soft iron core part of the apparatus constituting my present invention. Fig. 7, is a perspective view of a detail of my invention as hereinafter more fully described. Figs. 8, and 9, respectively, are two perspective views of part of the mechanism operated by the weight when it falls on being released by the action of the solenoid as hereinafter described.

In Figs. 1, 2, 3, 4, and 5, the tanks containing the oil, and the mechanism for making and breaking high potential circuits are marked A. Each of the tanks A, rests upon beams B, Figs. 1, 2, 3, and 4, of wood, iron, or other suitable material. In each of the two spaces between the central and end tanks A, A, as shown in Figs. 1, 2, 3, and 4, there are situated the A-shaped framings C, of cast iron. In the lower part of these framings C, the shaft D, is carried rotatably in bearings, as shown in dotted lines in Fig. 1, in plan in Fig. 2, and in transverse section in Figs. 3, and 4. These A-shaped framings C, are securely bolted to the beams B, upon which the tanks A, rest. Near one end of the shaft D, an operating lever or handle E, is carried loosely or rotatably upon the shaft, and near the opposite end of the shaft D, the cooperating weight F, is also attached by the lever as shown in Figs. 1, and 2. Two levers G, G, are fastened upon the shaft D, one of these levers being beneath each of the frames C, and therefore not seen in the plan Fig. 2, and are each connected pivotally by a link H, Figs. 3, and 4, to the lower end of each vertical rod I, to the upper part of which rods the channel iron J, is securely fastened, and therefore connects the vertical rods I, I. The channel iron J, is also connected at its cen-

ter and ends by a strong porcelain insulator K, to a thick rod L, of wood, and the lower end of each thick wooden rod L, is connected to the two movable blades or switch arms M, M, within each tank A, as shown in one of the tanks at Fig. 5. These switch arms M, M, make and break contact with the fixed poles N, N, of the switch. The arms M, M, are pivotally connected by the bolts O, O, to the metallic attachment P, fastened to the lower end of the wooden rod L, in any convenient and sufficiently strong manner, and the switch blades M, M, are by the pivotally jointed links Q, Q, coupled to the upper central part of the lower insulators K, each of these insulators being fastened to the wooden rail S, stretching across the bottom of each tank A, as more especially shown in Fig. 5. To the fixed contacts or poles N, Fig. 5, the portions of the circuit T, which enter the switch are connected, and these portions T, pass out through the cover of each tank through insulators T'. Each of the two blades or switch arms M, M, are respectively united at their upper part by means of connectors U, which are held by bolts U', in close metallic contact with the blades M, M, and these conductors U, are connected together by a piece of flexible cable U². The construction of the insulators T', through which the conductors T, pass, is the same as that described in my aforesaid specification, and as shown in section in Fig. 5, consisting of the upper porcelain part V, through which one of the conductors T, pass. This portion V, is flanged at the top so that it may rest securely upon the lower part T', of the insulator, which again is formed with a flange so as to rest upon the top of the slate or marble cover of the tanks A. The insulators K, are of the same kind shown in the drawings, described in the specification, and claimed in the claims of my aforesaid application for Letters Patent, and do not in themselves constitute any part of my present invention. The clips made of the parts X, and Y, shown in Fig. 5, for connecting the insulators to the parts of my device, are also of the same construction as shown in the drawings, described in the specification and claimed in my aforesaid application for Letters Patent, and need not therefore be herein further referred to. Both the insulators K, and the clips X, and Y, are fastened to the wooden beam S, and to the channel iron J, by tap bolts, all as shown and described in my aforesaid application for Letters Patent, and not constituting any part of my present invention need not be herein further referred to.

When the apparatus constituting my present invention is closed, the several parts thereof are in the positions and relationships represented by Figs. 3, and 5, and are

maintained in those positions and relationships by the pawl *g*. There is a spring *W*, in each of the frames *C*, and there is a collar *W'*, on each of the rods *I*. When the lever *E*, is in the position shown at Fig. 3, then each of the coiled springs *W*, is compressed by the collar *W'*, on each rod *I*, forcing each spring *W*, downward upon the cross bar *W²*, of each frame *C*, and the reaction of each spring *W*, against each collar *W'*, tends to force each rod *I*, upward, and thereby to cause each rod *I*, by means of the links *H*, to pull upward the levers *G*, and rotate the shaft *D*. The shaft *D*, and its connections are, however, prevented from being so moved by means of the pawl *g*, being in engagement with the nose of the lever *b*, which is securely fastened on the shaft *D*, therefore the shaft *D*, and its connections will then remain locked until the pawl *g*, becomes disengaged from the lever *b*, by the action of the falling weight *O*, as hereinafter described.

The shaft *D*, shown in plan in Fig. 2, in dotted lines in Fig. 1, and in side elevation in the cross section Figs. 3, and 4, is, as aforesaid, carried in bearings at the lower end of the A-shaped framing *C*. The operative lever or handle *E*, is carried loosely upon said shaft *D*, between the two short locking levers *a*, and *b*, secured to the shaft *D*, shown in two operative positions at Figs. 3, and 4, and in perspective in Figs. 8, and 9. These locking levers *a*, and *b*, respectively are keyed to the shaft *D*. The lever *E*, has upon its lower end an upturned extension *c*, upon which is pivotally carried a pawl *d*, pressed downward by means of the spring *e*, secured to the lever *E*. When the switch is open as indicated by the position of the interlocking parts in Fig. 4, and the lever *E*, is in horizontal position, the pawl *d*, carried in the upturned arm or extension *c*, of the lever *E*, is in contact with the lever *a*, as shown in perspective view Fig. 9, and engages the locking lever *a*, with the detent *f*, thereof, so that when the operator pulls the lever *E*, upward to close the switch, the pawl *d*, engaging the lever *a*, will rotate the shaft *D*, and with it the other lever *b*, which engages with a pawl *g*, carried on a stationary bracket *h*, forming part of the frame-work as shown in Figs. 3, and 4, and in perspective in Figs. 8, and 9. When the weight *O*, is released by the upward movement of the lever *L*, upon its pivot *m*, and the consequent withdrawal of the hook *n*, from beneath the weight *O*, which takes place when the load of the circuit is becoming great enough, or when the circuit will have become short circuited, then the weight *O*, drops and strikes upon the rear ends of both pawls *d*, and *g*, simultaneously. When the solenoid coil part *q*, of the circuit is sufficiently excited to pull

upward the soft iron core *r*, its wooden or non-conducting rod *s*, causes the cross pin *t*, to be brought into contact with the lever *u*, firmly fastened upon the shaft *v*, and by this pin *t*, continuing to move upward by the further pull of the solenoid coil *q*, upon the soft iron core *r*, the cam *w*, upon the shaft *v*, is caused to press upwardly upon the arm *l*, thereby moving the arm *l*, upward upon its pivot, until the weight *O*, is released from support by the hook *n*, when it immediately drops and in striking the pawl *g*, releases the entire apparatus. Then the re-action of the compressed springs *W*, takes place, and the upward movement of the rods *I*, the channel iron *J*, the insulators *K*, the wooden rods *L*, and the pulling out of the blades *M*, *M*, from the fixed poles *N*, *N*, takes place, and the circuit is instantly open and broken, and continues open or broken until the poles of the blades *M*, *M*, and the fixed poles *N*, *N*, are moved into operative contact again, by the lifting of the lever *E*, by an attendant, and the consequent rotation of the shaft *D*, the downward movement of the lever *G*, by means of the links *H*, the rods *I*, and collars *W'*, again compressing the springs *W*, and moving the switch blades *M*, *M*, into operative contact with the fixed poles *N*, *N*, in which positions and conditions the parts of the apparatus remain so long as the short arm *b*, upon the shaft *D*, is retained by the hook, of the pawl *g*, carried by the fixed part of the base *h*.

From the construction and operation of the automatic switch or circuit breaker apparatus or mechanism hereinbefore described, it is obvious that if at the time of the closing of the switch the load on the circuit should be great enough to excite the solenoid coil sufficiently, to then pull upward the soft iron core *r*, and release the weight *O*, in the manner hereinbefore described, so that the weight *O*, would fall and strike upon the pawl *d*, would release the shaft *D*, and thereby render the springs *W*, free to re-act by rotating the shaft *D*, and moving the links *H*, and rods *I*, to instantly open the switch, and maintain the switch open until the load on the circuit has become sufficiently reduced so as not to excite the solenoid and operate the weight maintaining and releasing mechanism at the time of closing the switch. This condition of the apparatus results from the connection of the lever *E*, the shaft *D*, being such that the lever *E*, the shaft *D*, are rotatable with respect to each other. Instantly that the springs *W*, re-act and cause the lifting of the channel iron *J*, to which the rod *x*, is attached as shown at Figs. 3, and 4, the upward movement of the rod which has a nut *x'*, on the bottom thereof, causes the weight *O*, to be simultaneously lifted up to the position wherein the weight

O, reengages with the hook *n*, of the pivotal lever *l*, in which position the weight O, is maintained ready to be released and fall at the next overload or short circuiting of the circuit *q*, to again act upon the switch or circuit breaker.

I claim as my invention.

1. In a high potential switch and circuit breaker wherein the parts for opening the circuit are operated from a rotatable shaft, a lever having an upturned arm movable rotatively upon said shaft, said upturned arm of said lever carrying a pivoted pawl acted upon by a spring carried by said lever, a lever fixed upon said rotatable shaft, said lever being formed as a detent with which said pawl engages, another lever fixed upon said rotatable shaft also formed as a detent with which another pawl carried pivotally in a fixed projection engages, said lever having said upturned arm, said pivoted pawls, said spring operating upon the pivoted pawl carried in said upturned arm of said lever, said levers formed as detents, levers fixed on said rotatable shaft, links connecting said levers to the lower ends of vertical rods, each such rod having a collar, a frame in which each of said rods is carried, a support in each such frame beneath the collar on each of said vertical rods, coiled compressible springs, the ends of each of which springs are in pressing contact with the collar of each of such vertical rods and each such support respectively, a stiff member to which the upper ends of said vertical rods are connected, said member when moved in one direction opening the circuit, and when moved in the opposite direction closing the circuit, by operating opening and closing switch arms connected insulatedly to said member, a weight which on falling strikes upon said pawls releasing them from the levers formed as detents and simultaneously releasing the compressed springs for opening the circuit.

2. In a high potential switch and circuit breaker wherein the parts for opening the circuit are operated from and by the moving of a stiff member, a vertical rod suspended from said stiff member, a weight having a hole through it encircling said vertical rod thereby connecting said weight to said stiff member, said vertical rod having a stop at its lower end by which said weight is lifted into potential position by the moving of said stiff member after said weight has fallen upon the pawls and released the opening mechanism of the circuit breaker.

3. In a high potential switch and circuit breaker wherein the parts for opening the circuit are operated from a rotatable shaft, a lever having an upturned arm movable rotatively upon said shaft and carrying a pivoted pawl acted upon by a spring carried by said lever, a lever fixed upon said rotatable

shaft, said lever being formed as a detent with which said pawl engages, another lever fixed upon said rotatable shaft also formed as a detent with which another pawl carried pivotally in a fixed projection engages, said lever having an upturned arm, said pivoted pawls, said spring operating upon the pivoted pawl carried in said upturned arm of said lever, said levers formed as detents, levers fixed on said rotatable shaft, links connecting said levers to the lower ends of vertical rods, each such rod having a collar, a frame in which each of said rods is carried, a support in each such frame beneath the collar on each of said vertical rods, coiled compressible springs, the ends of each of which are in pressing contact with the collar of each of such vertical rods and each such support respectively, a stiff member to which the upper ends of said vertical rods are connected, said member when moved in one direction operating to open the circuit, and when moved in the opposite direction operating to close the circuit, by moving opening and closing switch arms connected insulatedly to said member, a weight which on falling strikes upon said pawls releasing them from the levers formed as detents and simultaneously releasing the compressed springs for opening the circuit, a vertical rod suspended from said stiff member, said weight being formed with a hole encircling said vertical rod, said vertical rod having a stop at its lower end by which said weight is lifted into potential position after it has fallen upon the pawls and released the opening mechanism of the circuit breaker.

4. In a high potential switch and circuit breaker, a trip and catch lever for engaging and disengaging a detachable weight carried slidably upon a vertical rod suspended from a stiff member which on moving opens the circuit, said trip and catch lever engaging with said weight when said weight has been restored, by the rising of the vertical rod, to the height from which it falls, said trip lever operated by the lifting action of a soft iron core operated by a solenoid coil, said soft iron core and means for operating said trip lever being connected by a link of insulating material.

5. In a high potential switch and circuit breaker wherein the parts for opening the circuit are operated from a rotatable shaft, a lever having an upturned arm movable rotatably upon said shaft and carrying a pivoted pawl acted upon by a spring carried by said lever, a lever fixed upon said rotatable shaft, said lever being formed as a detent with which said pawl engages, another lever fixed upon said rotatable shaft also formed as a detent with which another pawl carried pivotally in a fixed projection engages, said lever having an upturned arm, said pivoted pawls, said spring operating upon the piv-

oted pawl carried in said upturned arm of
said lever, said levers formed as detents,
levers fixed on said rotatable shaft, links
connecting said levers to the lower ends of
5 vertical rods, each such rod having a collar,
a frame in which each of said rods is carried,
a support in each such frame beneath the
collar on each of said vertical rods, coiled
compressible springs, the ends of each of
10 which are in pressing contact with the collar
of each of such vertical rods and each such
support respectively, a stiff member to which
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nected, said member when moved in one
15 direction operating to open the circuit, and
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with a hole encircling said vertical rod, said 25
vertical rod having a stop at its lower end
by which said weight is lifted into potential
position after it has fallen upon the pawls
and released the opening mechanism of the
circuit breaker, a trip and catch lever engag- 30
ing with said weight when said weight has
been restored to the height from which it
falls, said trip lever operated by the lifting
action of a soft iron core operated by a
solenoid coil forming part of a high poten- 35
tial circuit, said soft iron core and means for
operating said trip lever being connected by
a link of wood, fiber, and equivalent insulat-
ing material.

In testimony whereof, I have hereunto set 40
my hand and seal at the city of Los Angeles
aforesaid, in the presence of two subscribing
witnesses.

JOSEPH NELSON KEILMAN. [L. S.]

Witnesses:

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J. D. CORY.