A. H. K. FRIEDEMANN.

ELECTROMAGNETIC SWITCH.

APPLICATION FILED AUG. 9, 1913.

1,187,897.

Patented June 20, 1916.

2 SHEETS—SHEET 1.

Fig 1.

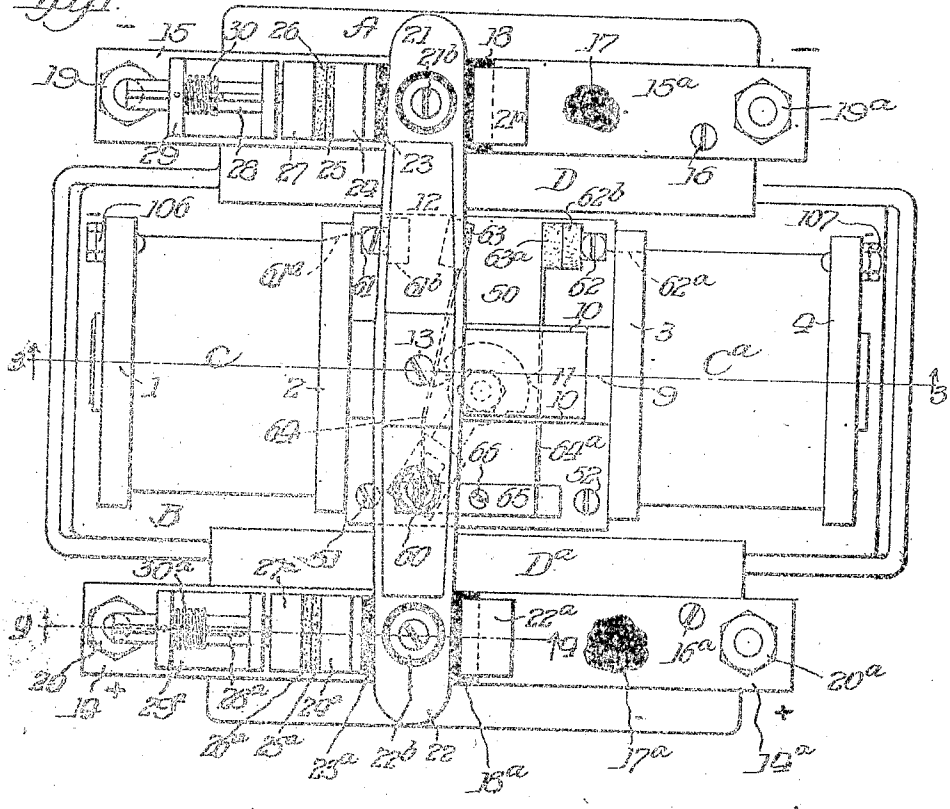
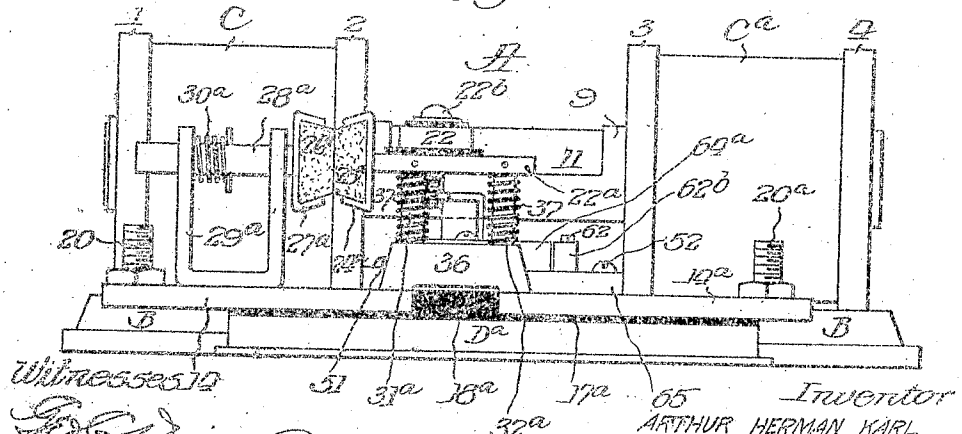


Fig 2.



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2 SHEETS—SHEET 2.

Fig. 3

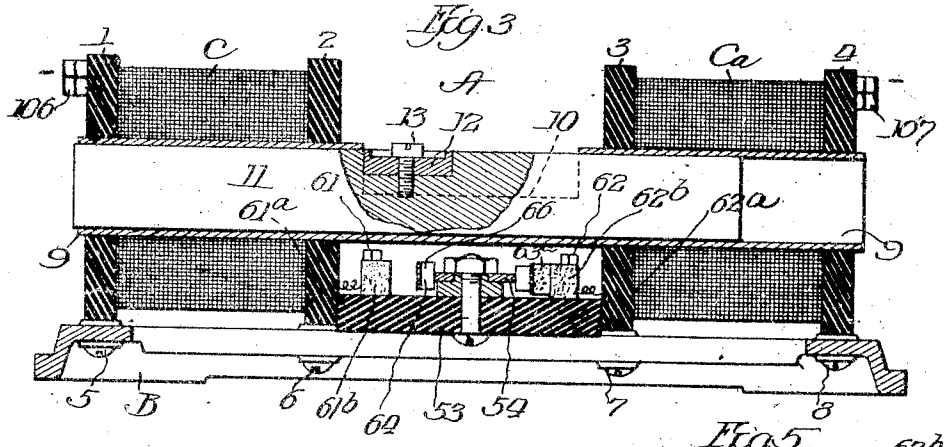


Fig. 4

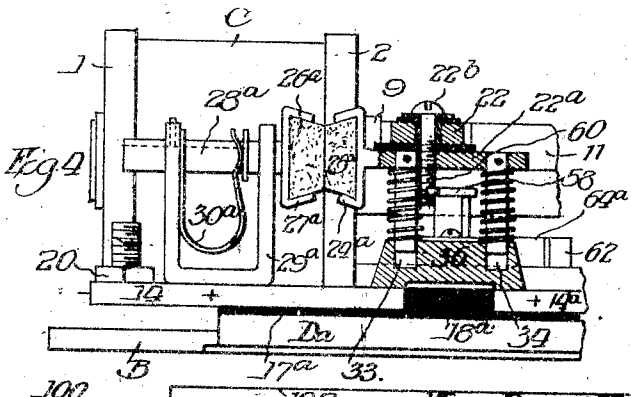


Fig. 5

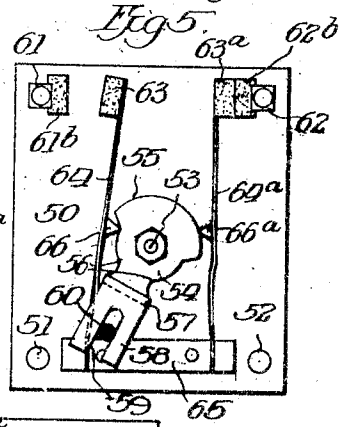
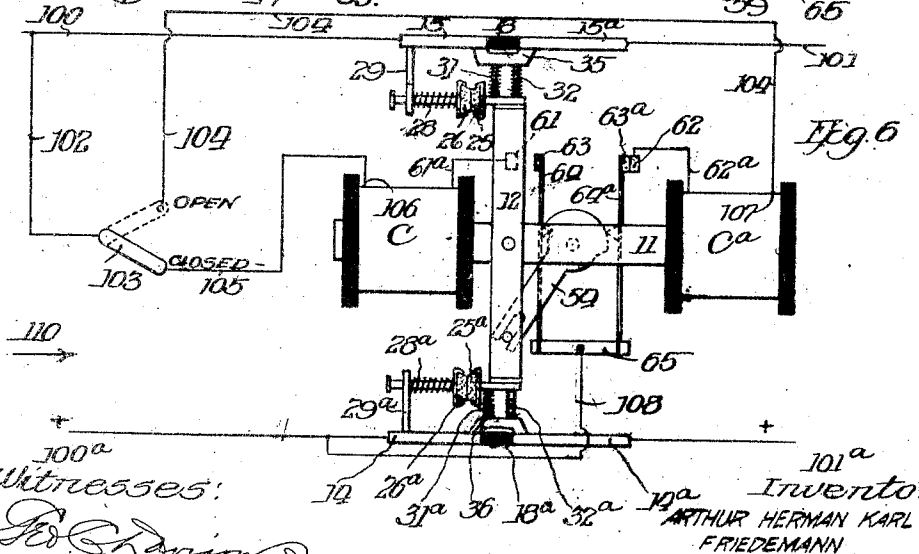


Fig. 6



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ELECTROMAGNETIC SWITCH.

1,187,897. Specification of Letters Patent. Patented June 20, 1916.

Application filed August 9, 1913. Serial No. 783,936.

To all whom it may concern:

Be it known that I, ARTHUR HERMAN KARL FRIEDEMANN, a subject of the Emperor of Germany, and a resident of the city of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electromagnetic Switches; and I do hereby declare that the following description of my said invention, taken in connection with the accompanying sheets of drawings, forms a full, clear, and exact specification, which will enable others skilled in the art to which it appertains to make and use the same.

This invention has general reference to improvements in electro-magnetic switches, and it consists, essentially, in the novel and peculiar combination of parts and details of construction, as hereinafter first fully set forth and described, and then pointed out in the claims.

In the drawings already referred to, which serve to illustrate my said invention more fully, Figure 1 is a plan of my magnetically actuated line switch and, Fig. 2, a projected side elevation thereof. Fig. 3 is a longitudinal, vertical section in line 3—3 of Fig. 1. Fig. 4 is a similar section of a fragment of my device in line 4—4 of Fig. 1. Fig. 5 is a pole changing switch for shunt circuits employed in my device, and Fig. 6 a diagrammatic sketch of the wiring.

Like parts are indicated by corresponding characters and symbols in the various figures of the drawings.

Due to the present day progress in matters electrical there has developed a distinct and widespread demand for a thoroughly practical line closing and opening switch which is controllable from a remote point, which switch must be capable of handling either direct or alternating current of high potential with safety; a switch comprising the fewest possible parts and having the least possible motions to produce the desired result, so to insure the maximum of simplicity; a switch in which the current consumption for its operation is reduced to an imperceptible quantity; and a switch in which is embodied the greatest degree of reliability.

The essence of my invention, therefore, resides in the provision of means to fulfil the above requirements and I accomplish these results by introducing into the main line a shunt circuit controlled by a two pole hand or time operated switch. Included in this shunt circuit are two solenoid coils, arranged in alinement a suitable distance apart, and adopted to alternately act upon a common solenoid core. Connected to this core, and insulated therefrom, are main line opening or closing devices; and, actuated by said core, located between said solenoids, there is placed a pole changing mechanism for the shunt circuit, whereby the coil energized by the manipulation of the two pole switch into "closed" position, becomes instantaneously deënergized as the main line is closed by the movement of the solenoid core. At that same instant said pole changing mechanism is caused to contact with the pole of like polarity of the opposing solenoid, so that the instant the two poles switch is moved to "open" position, the last named solenoid becomes energized, attracts the common core, opens the main line, and instantaneously therewith breaks the circuit in the shunt thereby deënergizing said last named coil. Coincidently with the performance of these functions the pole changing mechanism is returned into contact with the pole of like polarity of the initially indicated solenoid, ready for the next manipulation of the shunt switch. It will thus be observed that in this device the respective coils are only energized for that fractional part of a unit of time required for the travel of the core. This type of construction is productive of a great saving in electrical energy over switches for this class of work wherein one or the other of the coils must be in a continuous state of energization, in a manner readily understood. The two pole switch hereinbefore repeatedly mentioned may be a typical two pole push button, a two pole knife switch, or an automatically time or otherwise actuated switch as individual conditions of service may require. It may be located as distantly from the line switch as may be desired without affecting the functions of the latter.

Now, to better understand the details of construction, I hereby refer to the drawings made a part hereof, wherein A indicates the main switch in its entirety, and B a base plate of soft cast iron or similar material properly shaped and designed for the reception of the various parts of the switch.

Mounted upon the top surface of base B, at both ends, along the longitudinal center line thereof, are properly wound solenoids C and C^a, which solenoids have ends 1—2

and 3—4 of insulating material, by means of which and screws 5—6 and 7—8 passing through base B and screwed into said ends, the said coils are firmly maintained in place. As stated before, the solenoids are in true axial alinement and passing through their axial openings and fixed therein against longitudinal movement is a common tube 9 of non-magnetic material such as brass. The upper half of the circumference of this tube, between the ends 2 and 3 of the coils C and C^a, is cut away as at 10, the length of which cut out is equal to the predetermined travel of a continuous solenoid core 11 plus the width of a cross bar 12, which bar is fixed to the core 11 by a suitable screw 13, or other means, at a point medially of the length of said core.

Projecting laterally from base B, on each side thereof, medially about its transverse center line are lips D and D^a, whose top surfaces are on a slightly lower plane than that of said base. Fixed to the upper faces of aforesaid lips parallel to and equidistant from the longitudinal center line of the base B are non-magnetic, stationary line contact-bars 15 and 15^a and 14 and 14^a. The first named are fixed to lip D by screws 16 or equivalent fastening and are insulated from said lip by approved insulating material 17. They are also insulated from each other by similar insulation 18. Bars 14 and 14^a are attached to lip D^a by fasteners 16^a, insulated from said lip by insulation 17^a, and from each other by like material 18^a. Throughout the drawings bars 15 and 15^a are indicated as of negative and bars 14 and 14^a as of positive polarity, it being understood that my device is intended to make or break both leads of an all metallic circuit. At the ends of bars 15 and 15^a are suitable binding posts 19 and 19^a for evident purposes, while like posts 20 and 20^a perform the same functions for bars 14 and 14^a.

Cross bar 12 on solenoid core 11 extends transversely of said core an equal distance on both sides of the axis thereof, to a point above and beyond bars 15—15^a and 14—14^a. Directly above these said bars, parallel thereto, and in alinement therewith, and fixed to the under side of the opposite ends 21 and 22 of cross bar 12, by means of duly insulated fasteners 21^b and 22^b, are short longitudinal non-magnetic bars 21^a and 22^a, which same are insulated from cross bar 12 by suitable material 23 and 23^a. Said bars 21^a and 22^a are possessed at one end of carbon holders 24 and 24^a having carbon blocks 25 and 25^a. As the solenoid core 12 is traveling in a direction to close the main line circuit, these carbon blocks contact with similar blocks 26 and 26^a, maintained in holders 27 and 27^a, which holders are attached to rods 28 and 28^a, supported in brackets 29 and 29^a in a horizontal plane. Said brackets are in electrical connection with the line contact bars 14 and 15, and the rods 28 and 28^a are provided with helical or blade springs 30 and 30^a so arranged as to offer resistance to the advance of carbons 25 and 25^a.

Depending from the bars 21^a and 22^a on cross bar 12 are studs 31—32 and 31^a and 32^a respectively, which studs are firmly fastened into their respective plates, but are permitted to loosely project into apertures 33 and 34 formed in sliding contact blocks 35 and 36, which blocks are slidable along the upper faces of line contact bars 15 and 15^a and 14 and 14^a. Springs 37 are provided to embrace rods 31—32 and 31^a and 32^a, so as to create a slight pressure of contact between the contact blocks and their respective contact plates to secure a good electrical connection. Attention is now directed to the fact said blocks 35 and 36 are made of sufficient length as to not only bridge the insulations 18 and 18^a but to retain sufficient surface contact with the bars 15—15^a and 14—14^a, respectively, to safely carry the electrical load for which the switch may be designed. Attention is further directed to the fact that before the blocks 35 and 36 have traveled over the insulations 18 and 18^a, carbons 25—26 and 25^a—26^a, have already contacted, thereby preventing any tendency of the electrical current to "arc" as the metallic circuit is closed. In a word these carbons are the first to contact and the last to break contact, the result being a much longer life to and more perfect electric connection with the various metallic contacts due to the absence of arcing.

In Fig. 5 is disclosed in detail the mechanical construction of the pole changing switch employed in my invention. It consists, first of all, of a flat rectangular plate 50 produced from, fiber, vulcanite, or other approved insulating material. This plate is of a size both longitudinally and laterally to just fit between the solenoid coils C and C^a on the base B, to which it is attached by screws 51 and 52. Centrally of this plate, which is also practically the longitudinal and transverse center of the said base B there is located a vertical pivot or fulcrum 53 formed by a bolt and nut. Rotatably mounted on this pivot is a cam lever 54, the larger arc 55 of which extends for practically half a revolution or 180° and then sharply reduces to an arc 56 of smaller diameter, which latter arc merges into an upwardly extending shank 57; the latter terminating in a horizontally disposed end 58 possessed of a longitudinal slot 59. Depending from cross bar 12 on solenoid core 11 there is a thoroughly insulated stud 60, which stud engages the slot 59 in cam lever 54, so that as the core 11 is caused to travel forward or backward, the said lever will oscillate in the same direction. Located at

the rear of plate 50 directly opposite fastening screws 51—52 are binding posts 61 and 62, the former of which is connected to the terminal lead of 61^a from the solenoid C and the latter to a similar lead 62^a from solenoid C^a. Both of said binding posts have carbon contact pieces 61^b and 62^b, respectively, which are adopted to alternately contact with similar members 63 and 63^a on flat blade springs 64 and 64^a. The opposite ends of these springs are fixed to and in electrical connection with a metallic bar 65 fixed to the front end of plate 50 by screws 66 or equivalents thereof.

Approximately medially of the length of the flat blade springs 64 and 64^a, fixed to the same or made a part thereof, and adapted to contact with the cam portions 55—56 of cam lever 54, are provided triangular projections 66 and 66^a. The relationship of these parts is such that when the said cam lever 54 is oscillated in a direction to break the contact between carbons 62^b and 63^a, before this contact is broken, carbons 63 and 61^b have already entered into electrical engagement and vice versa in a manner readily comprehended.

I will now describe the wiring diagram Fig. 6 and the cycle of functions performed by my switch. It is first assumed that a negative lead 100 from the source of electrical energy is connected to contact bar 15 and a lead of like polarity 101 emerges from bar 15^a. Also that a positive lead 100^a is connected to bar 14 and a wire 101^a of the same polarity emerges away from bar 14^a. It is also assumed that the flow of electrical energy is in the direction of the arrow pointer 110, so that the left hand side of the diagram is the live end thereof. A conductor 102 is now taken from lead 100 and connected to switch 103. A conductor 104 from the pole of said switch marked "open" is connected to the negative binding post 107 of solenoid C^a. A conductor 105 from the switch pole marked "closed" is led to negative binding post 106 on coil C. A conductor 108 is led from bar 65 to positive lead 100^a.

Control switch 103 is shown in "closed" position and it will be observed that sliding blocks 35 and 36 have bridged the insulations 18 and 18^a and have closed the main line circuit. But now trace the shunt circuit to coils C and C^a: conductor 105 leads from the "closed" pole of the control switch to negative binding post 106 of the said coil. Wire 61^a leads to post 61 where a break occurs, declaring the coil C as dead. And it is self evident that coil C^a is dead because of the break at the switch 103. If now the switch lever of switch 103 be shifted to "open," current will flow through wire 104, coil C^a, wire 62^a, contacts 62^b and 63^a, blade spring 64^a, bar 65, and wire 108 back to positive lead 100^a, closing the shunt circuit to coil C^a and energizing the same. Instantaneously core 11 is attracted and contact blocks 35 and 36 removed from contact with bars 14 and 15, thereby opening the main line circuit. Simultaneously with this, the contact between 62 and 63^a has been broken, thus deënergizing coil C^a. As the contact between 62 and 63^a breaks, contact 61 and 63 is formed, placing coil C in due form for the next reversal of controlling switch 103.

It is now to be stated that my switch may be used in either direct or alternating current lines, either of high or low potential as may be desired.

While herein I have disclosed the preferred mode of practising my invention I desire it understood that I may make such changes as might suggest themselves to one skilled in the art or permitted under the doctrine of mechanical equivalents.

Having thus fully described my invention, I claim as new and desire to secure to myself by Letters Patent of the United States:—

1. In combination, two alined stationary contact pieces separated from each other at their adjacent ends, an actuating member movable parallel with the direction of the length of said stationary contact pieces, a contact block yieldingly supported on said actuating member and movable from a position in which it electrically connects the stationary contact pieces together to a position in which it is out of engagement with one of the stationary contact pieces, an arm projecting laterally from the latter stationary contact piece, a stem supported by said arm so as to be movable in the direction of the length of the stationary contact pieces, an auxiliary contact carried by said stem, a coöperating auxiliary contact carried by said actuating member and electrically connected to the aforesaid contact block, and a spring acting on said stem and tending normally to hold the auxiliary contact carried by the stem in a position to cause the auxiliary contacts to engage with each other before the contact block engages with the stationary contact piece on which the stem is mounted and to maintain the auxiliary contacts in engagement with each other until after the contact block has passed out of engagement with the last mentioned stationary contact piece.

2. In an electro-magnetic switch, separated alined actuating coils, a core extending into and movable axially of the coils, a main switch including a movable contact member connected to the core; two controlling switches lying on one side of the core between said coils, each controlling switch comprising a stationary contact and a spring actuated movable contact tending normally to move out of engagement with the stationary contact; a cam lying between said spring

actuated movable contacts and having two positions in each of which it closes one of the controlling switches and allows the other to remain open; and a connection between said cam and said core for shifting said cam from one position to the other just before the core reaches the limits of its movements.

3. In combination, two alined stationary contact pieces separated from each other at their adjacent ends, a member lying above and movable in the direction of the length of said stationary contact pieces, a contact block, a spring between said contact block and said member, an auxiliary contact connected to one stationary contact piece, a second auxiliary contact connected with said member and adapted to coöperate with the other auxiliary contact, and means acting on one of said auxiliary contacts tending to hold it in a position to engage with the other auxiliary contact while said block is still out of engagement with one of the stationary contact pieces.

In testimony whereof, I have hereunto set my hand in the presence of two subscribing witnesses.

ARTHUR H. K. FRIEDEMANN.

In the presence of—
W. O. STARK,
A. N. LURIE.