

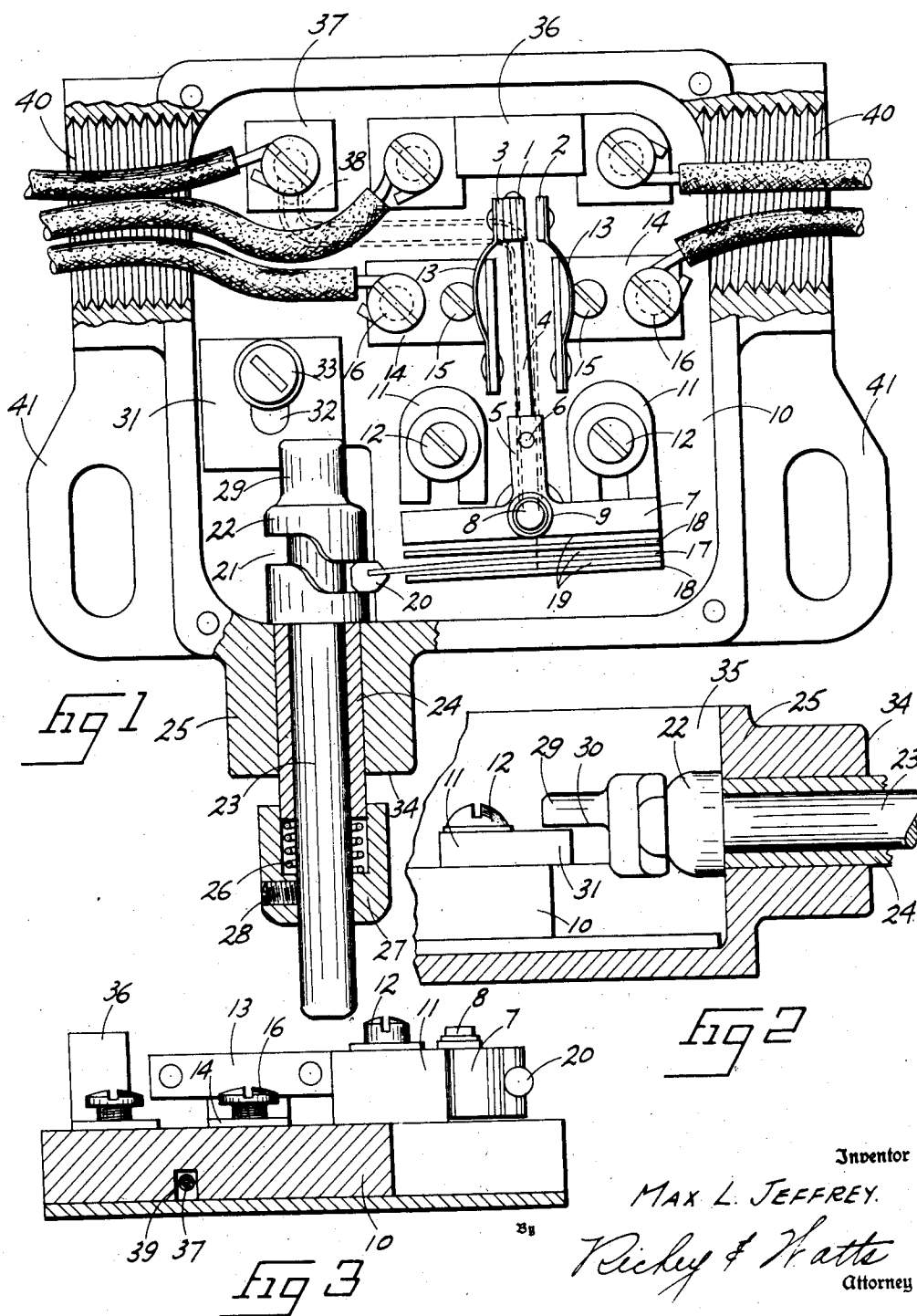
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SWITCH CONSTRUCTION

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SWITCH CONSTRUCTION

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This invention relates to a novel switch mechanism.

More particularly this invention relates to a novel switch construction which affords a positive, quick, make and break of contacts. It is an object of this invention to provide a novel form of switch construction such that make and break between contacts will be substantially instantaneous, certain, and unhindered by any organization of elements likely to get out of order. Another object of this invention is to provide for the operation of the switch by any of a plurality of different types of motion which may be selected to the exclusion of the others. It is another object of the present invention to provide a novel switch construction affording a movable contact arranged to engage a plurality of other contacts and to provide for instantaneously shifting the movable contact from one to the other of the contacts and also, to effect such instantaneous operation of the movable contact under the control of motive forces which act substantially continuously and throughout substantially the whole of the movement of the contact. Another object of this invention is to provide a novel switch mechanism employing a plurality of magnets. Another object of the invention is to provide a novel switch operating mechanism acting under the control of magnets and actuated by spring tension imposed upon the movable elements under the control of the magnets. Another object of the invention is to provide a novel form of switch construction in which the functions of a terminal box are combined with and are inherent in the switch construction. Another object of the invention is to provide a switch construction which is simple, reliable and adapted to be manufactured inexpensively.

Other objects and advantages of the present invention will appear in the following detailed description taken in connection with the accompanying drawing in which:

Fig. 1 is a plan view illustrating a switch construction embodying the principles of my invention.

Fig. 2 is a detail view in side elevation, partly in section, illustrating adjustable parts for selecting the type of movement which may be employed to operate the switch.

Fig. 3 is a sectional view of the mechanism illustrated in Fig. 1.

According to this invention, it is desired to provide contacts such as illustrated at 1, 2 and 3 between which circuit making and breaking operations may be effected instantaneously with

certainty. The contact 1 is shown as a movable contact carried upon a substantially rigid element 4. In order that the contact 1 may be replaced conveniently the rod 4 is received in the socket member 5 and secured in place by a set screw 6. Socket member 5 is united with an armature 7 of magnetic material supported by a pin 8, the armature 7 being provided with bushings or bearings 9 adapted to rotatably engage the pin or shaft 8. The shaft 8 is carried rigidly in the base member 10 which may be and preferably is a molding of suitable insulating material such as bakelite. The shaft or pin 8 may be mounted in the base 10 by molding it therein or it may be threaded through a suitable socket molded or otherwise secured in the base plate 10. Magnets 11, which conveniently and preferably are permanent magnets, are mounted upon the base plate 10 and secured in place by screws and washers 12 which permit adjustment of the position of the magnets 11 upon loosening. The magnets 11 may be electromagnets, if desired. The magnets 11 are so distributed that the armature 7 may be tilted so as to contact with and be held stationary by either of the magnets 11, selectively. The contacts 2 and 3 are so arranged that when the armature 7 is in engagement with either of the magnets 11 the contact 1 will be in engagement with either one or the other of the contacts 2 and 3. The contacts 2 and 3 are carried upon supporting members 13 which may take the form of flexible conducting spring strips. The strips 13 may be mounted upon brackets 14 by riveting, soldering or in any other suitable manner. The brackets 14 are mounted upon the base plate 10 by suitable means such as screws. Terminals 16, of a conventional type, are provided in the brackets 14 to permit connection of conductors therewith. The brackets 14 are of electrical conducting material thereby affording a path for the flow of electrical energy from conductors to the contacts 2 and 3. The location of the contacts 2 and 3 is such that, when contact 1 is moved into engagement with either, the corresponding spring strip 13 is flexed slightly to insure good engagement between contacts while not unduly stressing any part of the movable system of elements associated with the armature 7.

The magnets 11 serve to maintain the armature 7 in a contact making position by a sufficiently great force as to insure a certainty of contact against the intervention of extraneous influences such as vibration or mechanical blows accidentally directed to the switch construction.

Also the magnets 11 assist in moving the contact 1 toward either of the contacts 2 and 3 thereby assisting in a rapid make of the electrical contact. The magnetic force exerted upon the armature actuated toward a new position increases rapidly as the armature approaches a magnet 11. Similarly the force exerted by either of the magnets 11 upon the armature 7 serves to prevent motion of the contact 1 until such a force has been imposed upon the movable system as is necessary to overcome the attraction of a magnet 11 upon the armature 7; the strength of the magnetic field being such that the force applied to the movable system necessary to overcome the magnetic attraction is sufficiently great, as compared to the inertia of the movable system, that a rapid and certain movement of the contact 1 will result when such a force is applied. Thus the magnets 11 cooperating with the armature 7 assist in insuring a rapid break of electrical contact and also in causing a rapid actuation of the switch.

It commonly happens that the force or movement, to be employed for effecting the actuation of the switch, is one which proceeds at a rate which is slow as compared to the rapidity of switch actuation sought for. Also, it is desirable, due to the inherent nature of the mechanical parts provided for introducing the switch actuating force, that such parts be actuated at a lesser rate of speed than the rate of make and break of contacts. Inasmuch as the magnets 11 together with the armature 7 impose a retaining force inhibiting operation of the switch until a predetermined actuating moment be applied to the movable system carrying the contact 1, it is possible and desirable to more slowly impose such an actuating force upon the movable system. To accomplish that end spring elements, which may take various forms, may be employed to connect the movable contact system with those elements by which the switch actuating force is introduced. Such a spring system is employed to gradually build up the force necessary to overcome the attraction of a magnet 11 upon the armature 7 until the movable contact system is eventually thrown over to a new position. A convenient and efficient, both from the manufacturing and operating standpoint, form of spring construction is illustrated in Fig. 1. The spring may conveniently be mounted directly upon or operatively connected with any of the elements of the movable system carrying the contact 1, the armature 7 being selected in the particular embodiment of the invention disclosed, as such a suitable element, to which the blade spring 17 is connected. The blade spring 17 may take any suitable form such as that illustrated wherein it is interposed between a pair of substantially rigid blade members 18 which, together with the blade spring 17 and spacing members 19 interposed therebetween, are mounted upon the armature 7 in any suitable manner as by screws passing through those elements and threaded into the armature 7. The spacing members may be of any suitable material such as fiber or bakelite. The spring element may be of any suitable material such as spring brass, steel, or the like, while the rigid strip elements 18 may be of strip brass, steel, or the like. A force applied to the free end of the spring 17 so as to move it into contact with the free ends of either of the rigid strips 18 gradually imposes an increasing moment acting to turn the movable contact carrying system about its axle 8. Spring characteristics of

the element 17 are such that when its free end has been moved into contact with either of the elements 18 a sufficient load has been applied to the movable system as to overcome the attraction of magnet 11 on armature 7 and cause the system to turn. The spacing between the elements 17 and 18 is such that, in effecting such a turning movement of the movable system, the armature 7 is shifted to an extent such as to bring the spring 17 to a substantially neutral position between the strips 18 or, at least, not to impose any substantial force upon the spring 17 as would tend to retard or prevent the movement of the system about the axle 8. It is preferable to so arrange the spacing of blade 17 and the associated elements that it will continue to impose a torque upon the movable contact carrying system throughout its travel from one position to another. As the movement of the contact carrying system proceeds the magnet 11, which is being approached, assists in and makes certain that the motion will be completed. It is convenient to employ the poles of the magnets 11 as abutments against which the armature 7 may strike in order to determine the limiting positions of the movable contact carrying system. It is evident that by the construction just described a contact actuating construction has been provided in which no dead center is present and is one in which the forces promoting the actuation of the switch are effective substantially throughout the whole actuation of the switch.

Depending upon the manner in which the switch is used, the motion which affords the switch actuating force may be either one of rotation, oscillation or reciprocation. It is desirable therefore to provide a form of force transmitting elements for actuating the switch which is adapted to any of those forms of motion. In order to achieve that end, according to this invention, the free end of the spring 17, which may be provided with a shoe 20 in order better to resist wear, is arranged to move in the slot 21 of the cam 22 carried upon the end of shaft 23 which is mounted for rotation, oscillation or reciprocation in a suitable journal 24 carried in any suitable manner in the casing 25 of the switch. As shown in the drawing, the mechanism is arranged for operation of the switch by reciprocatory movement. Reciprocatory motion applied to the shaft 23 moves it up and down, as illustrated in Fig. 1, against the restoring force exerted by the spring 26 acting, at one end, upon the journal 24 and, at the other end, upon the sleeve 27 which may be secured in any suitable position along the shaft 23 by set screw 28. Movement of the shaft 23 in an upward direction, as illustrated in Fig. 1, will move the spring 17 toward the upper strip 18 causing clockwise rotation of the movable contact carrying system. Return movement of the shaft 23 to the position illustrated in Fig. 1 of the drawing, will cause counterclockwise rotation of the movable contact carrying system into that position shown in Fig. 1. The return movement may be effected under the restoring force of the spring 26 or, if desired, the movement of the shaft 23 may be under the control of the actuating force at all times. Alternatively, a restoring spring may be provided for effecting a return movement of the shaft 23 in an upward direction, the actuating force acting in a downward direction, referring to the position of the parts as illustrated in Fig. 1. Where reciprocatory move-

ment is employed to actuate the switch it may be desirable to prevent rotational movement of the shaft 23. For that purpose, the cam 22 may be provided with the extension 29 having a flat face 5 30 adapted to overly and over-ride the plate 31 adjustably carried upon the base plate 10 by the slot 32 and screw 33 passing therethrough and threaded into the base plate 10. The plate 31 is in a position to cooperate with the extension 10 29 to prevent rotation thereof, while allowing the shaft to be reciprocated.

Where it is desired to operate the switch by rotation or oscillation, the plate 31 is adjusted to a non-operative position where the extension 29 15 is free to turn. Upon rotation of the shaft 23 the cam slot 21 effects reciprocation of the shoe 20, as it rides therearound, thereby effecting operation of the switch in the manner before described. The movement of the shaft 23 may be 20 in rotation in which case the switch will be operated through a complete cycle with each rotation of the shaft 23 or, if it be desired, the cam slot 21 may be provided with additional rises and falls to increase the number of complete cycles 25 of operation of the switch with each revolution of the shaft 23. Where the movement of the shaft 23 is oscillatory the shaft may be adjusted to a position where the shoe will ride up and down a rise or fall in the cam slot 21 throughout 30 each period of oscillation thereby effecting the operation of the switch. It may be desirable when operating the switch by either movement of rotation or oscillation to prevent reciprocation of the shaft 23. In that case, the sleeve 27 35 may be adjusted to a position where the end thereof abuts the face 34 on the housing 25, the sleeve 27 being held in that position by the set screw 28. If desired, the plate 31 may be adjusted to a nonoperative position relative to the 40 extension 29 and the sleeve 27 may be retained in that position illustrated in Fig. 1 in which case the switch may be operated by reciprocation, rotation or oscillation in any desired combination. The cam element 22 is preferably of insulating material such as bakelite and the shoe 45 20 may be an insulator in order to insure that no electrical circuit proceeds through the spring 17 to the case 25.

The operating mechanism of the switch together with the terminals, except the shaft 23 50 and immediately associated parts, are all carried upon the base plate 10 which may be of flat rectangular configuration. The base plate 10 may be fitted into the chamber 35 of the housing 25 and secured in place by screws passing through 55 the bottom of the housing 25 inserted into the base plate 10. Thus a very simple, easily manufactured and serviced form of switch construction is provided. In addition the base plate 10 carries the terminals 36 and 37. The terminal 36 60 may serve only as a connector leading from one conductor to another to complete a circuit extending through the housing. The terminal 37 serves to connect the movable contact in an electrical circuit. For that purpose a conductor 65 38 extends from the terminal 37 in a slot 39 formed in the base member 10 (Fig. 3) and leads to the pin 8 through which the electrical circuit extends to the members 5 and 4 of conducting material to the contact 1 carried thereby. The housing 25 is provided with threaded passages 40 70 adapted to receive suitable fittings for uniting conduits to the housing adapted to carry the conductors. By providing a complete set of terminals within the housing 25, preferably on the

base member 10, and by providing passages for inlet and outlet terminals of the electrical circuit, the use of an additional terminal box is rendered unnecessary. Suitable fastening lugs 41 5 may be provided upon the casing 25 to mount it as desired. A cover may be arranged over the recess 35 in the housing 25 to completely enclose the operating parts except for the shaft 23.

While one form of the invention has been described by way of illustration it is not intended 10 so to limit the invention inasmuch as modifications in the construction and arrangement of the parts thereof may be made as will be apparent to one skilled in the art without departing from the spirit and scope of the invention, as defined 15 in the following claims.

What I claim is:

1. A switch having an arcuately movable element, an electrical contact carried thereby, a magnetic armature arranged to move said element and positioned at substantially right angles 20 thereto, magnets disposed to act on opposite extremities of the armature to selectively hold the latter in limiting positions of movement thereof, and means for imposing a resilient actuating 25 force on the armature to effect a snap-action movement of the said element upon overcoming the magnetic holding force on the armature.

2. A switch having an arcuately movable element, an electrical contact carried thereby, a 30 pivotally mounted magnetic armature to which said element is secured, magnets disposed to act on opposite extremities of the armature to selectively hold the latter in limiting positions of 35 movement thereof, an actuating spring arranged longitudinally of said armature, and means for stressing said spring to effect a snap-action movement of the said element upon overcoming the magnetic holding force on the armature.

3. A switch comprising a pivotally mounted 40 armature, a contact carrying element secured to said armature and projecting at substantially right angles therefrom, magnets disposed to act on opposite extremities of the armature to selectively hold the latter in limiting positions of 45 movement thereof, a spring arranged longitudinally of said armature, and means for stressing said spring to effect a snap-action movement of the said element upon overcoming the magnetic holding force on the armature. 50

4. A switch comprising a pivotally mounted substantially T-shaped armature member, a substantially rigid contact carrying element secured to said armature, an electrical contact carried 55 by said element, magnets disposed to act on opposite extremities of the armature to selectively hold the latter in limiting positions of movement thereof, an elongated spring arranged longitudinally of said armature, and means for stressing 60 said spring to effect a snap-action movement of the said element upon overcoming the magnetic holding force on the armature.

5. A switch having a movable, substantially rigid element, an electrical contact carried thereby, a pivotally mounted magnetic armature 65 affixed to said element, a plurality of magnets arranged to selectively hold said armature in limiting positions of movement thereof, contacts to be engaged by the first-named contact arranged 70 to be displaced by pressure of the latter thereagainst and to resiliently resist such displacement, and means for imposing a resilient actuating force on the armature to effect a snap-action movement of the said element upon over- 75

coming the magnetic holding force on the armature.

6. A switch having a movable member and means for operating the movable member in response to reciprocatory and/or rotatory and/or oscillatory motion, means for preventing actuation of the first mentioned means in response to rotatory and oscillatory motion.

7. A switch having a movable contact-carrying member, a switch operating member including a cam engaging an element of the movable member, said cam having a way adapted to reciprocate said element upon rotatory or oscillatory motion of the operating member, said operating member being reciprocable to effect reciprocation of the element.

8. A switch having a movable contact-carrying member, a switch operating member mounted for reciprocation, oscillation, and rotation, a cam carried by the operating member coacting with an element of the movable member, said cam being constructed and arranged to effect movement of the movable member upon rotation, oscillation, and reciprocation of the operating member, an adjustable guide for preventing oscillation and rotation of the operating member, an adjustable stop for preventing reciprocation of the operating member.

9. A switch having a movable contact-carrying member, a magnetic armature movable with said member, magnets arranged to coact with said armature to hold the armature and movable member in limiting positions, spring means connected with the armature, said spring means being constructed and arranged to be gradually stressed until the holding action between a magnet and the armature is broken and to urge the armature and movable member toward another limiting position, an operating member for actuating the switch mounted for reciprocation, oscillation or rotation, cam means carried by the operating member and coacting with the spring means so as to stress spring means for effecting operation of the switch upon rotation and/or oscillation and/or reciprocation of the operating member.

10. A switch having a movable contact-carrying member, a magnetic armature movable with

said member, magnets arranged to coact with said armature to hold the armature and movable member in limiting positions, spring means connected with the armature, said spring means being constructed and arranged to be gradually stressed until the holding action between a magnet and the armature is broken and to urge the armature and movable member toward another limiting position, an operating member for actuating the switch mounted for reciprocation, oscillation or rotation, cam means carried by the operating member and coacting with the spring means so as to stress spring means for effecting operation of the switch upon rotation and/or oscillation and/or reciprocation of the operating member, means for limiting the movement of the operating member to reciprocation.

11. A switch having a movable contact-carrying member, a magnetic armature movable with said member, magnets arranged to coact with said armature to hold the armature and movable member in limiting positions, spring means connected with the armature, said spring means being constructed and arranged to be gradually stressed until the holding action between a magnet and the armature is broken and to urge the armature and movable member toward another limiting position, an operating member for actuating the switch mounted for reciprocation, oscillation or rotation, cam means carried by the operating member and coacting with the spring means so as to stress the spring means for effecting operation of the switch upon rotation and/or oscillation and/or reciprocation of the operating member, means for limiting the movement of the operating member to rotation and oscillation.

12. A switch construction having a chambered housing, a plate of insulating material received in the chamber, electrical terminals mounted on the plate, switch operating elements mounted on a plate and electrically connected with the terminals, a plurality of conduit receiving apertures in the housing, a switch operating mechanism mounted on the housing for reciprocation, oscillation and rotation, said mechanism extending exteriorly of the housing for actuation.

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