My invention relates to snap acting devices and more particularly to a device of this type in which a force is applied to store energy in a member to be actuated to provide snap motion when the applied force exceeds a predetermined amount.

In electrical switches of the snap acting type, it has heretofore been the practice to apply an actuating force to a lever through a spring or toggle arrangement to move a contact carrying arm in the opposite direction. Snap acting switches have also been constructed in which pressure has been applied to a flexible contact carrying member against an opposing force to provide snap motion of the member when the pressure of the opposing force is exceeded. Such switches are not very sensitive, however, because the opposing force is usually provided by means of a spring that must be compressed to a considerable extent during movement of the member to be actuated. It is the purpose of the present invention to provide a snap acting device of this type in which the direction of the opposing force of the spring is quickly changed when sufficient energy has been stored in the member to be actuated to overcome the opposing force of the spring and consequently rapid motion of the member to be actuated takes place. This change of direction of the force of the spring also takes place when the actuated member returns, or is returned to its original position, and consequently my improved device is particularly suitable for use in electrical switches because it provides a quick make and break of contacts carried by the member to be actuated and fixed contacts arranged on opposite sides of the contact carrying member, thus minimizing volatilization at the contacts. My invention also contemplates providing means to adjust the force opposing movement of the member to be actuated to provide a snap acting device that may be actuated by any desired pressure of the actuator.

It is therefore one of the objects of the present invention to provide an improved snap acting device in which energy is stored in a member to be actuated against an opposing force during the initial movement of an actuator to cause a snap motion of said member when the force of the actuator exceeds the opposing force.

Another object of the invention is to provide an improved snap acting device in which energy is stored in a member to be actuated against an opposing force during initial movement of an actuator to cause snap motion of said member when the force of the actuator exceeds the opposing force, including means for adjusting the opposing force to regulate the amount of pressure required to actuate the device.

A further object of my invention is to provide an improved snap acting switch in which energy is stored in a contact carrying member during the initial movement of an actuator against an opposing force and in which the direction of the opposing force changes quickly when the contact on the carrying member is moved from engagement with a fixed contact.

Another object of the invention is to provide an improved snap acting device in which the parts may be easily and simply constructed and readily assembled in place.

As still further object of my invention is to provide a simple and improved means for permitting over travel of an actuator when the parts reach their actuated position.

Other objects and advantages of my invention will be apparent as the specification proceeds when taken in conjunction with the accompanying drawings although it will be understood that the drawings are merely illustrative as my improved device may be utilized in conjunction with other apparatus, such as valves, relays, and the like.

As shown in the drawings:

Fig. 1 is a plan view of my improved switch with parts broken away to show underlying structure;

Fig. 2 is a cross sectional view on the line 2—2 of Fig. 1 with parts in their normal position;

Fig. 3 is a side elevational view of the upper portion of the switch, showing in dotted lines the initial movement of the contact carrier;

Fig. 4 is a view similar to Fig. 3 with the parts in the actuated position;

Fig. 5 is a plan view of a stamping from which the contact carrier and spring support is formed;

Fig. 6 is a perspective view of the stamping after it has been formed for assembly;

Fig. 7 is a view showing the loose connection.
between the spring and projections on the contact carrier and spring support;

Fig. 8 is a side elevational view of the upper portion of the switch with the cover in section and showing in elevation means to permit over travel of the actuator.

Fig. 9 is a plan view of the spring which permits over travel of the actuator.

Fig. 10 is a view similar to Fig. 8 with the parts in actuated position;

Fig. 11 is a cross sectional view on the line 11—11 of Fig. 10, looking in the direction of the arrows;

Fig. 12 is a view of the upper portion of the switch, showing the arrangement of the parts when the switch is to be actuated through dead center;

Fig. 13 is a view similar to Fig. 12 with the parts in a different position;

Fig. 14 is a plan view of a modified form of switch with parts broken away to show underlying structure;

Fig. 15 is a side elevational view of the switch shown in Fig. 14 with the cover and other parts of the switch in section;

Fig. 16 is a fragmentary portion of the switch shown in Fig. 15 with the parts in the actuated position;

Fig. 17 is a side elevational view of a modified form of my improved switch attached to a base, a fragmentary portion of which is shown in elevation;

Fig. 18 is a view similar to Fig. 17, showing another modification of my improved switch;

Fig. 19 is a view similar to Fig. 18 with the parts in a different position; and

Figs. 20 and 21 are cross sectional views on the lines 20—20 and 21—21, respectively, of Fig. 19.

While my improved snap acting device may be constructed in various ways and utilized for any suitable purpose, in Figs. 1 to 7 of the drawings it is illustrated as forming part of an electrical switch in which the free end of flexible contact carrier 1 is movable between a pair of spaced contacts 2 and 3 against the force of a spring 4, one end of which engages the contact carrier adjacent its free end and the other end of which engages a downwardly biased arm or support 5.

The means for supporting my improved device will of course depend upon the function it is desired to perform and the particular apparatus with which it is associated. For purposes of illustration, an assembly is shown comprising a base 6 formed of a suitable insulating material, such as a molded phenolic condensation product, having a downwardly inclined portion 7 and a cover 7a which is also preferably formed of a similar molded material. The cover is provided with an aperture which receives a freely slideable plunger 8 for moving the contact carrier against the force of spring 4, the head or button 9 of which plunger is also preferentially formed of molded insulating material.

While the contact carrier 1 and the arm or support 5 may be formed separately, they are preferably stamped from a sheet of thin spring stock as illustrated in Fig. 5 with a lug or tongue 10 extending from arm 5, a U-shaped slot 11 formed at the junction of arm 5 and contact carrier 1, and a slot 12 formed in the contact carrier into which extends a lug or tongue 13. The contact carrier 1 and arm 5 are therefore resilient. Aperture 14 is also preferably punched in the material for purposes to be described.

The stamping is bent on substantially the line A—A as shown in Fig. 5, the outer sides adjacent the slot 11 being bent in an arcuate shape to form resilient connectors 11a between carrier 1 and arm 2 and for providing proper spacing of the lugs 10 and 13 to receive the spring 4. Connectors 11a in conjunction with spring 4 also serve to maintain contact carrier 4 and arm 5 in a normally spaced relation throughout their length.

Means associated with the base are provided for suitably securing the preformed stamping in place and for establishing an electrical circuit when a contact arranged on one side of the contact carrier engages contact 2 and a different electrical circuit when the contact on the opposite side of the carrier engages contact 3. To provide contact between the stamping and one terminal of an electrical circuit, the preformed stamping is arranged upon the base with one end in contact with an internally threaded insert 15 and the aperture 14 in the stamping aligned with the bore of the insert to receive the shank of a headed screw 16 which as shown is inserted through a washer, the aperture in the stamping, and is threaded in insert 15. Insert 15 is embedded in the base 6 and its opposite end receives terminal screw 17. Contacts 2 and 3 may be of any desirable shape and are connected to suitable terminals in any convenient manner. As illustrated, contact 2 is of angular shape with one leg resting upon a projection 18 through which an internally threaded metal insert 19 extends which receives a terminal screw 20 and in a like manner an internally threaded metal insert 21 extends through leg 22 of contact 3 to receive a suitable terminal screw not shown.

As illustrated in the drawings, the free end of contact carrier 1 is provided with contacts 23 and 23a, contact 23 being in engagement with the contact 2 when the switch is in the position shown in Fig. 2 and contact 23a being in engagement with contact 2 when the parts are in the position shown in Fig. 4.

Contact 23 is normally held in engagement with contact 2 by means of a spring 4, one end of which engages the downwardly biased arm or support 5 and the other end of which engages contact carrier 1. The spring 4 may be of any suitable form in which the capacity for supporting the contact carrier 1 and the arm 5 and for engaging in contact 23 in engagement with contact 2 and which is capable of rocking upon the tongues or projections formed upon contact carrier 1 and arm 5, or upon the abutments or shoulders adjacent to the tongues or projections, to quickly change the direction of its force when a sufficient amount of pressure is applied to the contact carrier 1 adjacent its fixed end. Preferably, the spring is of arcuate shape, as shown in Patent No. 2,237,765 granted to me on April 8, 1941, and which is here illustrated in detail in Fig. 7, and while it may be preformed, it preferably consists of a thin flat piece of resilient metal of spring temper, such as steel, a beryllium-copper alloy, bronze, or similar material, and is provided with slots or apertures in the margins adjacent each end, one of which overrides the other, the slot in the one end permits the portion of the spring adjacent the aperture to bear against shoulders or abutments 25 and 26 and the other end of which loosely receives tongue or lug 13 and bears against the shoulders or abutments 27 and 28 adjacent tongue 13 which the spring is compressed into an arcuate shape.

The apertures or slots are wider than the respective tongues 10 and 13 to permit free rocking
movement of the spring upon the abutments or shoulders adjacent tongues 10 and 13. They should not, however, be substantially wider than is necessary for this purpose, otherwise the spring is liable to become disengaged from the tongues in service.

As illustrated in Fig. 2 of the drawings, the switch parts are in normal position with an electrical circuit established between terminal 17, contact carrier 1, contact 2, insert 19 and terminal 20. Assuming that it is desired to interrupt this circuit, or to interrupt this circuit and establish a circuit through contact 3 and insert 21 to an additional terminal, plunger 6 is applied to contact carrier 1 adjacent its fixed end. Contact 23 upon the free end of contact carrier 1, however, is held in engagement with contact 2 by the force of spring 4. During the initial movement of the plunger 6, contact carrier 1 is therefore first flexed as shown in dotted lines in Fig. 3 and energy is stored therein which increases as the plunger is moved downwardly but when sufficient energy is stored in contact carrier 1 to overcome the upward component of the force of spring 4, it is forced downwardly with a snap motion. When contact 23 disengages contact 2, the energy stored in contact carrier 1 is of course gradually released but this decrease in the stored energy of the contact carrier is more than offset by the decrease in the upward component of the force of spring 4 which is rapidly rocked upon the shoulders or abutments adjacent tongues 10 and 13, thereby decreasing the upward component of the force of spring 4, and consequently contact 22 is movable from engagement with contact 3 under a snap motion which is accelerated due to the rapid change in direction of the force of spring 4. In the construction illustrated, it will be particularly noted that when contact 23 is moved from contact 2, it causes only a slight additional compression of spring 4 and this is maintained in engagement with contact 2 by the upward component of the force of the spring is caused primarily by the change in direction of the force of the spring.

It will of course be understood that if it is desired to establish and interrupt one circuit only, either contact 2 or contact 3 may be utilized as a stop. When only one circuit is to be interrupted and established in the switch shown in Figs. 1 to 7, it is preferable, however, to interrupt the circuit between contacts 2 and 23 because when contact 23 is in the position shown in Fig. 2, it is maintained in firm engagement with contact 2 by the upward component of the force of spring 4.

When the parts are in the position shown in Fig. 4, it will be apparent that the parts will be returned to the position shown in Fig. 2 with a snap motion when the force upon actuator 8 is released. This return movement takes place because when the parts are in the position shown in Fig. 4, the upward component of the force of spring 4 while small is sufficient to initiate upward movement of the free end of contact carrier 1, and when contact 23 is moved from engagement with contact 3, the spring 4 under load upon the abutments or shoulders adjacent tongues or lugs 10 and 13, thus rapidly increasing the upward component of the force of spring 4 and returning contact 23 into engagement with contact 2 with a snap motion where it is held firmly in place by the force of spring 4 until pressure is again applied to plunger 6.

In my improved switch, means may also be provided for adjusting the position of the downward biased arm or support 8 to regulate the force required to actuate the switch, and while any suitable means may be provided for this purpose, as illustrated in the drawings, a screw 28 threaded in base 6, has an upper pointed end which bears against the arm or support 8 and its lower end is provided with a slot 29 to receive a nut 30 for adjusting the position of the screw. From the drawings, it will be apparent that by adjusting screw 28 upwardly, arm 5 is raised and the upward component of the force of spring 4 is reduced, thus enabling the switch to be actuated with less force upon the contact carrier than when the parts are in the position shown in Fig. 2.

On the other hand, when screw 28 is adjusted downwardly, the free end of arm 5 which is biased downwardly is lowered which increases the upward component of the force of spring 4 and consequently more force is required to actuate the contact carrier than when the parts are in the position shown in Fig. 2.

Means may also be provided to permit over travel of the actuator 8 when the parts have been moved to their actuated position. For this purpose, an over travel spring, as illustrated in Figs. 8 to 11 of the drawings is inserted between the head 9 of plunger 8 and the contact carrier 1. This spring may be stamped from a single sheet of spring metal and preformed to the shape shown in Figs. 6 and 9. As illustrated in Figs. 6 and 9, the spring comprises a base portion 32 having a boss 33 formed thereon which engages contact carrier 1 and an upper portion 34, the front portion of which is biased upwardly into engagement with flanges 35 and 36 formed upon spaced tongues 37 and 38 extending upwardly from the bottom portion. To secure the spring in place, the bottom portion is provided with a narrow strip 39 extending downwardly from the bottom portion 42 that terminates in an eyelet 40 which is inserted over the head of screw 16.

In the construction shown in Figs. 8 to 11, it will be noted that the head or button 9 bears upon the upper portion 34 of the over travel spring between flanges 35 and 36 and when the parts are in the position shown in Fig. 8, the over travel spring is of sufficient strength to store energy in contact carrier 1 and actuate the contact carrier against the upwardly acting component of the force of spring 4 without changing the position of the upper portion 34 of the spring. When the parts are in the actuated position shown in Fig. 10, however, further downward movement of the over travel spring will flex the contact carrier 1 until the resistance of the flexed carrier overcomes the force of the over travel spring. Further downward movement of the actuator 8 will then force the upper portion 34 of the over travel spring downwardly without further flexing of the contact carrier as illustrated in Fig. 11.

The other parts of the switch shown in Figs. 8 to 11 of the drawing are similar to the parts shown in Figs. 1 to 7 and have accordingly been designated by the same numerals.

The switch shown in Figs. 12 and 13 has the same mode of operation as is similar to that shown in Figs. 1 to 7, inclusive, with the exception that contact 3 is located sufficiently below contact 2 so that when the contact carrier is actuated, its free end is moved below dead center.
and the downward component of the force of the spring maintains it in this position and consequence- 5 quently in a switch of this type, a second actuator 10 41 is provided having a head 42 which extends through an opening in the arm 5 and engages the contact carrier 1 to move contact 25 in engagement with contact 2 against the downward component of the force of spring 4 when pressure is applied to the contact carrier adjacent its fixed end.

Another modification of my improved switch is shown in Figs. 14 to 16 inclusive. This switch is more compact than the switch shown in Figs. 1 to 7, and consequently these parts have been designated by the same numerals. In the modification shown in Figs. 14 to 16, however, the contact carrier 43 is formed separately from the arm or spring support 44 and is provided with a projection 45 terminating in an eyelet 46 which is held in place by the head of screw 16 and the free end is provided with contacts 47 and 48, contact 47 being in engagement with a contact 49 on arm 59 when the parts are in the position shown in Fig. 16 and contact 48 being in engagement with the contact 51 on arm 52 when the parts are in the actuated position as shown in Fig. 16. One end of arm or spring support 44 is attached to the base 6 by any suitable means, such as a rivet 53, and its free end is biased upwardly against the head 44 of a screw 54 which serves as the means for adjusting the force required to actuate the switch.

Spring 55, whilerock mounted upon abutments formed on the free end of arm 44 and an abutment formed adjacent the free end of contact carrier 43, is held in engagement with the contact carrier and arm in a manner somewhat different than that shown in Figs. 1 to 7. As illustrated more particularly in Fig. 14, notches or slots are formed at opposite sides adjacent the margins of the free ends of springs 55 and projections 56 and 56a extending from opposite sides of arm 44 are received in the notches or slots at one end of the spring and shoulders or projections 57 and 58 adjacent the free end of contact carrier 43 are received in the notches or slots at the opposite end. It will of course be understood that the notches or slots at one end of the spring are wider than the tongues or projections 56 and 56a received therein and the notches or slots adjacent the other end of the spring are wider than the shoulders or projections 57 and 58 to permit free rocking movement of the spring upon the abutment at the end of arm 44 and the abutment adjacent the free end of contact carrier 43. This method of connecting the spring 55 to the free end of arm 44 and adjacent the free end of contact carrier 43 is illustrated in more detail in my pending application, Ser. No. 383,430 filed on March 14, 1941.

The mode of operation of this switch is similar to that shown in Figs. 1 to 7 with the exception that when screw 54a is adjusted downwardly the upward component of the force of spring 55 is increased and more force is required to actuate the switch than when the parts are in the position shown in Fig. 15. On the other hand when the screw 54 is adjusted upwardly, less force is required to actuate the switch than when the parts are in the position shown in Fig. 15.

Another form of my improved switch is shown in Fig. 17 of the drawing which is somewhat similar to that shown in Figs. 1 to 7 with the exception that the arm 5 is not biased downwardly but is free to move when the contact 23 is forced from engagement with contact 2. In the operation of the switch shown in Fig. 17, when actuator 8 is applied to the contact carrier 1 against the force of spring 4, the contact carrier is first flexed as shown in dotted lines in Fig. 17 and when sufficient energy has been stored in the contact carrier to overcome the force of spring 4, contact 23 is moved from contact 2 with a snap motion which is accelerated during movement of contact 23 to contact 3 by the decrease in the upward component of the force of spring 4 which is rock upon its supports to change the direction of the force of spring 4 which in the position shown in dotted lines in Fig. 17 has a downward component of force acting upon the free end of contact carrier 1 and an upward component of force acting upon the free end of arm 5 which moves the free end of arm 5 upwardly and maintains it in a stressed condition. When the contact carrier is released, however, arm 5 because of its stressed condition returns to its original position, rocking spring # upon its supports to a position in which it provides an upward component of force upon contact carrier 1, thereby returning the parts to their original position with a snap motion.

The switch illustrated in Figs. 18 to 21 is similar to that shown in Fig. 17 with the exception that contact 3 is arranged at a sufficient distance below contact 2 so that when or when applied to actuator 8, the parts remain in their actuated position. It is therefore necessary to provide an additional actuator to return the parts to their original position. For this purpose, an actuator 8 is provided which is freely slideable through an opening in the cover in the same manner as actuator 8 and is provided with a head 60 which rests upon the free end of arm 5. When the parts are in the position shown in Fig. 1, pressure is applied to actuator 8 to stress contact carrier 1 and force contact 23 from engagement with contact carrier 1 with a snap motion when the opposing force of spring 4 is overcome as more particularly described in connection with the operation of the switch shown in Fig. 17. When it is desired to return the parts to their original position, pressure is applied to actuator 8 to return the contact carrier to its original position. The advantage of this structure is that actuator 8 and 55 may be positioned adjacent to each other and both may slide freely through apertures in the same cover.

It will be particularly noted that in all forms of my improved device, except in the actuator 8 utilized to return the parts to their original position as shown in Fig. 19, the pressure for actuating the device is applied to the long arm which in case of a switch is the contact carrier. There is a distinct advantage in this for the force directly to the contact carrier because in such case positive actuation is obtained. It will also be noted that in applicant's improved structure, the contact carrier is longer than the arm supporting the spring and consequently energy may be stored to actuate the switch member rather than in a shorter arm acting through the intermediary of a spring or other toggle arrangement to effect snap motion of the contact carrier.

What I claim is:

1. In combination, a switch having a resilient
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arm movable from a normal to an actuated position and mechanism for actuating said arm including a spring having upper and lower substantially flat arms with a portion of the lower arm engaging the resilient arm of said switch and the upper arm being biased away from the lower arm, means associated with the arms of said spring for maintaining them in spaced relation, and an actuator engaging the upper arm of said spring, said spring being of sufficient strength to move the resilient arm of said switch from its normal to its actuated position without flexing said spring when pressure is applied to said actuator, and the upper arm of said spring being flexible to permit overtravel of said actuator after the resilient arm of said switch is moved to its actuated position.

2. In combination, a switch having a resilient member to be actuated, a spring for maintaining said member in a predetermined position, actuating mechanism for said switch including a second spring having upper and lower substantially flat arms with the lower arm being provided with a boss which rests upon the member to be actuated and the upper arm being biased away from the lower arm, and means associated with the lower arm of the second spring for maintaining the arms of the second spring in spaced relation, and an actuator engaging the upper arm of said second spring, said second spring being of sufficient strength to move the resilient member of said switch from its normal to its actuated position without flexing the second spring when pressure is applied to said actuator, and the upper arm of the second spring being flexible to permit overtravel of said actuator after the resilient member of the switch is moved to its actuated position.

3. In combination, a switch having a resilient member movable from a normal to an actuated position and mechanism for actuating said member including a spring having integral upper and lower substantially flat arms with the lower arm being provided with a boss which rests upon the resilient member and the upper arm being biased away from the lower arm, means integral with the lower arm for maintaining the arms in spaced relation, and an actuator engaging the upper arm of said spring, said spring being of sufficient strength to move the resilient member of said switch from its normal to its actuated position without flexing said spring when pressure is applied to said actuator, and the upper arm of said spring being flexible to permit overtravel of said actuator after the resilient member of said switch has been moved to its actuated position.

4. Apparatus of the class described comprising a stationary contact, a resilient contact carrier having a fixed end and a free end and being provided adjacent its free end with an abutment, first and second movable contacts affixed to opposite sides of said carrier adjacent its free end, the first being movable into and from engagement with the first stationary contact and the second being movable into and from engagement with the second stationary contact, a resilient arm having a free end projection which is shorter than said contact carrier and which projection is provided with an abutment, a spring having its opposite ends rockably mounted on said abutments for normally maintaining the movable arm in engagement with the stationary contact and the free end projection of said arm in spaced relation to said carrier, and an actuator applied to said carrier adjacent to its fixed end on the side opposite to that from which the arm is spaced, and said arm being perpendicularly spaced at a sufficient distance from said contact carrier opposite to the position at which said actuator is applied to permit sufficient flexure of the carrier in the space between the plane of said carrier and the plane of said arm to store sufficient energy in said carrier under the influence of said actuator to move the carrier with a snap motion when the opposing force of said spring is exceeded.

6. Apparatus of the class described comprising a stationary contact, a resilient contact carrier having a fixed end and a free end and being provided adjacent its free end with an abutment and with a contact which is arranged opposite to the fixed end of the contact and which is movable into and from engagement therewith, a resilient arm having a free end projection which is shorter than said contact carrier and which projection is provided with an abutment, a spring having its opposite ends rockably mounted on said abutments for normally maintaining the movable arm in engagement with the stationary contact and the free end projection of said arm in spaced relation to said carrier, and an actuator applied to said carrier adjacent to its fixed end on the side opposite to that from which the arm is spaced, and said arm being perpendicularly spaced at a sufficient distance from said contact carrier opposite to the position at which said actuator is applied to permit sufficient flexure of the carrier in the space between the plane of said carrier and the plane of said arm to store sufficient energy in said carrier under the influence of said actuator to move the carrier with a snap motion when the opposing force of said spring is exceeded.
ment on said arm that the second movable contact engages the second stationary contact to limit the movement of the contact carrier before it passes into alignment with the abutment on said arm, whereby said spring retains a component of force which is effective in initiating the return movement of the first movable contact to engagement with the first stationary contact when the force upon said carrier is released, and the return movement of said carrier being effective in causing a rocking movement of said spring upon said abutments to return the first movable contact into engagement with the first stationary contact with a snap motion.

7. Apparatus of the class described comprising a stationary contact, a resilient contact carrier having a fixed end and a free end and being provided with an abutment adjacent its free end, a movable contact fixed adjacent the free end of said carrier, a resilient arm having a free end projection shorter than said contact carrier with a projection is provided with an abutment, a support, means for securing the opposite end of said arm to said support, the free end of said carrier and the free end projection on said arm being extended in the same direction from said support and the free end projection of said arm being biased away from said carrier, a spring rockably mounted on said abutments and normally maintaining the movable contact in engagement with the stationary contact, an actuator applied to said contact carrier adjacent its fixed end, and resilient means for perpendicularly spacing said arm at a sufficient distance from said contact carrier opposite to the position at which said actuator is applied to permit sufficient flexure of the carrier in the space between the plane of the carrier and the plane of the arm to store sufficient energy in said carrier under the influence of said actuator to disengage the movable contact from the stationary contact with a snap motion.

8. Apparatus of the class described comprising first and second spaced stationary contacts, a resilient contact carrier having a fixed end and a free end, first and second movable contacts fixed to opposite sides of said contact carrier adjacent its free end and said carrier being provided with an abutment adjacent its free end, a resilient arm having a projection shorter than said carrier which projection is provided with an abutment, a spring rockably mounted on said abutments and normally maintaining the first movable contact in engagement with the first stationary contact and the free end of said projection in spaced relation to said carrier, an actuator applied to said carrier adjacent its fixed end on the side opposite to that from which said projection is spaced, said arm being perpendicularly spaced at a sufficient distance from said contact carrier and the plane of said arm to store sufficient energy in said carrier under the influence of said actuator to disengage the first movable contact from the stationary contact and force the second movable contact into engagement with the second stationary contact, and thereby rocking said spring on said abutments to change the direction of the force of said spring to flex said arm in a direction opposite to the movement of said carrier and store energy therein, and the fixed contacts being so disposed relative to each other and the abutment on said projection that the contact carrier passes the abutment on said projection during movement of the second movable contact into engagement with the second stationary contact, and the energy stored in the free end of said arm being effective in returning the first movable contact into engagement with the first stationary contact when the force upon said actuator is released.

9. Apparatus of the class described comprising a stationary contact, a resilient contact carrier having a fixed end and a free end and being provided with an abutment adjacent its free end, a contact affixed to said carrier adjacent its free end which is movable into and from engagement with the stationary contact, a resilient arm having a free end projection shorter than said contact carrier and said projection being provided with an abutment, a spring having its opposite ends rockably mounted on said abutments for normally maintaining the movable contact in engagement with the stationary contact and the free end of said projection in spaced relation to said carrier, an actuator applied to said contact carrier adjacent its fixed end on the side opposite to that from which said projection is spaced, said arm being perpendicularly spaced at a sufficient distance from said contact carrier and projection of said arm being biased away from said carrier, a spring rockably mounted on said abutments and normally maintaining the movable contact in engagement with the stationary contact, an actuator applied to said carrier adjacent its fixed end, and resilient means for perpendicularly spacing said arm in the space between the plane of said carrier and the plane of said arm to store sufficient energy in said carrier under the influence of said actuator to move the carrier with a snap motion when the operating force of said spring is exceeded, and means for adjusting the free end projection of said arm to vary the force required to actuate said contact carrier.

10. Apparatus of the class described comprising a stationary contact, a resilient contact carrier having a fixed end and a free end and being provided adjacent its free end with an abutment, a movable contact affixed adjacent the free end of said carrier, a resilient arm having a free end provided with an abutment, a support, means for securing the opposite end of said arm to said support, the free ends of said carrier and arm being extended in the same direction from said support and the free end of said arm being of less length than said carrier and being biased away from said carrier, a spring rockably mounted on said abutments and normally maintaining the movable contact in engagement with the stationary contact, an actuator applied to said contact carrier adjacent its fixed end, means for perpendicularly spacing said arm at sufficient distance from said contact carrier opposite to the position at which said actuator is applied to permit sufficient flexure of the carrier in the space between the plane of the carrier and the plane of the arm to move said carrier under the influence of said actuator with a snap motion to disengage the movable contact from the stationary contact, and means for adjusting the position of the free end of said arm to vary the force required to actuate said contact carrier.

11. Apparatus of the class described comprising first and second spaced stationary contacts, a resilient contact carrier having a fixed end and a free end and being provided adjacent its free end, a resilient arm having a free end projection shorter than said carrier which projection is provided with an abutment, a spring rockably mounted on said abutments and normally maintaining the first movable contact in engagement with the first stationary contact and force the second movable contact into engagement with the second stationary contact, and thereby rocking said spring on said abutments to change the direction of the force of said spring to flex said arm in a direction opposite to the movement of said carrier and store energy therein, and the fixed contacts being so disposed relative to each other and the abutment on said projection that the contact carrier passes the abutment on said projection during movement of the second movable contact into engagement with the second stationary contact, and the energy stored in the free end of said arm being effective in returning the first movable contact into engagement with the first stationary contact when the force upon said actuator is released.
projection shorter than said carrier which projection is provided with an abutment, a spring rockably mounted on said abutments for normally maintaining the first movable contact in engagement with the first stationary contact and the free end projection of said arm in spaced relation to the contact carrier, an actuator applied adjacent the fixed end of said carrier upon the same face thereof which carries the first movable contact, said arm being perpendicularly spaced from said contact carrier, the term of which lies intermediate planes perpendicular to the opposite ends of said contact carrier, said arm having a fixed end and being provided with an abutment adjacent its free end, and means for perpendicularly spacing said arm through an adjustable distance from said contact carrier throughout the length of said arm, including a spring rockably mounted upon said abutments to space the free end of said arm from the free end of said carrier, and spaced arcuate-shaped connectors integral with said arm and said contact carrier arranged adjacent the fixed end of said arm which space the contact carrier at a sufficient perpendicular distance from said arm to permit sufficient flexure of said contact carrier in said space to store sufficient energy in said carrier to move its free end with a snap motion when force is applied to said contact carrier adjacent said connectors.

14. Apparatus of the class described comprising:
(a) a stationary contact, a resilient contact carrier having a free end and being provided adjacent its free end with an abutment and with an actuator which contact is arranged opposite to the stationary contact and which is movable into and from engagement therewith, a spring for normally maintaining the movable contact in engagement with the stationary contact, said spring having one end rockably mounted on said abutment, means extending in substantially the same direction as said contact carrier and having a free end projection provided with an abutment on which the opposite end of said spring is rockably mounted, and the abutment on said projection being perpendicularly spaced from said contact carrier and arranged intermediate planes perpendicular to the opposite ends of said contact carrier, an actuator applied to said carrier adjacent its fixed end, and said means being perpendicularly spaced at sufficient distance from said contact carrier opposite to the position at which said actuator is applied to permit sufficient flexure of said carrier in said space to store sufficient energy in said carrier to move the movable contact from the stationary contact with a snap motion when force is applied to said actuator, and the abutment on said projection being arranged at a closer distance to the abutment on said carrier than to said actuator.

15. Apparatus of the class described comprising a stationary contact, a resilient contact carrier having a free end and being provided adjacent its free end with an abutment and with a contact which contact is arranged opposite to the stationary contact and which is movable into and from engagement therewith, an arm extending in substantially the same direction as said contact carrier and having a fixed end and a said abutment projection provided with an abutment arranged in a position which is perpendicularly spaced from said contact carrier and intermediate planes perpendicular to the opposite ends of said contact carrier, a spring having its opposite ends rockably mounted on said abutments, an actuator applied to said contact carrier adjacent its fixed end on the side opposite to that from which said arm is spaced, and said arm being perpendicularly spaced at a sufficient distance from said contact carrier opposite to the position at which said actuator is applied to permit sufficient flexure of said carrier in the space between said carrier and said arm to
store sufficient energy in said contact carrier to
disengage the movable contact from the stationary
contact when force is applied to said actuator, and
the abutment on said arm being arranged at a
closer distance to the abutment on said carrier
than to said actuator.

EVERARD F. KOHL.

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