Feb. 24, 1953 G. B. BENANDER 2,629,789

PULL-OPERATED SWITCH

Filed March 13, 1951

Fig. 1.

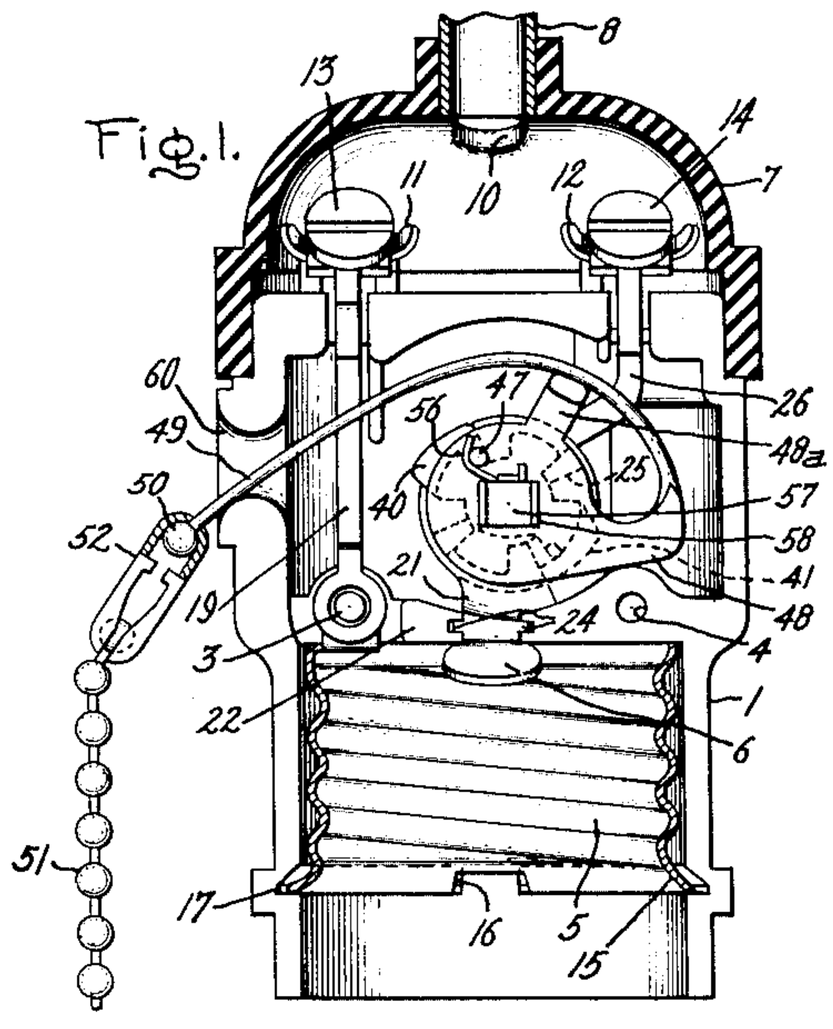



Fig. 2.

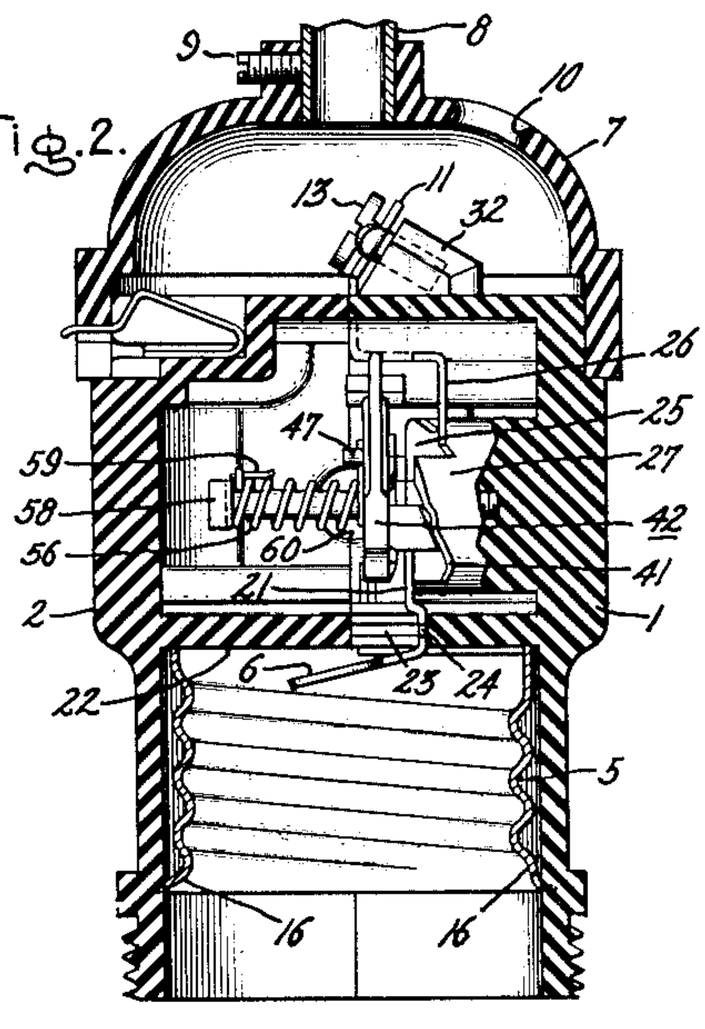



Fig. 3.

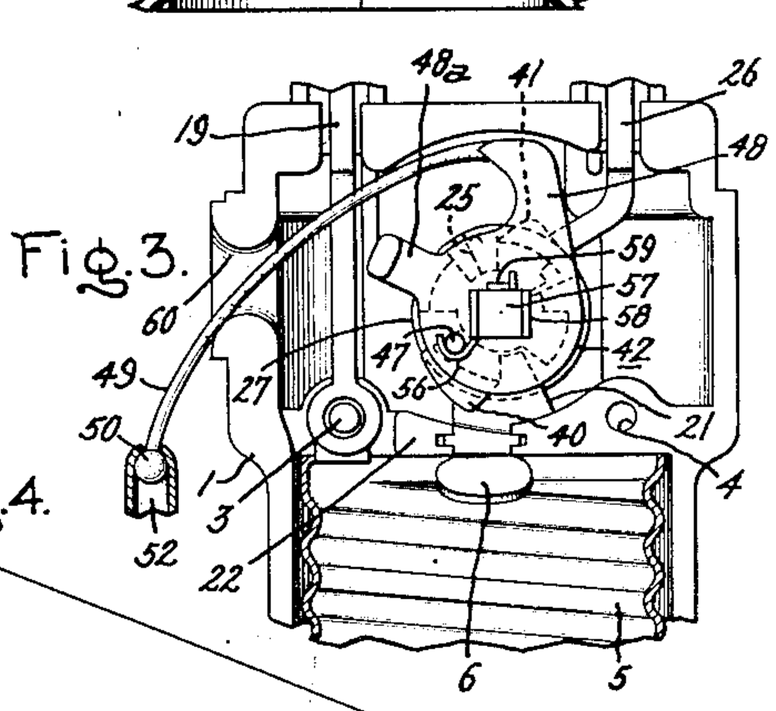
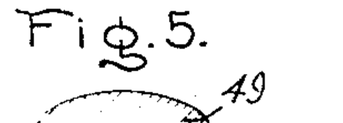



Fig. 4.




Fig. 5.

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# UNITED STATES PATENT OFFICE

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## PULL-OPERATED SWITCH

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6 Claims. (Cl. 200—51.15)

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My invention relates to a pull-chain-operated electric switch, and more particularly to a switch having a ratchet-operating mechanism.

This application is a continuation in part of my copending application Serial No. 109,008, filed August 6, 1949, now Patent No. 2,606,258, dated August 5, 1952, and assigned to the same assignee as that of the present application.

Pull-operated switches commonly employ a pull chain to operate the switch to its successive positions through a ratchet mechanism. Such a switch has required a number of components including a ratchet of insulating material to drive the movable contactor and a driving connection between the pull chain and ratchet. In addition, Underwriter's Laboratory requires an insulating link in the pull chain whenever the switch is to be used in damp locations. There is an inherent possibility with such switches of the pull chain breaking inside the switch case, resulting in a short circuit.

A primary object of my invention is to provide a pull-operated switch with a reduced number of component parts while providing a mechanism of increased reliability.

Another object of my invention is to construct a pull-chain-operated switch, equally suitable for damp or dry locations, at a reduced manufacturing cost.

A further object of my invention is to eliminate the possibility of short circuits within the switch due to breakage of the pull chain.

Still another object of my invention is to provide a pull-chain-operated switch with an improved ratchet-operating member having an insulating link extending outside the switch case to convert the longitudinal pull applied outside of the switch into a rotary motion for operating the contactor.

In accomplishment of the foregoing objectives, a feature of my invention consists of an improved ratchet and pull link member, formed as an integral unit from an insulating plastic material, such as for example a nylon, for a pull-operated switch. This member, mounted coaxially with a rotary contactor of the switch, has a ratchet face to provide a one-way driving engagement with the rotary contactor, and includes an elongated flexible portion extending outside the switch housing which serves as a pull link to operate the switch. The pull link has a transverse cross-section that provides a major and a minor axis with provision being made for the flexing of this link relative to the major axis.

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My invention will be better understood from the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

Referring to the drawing, Fig. 1 is a front elevation of my improved socket and switch assembly, partially in section, with a portion of the switch housing removed; Fig. 2 is a cross-sectional view, in elevation, taken at right angles to the view shown by Fig. 1; Fig. 3 is a partial view of the socket switch shown by Fig. 1 with the switch operating mechanism in a different position; Fig. 4 is an exploded view in perspective of the component parts making up this socket and switch assembly; while Fig. 5 is a cross-sectional view of a transverse section of the pull link.

The embodiment of my invention illustrated by the drawing is in the form of a socket and pull-chain-operated switch. The switch and socket assembly is enclosed within an insulating housing of generally cylindrical configuration, which is formed in two parts 1 and 2 from a material such as a molded plastic. Thus the semi-cylindrical portion 2 of the housing may be removed for assembly. A threaded fastening device 3 mounted in body portion 1 engages body portion 2, and likewise a similar threaded element mounted in body portion 2 is engageable in the hole 4 in body portion 1 in order to hold these two separable portions of the case in assembled relation. The socket portion of this assembly includes a cylindrical member 5 with a rolled thread to receive a threaded base of an electric lamp or similar device. As is conventional in socket construction, cylindrical member 5 is of electrical conducting material to form one of the socket contacts. The other socket contact is formed by a button 6 centrally mounted within the socket. A cap 7 is adapted to fit over the upper end of the case formed by members 1 and 2, as best shown by Figs. 1 and 2. The entire assembly may be supported from a wall or ceiling, and for this purpose cap 7 is apertured to receive a supporting member, such as tube 8. A set screw 9, threaded through the neck portion of cap 7, engages tube 8. An aperture 10 in cap 7 permits the entrance of the electrical supply lines for attachment to terminals 11 and 12. Screws 13 and 14 provide a means for attaching such electrical conductors to these terminals. Part 1 of the switch housing includes terminal housing 32 and 33 for receiving terminals 11 and 12 respectively and their corresponding terminal screws 13 and 14.

The cylindrical socket member 5 and central contact 6 are electrically connected through the switching mechanism to the terminals 11 and 12. In order to mount the cylindrical member 5 within the housing, it is provided with a laterally extending flange 15 around its lower edge, and this flange is slotted at one or more points as at 16. The socket housing is provided with an annular groove 17 co-operable with flange 15, and this groove is interrupted at spaced points to correspond with slots 16. By this construction the cylindrical member 5 is prevented from any longitudinal or rotary movement with respect to the housing. Cylindrical member 5 includes an inturned lip 18, as shown by Fig. 4, which provides a connecting point for a terminal strip 19. Strip 19 may be riveted or otherwise firmly secured to lip 18, and an aperture 20 at the point of connection between these two parts is adapted to fit over threaded fastening device 3 to anchor strip 19 in position. Strip 19 thus forms a through electrical connection from terminal 11 to the cylindrical socket member 5.

The central contact 6 of the socket is electrically connected to terminal 12 through a movable contact of the switching mechanism. Integrally formed with contact 6 is an arcuate shaped portion 21 which provides one of the fixed contact members for the switch. The switch and socket housing formed by members 1 and 2 is provided with a wall 22 to divide the socket portion of this device from the chamber containing the switching elements. As shown by Fig. 4, the portion of wall 22 which forms part of the housing portion 1 is slotted and grooved as at 23 to receive laterally projecting ears 24 on the neck portion between central contact 6 and the arcuate contact 21. As best shown by Fig. 4, a second arcuate member 25 forms the other fixed contact for the switch assembly. This arcuate member 25 is connected by a terminal strip 26 to terminal 12.

Fixed contacts 21 and 25 of this switch assembly are mounted in the switch housing 1 in a manner to provide a snap action for the switch. For this purpose, a post or cylindrical member 27 forms a part of and extends inwardly within the switch housing portion 1. The end of post 27 is shaped to provide a plurality of sloping arcuate surfaces arranged around the end of the post in stepped relation. These arcuate, sloping, and stepped surfaces are best shown by Fig. 4 as surfaces 28, 29, 30, and 31. Arcuate fixed contact 21 overlies the surface 30 and contact 25 overlies surface 28, leaving surfaces 29 and 31 without contacts for the off position of the switch.

Cooperating with fixed contact members 21 and 25 is a rotary contact member 34, the details of which are most clearly illustrated by Fig. 4. Rotary contactor 34 is centrally apertured at 35 so that it may be mounted on the end of post 27 to rotate to its various contact positions. Rotary contact element 34 includes laterally projecting arms 36, 37, 38, and 39, which serve in connection with the driving of this contactor in its rotary motion. The arms 37 and 39 carry the contact feet 40 and 41 which are shaped to facilitate rotation over the arcuate surfaces on the end of post 27 and to make contact with fixed contact members 21 and 25.

To drive rotary contactor 34, a combined ratchet and pull link member 42 is employed. The details of member 42 are most clearly illustrated by Fig. 4. This member is fabricated from an insulating material since it is in direct engagement with the electrically conducting rotary contactor. For the purpose of providing a one-way drive for contactor 34, member 42 has a ratchet face with a plurality of ratchet protuberances 43, 44, 45, and 46. These protuberances co-operate with the laterally projecting arms of the rotary contactor so that upon rotation of member 42 in one direction, rotary contactor 34 is also rotated. However, rotation of member 42 in the opposite direction does not drive the rotary contactor because of the sloping surfaces of this series of protuberances. The face of member 42 opposite the ratchet face has projecting therefrom a pin 47 which co-operates with a resilient means, to be described later, to return the ratchet member to its initial position after each rotation. So that ratchet member 42 may be rotated from a point outside the switch housing, it includes a radially extending arm 48, the arm 48 extends into an elongated flexible link 49 having sufficient length to extend outside of the switch housing as shown by Fig. 1. The flexible link 49 is constructed to provide a major and a minor axis. In a preferred embodiment, as shown in Fig. 5, this cross-section is oval shaped to provide for the flexing of the link about the major axis 49*a*. It is understood that this invention is not to be limited to this particular improvement, but that it has been chosen to illustrate one example of the cross-section having a major and a minor axis. With the cross-section formed in accordance with these requirements, a link of improved flexibility is provided thereby improving the operation of the switch without sacrificing the strength of the pull link member. The housing has an aperture 60 with rounded edges through which link 49 may extend. The outer extremity of this flexible elongated link 49 has a ball 50 to provide a means for attachment to a pull chain 51 through a connecting link 52. It will be understood, of course, that a pull cord or other means might be connected to link 49 to extend to a more convenient point of operation; or the link 49 itself may be formed with additional length so that it would hang down to a convenient point for switch operation. A second radially extending arm 48*a* forming part of member 42 co-operates with the elongated link 49 in order to increase the torque applied tending to rotate member 42 upon application of the initial force to operate the switch. Member 42 is also centrally apertured at 35*a* so that it may be mounted coaxially with rotary contactor 34.



While there may be a number of materials from which the ratchet and pull link member 42 can be made, I find it preferable to employ a synthetic resin capable of being molded to the desired shape. As an example, super polyamides, commonly available under the name nylon, are particularly well suited since such resins can be economically injection molded from a powder to produce a long-wearing and strong member free from atmospheric influences, while still having adequate resiliency and strength to form the flexible link portion 49. The plastic material employed must, of course, be an electric insulator and have a relatively high softening temperature for this application, in addition to having the characteristics of strength and resiliency. In particular, I have found that Du Pont nylon No. FM–10001 is well suited to these particular requirements, although other nylons and plastic compounds may be employed.

The rotary contactor 34 and the pull link and ratchet member 42 are held in assembled relation with respect to the end of post 27 and the fixed contacts of the switch by means of pin 53.

Pin **53** is threaded at **54** and these threads cooperate with an internally-threaded aperture **55** centrally located in the end of post **27** of the switch housing. Both contactor **34** and ratchet member **42** are freely rotatable about this pin so that the contactor may be rotated to its contact positions upon rotation in a driving direction of ratchet member **42**. A resilient means **56**, here shown as a helical spring, is provided to engage pin **47** on ratchet member **42** for an automatic return of the ratchet member to its initial position after each operation of the switch. Pin **53** has a square head **57** to engage the side walls of spring retainer **58**. The retainer **58** is thus non-rotatably associated with pin **53**, and it includes a tongue **59** to engage one end of spring **56** to prevent the spring from rotating when it is installed in operative position. Spring **56** is installed in this assembly so that it is at all times under slight torsional stress. This insures that the ratchet member **42** will always be returned to its initial position after an operation of the switch.

Spring **56** is also under compression at all times in order to force the ratchet member **42** into engaging relation with the rotary contactor **34**, and to force rotary contactor **34** into firm contact with the fixed contacts **21** and **25** as they are positioned on the end of the post **27**.

The method of assembly of this socket and switch will be understood by a reference to Fig. 4. The cylindrical socket member **5** with its terminal strip **19** riveted thereto is first placed in position in the half portion **1** of the housing. Screw **3** projects through the aperture **20** and the flange **15** lies within the groove **17** of the housing to properly position the cylindrical member **5**. Central contact **6** and its arcuate portion **21** may next be installed with arcuate portion **21** overlying and in contact with surface **30** on the end of post **27**. The other fixed contact as formed by the arcuate portion **25** along with its corresponding terminal strip **26** and terminal **12** is placed in position with the arcuate portion **25** overlying and in contact with surface **28** on post **27**. It is thus seen that the two fixed contacts are arranged in diametrically opposite relation, and the sloping surfaces **29** and **31** present only the insulating material from which the switch housing and post **27** are fabricated. Therefore, when the rotary contactor **34** is placed in position on the end of post **27** its contact feet **40** and **41** may rest either on the fixed contacts **21** and **25** or on the insulating surfaces **29** and **31**, corresponding respectively to the on and off positions of the switch. With the rotary contactor in position the ratchet member **42** is placed over the rotary contactor **34** with its ratchet face in contact with the laterally extending arms of the rotary contactor. Pin **53** with its spring **56** and spring retainer **58** is next secured in position rotatably supporting the ratchet member **42** and rotary contactor **34** in assembled relation on the end of post **27**. To complete the assembly it is merely necessary to attach the other half **2** of the switch and socket housing to the housing half **1** and attach cap **7** to the completed assembly.

To operate this device after the socket assembly has been attached to a suitable support and the electrical supply line has been connected to terminals **11** and **12** by means of the terminal screws **13** and **14**, it is merely necessary to pull on the chain **51** to throw the switch to its next position. In the particular embodiment illustrated the switch has only two positions, that is



on or off. It is to be understood, however, that this same type of assembly could be employed with a multi-position switch by increasing the number of steps and contact points for one complete revolution for the rotary contactor. After the force has been applied to the chain **51** to throw the switch to its next position, the chain is then released and the switch is automatically reset for the next switch operation. The force applied to the pull chain is transmitted through the connecting link **49** to provide a torque through the arms **48** and **48***a* to rotate ratchet member **42**. Since the combined ratchet and pull link member is made of a plastic which is also an insulating material, danger is eliminated of a short circuit occurring within the switch through pull link **49**. The ratchet protuberances on the ratchet face of member **42** engage the laterally extending arms of the rotary contactor **34** to cause it to rotate one step. During this rotation the contact feet **40** and **41** of the rotary contactor ride up the sloping arcuate surfaces formed by either the faces **29** and **31** of post **27** of the housing or on the similar surfaces formed by the fixed contacts **21** and **25**. When the contact feet have passed over the highest point on these sloping surfaces, the rotary contact element, under the influence of the compression of spring **56**, snaps down to the next contact position. Thus each operation of the switch results in a snap action to quickly make or break the electrical circuit.

From the above description, it can be seen that I have provided a new and improved socket and switch assembly in which the number of component parts making up the assembly have been minimized. Such a construction permits increased economy in manufacture of the completed article. At the same time, due to the simplicity of the operating parts, a high degree of reliability is achieved. In particular, a greatly improved means is provided for driving the movable contact member of the switching assembly which includes as an integral part thereof an insulating link extending outside the switch housing.

While the present invention has been described by reference to a particular embodiment thereof, it will be understood that numerous modifications may be made by those skilled in the art without actually departing from the invention. I, therefore, aim in the appended claims to cover all such equivalent variations as come within the true spirit and scope of the foregoing disclosure.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a pull operated switch having a rotary contactor for making and breaking the circuit through fixed contacts, a ratchet and pull link member for operating said rotary contactor in steps, and a pin forming an axis about which said member and said contactor rotate, said member being integrally formed from nylon and comprising a ratchet face providing a one-way drive for rotating the contactor, a protuberance on the face thereof opposite said ratchet face engageable with a resilient means to return said member to its initial position independently of the contactor after each operation of the switch, a radially extending arm, an elongated flexible portion extending from the end of said arm forming the pull link for the switch, said link having a transverse cross-section providing a major and a minor axis with said

link being positioned relative to said switch to permit the flexing of said link relative to the major axis of its cross section, and a second radially extending arm forming a bearing for said pull link to increase the torque resulting from a given pull on said link during initial rotary movement.

2. A socket and pull switch assembly comprising an insulating case for the assembly, a socket within said case having socket contacts, terminals supported by said case for connecting said socket contacts to an electrical supply line, and a switch mechanism within said case for making and breaking the circuit through said socket contacts, said switch mechanism comprising a post forming a part of and extending inwardly within said case, the end of said post having a plurality of arcuate sloping surfaces in stepped relation, a fixed contact associated with one of said terminals overlying one of said surfaces, a second fixed contact associated with one of said socket contacts overlying a second of said surfaces, a rotatable contactor made of electrical conducting material having radially extending arms including foot portions engageable with said fixed contacts to make and break the circuit through said fixed contacts upon rotation, an integral nylon ratchet and pull link member mounted coaxially with said rotatable contactor with the ratchet face of said member engaging said arms to effect the rotation of said rotary contactor through one rotary step, said link having a transverse cross-section providing a major and a minor axis with said link being positioned relative to said switch to permit the flexing of said link relative to the major axis of its cross-section, and resilient means returning said member to its initial position without moving said rotary contactor.

3. A socket and pull switch assembly comprising an insulating case for the assembly, a socket within said case having socket contacts, terminals supported by said case for connecting said socket contacts to an electrical supply line, and a switch mechanism within said case for making and breaking the circuit through said socket contacts, said switch mechanism comprising spaced fixed contacts, a rotatable bridging member made of electrical conducting material engageable with said fixed contacts to make and break a circuit between said fixed contacts upon the rotation of said bridging member through successive rotary steps, an integral nylon ratchet and pull link member mounted coaxially with said rotatable bridging member with the ratchet face of said ratchet member engaging said bridging member to effect the rotation thereof through one rotary step, said link having a transverse cross-section providing a major and a minor axis with said link being positioned relative to said switch to permit the flexing of said link relative to the major axis of its cross-section, and a resilient means returning said ratchet member to its initial position without moving said rotary bridging member.

4. In a pull-operated switch having co-operating movable and fixed contacts, a ratchet and pull link member for operating said movable contactor in steps, comprising a relatively rigid ratchet disc and a flexible insulating link extending from the edge of said disc for rotating the disc, said link having a transverse cross-section providing a major and a minor axis with said link being positioned relative to said switch to permit the flexing of said link relative to the major axis of its cross-section, a radially extending arm forming a bearing for said pull link to increase the torque resulting from a given pull on said link during initial rotary movement, said disc, said link and said arm being integrally molded from a super polyamide.

5. A rotary switch operable to successive positions by repetitive longitudinal force comprising a plurality of fixed contact positions including an off position, a rotary contactor made of electrically conducting material having feet adapted to sweep over said fixed contact positions for making and interrupting electrical circuits, a combined driving member and pull link for operating said rotary contactor comprising a super polyamide molded to form integrally a rigid ratchet faced element engageable with said rotary contactor for operating the same and an elongated flexible pull link element for rotating said rigid ratchet faced element whereby longitudinal force which is applied to said pull link rotates said rigid ratchet faced element to move said rotary contactor one step, said elongated flexible pull link element having a transverse cross section providing a major and a minor axis with said link being positioned relative to said switch to permit the flexing of said link relative to the major axis of its cross section, and resilient means to return said combined member to its initial position independently of said contactor after each operation of the switch.

6. In a pull-operated switch having cooperating rotatable and fixed contacts, a combined driving member and pull link for operating said rotatable contacts comprising a super polyamide molded to form integrally a rigid ratchet faced element engageable with said rotatable contacts for operating the same and an elongated flexible pull link element for rotating said rigid ratchet faced element, said elongated flexible pull link element having a transverse cross section providing a major and a minor axis with said link being positioned relative to said rigid ratchet faced element to permit the flexing of said link relative to the major axis of its cross section.

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