

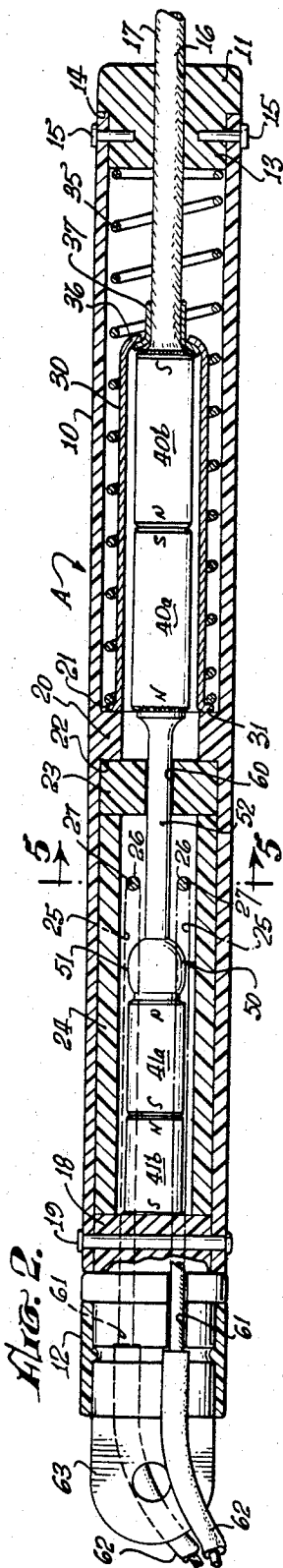
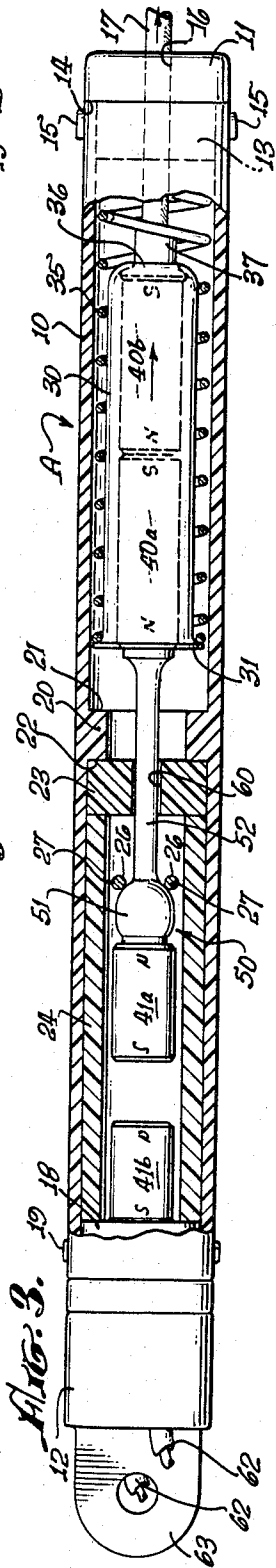
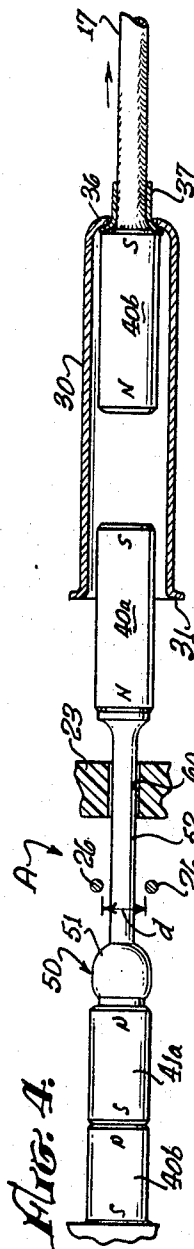
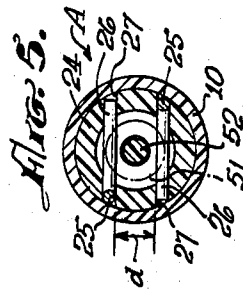
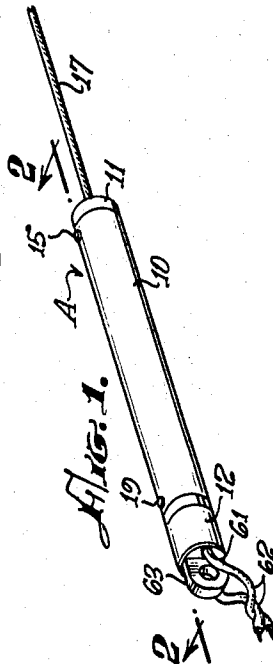
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MAGNETICALLY COUPLED MOMENTARY SWITCH

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## 3,414,853 MAGNETICALLY COUPLED MOMENTARY SWITCH

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### ABSTRACT OF THE DISCLOSURE

A momentary switch which utilizes the unequal magnetic coupling of first and second pairs of magnets to cause return of a contact assembly to the unactuated position of the switch if the actuating means is not released. The switch is actuated by pulling the actuating means, such as a cable, which moves a contact assembly into a closed contact position by separating the first magnet pair which has the lesser coupling force of the two magnetic coupled pairs of magnets in the unactuated condition. If the cable is not released, separation of the stronger coupled second pair occurs and the coupling force at this actuated position becomes less than that between the separated first pair allowing the first pair to recouple to break the contact.

This invention relates to an electrical switch and, more particularly, to a momentary contact electrical switch.

A momentary contact electrical switch is a switch which when actuated makes its electrical connection momentary i.e., the electrical connection is broken after a moment of time without the necessity of further actuation of the switch.

For example, as defined herein, the typical push-button as used in a door bell system is not a momentary electrical switch. This is so because the button must be released to break the electrical connection. To be a momentary switch, upon pushing the button an electrical connection would be made and broken a moment later whether or not the button is released.

Momentary contact switches are particularly desirable for use in control circuits where momentary electrical connection is all that is necessary as, for example, where controls are solenoid actuated. Further uses for momentary switches are installations and devices operated by unskilled personnel that would apply an electrical connection for too long a period and thus harm circuitry or drain power sources. A particularly desirable use for a momentary electrical switch is in solenoid actuated prosthetic appliance controls which must often be operated by children who are not capable of determining the correct time of maintaining an electrical connection. Further, a prosthetic device such as an artificial arm may not impart the necessary sensory stimuli to an amputee to inform him that a regular switch is "on" so that the battery supply will drain and thus cause great inconvenience and higher expenses as well as failure of the device.

A momentary electrical switch that can be cable actuated is particularly desirable for certain applications such as in prosthetic appliances where a cable is the most compact and convenient actuation means and as another example in control or instrumentation systems of aircraft and missiles where the switch is to be actuated by a remote means such as a control surface on a wing or a break-away point.

Accordingly, it is an object of this invention to provide a momentary contact electrical switch.

It is another object of this invention to provide a momentary contact electrical switch which is reliable in operation.

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It is another object of this invention to provide a momentary contact electrical switch which is easy to manufacture.

It is another object of this invention to provide a momentary contact electrical switch which is capable of being actuated by a control cable.

It is another object of this invention to provide a momentary contact electrical switch which is compact.

The invention herein comprises a momentary contact electrical switch which is magnetically operated. The invention has a contact assembly which is generally rod like and has magnets at the ends thereof. The ends are enlarged. Between the ends of the contact assembly is a fixed contact so arranged as to allow the rod like portion of the contact assembly to pass by but prevent the enlarged end from passing. The contact assembly at each end has magnets in an opposing polarity relationship acting upon it with the magnetic attraction thereby created stronger on one side than on the other. Spring biasing means overcome the magnetic force on the stronger side so that unactuated the switch is open. A cable is attached to the stronger magnet. When the cable is actuated, the spring biasing force is overcome and the enlarged end of the contact assembly near the weaker magnet makes contact with the fixed contact, which because the enlarged end cannot pass by, restrains the contact assembly and as the cable is drawn further, the stronger magnet withdraws from the contact assembly so that the force exerted by the weaker magnet exceeds that of the stronger magnet and the contact assembly returns to its original condition, thus, a momentary contact is achieved.

The novel features which are believed to be characteristic of the invention, both as to its organization and method of operation, together with further objects and advantages thereof will be better understood from the following description considered in connection with the accompanying drawing in which a presently preferred embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawing is for the purpose of illustration and description only, and is not intended as a definition of the limits of the invention.

In the drawing:

FIG. 1 is a perspective view of a momentary electrical contact switch constructed in accordance with the invention.

FIG. 2 is a sectional view taken along line 2-2 of FIG. 1 showing the switch in the unactuated open condition.

FIG. 3 is a similar view to that of FIG. 2 showing the switch in an actuated closed condition.

FIG. 4 is a partially schematic view similar to FIG. 2 showing the switch in an actuated open condition.

FIG. 5 is a sectional view taken along line 5-5 of FIG. 2 showing the arrangement of the fixed contacts of the invention.

Referring now to the drawing, a switch constructed in accordance with this invention is shown in FIG. 1 and denoted by the general character A. The switch comprises a tubular housing 10 terminating in end sections 11 and 12. End section 11 has a turned down section 13 which has a diameter substantially equal to but less than the inner diameter of tube 10 so that the section 11 is press fitted into the tube 10. Shoulders 14 determine the depth of insertion of end 11. For a secure connection end 11 is also affixed by pins 15 which transversely pin the end 11 to the tube 10. A centrally disposed opening 16 is drilled coaxially through end 11 to provide for the exit of cable 17 whose operation will be described hereinafter. Two pins 15 are utilized so that end 11 may be pinioned at diametrically opposed points without interfering with cable 17.

End section 12 has a turned down section 18 which is

constructed similarly to section 13 of section 11 and which is press fitted similarly into tube 10 at the end opposite that in which section 11 is fitted. A pin 19 extends transversely through end 12 and tube 10 to secure the two parts firmly together. Tube 10 has proximate its central portion a reduced inside diameter section 20 which creates shoulders 21 and shoulders 22.

Abutting against shoulders 22 is a circular plastic disc 23 which is held firmly against shoulders 22 by a tube section 24. Tube 24 has an outside diameter substantially equal to but less than the inside diameter of tube 10. Thus, tube 24 is easily press fitted into tube 10. The length of tube 24 is substantially equal to the distance between cofacing surfaces of disc 23 and end section 12 so that pin 19 retains tube 24 and disc 23 as well as end section 12. In the outside periphery of tube 12 are two longitudinal grooves 25 which are diametrically opposed. Silver contact wire is installed in grooves 25 to create fixed contacts 26. The contact 26 is formed, as can best be seen in FIG. 5, by right angle bends in the contact wire which are retained in holes 27 provided therefor in the wall of tube 24. As can be seen in FIG. 5, the fixed contacts 26 are parallel bars describing equal chords in the cross-sectional circle of tube 24. The spacing  $d$  between contacts 26 is predetermined as will be described hereinafter. The contacts 26 are located between end 12 and disc 23 and are fairly close to disc 23. In the preferred embodiment of the invention the contacts 26 are about 1/16 inch from disc 23, however, this distance is in no way critical and depends on the dimensions of other parts of the switch which can be varied as desired to meet special size and power requirements. In the preferred embodiment, the switch has an approximate overall length of two inches.

A brass tube housing 30 has a flange 31 which has a diameter less than the inside diameter of tube 10 but greater than the inside diameter of section 23. A spring 35 is retained by flange 31 at one end and by end 11 at the other end. In the unactuated portion of the switch, spring 35 forces flange 31 in abutment with shoulders 22. The tube 30 is formed to partially close by arcuate bend 36 to retain a cable collar 37.

Two cylindrical magnet pairs 40 and 41 are utilized. Each of the magnet pairs 40 and 41 have strength, however, magnet pair 40 has a higher strength than pair 41. The polarities of magnet pairs 40 and 41 are as indicated in FIGS. 2-4. Magnet 41b is affixed to end portion 18 by epoxy or any other cement or pin and the like. Magnet 40b is soldered or otherwise affixed to collar 37. Cable 17 is attached to magnet 40b. The diameter of the magnet are equal and greater than the diameter of collar 37 so that when cable 17 is pulled, tube 30 will move in the direction of the cable. If the cable 17 is released, spring 35 will force tube 30 back into its original position. Between magnets 40b and 41b is a movable contact assembly 50. The contact assembly 50 comprises magnet 41a, a silver ball 41, rod section 52 and magnet 40a. Magnets 40a and 41a are rigidly interconnected by rod 52 which has a diameter substantially less than the distance  $d$  between contacts 26. Soldered between the end of rod 52 and magnet 41a is a generally ball shaped piece of silver. The silver ball 51 has a diameter substantially greater than the distance  $d$  between the contacts 26. The diameter of ball 51 is the same approximately as the diameters of magnets 40 and 41. These diameters are less than the inside diameter of tube 24 so that the movable assemblies can move freely within the housing. Disc 23 has a central opening 50 with a diameter greater than that of rod 52 so that rod 52 moves freely through opening 60.

Suitable openings 61 are provided in end section 12 for lead wires 62 which are secured in any suitable manner to the wire 25 of contacts 26. A lug 63 of metal or plastic is embedded or otherwise secured in end section 12. The lug 63 provides a ready securing point for the switch A.

Referring to FIG. 2, the switch A is shown in an unactuated open position. Magnets 41 are contacting each other as are magnets 40. Spring 35 is forcing movable contact assembly 50 into light compression between magnets 40b and 41b. Silver ball 51 is not in contact with contacts 26 and flange 31 is abutting shoulders 21.

Pulling cable 17 will move silver ball 51 toward contacts 26 because of the magnetic coupling of magnets 40. The coupling of magnets 40, as discussed hereinabove, is stronger than the coupling of magnets 41, thus, the magnets 41 separate and the ball 51 comes into contact with contacts 26 and a connection is made between contacts 26 which connects a circuit attached to leads 62. The condition of the switch at the point at which ball 51 just contacts contacts 26 is best observed in FIG. 3.

The ball 51 cannot move further when the cable 17 is more fully drawn, since the movement of ball 51 and, thus, the contact assembly 50 in the direction of the cable 17 is constrained by the contacts 26. Thus, as can best be noted in FIG. 4, magnet 40b separates from magnet 40a reducing the magnetic coupling therebetween, until the coupling between magnets 40 becomes less than the coupling between magnets 41 so that magnets 41 contact each other bringing the ball 51 back to its original condition. Thus, the contact made by ball 51 with contacts 26 is a momentary contact and the contact is not maintained although the cable 17 is not released. If cable 17 is released, the switch returns to its original condition as shown in FIG. 1. Thus, there has been described herein a novel momentary contact electrical switch which is compact, reliable and easily actuable.

Although this invention has been disclosed and illustrated with reference to particular applications, the principles involved are susceptible of numerous other applications which will be apparent to persons skilled in the art. The invention is, therefore, to be limited only as indicated by the scope of the appended claims.

What is claimed is:

1. A momentary contact electrical switch comprising:
  - a first electrical contact;
  - a second electrical contact, said second contact being adapted to be movably connected to said first contact;
  - a first magnetic assembly and a second magnetic assembly, said second assembly being cooperatively affixed to said second contact and said first assembly being magnetically coupled to said second assembly;
  - said first magnetic assembly comprising a first magnet of a first predetermined magnetic strength and a second magnet of a second predetermined magnetic strength, said second magnet having a strength substantially greater than that of said first magnet, said first and second magnets being spaced apart to thereby define a first space therebetween and having like poles facing said first space therebetween;
  - said second magnetic assembly comprises a third magnet of a third predetermined magnetic strength and a fourth magnet of a fourth predetermined magnetic strength, said fourth magnet having a strength substantially greater than that of said third magnet, said third and fourth magnets being spaced apart to thereby define a second space therebetween and having like poles facing said second space therebetween, said like poles of said third and fourth magnets being of the same polarity as said like poles of said first and second magnets, said third and fourth magnets being positioned within said first space; and,
  - said second contact being positioned within said second space and affixed to said third and fourth magnets, said third magnet being proximate said first magnet and said fourth magnet being proximate said second magnet.

2. A switch as claimed in claim 1 including in addition; means for biasing said second magnet toward said first magnet;

means for selectively overcoming said biasing; and,

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means for spacing said second contact from said first contact when said biasing is not overcome.

3. A switch as claimed in claim 2 wherein said first contact is positioned between said second contact and said fourth magnet and including, in addition, means for limiting the travel of said second contact to the point of connection of said first and second contacts when said biasing is overcome. 5

4. A switch as claimed in claim 3 wherein said biasing means comprises a spring and said magnets are on a common longitudinal axis. 10

5. A momentary contact electrical switch comprising: a first electrical contact;

a second electrical contact, said second contact being adapted to be movably connected to said first contact; 15

a first magnetic assembly and a second magnetic assembly, said second assembly being cooperatively affixed to said second contact and said first assembly being magnetically coupled to said second assembly; 20  
said first magnetic assembly comprising a first magnet of a first predetermined magnetic strength and a second magnet of a second predetermined magnetic strength, said second magnet having a strength substantially greater than that of said first magnet, said 25

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first and second magnets being spaced apart to thereby define a first space therebetween;

said second magnetic assembly comprises a third magnet of a third predetermined magnetic strength and a fourth magnet of a fourth predetermined magnetic strength, said fourth magnet having a strength substantially greater than that of said third magnet, said third and fourth magnets being spaced apart to thereby define a second space therebetween, said third and fourth magnets being positioned within said first space; and,

said second contact being positioned within said second space and affixed to said third and fourth magnets, said third magnet being proximate said first magnet and magnetically coupled thereto and said fourth magnet being proximate said second magnet and magnetically coupled thereto.

#### References Cited

#### UNITED STATES PATENTS

2,341,931 2/1944 Lloyd ----- 200—160 X

BERNARD A. GILHEANY, *Primary Examiner.*

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