June 1, 1943. E. W. LOGAN 2,320,942

SWITCH

Filed Dec. 29, 1939

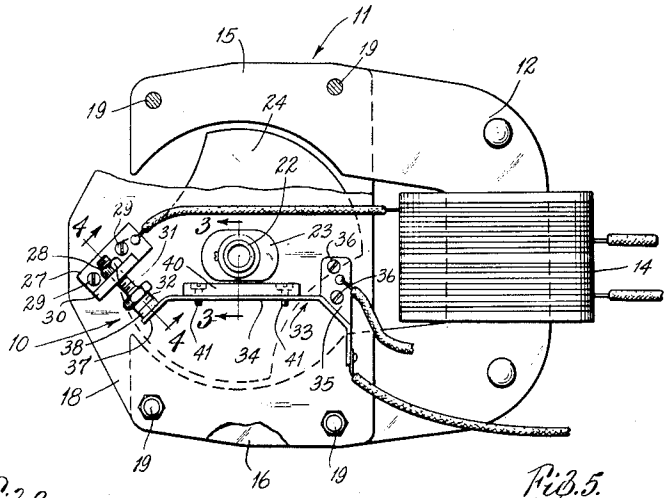


Fig. 1.

Fig. 2.

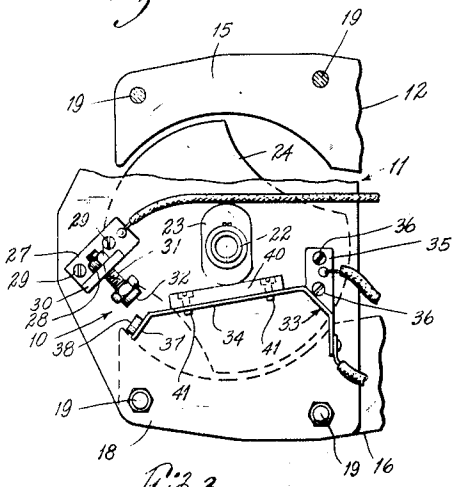
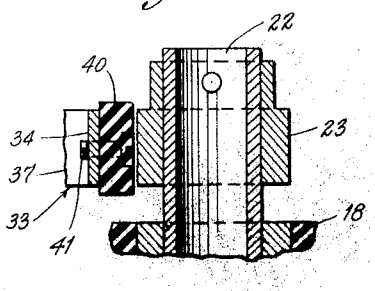


Fig. 3.



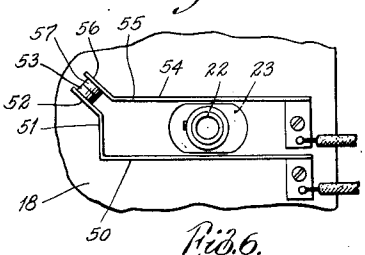


Fig. 5.

Fig. 6.

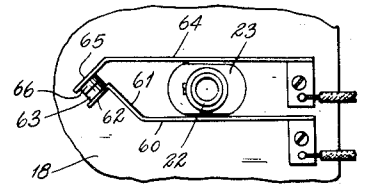


Fig. 7.

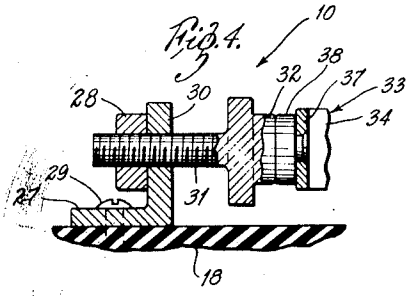


Fig. 4.

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SWITCH

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1 Claim. (Cl. 200—30)

The present invention relates generally to switches, and more particularly to a switch construction which finds particular application in combination with a motor capable of attaining high speeds, such as an impulse electric motor.

An object of the present invention is to provide a novel switch of a construction to prevent rebound between the contacts ordinarily caused by the very rapid impact when they come together.

Another object is to provide a novel switch which includes contacts having contact faces so disposed as to deflect contact forces and particularly their reactions that tend to cause rebounding of the contacts. More specifically, this object is to have contact faces angularly related to the direction of relative movement of the contacts themselves, such that the forces at contact of the surfaces are deflected to have a minimum, if any, component of rebound.

Another object is to provide a novel switch of a construction to provide resilient support for the contacts designed to absorb a part of the forces of engagement between the contacts, and thus dissipate those forces to reduce their effect in producing rebound.

A further object is to provide such a switch having a wiping action between the contacts.

Another object is to provide a switch of simple yet thoroughly efficient construction to obtain the objects and advantages sought therefor.

Other objects and advantages will be apparent from the following description, taken in conjunction with the accompanying drawing, in which:

Fig. 1 is a view of the present invention in operative combination with a high speed electric motor, the contacts of the switch being shown in contacting relationship, parts being broken away for clarity;

Fig. 2 is a fragmentary view similar to Fig. 1, showing the contacts of the present switch in break relationship;

Fig. 3 is a section on the line 3—3 of Fig. 1;

Fig. 4 is a section on the line 4—4 of Fig. 1; and,

Figs. 5 and 6 are views of modified forms of switches embodying the present invention.

Referring to the drawing more particularly by reference numerals, 10 indicates generally a switch constructed in accordance with the teachings of the present invention disposed in operative combination with an impulse motor generally designated 11.

The impulse motor 11 includes a U-shaped field member 12, on the bight portion of which is a winding 14 that, when energized, sets up a magnetic flux producing poles 15 and 16. The opposite sides of the poles 15 and 16 have cover plates 18, preferably of non-magnetic and electrically non-conducting material, which are secured in place by bolts 19.

A hollow shaft 22 is rotatably supported by bearings in the cover plate, the shaft having a cam 23 secured thereto at a free end disposed exteriorly of one cover plate 18. A rotor 24, of familiar impulse motor shape, is adjustably secured to the shaft 22, by means not shown, to permit adjustment of the cam relative to the rotor.

The switch 10 is operatively mounted on the exterior face of one plate 18. A bracket 27 (Figs. 1 and 4) is secured to the plate 18 by screws 29. A flange 30 of the bracket 27 extends at right angles to the plate 18 and threadedly receives a member 31 having a flat-faced contact element 32 at one end thereof. A lock nut 28 cooperates with the member 31 to secure the contact element 32 in predetermined position.

The switch 10 also includes a movable member 33 made of spring material comprising an arm 34 secured to the plate 18 by an extension 35 through which screws 36 extend into the plate 18. The arm 34 includes a segment 37 at the free end thereof which is disposed, as by being bent, at an angle (such as 45°) to the main portion thereof. A contact element 38 is secured to the segment 37. The main portion of the arm 34 and the segment 37 are in planes at right angles to the plane of the extension 35. A block 40 of insulating material is attached to the arm 34 by screws 41. The disposition of the arm 34 is such that the block 40 is contacted by the cam 23 to be displaced thereby, after which the arm returns by its resiliency. This movement is approximately at right angles to the direction of movement of the main portion 34 of the switch.

Figs. 5 and 6 show two modifications in which both blades are movable. In Fig. 5 the first blade 50 has an upturned end 51 and a bent contact element holding segment 52 supporting a contact 53. The second blade 54 is the same as the blade 33, with a main section 55, an end segment 56 and a contact element 57.

In Fig. 6 the first blade 60 has an inturned end 61, a reversely bent segment 62 and a contact element 63. The second blade 64 has an inturned end segment 65 with a contact element 66.

All of the blades in Figs. 5 and 6 are resilient and normally seek to move toward the shaft 22. And in all, at least one of the contacts has at

least the contacting part of its surface disposed at an acute angle, preferably 45° or more, relative to the direction of relative movement of the contacts. Or, stated differently, a normal to the contacting surface of at least one contact is at an acute angle to the direction of relative contact movement.

Operation

In the operation of the impulse motor **11** there is a rapid make and break action of the contacts **32** and **38** of the switch **10**. As is customary in this type of motor, the field winding is in series with the switch, so as to be energized and de-energized twice during a revolution of the rotor, due allowance being made for any inertia of the field either in being built up or broken down. Thus, during each revolution of the shaft **22** and hence of the cam **23**, there are two complete make and break cycles of the switch **10**, inasmuch as the movable arm **34** is moved to the position shown in Fig. 2 twice during one full revolution of the shaft **22**. The resiliency of the arm **34** returns it to the position shown in Fig. 1. Manifestly, the number of make and break cycles of the switch **10** is determined by the number of cam surfaces of the cam **30**.

Since the motor may operate above ten thousand R. P. M., it is evident that other than a quick, clean, action of the switch is a source of considerable inefficiency. The rapidity of the closing action also causes an exaggeration of the rebound tendency.

As noted, the effective surfaces of the contact elements **32** and **38**, upon which contact is made, are at an angle to the direction of movement of the switch arms, which is an angle other than 90°, or an acute angle.

Considering the situation wherein the contact element **32** is fixed and the element **38** moves against it, the angle between the contacting surfaces is such that the moving contact, upon striking the fixed one, is given a deflecting tendency with its angle of reflection approximately equal or related to the angle of incidence. For this reason, if the angle between the surfaces is as much as 45° to the direction of movement of the contact, the deflection force has no component in a direction to cause rebound. A lesser angle is advantageous over a flat switch blade, but the larger angle increases the advantage, and the angle at which there is no component of rebound is best.

In addition, the fact that the forces of contact and rebound may act against the bent-over switch blade ends, enables the switch blade to absorb some of the force of contact in a ready deflection of these ends. Preferably both ends are bent, and the bending is such that the righting force component is not in the direction of rebound. In Fig. 2, the force is partially absorbed in bending of the segment **37** about its union with the portion **34**. This bending may also be transmitted through to other parts of this resilient member.

The deflection of the bent end also provides a wiping action of the contacts, since it shortens the length of the resilient switch arm **33** to enable the arm to move further toward the rotor axis. In so doing, the contact elements are necessarily together and one wipes across the other.

The modifications of Figs. 5 and 6 work on the same principles, since the movement of both arms may be resolved into movement of one relative to the other, assuming the second to be relatively fixed. These types have the advantage that both blades are resilient to absorb the contact impact.

It is understood that the foregoing description and accompanying drawing have been given by way of illustration and example and not for purposes of limitation, the invention being limited only by the claim which follows.

What is claimed is:

A switch comprising a relatively fixed first contact element, a movable switch arm, a second contact element thereon, means adapted to operate said switch arm so that the contact element thereon moves to and away from the first contact element, said means and said contact elements being arranged so that for a substantial part of the interval of time during which the contact elements are in contact with one another, the surface along which the contact elements touch each other makes an acute angle of substantially 45° to the direction of motion of the contact element on the switch arm.

EDWIN W. LOGAN.