

March 29, 1960

W. BAER

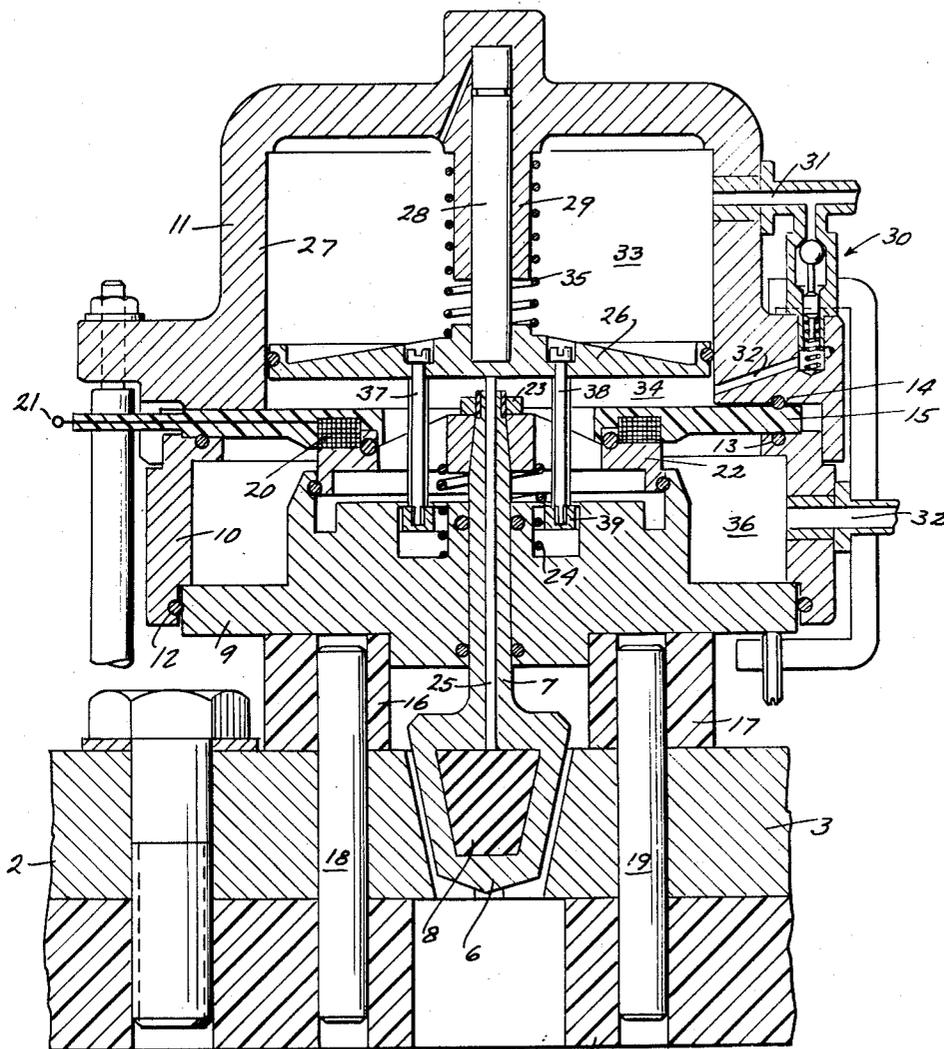
2,930,870

HIGH SPEED SWITCH

Filed April 24, 1958

2 Sheets-Sheet 1

FIG. 1



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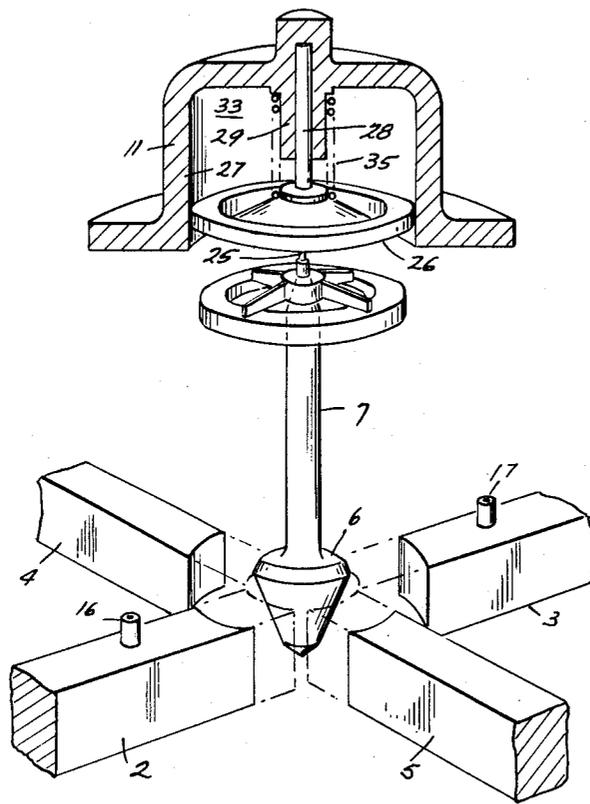
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FIG. 2.



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2,930,870

HIGH SPEED SWITCH

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Application April 24, 1958, Serial No. 730,587

8 Claims. (Cl. 200—87)

My invention relates to a high speed switch, and more particularly relates to a two-stage short circuiting device which operates in a very short time and achieves high contact pressure.

Short circuiters of the type to which my invention is directed are well known in the art, and are commonly used to short circuit a faulted piece of electrical equipment so as to protect the faulted equipment until slower series connected circuit interrupting apparatus may be operated.

Short circuiters are particularly useful in conjunction with rectifier equipment, as has been described in copending application Serial No. 725,035, filed March 31, 1958, entitled Parallel Connected Short Circuiters for Rectifier Devices, in the name of Johann Bohm.

The device described in the above noted application is comprised of two individual short circuiters wherein the first is of a relatively low capacity, while the second is of a relatively high capacity. The relatively low capacity short circuiter utilizes movable elements of relatively low mass so that its operation is extremely rapid. Thus, this first short circuiter short circuits the electrical equipment to be protected in an extremely short time. The second short circuiter, which is of a relatively high current carrying capacity and has movable elements of relatively high mass, closes second and provides the required short circuit capacity for the system.

Thus, the short circuiter is comprised of two individual elements which operate sequentially wherein initial low rated current capacity short circuit protection is provided within a very short time.

The principle of the instant invention is to provide the sequential short circuit protection described in the above noted application with a single short circuiter.

More specifically, I provide a movable element which is accelerated by an extremely high initial force such as electrodynamic forces or by an explosive charge. Once the movable contact engages its cooperating stationary contact, a substantial part of the accelerating force is lost, since by the nature of the very rapid accelerating operating means, the extremely high initial operating forces decrease very rapidly.

The second stage of the novel short circuiter causes an expansion of the movable contact so that substantially high contact engaging forces are achieved whereby the movable contact, which is initially moved to its engaged position under extremely high accelerating forces and with a relatively low contact pressure, is expanded to provide the required high contact pressure required for conduction of relatively high short circuit current. This second operating means may be hydraulically energized, and comprises a piston type device which cooperates with a relatively non-compressible medium within the core of the movable contact. Thus, when the piston moves into the core, the sides of the movable contact bulge outwardly, but within their elastic limit. Thus, high contact pressures are achieved, but when the hydraulic expanding

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force is removed, the movable contact material will return to its initial shape.

Accordingly, the primary object of my invention is to provide a novel high speed circuit closing device.

Another object of my invention is to provide a novel short circuiter which operates first in a high speed engaging action, and, secondly, in a contact expanding action.

Another object of this invention is to provide a two-stage short circuiter utilizing a single set of components wherein the initial stage is operated by an operating means which is characterized in delivering an extremely high accelerating force for a relatively short time, and to thereafter or at the same time, apply a second operating force at a relatively low acceleration, but characterized in delivering a relatively constant force.

Another object of this invention is to accelerate the movable contact of a short circuiter device by an initial extremely high accelerating force until the movable contact engages the stationary contact, and to thereafter cause the movable contact to deform so as to achieve a relatively high contact pressure between the stationary contact and movable contact.

These and other objects of my invention will become apparent from the following description when taken in conjunction with the drawings, in which:

Figure 1 is a side cross-sectional view of a preferred embodiment of my invention.

Figure 2 is a perspective view of portions of the structure of Figure 1.

Referring now to Figure 1, the complete short circuiter device is mounted on an insulating base plate 1 which carries the bus bars 2 and 3, as seen in Figures 1 and 2, as well as bus bars 4 and 5 of Figure 2.

It is to be understood that as many buses will be provided as there are electrical connections to be connected in short circuit relationship.

The end of each of the buses 2, 3, 4 and 5 are terminated to define a conical aperture with the individual buses being spaced apart from one another so as to electrically isolate them from one another.

The movable contact is comprised of conically-shaped contact 6 which is carried by operating pushrod 7 where the conical surface of contact 6 is spaced from the conical surfaces of buses 2, 3, 4 and 5. The interior of contact 6 is comprised of a core 8 of relatively non-compressible material which, as will be seen hereinafter, has a pressure applied thereto so as to cause the periphery of the cone-shaped contact which engages the stationary contacts to expand after contact engagement and thus achieve a relatively high contact pressure.

The operating system for operating pushrod 7 and, thus, the contact 6 is supported within a housing formed by disc 9, cylindrical housing 10, and bell-shaped dome 11. These members are connected together in airtight relationship, as by the gasket means 12, between disc 9 and cylinder 10 and the gasket means 13 and 14 on either side of insulator disc 15 which is sandwiched between bell-shaped dome 11 and cylinder 10. The entire assembly is supported from the bus bars, as by insulating cylinders 16 and 17 of Figures 1 and 2, which have one end of bolts 18 and 19 respectively terminated therein with the other end of bolts 18 and 19 terminated in the insulating support 1.

For purposes of illustrating this novel invention, I have chosen to initially accelerate the movable contact 6 to its engaged position by a dynamic accelerating system of the type set forth in copending application Serial No. 558,522 filed January 11, 1956, entitled Electrodynamic Circuit Breaker in the names of Fritz Kesselring and Edward J. Diebold. To this end, the disc 15 carries a winding 20 therein which is energizable as by energization of

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terminal 21 with the other end of coil 20 being grounded to a ground which could be common to the energizing source. This energizing source will be activated responsive to a predetermined condition, such as a fault on the electrical equipment being protected by the short circuiting device.

Coil 20 cooperates with a disc 22 of conductive material which is supported from pushrod 7 by spoke means, as best seen in Figure 2, and is secured thereto in any desired manner, such as by bolt 23. The conductive ring 22 operates as a winding which is inductively coupled with winding 20 whereby energization of winding 20 will induce a circulating current in ring 22 so that the magnetic fields of the currents in winding 20 and winding 22 will oppose one another to cause an extremely high repulsive force which will drive ring winding 22 downwardly. This force will initially be of a substantial magnitude so as to drive contact 6 towards the contact engaging position within a very short time after the energization of winding 20. However, once the ring 22 has moved downwardly, the force applied thereto because of winding 20 is substantially diminished. Thus, while initial contact engagement is achieved extremely rapidly, this contact engagement is without any substantial contact pressure so that the movable contact 6 will weld with respect to its stationary contacts, if a substantial current is conducted thereby.

It is to be noted that the disc 22 is biased into extremely close proximity with respect to winding 20 by the biasing spring 24.

In order to impart a high contact pressure to the system once the contacts have been initially closed, the pushrod 7 is provided with an aperture which contains a movable rod 25 therein which is movable into engagement with the relatively non-compressible core 8.

The protruding end of rod 25 is engageable by piston 26 which is movable within the cylinder 27 formed by bell-shaped member 11, and is carried therein by piston rod 28 supported from extension 29 of bell-shaped member 11.

A valve 30, which may be of any desired type, admits pressure from a pressure source (not shown) through passage 31 and passage 32 into areas 33 above the piston 26, and area 34 below the piston 26 respectively. With these two areas at the same pressure the piston 26 will be held in position by spring 35 which is relatively weaker than spring 24. Thus, prior to automatic operation of the system, the piston 26 will be in the position shown.

Area 34 is isolated from area 36 which communicates with a relatively low pressure area by conduit 37 when the disc member 22 is in the non-operated position shown, since the outer periphery of disc 22 forms a closed slide valve which prevents communication between areas 34 and 36.

In operation, energization of terminal 21 will cause the initial downward movement of disc 22 and initial high speed contact engagement of contact 6. Simultaneously, the movement of disc 22 will allow communication between the relatively high pressure area 34 and relatively low pressure area 36 whereby the gas or fluid in area 34 will be vented so as to allow the relatively high pressure in area 33 on top of piston 26 to drive piston 26 downwardly. The downward motion of piston 26 will cause a downward motion of rod 25 which moves into engagement with the relatively non-compressible mass 8 whereby the sides of contact 6 will bulge to cause a high pressure contact engagement of contact 6 with respect to the stationary contacts, such as stationary contacts 2, 3, 4 and 5 of Figure 2.

The deflection of the walls of contact 6 will be kept within its elastic limit so that when the short circuiter is to be reset the pressure is removed from core 8, and the walls of contact 6 will assume their original dimensions.

In order to reset the disc 22, piston 26 is provided with

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extensions 37 and 38 which extend through apertures in disc 22 and are terminated by a ring 39 which is below the disc 22. Therefore, it is only necessary to apply pressure at conduit 32 and decrease the pressure at conduit 31 (vent 32 being closed off by piston 26) whereby a pressure is applied in area 34 to move piston 26 upwardly, the ring or disc 22 being moved upwardly along with piston 26. This upward motion will continue until the ring 22 closes off the communication between area 36 and 34, at which time vent 32 is exposed and equalizes the pressure on either side of ring 26 and the short circuiter system is then reset for a new operation.

Although I have described preferred embodiments of my novel invention, many variations and modifications will now be obvious to those skilled in the art, and I prefer therefore to be limited not by the specific disclosure herein but only by the appended claims.

I claim:

1. A short circuiter device comprising a relatively movable contact and a pair of relatively stationary contacts positioned to be bridged by said movable contact; a first operating means for operating said movable contact, said first means being operatively connected to said movable contact and being characterized in imparting a relatively high initial acceleration to said movable contact for moving said contact to its bridging position with respect to said pair of stationary contacts; a second operating means for operating said movable contact; said second means being operatively connected to said movable contact and being characterized in imparting a relatively constant force to said movable contact for achieving a relatively high contact pressure between said movable contact and said pair of stationary contacts; said first and second operating means being operatively associated with respect to one another for sequential operation; said first operating means initiating operation of said second operating means after a predetermined motion of said first operating means; said second operating means becoming operative after said first operating means positions said movable contact in its said bridging position.

2. A short circuiter device comprising a relatively movable contact movable into engagement with a relatively stationary contact; a first operating means for operating said movable contact to said engaged position; said first operating means being operatively connected to said movable contact and being characterized in imparting a relatively high initial force to said movable contact to accelerate said movable contact toward its said engaged position; a second operating means for said movable contact; said second operating means being operatively connected to said movable contact and being characterized in imparting a relatively constant force to said movable contact for achieving a relatively high contact pressure between said movable contact and said stationary contact; said first and second operating means being operatively associated with respect to one another for sequential operation; said first operating means initiating operation of said second operating means after a predetermined motion of said first operating means; said second operating means becoming operative after said first operating means positions said movable contact in its said bridging position.

3. A short circuiter device comprising a relatively movable contact movable into engagement with a relatively stationary contact; a first operating means for operating said movable contact to said engaged position; said first operating means being operatively connected to said movable contact and being characterized in imparting a relatively high initial force to said movable contact to accelerate said movable contact toward its said engaged position; a second operating means for said movable contact; said second operating means being operatively connected to said movable contact and being characterized in imparting a relatively constant force to said movable contact for achieving a relatively high contact pressure between said movable contact and said stationary contact;

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said first operating means comprising an electrodynamic system including a first winding operatively secured to said movable contact; said first winding being inductively associated with an operating winding.

4. A short circuiter device comprising a relatively movable contact movable into engagement with a relatively stationary contact; a first operating means for operating said movable contact to said engaged position; said first operating means being operatively connected to said movable contact and being characterized in imparting a relatively high initial force to said movable contact to accelerate said movable contact toward its said engaged position; a second operating means for said movable contact; said second operating means being operatively connected to said movable contact and being characterized in imparting a relatively constant force to said movable contact for achieving a relatively high contact pressure between said movable contact and said stationary contact; said stationary contact being constructed to at least partially surround at least a portion of said movable contact when said movable contact is in its said engaged position; said second operating means imparting a physical stress to said movable contact to distort said movable contact into high pressure contact engagement with respect to said stationary contact.

5. A short circuiter device comprising a relatively movable contact movable into engagement with a relatively stationary contact; a first operating means for operating said movable contact to said engaged position; said first operating means being operatively connected to said movable contact and being characterized in imparting a relatively high initial force to said movable contact to accelerate said movable contact toward its said engaged position; a second operating means being operatively connected to said movable contact and being characterized in imparting a relatively constant force to said movable contact for achieving a relatively high contact pressure between said movable contact and said stationary contact; said stationary contact being constructed to at least partially surround at least a portion of said movable contact when said movable contact is in its said engaged position; said second operating means imparting a physical stress to said movable contact to distort said movable contact into high pressure contact engagement with respect to said stationary contact.

6. A short circuiter device comprising a relatively movable contact and a pair of relatively stationary contacts positioned to be bridged by said movable contact; a first operating means for operating said movable contact, said first means being operatively connected to said movable contact and being characterized in imparting a relatively high initial acceleration to said movable contact for moving said contact to its bridging position with respect to said pair of stationary contacts; a second operating means for operating said movable contact; said second means being operatively connected to said movable contact and being characterized in imparting a relatively constant

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force to said movable contact for achieving a relatively high contact pressure between said movable contact and said pair of stationary contacts; said first operating means comprising an electrodynamic system including a first winding operatively secured to said movable contact; said first winding being inductively associated with an operating winding.

7. A short circuiter device comprising a relatively movable contact and a pair of relatively stationary contacts positioned to be bridged by said movable contact; a first operating means for operating said movable contact, said first means being operatively connected to said movable contact and being characterized in imparting a relatively high initial acceleration to said movable contact for moving said contact to its bridging position with respect to said pair of stationary contacts; a second operating means for operating said movable contact; said second means being operatively connected to said movable contact and being characterized in imparting a relatively constant force to said movable contact for achieving a relatively high contact pressure between said movable contact and said pair of stationary contacts; said pair of stationary contacts being constructed to at least partially surround at least a portion of said movable contact when said movable contact is in said engaged position; said second operating means being constructed to impart a physical stress to said movable contact when said movable contact is in said bridging position to distort said movable contact into high pressure engagement with respect to said pair of stationary contacts.

8. A short circuiter device comprising a relatively movable contact and a pair of relatively stationary contacts positioned to be bridged by said movable contact; a first operating means for operating said movable contact, said first means being operatively connected to said movable contact and being characterized in imparting a relatively high initial acceleration to said movable contact for moving said contact to its bridging position with respect to said pair of stationary contacts; a second operating means for operating said movable contact; said second means being operatively connected to said movable contact and being characterized in imparting a relatively constant force to said movable contact for achieving a relatively high contact pressure between said movable contact and said pair of stationary contacts; said pair of stationary contacts being constructed to at least partially surround at least a portion of said movable contact when said movable contact is in said engaged position; said second operating means being constructed to impart a physical stress to said movable contact when said movable contact is in said bridging position to distort said movable contact into high pressure engagement with respect to said pair of stationary contacts; said first operating means comprising an electrodynamic system including a first winding operatively secured to said movable contact; said first winding being inductively associated with an operating winding.

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