United States Patent [19]

Miles

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[54] **VACUUM SWITCHING SYSTEM**

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[52] **U.S. Cl.** ..... **200/144 B**

[51] **Int. Cl.** **H01h 33/66**

[58] **Field of Search** ..... 200/144 B

[56] **References Cited**

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[57] **ABSTRACT**

A vacuum switching system having an evacuated housing and a plurality of electrical contacts therein. A buss is provided for internal connection to one of said contacts of said plurality of pairs. Another of said contacts may be connected to an external circuit. The other contacts of said pair are electrically connected to a shorting member and means are provided for electrically connecting and separating the pair of electrical contacts. Further, the system may comprise a plurality of sets of pairs of contacts with shielding means between adjacent sets. In addition, shielding means may be provided in the system wherever needed, in order to prevent splattering of parts of the system.

4 Claims, 3 Drawing Figures

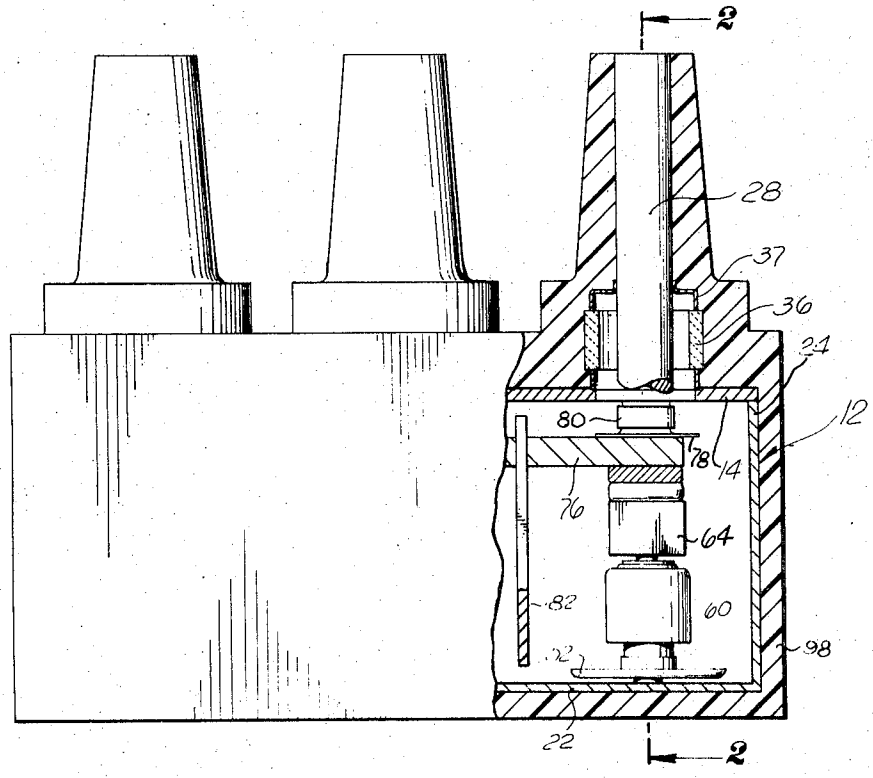
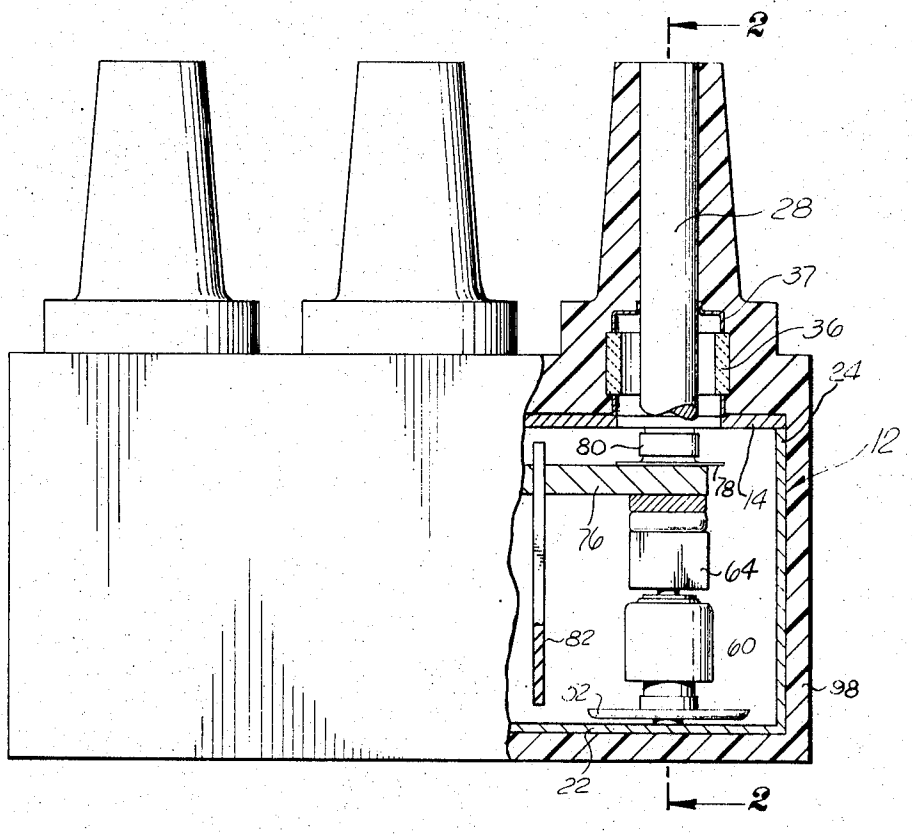


Fig. 1.



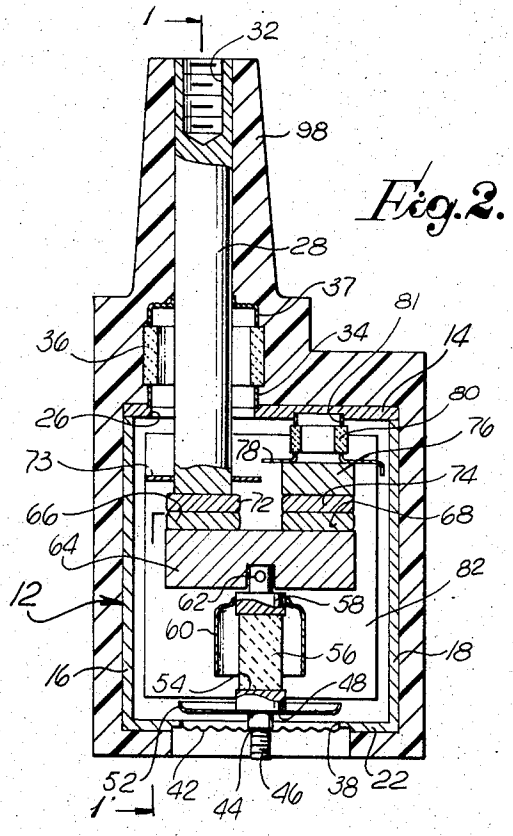
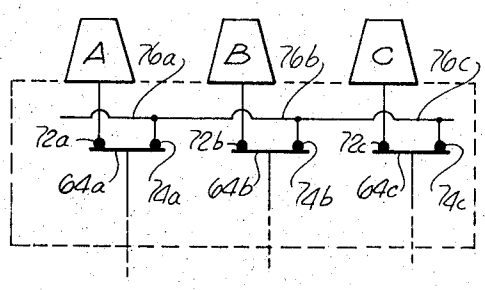


Fig. 2.

Fig. 3.



VACUUM SWITCHING SYSTEM

The invention relates in general to vacuum switching systems and, more particularly, to a multi-pole vacuum interrupter system.

BACKGROUND OF THE INVENTION

With the advent of greater use of underground power systems, it has been found that prior art underground installations have been extremely large as well as expensive. In the case of underground switching systems, two types of systems have previously been used. Where an air break system is used, it has been found that a costly maintainance program must be provided in order to continuously replace worn out parts in the system. Alternatively, oil filled switching members have been used, which have been found to be hazardous in that explosions, as well as fires have occured. Moreover, these systems are extremely large and are required to have extremely large vault installations.

In order to overcome the attendant disadvantages of prior art underground switching systems, the present invention is much smaller in physical size thereby required smaller vaults. Moreover, the safety hazards to maintainance and installation men are eliminated. With the improved safety and reduction in maintainace and physical sizes, installation problems which previously required a large crew are eliminated with the result that the entire switching system can be installed by a single person. Moreover, the unique modular construction of the system allows a multiplicity of switching arrangements.

The advantages of the invention, both as to its construction and mode of operation, will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like referenced numerals designate like parts throughout the figures.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 depicts a front view partly in section of the switching system in accordance with the invention;

FIG. 2 illustrates a side view of the switching system of FIG. 1 taken along the line 2—2 of FIG. 1; and

FIG. 3 shows a schematic diagram of the switching system to illustrate the alternative switching arrangements possible therewith.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings there is shown in FIGS. 1 and 2, a unique vacuum switching system made in accordance with the principles of the invention. The system comprises an elongated steel vacuum housing member 12 in which the contacts of the switching system are mounted. The housing member 12 comprises a top wall 14, side walls 16, 18, and a bottom wall 22, as well as end walls 24. Openings 26 are formed in the top wall through which conductor rods such as the member 28 protrude therethrough. The opening 26 has a diameter greater than the conductor rod 28. The conductor rod 28 extends upwardly from the housing member and terminates at a threaded portion 32 to which an electrical conductor (not shown) may be secured.

A metallic ring 34 having a diameter approximately equal to the opening 26 extends upwardly at one end from the opening and surrounds the conductor rod 28 but is spaced therefrom. The other end of the metallic ring 34 has secured thereto a ceramic insulator shell 36 which also surrounds the conductor rod 28 and is spaced therefrom. Secured to the other end of the insulator shell 36 is one end of a metallic end bell with the other end of the end bell being secured directly to the conductor rod 28 thus forming a vacuum seal between the conductor rod 28 and the housing 12.

Formed in the bottom wall 22 of the housing are openings 38 into which a metallic diaphragm 42 is inserted. The diaphragm 42 provides a tight vacuum seal to the opening 38 of the housing. An opening 44 is centrally formed in the diaphragm 42 and an actuating member is secured thereto. The connection between the diaphragm 42 and the housing opening 38 as well as the actuating member 46 is such that a tight vacuum will remain in the housing after the connections have been made.

The actuating member 46 contains a downwardly facing shoulder 48 to which a diaphragm shield 52 is secured. Further, the top surface 54 of the actuating member has secured thereto an insulator 56 at the bottom surface thereof. The top surface of the insulator contains a connecting member 58. A downwardly facing shield 60 is secured to the connecting member 58. The connecting member 58 contains a reduced diameter section 62 which fits into an opening formed in a generally rectangular shaped shorting bar 64. The top surface of the shorting bar 64 has secured thereto a pair of contacts 66, 68.

Secured to the bottom of the conductor rod 28 is a contact 72. The contact 72 is identical to the contact 66 and in the position shown in FIGS. 1 and 2 is electrically connected thereto. Further, a shield 73 is secured to the conductor rod 28 between the contact 72 and the opening 26 in the top wall so as to protect the ceramic insulator shell 36 from splatter. A contact 74 is adjacent to the contact 68 and also in the positions shown in FIGS. 1 and 2 is electrically connected thereto.

The top surface of the contact 74 is secured to an internal bussing member 76. Further, a header 78 is secured to the bussing member directly above the contact 74 and thus forms a shield as well. The central portion of the header is secured to a ceramic insulator 80 which electrically isolates the internal bussing member 76 from the housing 12. The header 78 is used to protect the insulator 80 from splatter. The insulator 80, in turn, is connected through a header 81 to the inner surface of top wall 14.

The internal bussing member 76 extends lengthwise along the housing and is secured to a conductive shield 82. The conductive shield forms a partition between adjacent sets of contacts in the housing member, and is electrically isolated from the housing 12. Thus, an identical arrangement as that shown in FIG. 2 is separated from the arrangement of FIG. 2 by means of the conductive shield 82. As can be readily seen, downward movement of the actuating member 46 in turn causes the shorting bar 64 and the contacts 66, 68 secured thereto to be separated from the contacts 72 and 74, respectively. This, in turn, would electrically disconnect the conductor rod 28 from the common terminal formed by the internal bussing member 76.

Referring now to FIG. 3, there is shown a schematic embodiment for a typical arrangement utilizing a plurality of sets of contacts of the type shown in FIG. 2. In FIG. 3, bussing bars **64***a*, **64***b* and **64***c*, are used to interconnect the contacts **72***a* and **74***a*, **72***b* and **74***b*, and **72***c* and **74***c*, respectively. The contacts **74***a*, **74***b*, **74***c*, in turn, are connected to an internal bussing arrangement formed by the interconnected members **76***a*, **76***b*, and **76***c*. Thus, as can be readily seen, movement of any one or all of the contacts **64**, **64***b*, and **64***c* can cause a variety of interconnections between the various terminals of the circuit.

Further, since the device is intended for use with very large currents, it is necessary to provide shields **52**, **60**, **73**, **78** and **82** to prevent spattering which may occur. Moreover, as is conventional, the entire housing is surrounded by a conventional filled epoxy potting compound **98**.

What is claimed is:

1. A vacuum switching system comprising:

an evacuated housing;

a plurality of sets of electrical contacts each comprising at least two pairs of contacts, each of said pairs comprising first and second contacts;

bussing means for internally connecting all of said first contacts of one of said pairs of each of said sets together;

and shorting means electrically and mechanically joining said second contacts of each of said pairs in each of said sets.

2. Apparatus according to claim **1** including a plurality of discrete external electrical terminal providing external connections, one from each first contact of the other pair of said contacts in each of said sets.

3. Apparatus according to claim **1** in which said first contacts of said pairs of contacts in each of said sets are fixed contacts and said second contacts joined by said shorting means are the moving contacts, thereby forming a double vacuum-gap switch within each of said sets.

4. Apparatus according to claim **1** in which said bussing means are secured to said housing through an insulating member and shielding means are provided for prevention of spatter deposition from said contacts onto said insulating member.

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