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SWITCHING ASSEMBLY COMPRISING A PLURALITY OF SEALED UNITS

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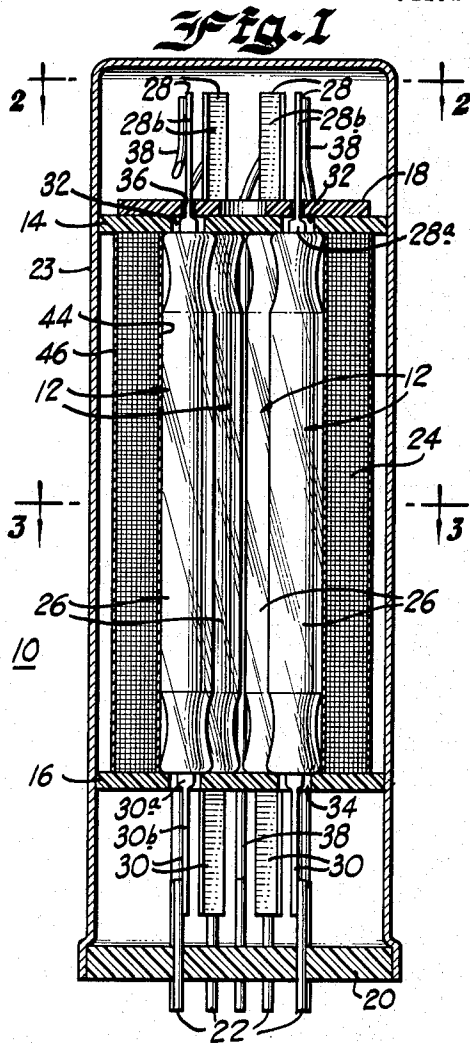
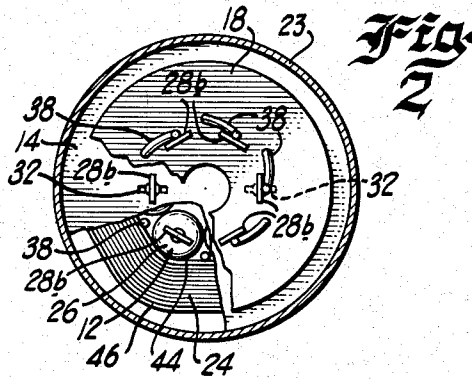
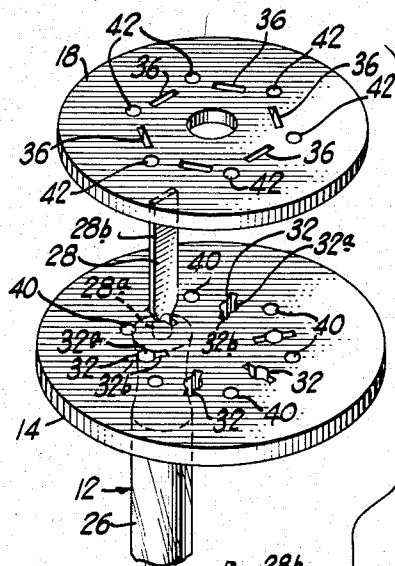
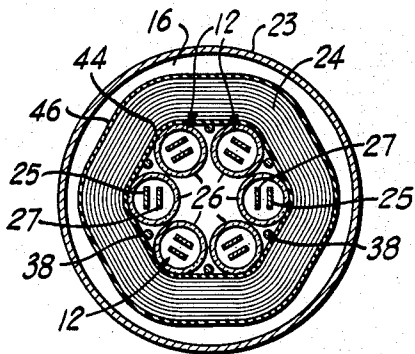
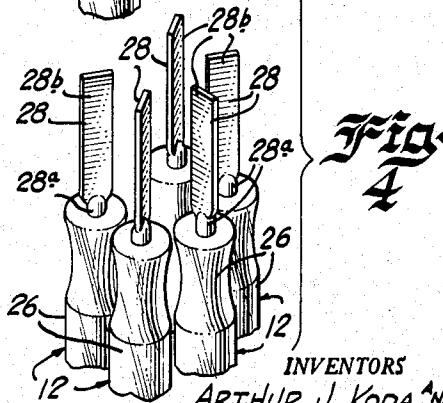


Fig. 3

Fig. 4

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SWITCHING ASSEMBLY COMPRISING A
PLURALITY OF SEALED UNITSArthur J. Koda, Morton Grove, Ill., and Donald R.
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6 Claims. (Cl. 200-87)

This invention relates to a switch construction, and more particularly, to a switching assembly including a plurality of sealed switch units and a method of making this assembly.

Because of the desirable operating characteristics of individual sealed switch units, such as mercury contact switches or dry reed switches, various devices have been proposed for using a plurality of these sealed units to provide a switch having a switching capacity approximating that of conventional multiple contact electromagnetic relays. In some of the prior devices, a plurality of sealed switch units are enclosed within a single operating coil so that all of the units are concurrently operated by the energization of the coil. However, many of these prior devices are costly to fabricate because of the variety of separate parts used and the number of assembly operations required. As an example, it is frequently necessary to provide separate structures for supporting the sealed switch units in a desired position and for providing a bobbin that carries the common operating coil. Thus, in addition to multiplying the separate parts required for the switch construction, a number of separate manipulative steps are required to form the separate sealed switch assembly and bobbin assembly and to assemble these two units.

Accordingly, one object of the present invention is to provide a new and improved switching assembly.

Another object is to provide a switch construction using a plurality of separate sealed switch units.

A further object is to provide new and improved means for supporting and making electrical connections to a plurality of sealed switch units.

Another object is to provide new and improved means for supporting a plurality of sealed switch units in a desired position in a switching assembly.

A further object is to provide a switching assembly in which a plurality of sealed switch units are held in predetermined positions by elements forming a part of a bobbin for receiving the operating winding for the assembly.

A further object is to provide a method of assembling a plural unit switch.

Another object is to provide a new and improved method of assembling a plurality of sealed switch units and of providing an operating coil for the switch units.

A still further object is to provide a method of making a switching assembly including a plurality of sealed switch units in which the operating coil is wound directly on the switch units in the assembly.

In accordance with these and many other objects, an embodiment of the invention comprises a switching assembly including a plurality of individual sealed switch units. Each of the sealed switch units includes an elongated dielectric housing or envelope from the opposite ends of which extend a pair of terminals having generally flat portions. A pair of spacer or bobbin plates are mounted on the terminals of the switch units, and these units are then rotated so that the plates are secured thereon by the flat portions on the terminals. A locking plate is placed on the flat portions of the terminals to prevent inadvertent rotation of the switch units to a position in which the spacer and bobbin plates can be disassembled from the switch units. To provide the sole

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means for supporting the sealed switch units and for extending electrical connections thereto, the terminals at one end of the housings are secured to pins on a header plate, and the terminals at the other end of the housings are connected to the terminal pins on the header plate by electrical conductors.

To provide an operating winding for the switching assembly, the assembly including the header plate, the sealed switch units, and the locking and bobbin or spacer plates is then placed in a coil winding machine and rotated so that the winding is wound directly on the dielectric housings of the sealed switch units disposed between the bobbin plates. The ends of the windings are electrically connected to the terminal pins on the header plate, and the assembly is inserted into a protective housing. By the use of the spacer or bobbin plates carried on the opposite ends of the dielectric housings of the plurality of sealed switch units, the number of parts required to form the switching assembly is materially reduced. Further, the use of these plates permits the operating winding for the switching assembly to be wound directly on the dielectric envelopes of the sealed switch units with the attendant reduction in the time required to make the switch.

Many other objects and advantages of the present invention will become apparent from considering the following detailed description in conjunction with the drawings in which:

FIG. 1 is a sectional view of a switching assembly embodying the invention;

FIG. 2 is a sectional view taken along line 2-2 in FIG. 1 assuming that the entire switching assembly is illustrated therein;

FIG. 3 is a sectional view taken along line 3-3 in FIG. 1, again assuming that the entire switching construction is shown in FIG. 1; and

FIG. 4 is a fragmentary exploded view illustrating the assembly of locking and spacing means with a plurality of sealed switch units included in the switching assembly.

Referring now more specifically to FIG. 1 of the drawings, therein is illustrated a switching assembly 10 which embodies the present invention and which includes a plurality of sealed switch units 12. The sealed switch units 12 are held in a generally parallel relationship by a pair of bobbin or spacer plates 14 and 16 which are secured to opposite ends of the sealed switch units 12 by interlocking means formed on the terminals of the switching units 12 and the spacer plates 14 and 16. A locking plate 18 disposed adjacent the upper spacer or bobbin plate 14 holds the switch 12 in interlocking relation with the plates 14 and 16. To provide the sole means for supporting the switch units 12 and to provide means for extending electrical connections thereto, a dielectric header plate 20 including a plurality of terminal pins 22 is provided. Some of the terminal pins are connected directly to the adjacent terminals of the switch units 12, and others of the terminal pins 22 are connected to the remote terminals of the switch units 12 by electrically conductive means.

To provide an operating winding for the switching assembly 10, the subassembly including the switch units 12, the header plate 20, the locking plate 18, and the spacer and bobbin plates 14 and 16 is placed in a coil winding machine and rotated. A length of an electrical conductor is then wound around the outer surfaces of the switch units 12 in the area disposed between the bobbin plates 14 and 16 to provide an operating winding 24. The leads to the winding 24 are connected to a pair of terminal pins 22, and a protective housing 23 is secured to the header plate 20 to seal the switching assembly 10. By providing the spacer and bobbin plates 14 and 16 for

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both securing the switch units 12 in the desired relative positions and providing bobbin plates for the winding 24, the number of parts required to form the switching assembly 10 is reduced. Further, the plates 14 and 16 permit the operating winding 24 to be directly wound on the switch units 12 to reduce the time required to make the switching assembly 10.

The individual sealed switch units 12 can comprise any of the constructions well known in the art, such as the dry reed relay shown in Ellwood Patent No. 2,289,830, the mercury contact switch shown in Burton Patent No. 2,577,602, or the pivoted armature switch unit shown in the copending application of Wilhelm Juptner, Serial No. 678,236, filed August 14, 1957, now Patent No. 3,033,956. In general, the switch units 12 each comprise an elongated and generally cylindrical dielectric or glass housing or envelope 26 containing one or more switching components, such as a pair of flexible magnetic elements 25 and 27 (FIG. 3), which are actuated by the application of a magnetic field. The actuation of the switching components selectively completes or interrupts conductive circuits between a pair of terminals and that are carried on and extend through the dielectric envelope 26. In the switching units 12 illustrated in the drawings, the upper end of the envelope 26 is provided with a single magnetic terminal 28 to which one of the elements 25 and 27 is secured, and the lower end of the envelope 26 is provided with a single electrically conductive and magnetic terminal 30 for supporting the other one of the elements 25 and 27. Each of the terminals 28 and 30 includes a generally cylindrical portion 28a or 30a disposed immediately adjacent the dielectric housing 26 and a flat portion 28b or 30b at the end of the terminal. The flattened portions 28b and 30b provide means for locking the plates 14 and 16 on the switch units 12.

The spacer and bobbin plates 14 and 16 provides means both for holding the switch units 12 in a desired position in which the housings 26 are generally parallel to each other and for providing the end elements of a bobbin construction for receiving the winding 24. When the switching assembly 10 is to be formed, the flat portions 28b of the terminals 28 on the switch units 12 are each inserted into an opening 32 (FIG. 4) in the plate 14 comprising a rounded portion 32a and an elongated portion 32b, and the switch units 12 are advanced so that the cylindrical portion 28a on each of the terminals 28 is received in the rounded portion 32a of the openings 32. In a similar manner, the terminals 30 at the other end of the housings 26 are each inserted into a similarly formed opening 34 (FIG. 1) in the spacer or bobbin plate 16. In order to secure the plate 14 and 16 in an assembled relationship, each of the switch units 12 is rotated through approximately 90° so that the flat portions 28b and 30b extend transverse to and out of alignment with the elongated portions 32b in the openings 32 and the similarly formed portions of the openings 34. Thus, the flat portions 28b and 30b and the openings 32 and 34 provide interlocking means for securing the bobbin and spacer plates 14 and 16 in a desired position in which the housings 26 of the switch units 12 extend generally parallel to and spaced from each other in a circular array.

To provide means for locking the switch units 12 in their rotated positions so as to prevent inadvertent movement of the flat portions 28b and 30b into alignment with the elongated portions of the openings 32 and 34, the locking plate or means 18 is provided. The plate 18 includes a plurality of elongated openings 36 (FIG. 4) adapted to receive the flat portions 28b of the terminals 28. After the plate 14 has been assembled on the terminals 28 and the switch units 12 have been rotated to the locking position, the flat portions 28b are inserted into the openings 36 and the plate 18 is moved adjacent the plate 14. The elongated openings 36 extend transverse to the elongated portion 32b of the openings 32 so

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that the terminals 28 and the switch units 12 are held in their displaced position. Therefore, these units cannot be inadvertently returned to a position in which the elongated portions 32b of the openings 32 are aligned with the flat portions 28b. By securing the switch units 12 in their rotated positions, the locking plate 18 prevents the terminals 30 from being turned into alignment with the elongated portions of the openings 34.

As indicated above, the header plate 20 and the terminal pins 22 carried thereon provide the sole means for supporting the sealed switch units 12 which the housing 23 and for extending connections to these units. After the sealed switch units 12 have been secured in their predetermined positions by the plates 14, 16 and 18, the header plate 20 is positioned adjacent the terminals 20, and certain of the terminal pins 22 are directly secured thereto, as by soldering. Others of the terminal pins 22 are connected to terminal pin extensions or electrically conductive wires 38 which extend upwardly between adjacent ones of the switch units 12 and pass through aligned holes 40 and 42 in the plates 14 and 18, respectively, and similarly located holes in the plate 16. The upper ends of the conductors 38 are secured to the flat portions 28b of the terminals 28. Thus, the plates 14, 16 and 18, the sealed switch units 12 and the header plate 20 are rigidly secured together.

To provide the operating winding or coil 24 for the switching assembly 10, the assembled switch units 12 together with the plates 14, 16, 18 and 20 are placed or "chucked" in a coil winding machine. A layer of dielectric material 44 is then wrapped around the outer surface of the dielectric envelopes 26, and one end of a length of wire is secured to the subassembly. The coil winding machine is then placed in operation so that the subassembly is rotated and the winding or coil 24 is wound directly on the dielectric layer 44 in the space between the plate 14 and 16 which provide bobbin end walls or plates. After the coil 24 has been wound, the rotation of the subassembly is stopped, the wire is cut, and the leads to the winding 24 are secured to two of the terminal pins 22 carried on the header plate. A dielectric layer 46 can be wrapped around the outer surface of the coil 24. The subassembly with the coil 24 wound thereon is removed from the coil winding machine and inserted into the open end of the can or housing 23. The lower end of the can be is swaged over or otherwise secured to the outer periphery of the header plate 20 so as to provide a dust free enclosure for the switching assembly 10.

If, in some installations, it is desirable to provide a separate bobbin construction with the coil or winding 24 previously mounted thereon, the plates 14, 16 and 18 can be used to secure the bobbin and winding 24 in a proper position on the assembled switch units 12. More specifically, the sealed switch units 12 can be inserted into the axial opening in the bobbin construction and the plates 14, 16 and 18 assembled in the manner described above so that the clamping of the plates 14 and 16 between the flat portions 28b and 30b and the adjacent portions of the dielectric housings 26 serves to positively secure the bobbin and coil 24 in a desired position on the assembly. The connections to the terminal pins 22 on the header plate 20 are then made and the assembly is inserted into the protective housing 23.

Although the invention has been described with reference to a single embodiment thereof, many other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of the present invention.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. A switching assembly comprising a plurality of sealed switch units, each of said switch units including an elongated dielectric housing and at least two terminals extending from opposite ends of the housing, each of

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said terminals including a generally flat portion, and a pair of spacer plates each including a plurality of openings with a circular portion and an elongated portion, said plates being mounted on the terminals at opposite ends of the housings with the terminals received in the circular portions of the openings and the flat portions of the terminals positioned out of alignment with the elongated portions of the openings, said spacer plates holding said switch units in a predetermined position relative to each other.

2. The switching assembly set forth in claim 1 including a locking plate with a plurality of elongated openings therein, said locking plate being mounted on the terminals at one end of said housings with the flat portions of said terminals received within the elongated openings in said locking plate to prevent rotation of said switch units relative to said locking and spacer plates.

3. A switching assembly comprising a plurality of sealed switch units, each of said switch units including an elongated dielectric housing and at least two terminals extending from opposite ends of the housing, at least some of the terminals at both ends of the housing having a generally flat portion, and a pair of plates having spaced openings therein at least some of which are elongated, one of said plates being mounted on the terminals at each end of said housings with the terminals received in said openings, said plates being secured to said switch units to hold said switch units in an assembled relationship by rotating the switch units having terminals with flat portions so that the flat portions are not aligned with the elongated openings.

4. The switching assembly set forth in claim 3 including a locking plate having a plurality of spaced and elongated openings, said locking plate being mounted on the terminals at one end of said housing with the flat portions of the terminals received in the elongated openings in the locking plate, the elongated openings in the locking plate being out of alignment with the elongated openings in the other plates to prevent rotation of the switch units.

5. A switching assembly comprising a plurality of sealed switch units, each of said switch units including an elongated dielectric housing and a pair of terminals extending from opposite ends of said housing, each of said terminals having a generally flat portion spaced from the adjacent end of the housing, a pair of bobbin plates each having a plurality of spaced and elongated open-

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ings for receiving said flat portions, said bobbin plates being mounted on the terminals at the opposite ends of the housings and being held in position thereon to secure said switch units in a spaced relationship by turning said switch units so that the flat portions on said terminals are not aligned with the elongated openings in said bobbin plates, a locking means including a plurality of spaced and elongated openings, said locking means being mounted on the terminals at one end of said housings with the flat portions on the terminals received in the elongated openings in said locking means, the elongated openings in said locking means and the related bobbin plate being positioned out of alignment to prevent rotation of said switch units, and a winding mounted on said housing and extending between said bobbin plates.

6. A switching assembly comprising a plurality of sealed switch units, each of said switch units including an elongated dielectric housing and a pair of terminals extending from opposite ends of said housing, each of said terminals having a generally flat portion spaced from the adjacent end of the housing, a pair of bobbin plates each having a plurality of spaced and elongated openings for receiving said flat portions, said bobbin plates being mounted on the terminals at the opposite ends of the housing and being held in position thereon to secure said switch units in a spaced relationship by turning said switch units so that the flat portions of said terminals are not aligned with elongated openings in said bobbin plates, locking means engaging the terminals to secure the flat portions of the terminals in a position out of alignment with the elongated openings in the bobbin plates to prevent the separation of the bobbin plates from the switch units, and winding means mounted on said housings and extending between said bobbin plates.

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