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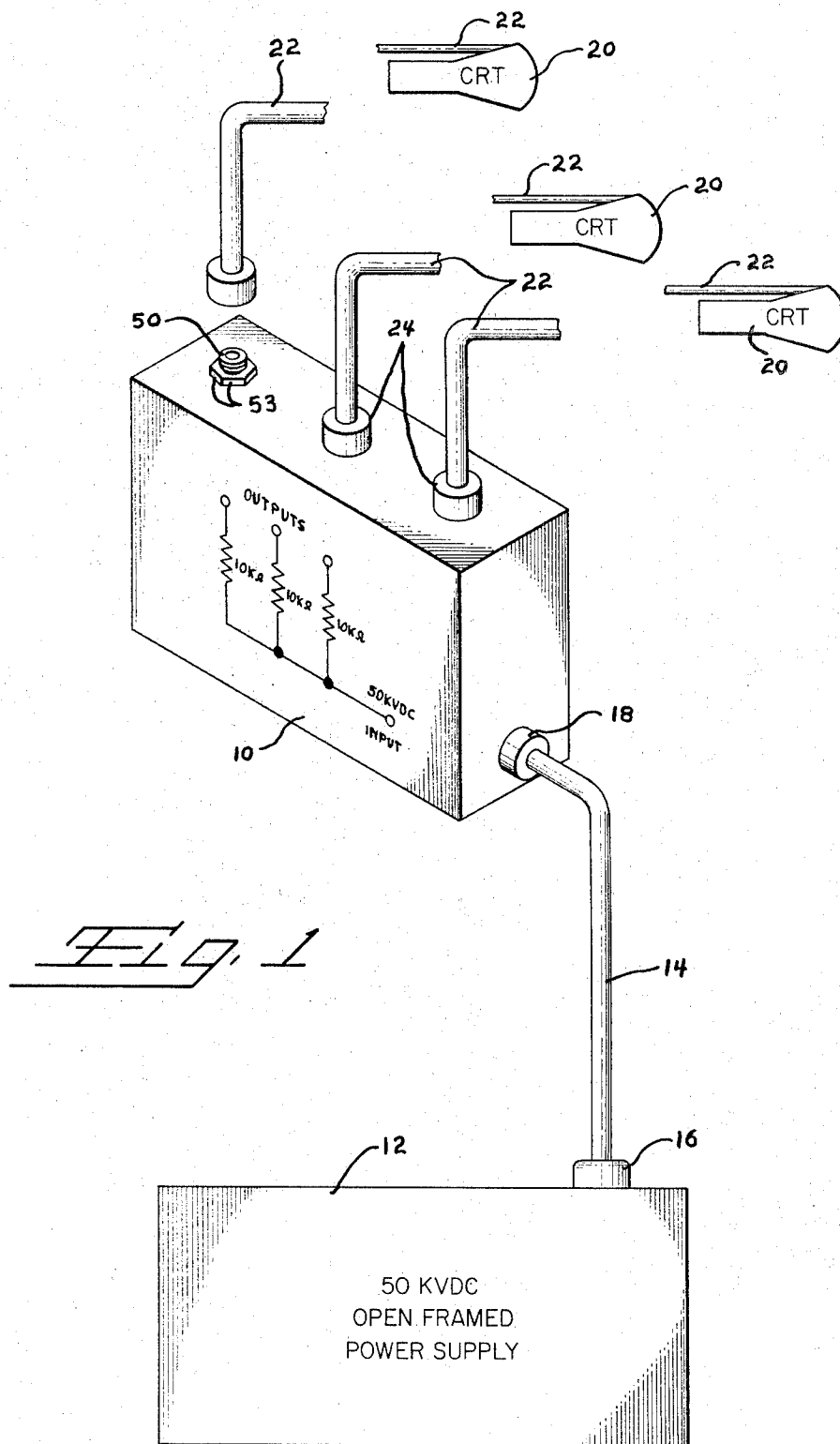
J. W. GAW

3,402,380

HIGH VOLTAGE COMPONENT PACKAGE

Filed March 16, 1967

2 Sheets-Sheet 1



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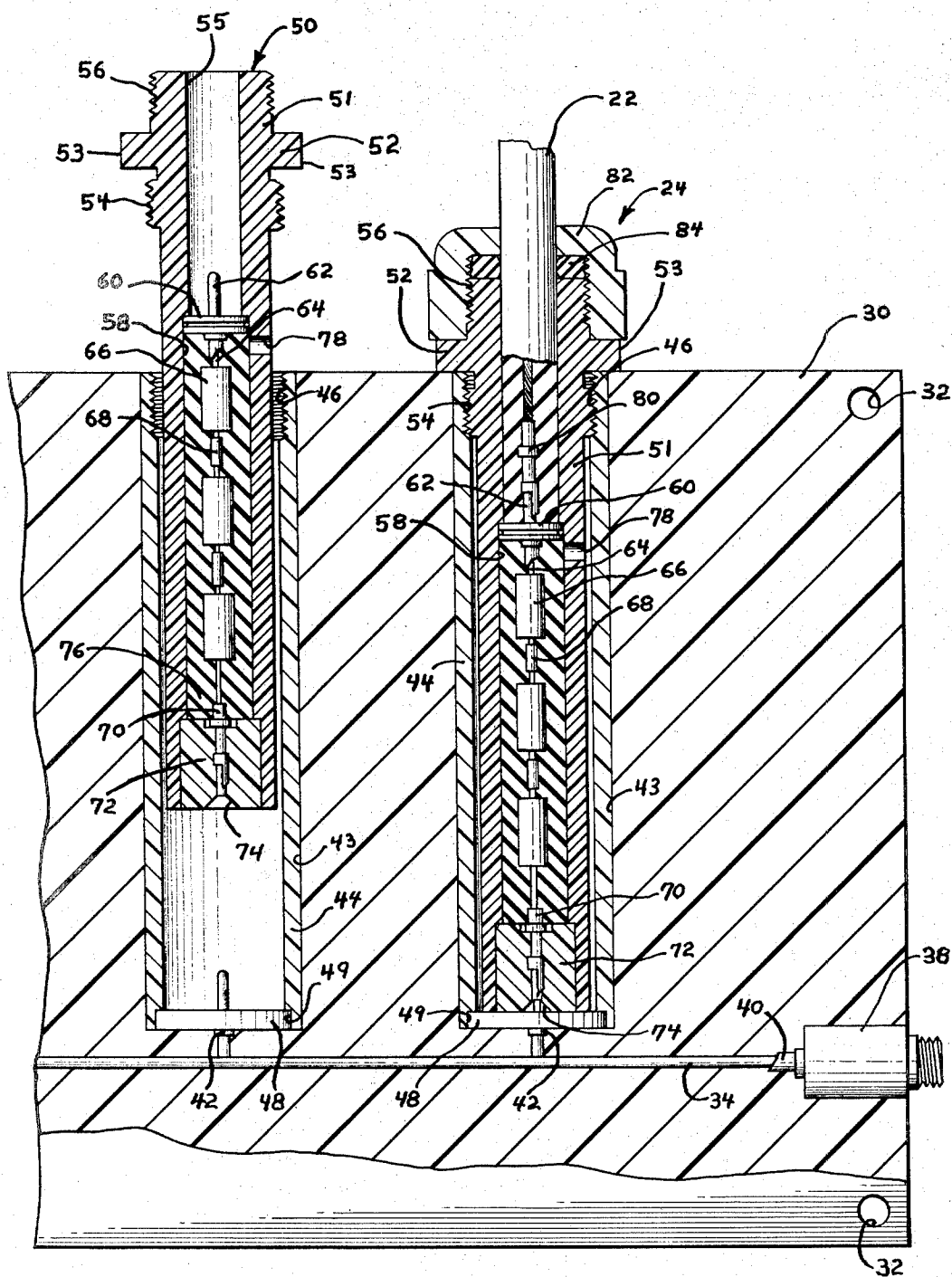


Fig. 2

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HIGH VOLTAGE COMPONENT PACKAGE
John William Gaw, Elizabethtown, Pa., assignor to AMP
Incorporated, Harrisburg, Pa.
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ABSTRACT OF THE DISCLOSURE

To provide a quick connect-disconnect and component replacement unit for high voltage circuits, conductive paths are encapsulated within an insulating block having a plurality of deep sockets. Each socket contains a contact member connected to a path as an output from a common input through a further contact member in a block receptacle supplied by a high voltage connector and input lead. Each output includes a removable plug member containing encapsulated surge resistors. The plug members are of a configuration to substantially fill a block socket and each plug member includes a contact mateable with the socket contact member at one end and a socket at the other end adapted to receive a high voltage connector and output lead.

Background of invention

The usual approach to eliminating corona discharge in high voltage circuits is to cover over all conductive paths so as to eliminate the presence of a corona supporting medium such as air. Typical high voltage leads are for this reason comprised of a thick covering of a corona resistant insulating material bonded to a conductive core. High voltage connectors are designed to exclude air from the mating conductive portions by providing inter-mating corona resistant insulating material driven in compression to surround the conductive portions. High voltage components are embedded or encapsulated in corona resistant material with connectors also encapsulated in the same package.

This latter practice has made component replacement expensive in that the associated connectors are replaced each time any component in the package is replaced. It has also made replacement of components difficult and not available to field services. With many types of equipment such as airborne, shipborne or vehicular radar, voltage variation is expected and surge resistors are employed in each high voltage supply. One example is in a cathode ray tube supply wherein three cathode ray tubes are supplied in parallel from a single 50 k.v. DC source. The 10K surge resistors employed in series with each tube high voltage circuit may be expected to fail or deteriorate to a point of required replacement rather frequently. Heretofore, replacement has taken considerable time and has required removal of the supply circuit chassis. The importance of this problem can be visualized by assuming that surge resistor failure occurs during a landing approach of an aircraft either using radar or being guided by the use of ground placed radar.

Summary of invention

The present invention relates to a high voltage corona resistant connector and component assembly which features quick connect-disconnect and component replacement for high voltage circuits. One object is to provide a compact and inexpensive solution to the problem of replacing high voltage components such as surge resistors, quickly and safely. Another object is to provide a high voltage termination block, permitting replacement of high voltage components connected in common to input and/or output leads. Still another object is to provide a corona

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resistant component, multiple connector assembly with all conductive paths sealed and surrounded by solid dielectric material. A further object is to provide a surge resistor connector block of a construction rugged enough for high voltage use in an adverse environment including vibration, moisture or high altitude.

The invention includes a block member of dielectric and insulating material having an input and a plurality of parallel output leads encapsulated therein. A high voltage connector receptacle is mounted in the block carrying a contact member connected to the input path and adapted to receive a high voltage connector and input lead. The parallel output leads in the block are connected to contact members at the bottom of relatively deep sockets formed in the block material. A plug member is provided for each socket and is made to substantially fill the volume of the socket. Each plug member contains a surge resistance encapsulated within the plug and connected at each end to a further contact member. One contact member is mateable with the socket contact member and the other is positioned within a plug socket and mateable with a high voltage connector and output lead.

In the drawings:

In FIGURE 1 is a schematic diagram in partial perspective showing the invention assembly relative to an exemplary voltage supply and load; and

FIGURE 2 is an elevation of the invention assembly shown in FIGURE 1, partially sectioned to reveal details of the structure.

Component description

Referring now to FIGURE 1, the invention assembly shown as 10 serves as a distribution network for a high voltage supply 12. The supply is connected to 10 by a high voltage lead 14 terminated at each end by a high voltage connector, connectors 16 and 18. The input to 10 is connected through parallel circuit paths therein each including a 10K surge resistor. Parallel outputs from 10 are connected to three cathode ray tubes 20 via high voltage connectors 24 connected to leads 22. These serve as the high voltage supply for the tubes 20.

As shown in FIGURE 2, the unit 10 is comprised of a block 20 of plastic material. A material of high insulating and dielectric strength such as epoxy is preferred. The block is poured in a mold and placed under vacuum to remove all air. The block is provided with means such as holes 32 which facilitate mounting of the block in or near the equipment chassis served by the unit. Embedded within 30 is a conductive path comprised of a heavy wire lead 34. The lead is connected to a conductive pin 40 at a point well within the body of 30. The pin 40 is centered with an epoxy receptacle 38 which is half of the high voltage connector 18. The connector 18 preferably has a configuration like that disclosed in U.S. Patent No. 2,958,844 to W. A. Smith et al. granted Nov. 1, 1960.

The lead wire 34 is also connected to contact pin members 42 each mounted at the bottom of a socket 43 in an epoxy disk 48 with a sleeve 44 bonded to the material of 30. Each sleeve 44 includes at the top end an internal threading 46 which mates within the threading of a plug 50. The lower end of 44 is relieved as at 49 to overlap 48.

Each plug 50 includes an outer epoxy shell 51. Each plug shell includes at the top a flange 52 which overlies and engages the entry of the sleeve 44 and the surrounding surface of the material of 30. The outer surface of 53 defines a series of flats 53 to facilitate manual insertion and removal of 50 from the block. On each side of 52 the plug shell includes threading as at 54 and 56 which serves to secure the plug within the sleeve 44 and to secure a high voltage connector within the plug.

Each plug has an outer diameter and length to substantially fill the volume of a sleeve 44 when the plug is seated therewithin. The slight spacing between the shell 51 and sleeve 44 is provided to facilitate movement of 50 as it is inserted to permit mounting with pin 42. A bore 55 which extends through the plug is dimensioned at the top portion to receive the insulating body of a lead 22 in a close fit. This top portion is of a length to carry the lead well down inside of the block when the plug is mounted therein. The lower portion of bore 55 is slightly enlarged as at 58 to receive an epoxy disk 60 carrying a contact pin 62 having a portion extending coaxially within the upper portion of bore 55 for engagement with a contact member connected to the lead 22. The lower portion of 62 is connected to a lead 64 of a resistor 66 in turn connected by a lead and connector member 68 to a further resistor. The three resistors shown provide a series resistance path to a further contact member 70 secured with an epoxy sleeve 72 in the bottom of bore 55. The contact member 70 is in a receptacle configuration to mate with pin 42 fixed in the bottom of the socket. The interior of sleeve 72 is shaped to permit spring action of 70 and includes a tapered opening 74 to aid proper mating of the contact members upon insertion of a plug within a socket.

In an actual embodiment the various resistors 66 were first joined together with the outboard leads crimped to the contact members 62 and 70 with the member 70 having the sleeve 72 secured thereover and the member 62 having the disk 60 thereon. The assembly of parts was then positioned within 55 and potted by flowing a potting material 76 through an aperture 78 in the wall of 50 until the volume between 60 and 72 was entirely filled. The potting material used was Silastic, a silicone rubber sufficiently resilient and heat accommodating to avoid damaging resistors 66 during circuit use.

The high voltage connector 24 for use with the plugs 50 includes a contact member 80 secured to the lead wire of 22 within a continuous portion of the lead insulation in the matter taught in U.S. Patent No. 3,163,692. Surrounding the lead is an epoxy nut 82 internally threaded to mate with the threading 56. Within nut 82 is a silicone rubber O-ring 84 dimensioned to be compressed axially and expanded radially to seal against the outside surface of the lead and inside surface of the nut.

With a plug 50 installed and with the connector 24 secured therein in an actual embodiment, the surface path length from 80 to the outside of 30 was approximately 3". The surface path length from 49 to the outside of 30 was approximately 7". With three 10K resistors 66 the assembled unit withstood a 65 K.V. DC hi-pot test (at sea level) without breakdown. The unit operated satisfactorily over a temperature range from -550° C. to +125° C. The foregoing operation was achieved with the plugs manually inserted without the use of tools with an entire output connection taking only a minute or so. The unit was found to be vibration and shock resistant and be adequately sealed against moisture and contamination.

Having now described my invention in terms intended to enable a preferred mode of practice thereof, I define it through the appended claims.

I claim:

1. In a device for connecting high voltage circuit components into a high voltage circuit, a high voltage connector and input lead, a high voltage connector and output lead, a block of insulating and dielectric material including a conductive path embedded therein and connected to said input lead, and at least one relatively deep socket extending therewithin with a contact member at the bottom of said socket connected to said path, a plug member of a size to fit within said socket substantially filling the volume thereof, said plug member having a component embedded in a dielectric and insulating material with means therein to connect said component to

said contact member and means to connect said component to said high voltage connector and output lead.

2. The device of claim 1 wherein said plug is comprised of a shell of relatively hard dielectric and insulating material having a bore therein with said component fitted therein, connected to contact members and embedded in a resilient dielectric and insulating material filling a portion of said bore.

3. The device of claim 1 wherein said plug is comprised of a shell including a bore with a contact member secured well down within said bore and engageable with a contact member on said high voltage connector and lead.

4. The device of claim 1 wherein said socket and plug include intermating surfaces operable when intermated to hold said plug against axial displacement relative to said block.

5. The device of claim 4 wherein said plug includes a radial and annular flange extending to contact the surface of said block when said plug is held within said socket whereby to seal the space between said socket and said plug.

6. A quick connect-disconnect component assembly for high voltage use including a block member formed of material of high dielectric strength, an input-output path embedded therein connected at one end to a high voltage connector receptacle and at the other end of a contact member positioned at the bottom of a socket formed in said block, a removable plug dimensioned to substantially fill said socket when inserted therein and means to hold said plug within said socket during use of said assembly, said plug including circuit components therewithin sealed by a material of high dielectric strength and including at each end a contact member, one mateable with the contact member at the bottom of the socket and the other mateable with a contact member carried by a high voltage connector and lead to connect said components on a high voltage circuit.

7. The assembly of claim 6 wherein said plug includes a socket containing the said other contact member positioned well within said block when said plug is inserted within the block socket.

8. In a device for providing a corona resistant connection of electrical components in a high voltage circuit, a plug member having a central bore containing a component therein embedded in an insulating and dielectric material, a first contact member at one end of said plug and a second contact member positioned within said bore in said plug at a point substantially removed from the other plug end, the said contact members being connected to said component, a block of insulating and dielectric material including a socket of substantial length relative to the maximum exterior dimension of the block, a conductive path embedded in said block connected to a third contact member extending into said socket and connected to fourth contact member of a high voltage connector receptacle embedded in said block with an end exposed for mating with a first high voltage connector and lead, the said plug member being of a configuration to fit within said socket with the second contact member positioned well within the said block and mateable with a second high voltage connector and lead having a fifth contact member inserted within said plug bore to engage said second contact member.

9. In a device for high voltage use in input path and at least one output path embedded within a block of insulating material, the input path being connected to a high voltage receptacle mateable with a high voltage connector and lead, the output path being connected to a contact member at the bottom of a socket extended well within the body of said block, a removable plug member having a configuration to fit within said socket and substantially fill the volume thereof in an operative position, securing means to secure said plug within said socket against displacement therefrom during device op-

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eration, said plug including a component carried therein and sealed therein by a solid insulating material, said component being connected to a contact member at each end, one plug contact member being mateable with the contact member in said socket and the other being mateable with a high voltage connector connected to an output lead, the said plug member including a bore extending therewith to receive a portion of said input lead whereby said other contact member is connected thereto is well within said block when said plug member is in an operative position.

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MARVIN A. CHAMPION, *Primary Examiner.*

J. H. McGLYNN, *Assistant Examiner.*