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N. E. PORTER
ELECTRICAL APPARATUS

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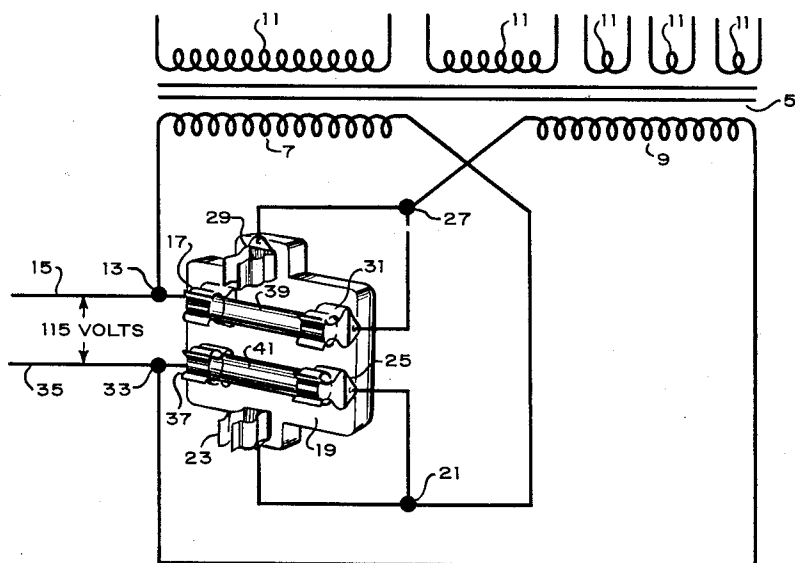


Fig. 1

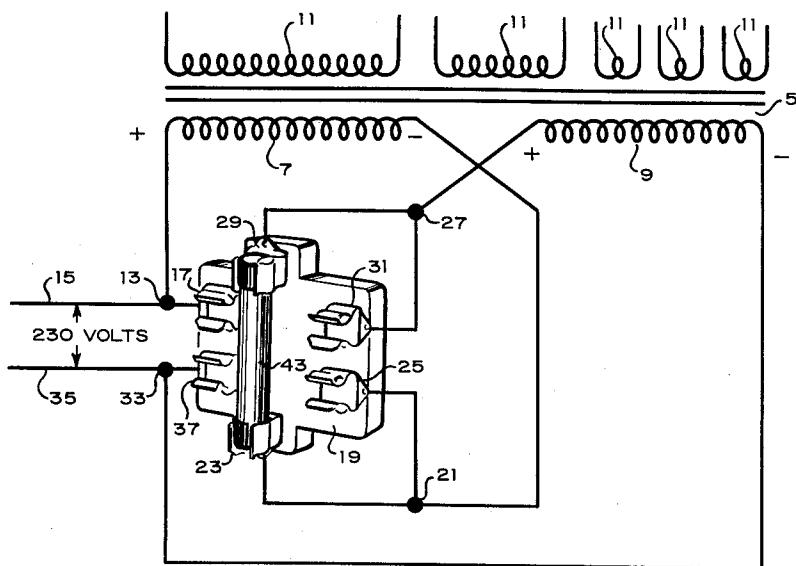


Fig. 2

INVENTOR
N. E. PORTER
BY *J. I. Chapman*
ATTORNEY

1

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Noel E. Porter, Palo Alto, Calif., assignor to Hewlett-Packard Company, Palo Alto, Calif., a corporation of California

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This invention relates to electrical apparatus designed to operate on either of two supply voltages, such as 115 and 230 volts. One or the other of these two voltages are standard in most industrial countries, and instruments designed for world markets are usually provided with means to convert from one to the other of these supply voltages. This is often done by providing the power transformer with a primary having dual windings, and using a plug or other means to connect these windings in parallel for 115 volts operation and in series for 230 volts operation.

One of the problems in this connection is that of providing proper fusing for dual voltage operation. If the proper fuse for 115 volts operation is a two-amperes fuse, the proper fuse for 230 volts operation is a one-ampere fuse. Conversion from one voltage to another may thus involve two operations, one to change transformer connections, and another to change fuses.

The main object of this invention is to provide means whereby these two operations can be cheaply and efficiently combined into one.

Other and incidental objects of this invention will be apparent from this specification and the drawing in which:

FIGURE 1 shows a circuit in accordance with this invention connected for low supply voltage (115 volts) operation; and

FIGURE 2 shows the same circuit connected for high supply voltage (230 volts) operation.

Referring now to the drawing, we see an input transformer 5 having two primary windings 7 and 9, and a plurality of secondary windings 11 providing operating potentials for an electrical instrument (not shown). The left-hand terminal 13 of winding 7 is connected to supply lead 15 and to terminal 17 of the multiple fuse-holder 19. The right-hand terminal 21 of winding 7 is connected to fuse-holder terminals 23 and 25. The left-hand terminal 27 of winding 9 is connected to fuse-holder terminals 29 and 31. The right-hand terminal 33 of winding 9 is connected to the other supply lead 35 and to the fuse-holder terminal 37.

FIGURE 1 shows the proper connection for 115-volts operation, with a first fuse 39 connecting fuse-holder terminals 17 and 31, and a second fuse 41 connecting fuse-holder terminals 25 and 37. Winding 7 is connected in a circuit that goes from lead 15 through elements 13, 7, 21, 25, 41, 37 and 33 to lead 35. Winding 9 is connected in a circuit that goes from lead 15 through elements 13, 7, 39, 31, 27, 9 and 33 to lead 35. The two windings 7 and 9 are thus connected in parallel. Fuses 39 and 41 are also connected in parallel. Thus if each of these fuses is a one-ampere fuse, the transformer is fused for two amperes.

FIGURE 2 shows the proper connection for 230-volts operation, with a single fuse 43 connecting fuse holder terminals 23 and 29. Windings 7 and 9 are connected in series in a circuit that goes from lead 15 through elements 13, 7, 21, 23, 43, 29, 27, 9 and 33 to lead 35. If fuse 43 is also a one-ampere fuse, the transformer is fused for one ampere.

It should be noted that the fuse-holder terminals are so designed that fuse 43 cannot be inserted across fuse-holder terminals 23 and 29 if either of fuses 39 or 41 are in position. Also, if fuse 43 is in position, neither fuses 39 or 41 can be inserted in the fuse holder. If

2

it were possible to insert simultaneously fuses 39 and 43, for instance, winding 7 would be shorted by a circuit going from terminal 13 through elements 17, 39, 31, 27, 29, 23 to terminal 21. Another way to provide this interlock is to mount on the instrument three standard fuse posts next to each other and on one line, with the two outer posts converging toward the center post by approximately ten degrees. The insertion of a cap in the center post would prevent the insertion of a cap on the outer ones and vice versa.

I claim:

1. An electrical instrument designed to operate on either of two supply voltages and comprising a power transformer having first and second primary windings, each having first and second terminals, the first terminal of the first winding being connected to a first lead of an electrical supply, the first terminal of the second winding being connected to the second lead of said electrical supply, first fuse means including a first fuse to connect together the second terminals of the first and second windings, second fuse means including second and third fuses; said second fuse being adapted to connect together the second terminal of the second winding and the first lead of said electrical supply, said third fuse being adapted to connect together the second terminal of the first winding and the second lead of said electrical supply, the fuses of the first and second fuse means being so positioned that the fuse of the first fuse means occupies portions of the space occupied by at least one of the fuses of the second fuse means, whereby a connection made by one fuse means prevents a connection from being made by the other fuse means.

2. An electrical instrument designed to operate on either of two supply voltages and comprising a power transformer having first and second primary windings, each having first and second terminals, the first terminal of the first winding being connected to a first lead of an electrical supply, the first terminal of the second winding being connected to the second lead of said electrical supply, first fuse means including a first fuse holder to connect together the second terminals of the first and second windings, second fuse means including a second fuse holder to connect together the second terminal of the second winding and the first lead of said electrical supply, third fuse means including a third fuse holder to connect together the second terminal of the first winding and the second lead of said electrical supply, the fuse holders being so positioned that a fuse inserted in the first fuse holder occupies a portion of the space occupied by a fuse inserted in at least one of the second and third fuse holders, whereby the insertion of a fuse in the first fuse holder prevents the insertion of a fuse in at least one of the second and third fuse holders.

3. An electrical instrument designed to operate on either of two supply voltages and comprising a power transformer having first and second primary windings, each having first and second terminals, the first terminal of the first winding being connected to a first lead of an electrical supply, the first terminal of the second winding being connected to the second lead of said electrical supply, first fuse means including a first fuse holder to connect together the second terminals of the first and second windings, second fuse means including a second fuse holder to connect together the second terminal of the second winding and the first lead of said electrical supply, third fuse means including a third fuse holder to connect together the second terminal of the first winding and the second lead of said electrical supply, the fuse holders being so positioned that fuses inserted in at least one of the second and third fuse holders occupy portions of the space occupied by a fuse inserted in the first fuse holder, whereby the insertion of a fuse in at

3

least one of the second and third fuse holders prevents the insertion of a fuse in the first fuse holder.

4. An electrical instrument designed to operate on either of two supply voltages and comprising a power transformer having first and second primary windings, each having first and second terminals, the first terminal of the first winding being connected to a first lead of an electrical supply, the first terminal of the second winding being connected to the second lead of said electrical supply, first fuse means including a first set of fuse-holder terminals to connect together the second terminals of the first and second windings, second fuse means including a second set of fuse-holder terminals located in the plane of the first set of fuse-holder terminals to connect together the second terminal of the second winding and the first lead of said electrical supply, third fuse means including a third set of fuse-holder terminals located in the plane of the first set of fuse-holder terminals to con-

4

nect together the second terminal of the first winding and the second lead of said electrical supply, the fuse-holder terminals being so positioned that a fuse in the first set of fuse-holder terminals occupies a portion of the space occupied by a fuse in at least one of the second and third sets of fuse-holder terminals, whereby the connection made by a fuse inserted in the first set of fuse-holder terminals prevents a connection from being made by fuses inserted in the second and third sets of fuse-holder terminals.

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