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HIGH-FREQUENCY CURRENT TRANSFORMER

Original Filed Nov. 29, 1945

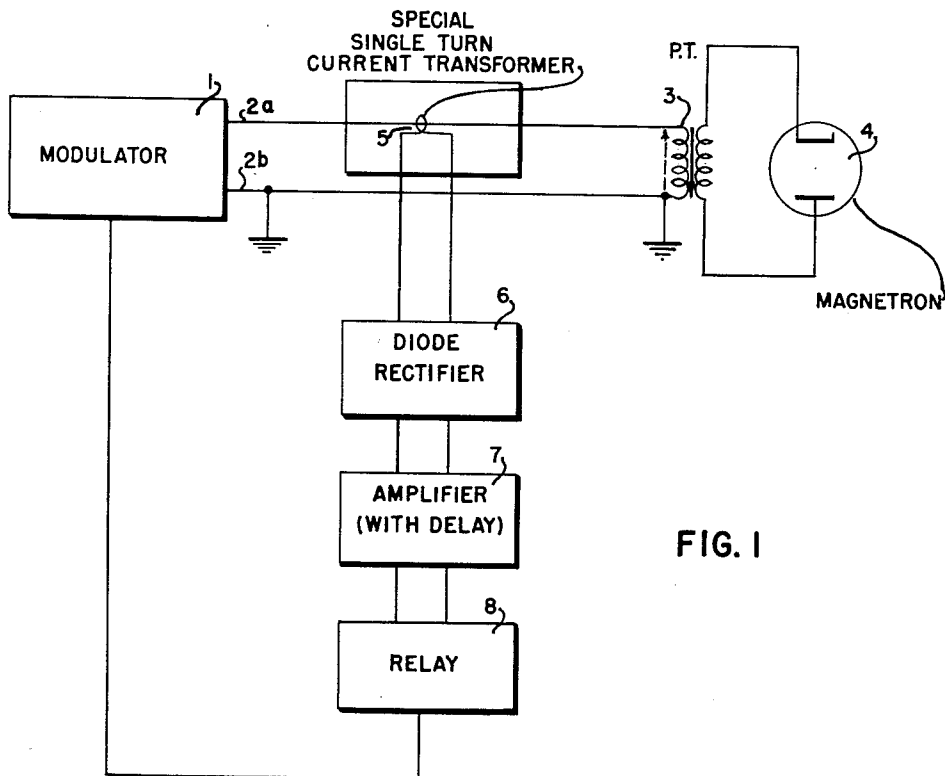


FIG. 1

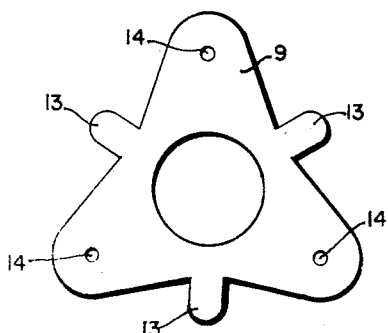


FIG. 2

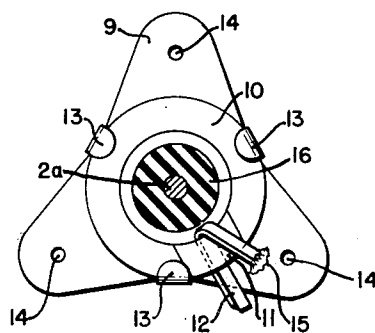


FIG. 4

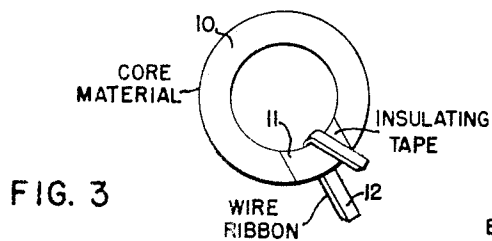


FIG. 3

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HIGH-FREQUENCY CURRENT
TRANSFORMER

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mesne assignments, to the United States of
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Original application November 29, 1945, Serial No.
631,749. Divided and this application May 7,
1948, Serial No. 25,701

4 Claims. (Cl. 175—358)

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This invention relates in general to a system for protecting apparatus from overload currents, and more particularly to a high frequency current transformer for use in such a system.

This application is a division of copending application, Serial No. 631,749, filed November 29, 1945, now Patent No. 2,509,703, and entitled Protecting Circuit.

In the radar art, a modulator is used to provide energy which is connected through a line to a pulse forming transformer, which in turn, energizes a magnetron or other oscillator device. These pulse transformers are necessarily of a precise design which makes it possible to pass a high power short duration pulse to the magnetron oscillator. If the magnetron becomes gassy, it acts as a direct short and overloads the modulator and the pulse transformer. More specifically, a gassy magnetron allows the pulse forming network to discharge at approximately twice the normal current, and leaves an opposite charge on the network which tends to discharge in the reverse direction. This current will thus be reflected from one end of the pulse forming line to the other with the result that the primary winding of the pulse transformer will be subjected to several reflections of a current high enough to damage the transformer.

It is the primary object of this invention to provide means for monitoring a pulse line and protecting modulator components from abnormal conditions as indicated by the existence of reverse currents of a high magnitude.

Another object of this invention is to provide a lightweight apparatus for protecting modulator components from overload currents.

Another object of this invention is to provide a coupling means for the pulse line to secure a relay actuating voltage, without appreciable loading effect on the line.

Other and further objects will be apparent upon consideration of the following description together with the accompanying drawing, in which:

Fig. 1 shows generally a block diagram of an embodiment of this invention;

Fig. 2 and Fig. 3 show parts of a transformer used in the system of Fig. 1; and

Fig. 4 is a view of the transformer.

In Fig. 1, energy is transferred from a modulator 1 through any conventional transmission line 2a and 2b to a pulse transformer 3 in order to modulate a magnetron 4. The normal current flow through the pulse transformer is as indicated by the solid arrow. In the event of a short circuit or a gassy magnetron a reverse current

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flows as shown by the broken arrow. A coupling means 5 for monitoring the pulse energy is connected to a diode tube rectifier 6, which is polarized to conduct only with a reversed current. The output from this rectifier is fed into a delayed amplifier 7, whose output, when sufficiently large, operates a relay 8, arranged to turn off the modulator 1.

The coupling means 5 is itself a feature of the invention, and its construction is shown in detail in Figs. 2, 3 and 4. Fig. 2 shows a brass blank approximately $\frac{1}{4}$ of an inch thick, and stamped out in the shape shown to form a mounting plate for the coupling means 5 (Fig. 1) which is essentially a current type transformer adding only negligible load or impedance to the pulse line 2a.

In Fig. 3 is shown the core 10 of the transformer consisting of a stack of thirty rings of .003 inch thickness transformer core material. A strip of insulating tape 11 is wound around the core so formed, and a single loop of ribbon type wire 12 is passed around the insulated portion. The entire core is then dipped in transformer sealing material to form a covering. This single turn loop 12 forms the secondary for the transformer, which is connected to the rectifier 6.

The completed transformer is shown in Fig. 4. The core 10 is placed on the brass mounting plate 9 and the three tabs 13 are bent over the core to hold it into place. In the particular case here shown, one end of loop 12 is soldered to the plate 9, as indicated at 15. The completed transformer is placed over the pulse terminal, which may be a socket or standoff insulator 16 on a chassis or grounded panel (not shown) and the plate 9 held in place by screws passing through the mounting holes 14 to the chassis or panel. The primary of the transformer becomes the lead or wire 2a through the insulator 16 to the pulse transformer. Hence, a relatively simple current monitoring transformer with a minimum loading characteristic results.

Referring again to Fig. 1, a reverse current flow will be picked up by the single turn transformer 5 and fed into the diode rectifier 6 which is polarized in such a manner as to conduct only in response to this reversed current. The resulting direct current output from the rectifier 6 is fed into an amplifier 7 with a time constant delay in its grid circuit so that random surges or minute stray arcing will not produce a voltage of sufficient duration to operate the relay. If a reversed current persists for a time sufficiently long, with respect to the delay time constant of the amplifier grid circuit, it will cause the relay to operate, thereby interrupting the modulator power sup-

ply holding circuit and stopping its operation. When the modulator is stopped, the modulation energy is removed from the pulse transformer, thereby providing an efficient safety device for the pulse transformer as well as the modulator.

Although in accordance with the provisions of the patent statutes this invention is described as embodied in concrete form and has been explained together with the best system in which it is now contemplated applying this invention, it will be understood that the apparatus shown and described is merely illustrative and that the invention is not limited thereto, since alterations and modifications will readily suggest themselves to persons skilled in the art without departing from the true spirit of the invention or from the scope of the annexed claims.

What is claimed is:

1. A low impedance high frequency current transformer comprising, a non-magnetic, electrically conducting mounting plate formed with tabs thereon, a laminated core formed of stacked annular rings of transformer core material secured to said plate by said tabs, said core being wrapped with insulation about a portion thereof and covered with a sealing material, a single loop of ribbon wire wound around said insulated portion, one end of said loop being electrically connected to said mounting plate, the secondary of said transformer being formed by said wire loop, said plate and core being adapted to receive a lead passing axially therethrough, the primary of said transformer being formed by said lead.

2. A high frequency current transformer comprising, a non-magnetic, electrically conducting mounting plate formed with tabs thereon and having an opening therethrough, a laminated core formed of stacked annular rings of transformer core material secured to said plate by said tabs, the internal diameter of said core being substantially equal to the diameter of said opening, a single loop of ribbon wire wound toroidally around a portion of said core and insulated therefrom, one end of said loop being electrically connected to said mounting plate, the secondary of said transformer being formed by said wire loop, said plate and core being adapted to receive a lead passing axially therethrough, the primary of said transformer being formed by said lead.

3. A low impedance current transformer for radio frequency systems comprising, a non-mag-

netic, electrically conducting mounting plate of generally triangular shape having a tab disposed on each edge thereof and a central opening there-through, a laminated annular core secured to said plate by said tabs and insulated therefrom, the internal diameter of said core being substantially equal to the diameter of said opening, a single loop of ribbon wire wound toroidally around said core and insulated therefrom, one end of said loop being electrically connected to said mounting plate, said single loop forming the secondary of said transformer, the primary of said transformer being formed by a single lead passing axially through said core and mounting plate.

4. Apparatus for obtaining a monitoring signal from high frequency energy flowing in a conductor comprising, a non-magnetic, electrically conducting mounting plate formed with tabs thereon and having a central circular opening therethrough, a laminated annular core secured to said plate by said tabs and insulated therefrom, the internal diameter of said core being substantially equal to the diameter of said opening, said conductor passing axially through said opening a single loop of wire wound toroidally around said core and insulated therefrom, one end of said loop being electrically connected to said mounting plate, said loop thereby coupling a small signal from said conductor without appreciably increasing the impedance to flow of energy in said conductor.

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