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(54) **An ignition device for a flame burner or the like permitting a limitation of radio interferences**

(57) The present invention proposes a solution alternative to the use of the conventional anti-atmospherics filters in order to make the functioning of the ignition device of a burner or the like acceptable with regard to the electro-magnetic compatibility and the atmospherics.

The said solution permits to reach practical advantages

relative to the fact that first of all the adopted measures are more economic than the known filters and solutions and above all these measures permit to reduce the dimensions of encumbrance to a minimum so that the same solution may be adopted also in those appliances in which the available spaces are reduced to the simplest terms.

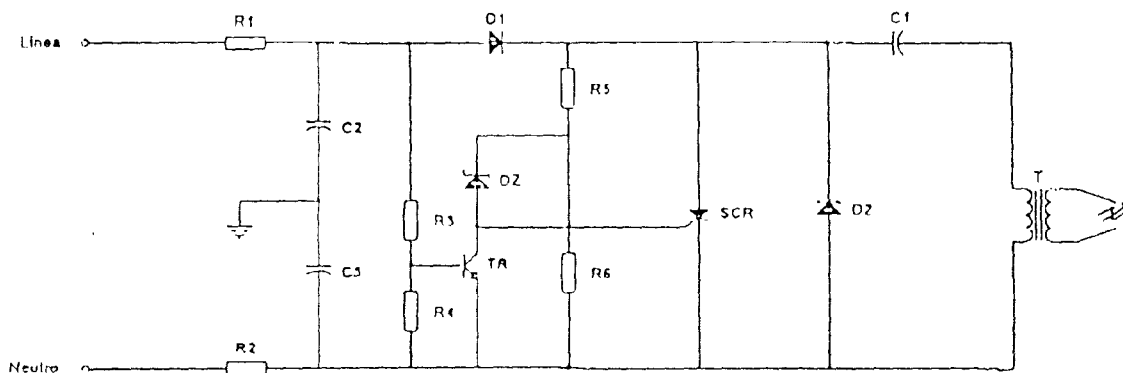


Fig. 16

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Description

The present invention refers to an ignition device for a flame burner or the like. This device is realized in such a way to permit a limitation of radio interference.

As it is known, the present art includes appliances in which it is necessary to light the fire for instance in a flame burner or the like. To this end, particular electron devices may be used and may be equipped with capacitive discharge transformers. Such transformers generate an electric discharge by using the energy accumulated by a condenser. In other cases, such devices may be provided with transformers which use oscillatory circuits in order to generate high-frequency electric discharges, for instance in the range of a few kHz.

However, till today in the planning and manufacture of such circuits the problem of the electro-magnetic compatibility and in particular the problem of the radio interference has not been considered and therefore the users were often obliged to install suitable filters, such filters being conceived and realized according to the known art by using inductors and condensers.

Concerning the construction of the ignition device, the above mentioned filters are sometimes integrated inside the ignition device itself. However, the results are not satisfactory.

In the Figure 1, one of the possible realizations is shown and refers to a circuitry of a known ignition device as actually realized. Its principle of working is the same as almost all the ignition devices with capacitive discharge. This principle of working is the following.

By supplying the circuit with the power, the charge of a condenser C1 starts through a resistance R1. This charge is possible only when a diode D1 is in conduction (positive half wave of input tension).

When the tension in the point common to resistors R2 and R3 is strong enough to reach the threshold tension or voltage of a Zener Diode, the current passing through the Zener diode permits a SCR to be conducted. The SCR discharges all the energy accumulated in the condenser C1 on the primary of a transformer T which serves to raise the tension of the primary according to the turns ratio between primary and secondary.

The transfer of energy between primary and secondary of transformer T causes the formation of a spark which triggers the process of combustion. A diode D2 is therefore a diode "flywheel". The repetition frequency of the spark, the tension in the secondary of the transformer T and the generated energy depend on the frequency of the input tension and on the dimensions of the used components.

Moreover, till today the constructors of ignition devices have always realized the transformers by obtaining both windings on the same axis or by winding both windings in a concentric way, the secondary being wound on the primary, without worrying about problems of electromagnetic compatibility.

According to the described solution and according

to all the known solutions, the problem of radio interference has not been therefore solved till now unless conventional filters are used. However, such filters are too cumbersome and do not offer satisfactory results.

By using the present invention, the above mentioned inconveniences are removed, or at least reduced. In particular, the present invention proposes a solution alternative to the use of the conventional anti-interference filters in order to make the working of the ignition device acceptable as concerns the electromagnetic compatibility in relation to the radio interference.

The present invention permits to reach some practical advantages relative to the fact that first of all the adopted measures are more economic than the known filters and solutions and above all these measures permit to reduce the dimensions of encumbrance to a minimum so that the same solution may be adopted also in those appliances in which the available spaces are reduced to the simplest terms.

The above particular aims, functions and advantages are all reached according to the present invention through an ignition device for a flame burner or the like permitting a limitation of radio interference, characterized by the fact of consisting of a circuit in which all or some of the following measures are provided: a SCR connection forms a current ring between the SCR and the transformer; a resistance controlling the charge of a condenser is divided in two parts, a resistance part being connected with a phase and the other part being connected with a neutral; a control synchronizer is used to prevent the formation of an electric discharge during the charge phase of the condenser; a comb is grounded and is placed under an ignition transformer; the transformer is realized by winding a primary on a secondary and in the inner part of both windings there is a ferrite or the like for optimizing the energy transfer; utilization of two condensers which discharge the generated radio disturbances to the ground and above all, such condensers filter all the radio disturbances which are caught by the primary winding; a direct connection of the ignition device or a direct connection of only a part thereof with a starting electrode; the said command pulse may be sent by a "diac" or "zener" or whatever component or electric circuit able to control the conduction of the SCR whenever the voltage across the condenser reaches a wished value; the said synchronizer may be for instance a "zero crossing" or other similar element avoiding the formation of a discharge during the charge phase of the condenser.

Further features and details of the present invention will better appear from the following description of a preferred embodiment which is represented in the accompanying drawings as an example not limiting the invention itself in which drawings:

Fig. 1 shows a diagram of one of the possible realizations of a known ignition device as realized at present;

Fig. 2 shows a diagram of a circuit according to the present invention in which the SCR connection forms a current ring between the SCR and the transformer when there is the discharge;

Fig. 3 shows a diagram of a circuit according to the present invention in which the resistance adjusting the charge of the condenser is divided in two resistances (R1 and R2);

Fig. 4 shows a diagram of a circuit according to the present invention in which a synchronizer or the like is installed;

Fig. 5 shows a schematic view of an earthed element or comb under the ignition transformer;

Fig. 6 shows a schematic view of the transformer T, which is realized by winding the primary on the secondary;

Figs. 7 and 8 show schematic views of two solutions of transformers, realized according to the known art;

Figs. 9-12 show diagrams of possible connections of two condensers (C2 and C3), used to discharge the generated radio interference to earth;

Figs. 13-15 show diagrams referring to the positioning of some possible components generating a command pulse;

Fig. 16 shows a view of a whole electric diagram according to the present invention referring to the solution of the problem of radio interference;

Fig. 17 shows a schematic view of a graph referring to the performances of the present invention;

Fig. 18 shows a schematic view of a graph referring to the performances of an ignition device of present production;

Fig. 19 shows a view of a diagram from which it appears the direct connection of the ignition device on the electrode.

The aim of the present invention has been reached through the following measures. Each of these single measures proved effective.

As it appears from Fig. 2, the first measure refers to the connection for the SCR which is arranged in such a way to form a current ring between the SCR itself and the transformer when there is the discharge. This permits to obtain a good reduction in the generated radio interference, especially as regards the low-frequencies (lower than 1 MHz).

The second measure as it appears from Fig. 3 refers to the resistance regulating the charge of the condenser, which resistance is divided in two resistances, the former being connected to the phase (R1) and the latter being connected to the neutral (R2). This solution permits a better balance of the radio interference which occurs in the phase and neutral. On the contrary, from the prior art it appears that the radio interference coupled with the neutral is very higher than the radio interference coupled with the phase.

A third measure refers to the use of a synchronizer

as it appears from Fig. 4. This synchronizer prevents the formation of an electric discharge during the charging phase of the condenser C1 and during the whole period in which the diode D1 is directly polarized. This measure prevents that a current source be generated when the device is connected to the input voltage through the conduction of the diode D1. Moreover, this measure permits that the radio interferences be generated only when the device is decoupled from the supply mains through the diode D1 which is denied in this phase. This measure is a further improvement as concerns the radio interferences, especially in case of low-frequencies (lower than 1 MHz).

The fourth measure resulting from Fig. 5 concerns the use of a grounded comb A placed under the ignition transformer B in order to absorb the generated radio interference as much as possible.

Fig. 6 shows a fifth measure according to which the transformer T is realized by winding the primary 1 on the secondary 2 so that the transformer T acts also as a screening element. In this way, it is not necessary to insert screens realized in conductive materials for screening the transformer according to the known art.

The more the primary winding includes the secondary, the higher the results are. A suitable ferrite 3 is placed in the inside of both windings. This ferrite optimizes the transfer of the energy. On the contrary, till today the constructors of ignition devices have always realized the transformers by getting both windings on the same axis as it is represented in Fig. 7 or by winding them in a concentric way, the secondary being wound on the primary without worrying about the problems of the electromagnetic compatibility (Fig. 8).

A sixth measure refers to the utilization of two condensers (C2 and C3) connected as it results from Figs. 9-12 and used to discharge the generated radio interferences to the ground. In particular, these condensers (C2 and C3) filter all the radio interferences which are caught by the winding of the primary, this winding having also a screening function. These condensers may be connected both upstream and downstream in respect to the resistors R1 and R2, as it is represented in Figs. 9-12. The connection assuring the highest effectiveness is to be determined each time depending above all on the arrangement of the components of the printed circuit or in the inside of the ignition device.

Finally, a further effective measure for reducing the radio interferences consists in directly connecting the ignition device 4 or only a part thereof to the ignition electrode 5, as it is schematically represented in Fig. 19. This measure eliminates the presence of a high-tension cable. This is advantageous since high-tension cables as aerials irradiate electromagnetic waves in the atmosphere. Accordingly, this measure cancels a part of the other measures.

The direct connection between the ignition device and the electrode offers the following advantages:

- a) the radio interferences are eliminated or reduced to the minimum since the connection between the outer device and the apparatus does not take place any more through a high-tension cable. The connection occurs through a usual cable;
- b) the resistance, which has been used till today to reduce the high-frequency radio interferences, is eliminated. This resistance was positioned near the ignition electrode;
- c) there is the possibility of further reducing the dimensions of the apparatus since there are no more high-voltage parts in the inner part of the apparatus itself.

The above-described measures may be utilized on the whole in order to reach the highest reduction in the radio interferences. However, it is possible to utilize only some of these measures according to the wished result. From Fig. 16 it results in detail the whole circuitry concerning the solution of the problem of radio interference. It is to be noted that the command pulse or signal shown in Fig. 4 may be generated by using for instance a diac (Fig. 13), a zener (Fig. 14) or whatever electric component or circuit which may control the conduction of the SCR whenever the voltage across the condenser C1 reaches the wished value (Fig. 15).

Moreover, there are other solutions for the circuitry different from the solution proposed to generate a synchronizing signal. One of these solutions is a "zero crossing" or the like.

Now we shall briefly describe the principle of working of the ignition circuit according to the present invention including the above described measures for limiting the radio interferences.

By feeding the circuit it is possible to start charging the condenser C1 through the resistors R1 and R2. The charge may occur only when the diode D1 is in conduction (positive half wave in this case).

When the voltage in the point common to resistors R5 and R6 is strong enough to reach the threshold voltage of the zener diode DZ near the half wave of the feed voltage opposite to the charge half wave (negative half wave in the represented case), in which phase the transistor TR is denied, the SCR discharges the energy which had been previously stored in the condenser C1 on the primary of the transformer T. The diode D2 is thus a "flywheel" diode.

During the discharge, a part of the generated radio interferences is absorbed by the grounded comb under the transformer while the greater part of the radio interferences is absorbed by the primary and discharged to the ground through the condensers C2 and C3.

The spark is generated during the half wave opposite to the charge half wave. In this way the remaining radio interferences are eliminated, especially in case of frequencies lower than about 1 MHz.

On the whole, the so-obtained solution permits to amply maintain the radio interferences generated by this

kind of ignition device within the limits provided for by the relevant provisions. On the contrary, the radio interferences issued by the currently used ignition devices always exceed the upper limit permitted by the provisions.

The above described difference will be better comprised from the accompanying graphs which show the new solution in question (Fig. 17) and an igniter of present production (Fig. 18) for a frequency field included between 150 KHz and 30 MHz; the broken line indicates the upper limit permitted.

The present device for limiting the radio interferences in a capacitive discharge igniter has been described and illustrated according to the preferred solutions. However, there may be provided variants which are technically equivalent to the described parts and components and are included within the scope of protection of the present invention.

Claims

1. An ignition device for a flame burner or the like for limiting the radio interferences, characterized by the fact of comprising a circuit in which the connection of the SCR forms a current ring between the SCR itself and a transforming element (T), and in which the said transforming element (T) is realized by winding the primary (1) on the secondary (2), a ferrite (3) or similar element being placed in the inner part of the said windings for optimizing the transfer of energy; the said circuit is provided with a resistance (R) for regulating the discharge of the condenser, the said resistance being divided into two parts (R1, R2), the former being connected to the phase and the latter being connected to the neutral; the said circuit comprises a control synchronizer for avoiding the formation of an electric discharge during the charging phase of the condenser and for the whole period in which the diode is directly polarized; a grounded element or comb (A) is provided under the ignition transformer (B); at least two condensers (C2 and C3) are provided to permit the discharge to ground of the generated radio interferences and above all to filter all the radio interferences caught by the primary winding; finally there is a direct connection for the ignition device (4) or only a part thereof on the ignition electrode (5).
2. An ignition device for a flame burner or the like, as claimed in claim 1, characterized by the fact that the said command signal may be transmitted by a "diac" or by a "zener" or whatever electric component or circuit which may control the conduction of the SCR whenever the voltage across the condenser (C1) reaches the wished value.
3. An ignition device for a flame burner or the like, as

claimed in the foregoing claims, characterized by the fact that the said synchronizer may consist for instance of a "zero crossing" or the like avoiding the formation of the discharge during the charging phase of the condenser.

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4. An ignition device for a flame burner or the like, as claimed in the foregoing claims, characterized by the fact that the devices as described in the foregoing claims may all be inserted in the circuit in order to reach the highest level of reduction in the radio interferences; otherwise it is possible to utilize only some of the described components according to the wished results, the innovative concept of the ignition circuit remaining the same.

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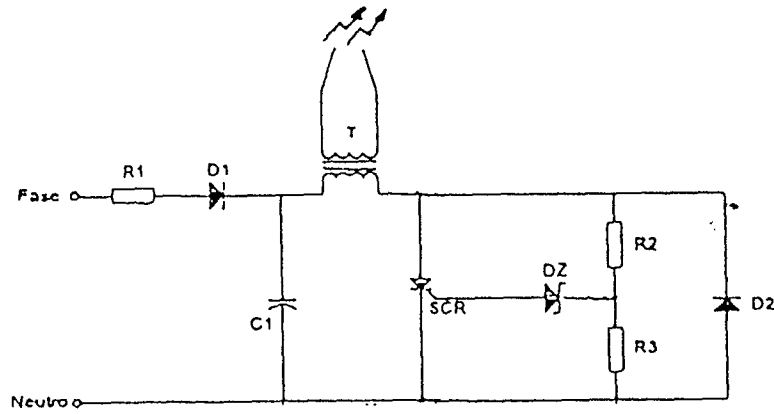


Fig. 1

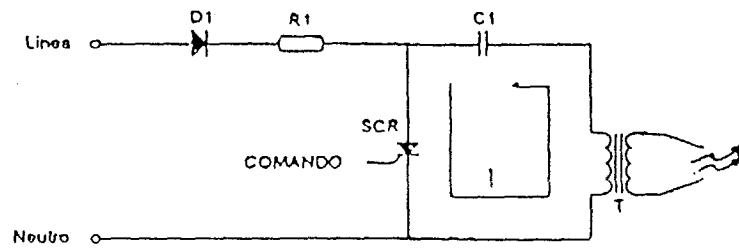


Fig. 2

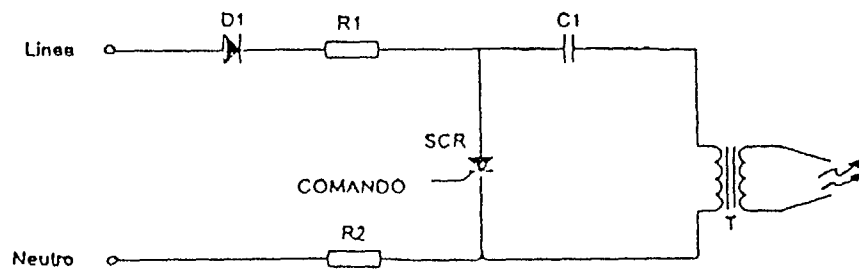


Fig. 3

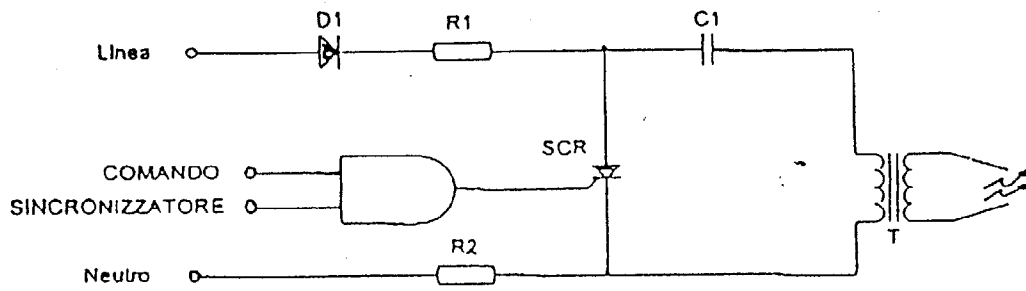


Fig. 4

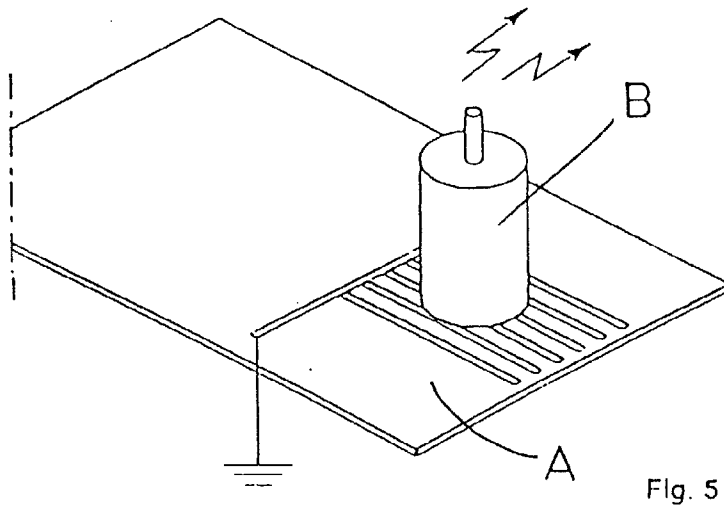


Fig. 5

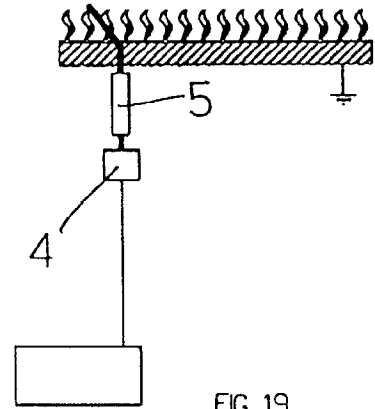


FIG. 19

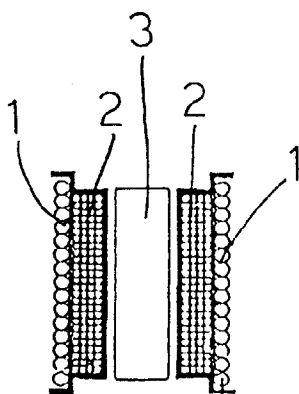


Fig. 6

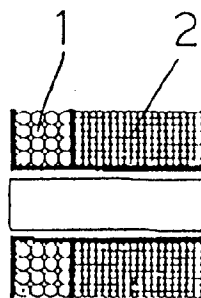


Fig. 7

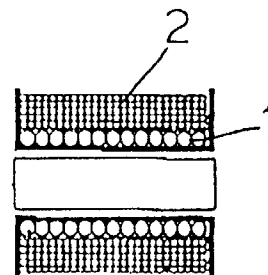


Fig. 8

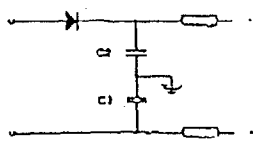


Fig. 9

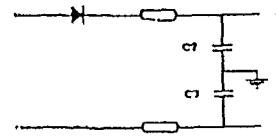


Fig. 10

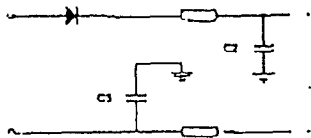


Fig. 11

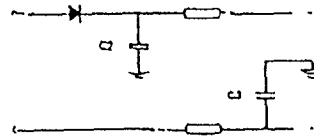


Fig. 12

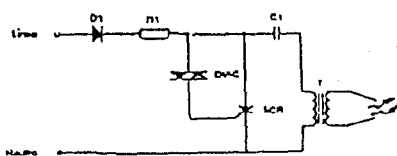


Fig. 13

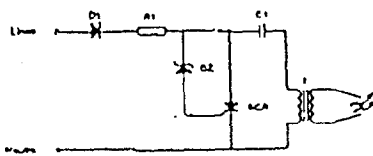


Fig. 14

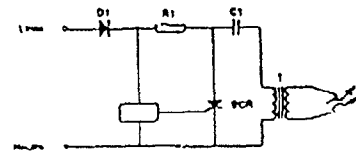


Fig. 15

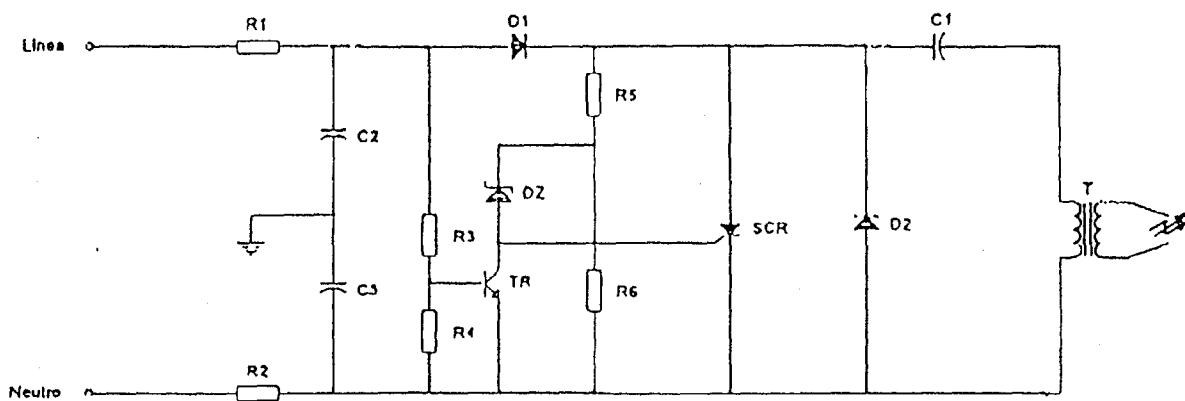


Fig. 16

Scan Settings (1 Range)
 Start 150kHz Stop 30MHz
 IF BW 120kHz Step 3.1%
 Detector OP
 M-Time 1 sec
 Preamp OFF
 Atten Auto
 OpRge 80dB

Prescan Measurement: X PK
 Meas Time: see scan settings
 Subranges: 100
 Acc Margin: 20 dB

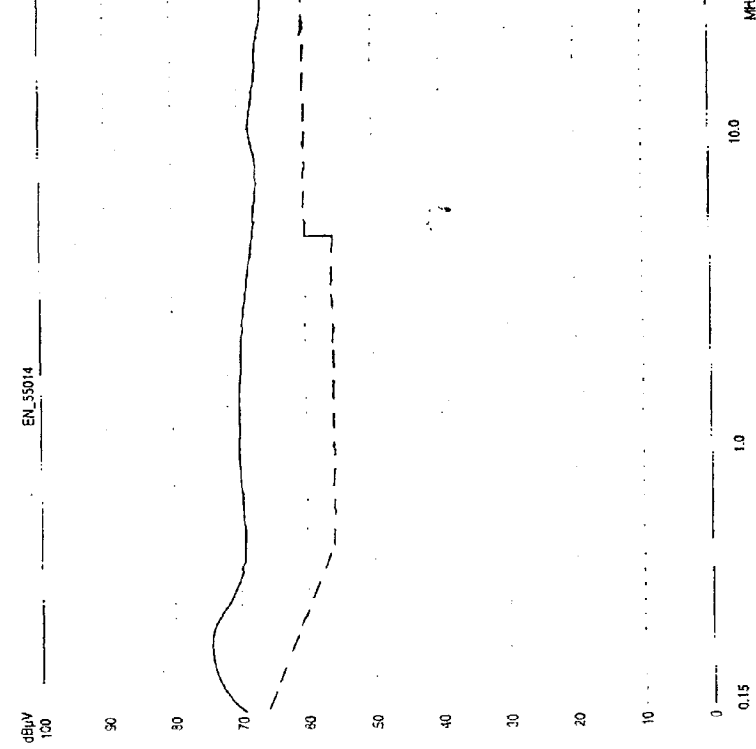


Fig. 17

Scan Settings (1 Range)
 Start 150kHz Stop 30MHz
 IF BW 120kHz Step 3.1%
 Detector OP
 M-Time 1 sec
 Preamp OFF
 Atten Auto
 OpRge 80dB

Prescan Measurement: X PK
 Meas Time: see scan settings
 Subranges: 100
 Acc Margin: 20 dB

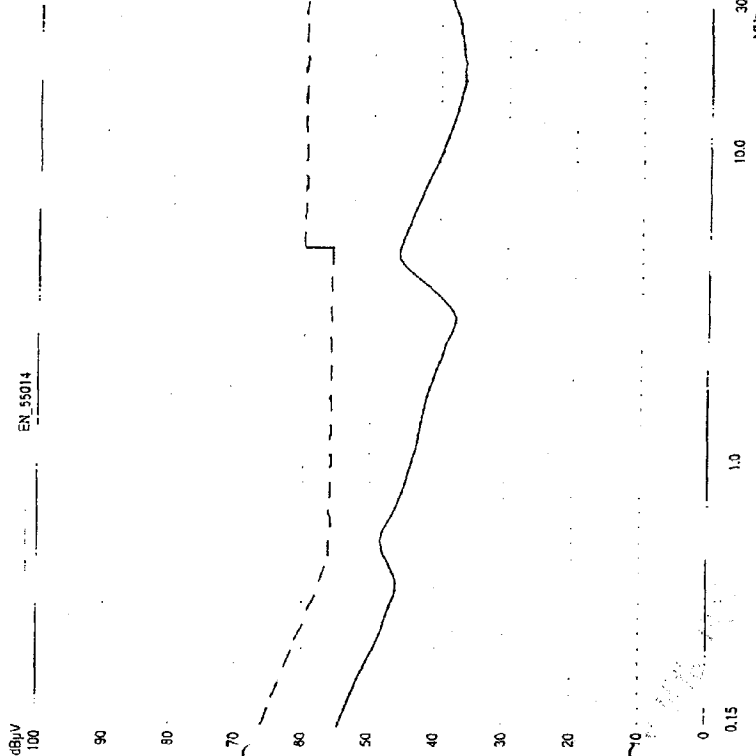


Fig. 18