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(54) **A Retrace Voltage Blocking Circuit**

(57) The retrace voltage blocking circuit is for association with an electronic scanning generator (S_g) of the type in which the retrace voltage formed across a reactive element which accumulates energy supplied during the trace is limited in value by a voltage obtained from a voltage doubler supplied from the supply voltage (V_s) of the scanning generator (S_g). The voltage doubler has a diode (D), a doubling capacitor (C) and switches (S_1, S_2) for the alternate series-parallel connection of the capacitor (C). A regulator (R) containing the switches is also supplied by the voltage (V_s) and is arranged to limit the voltage from the voltage doubler to be less than or equal to double a settable reference voltage. In this way the supply voltage V_s can vary upwardly over a wide range without permitting the retrace voltage clamp level to rise in the same proportion.

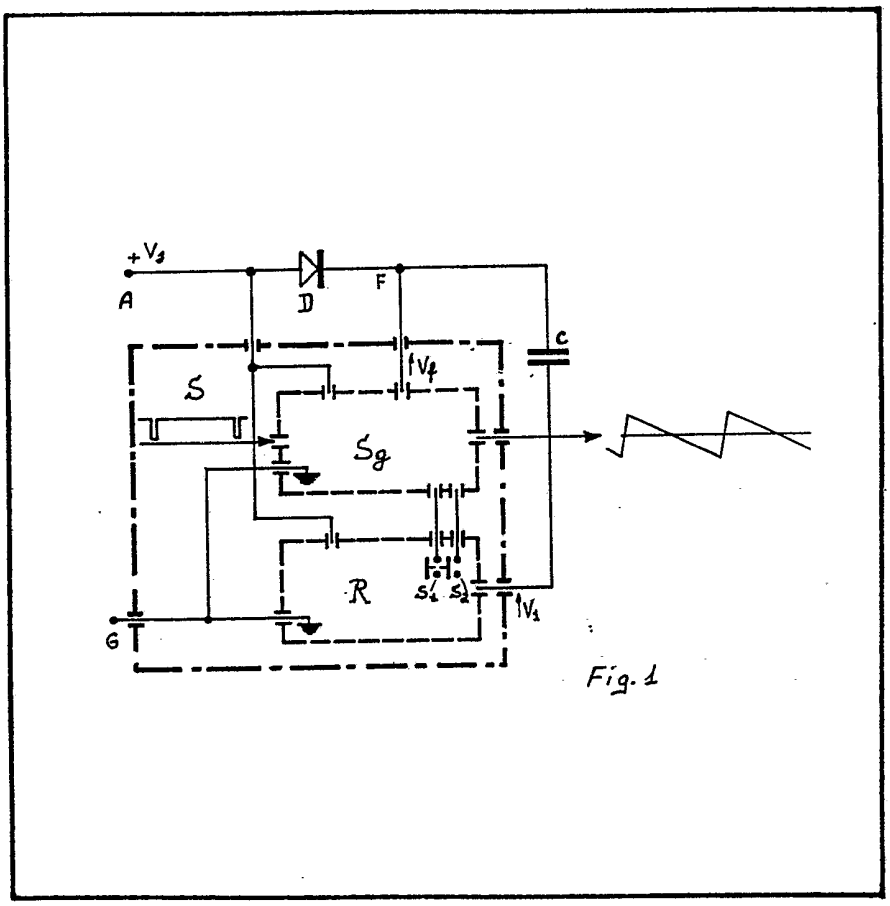


Fig. 1

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(1-2)

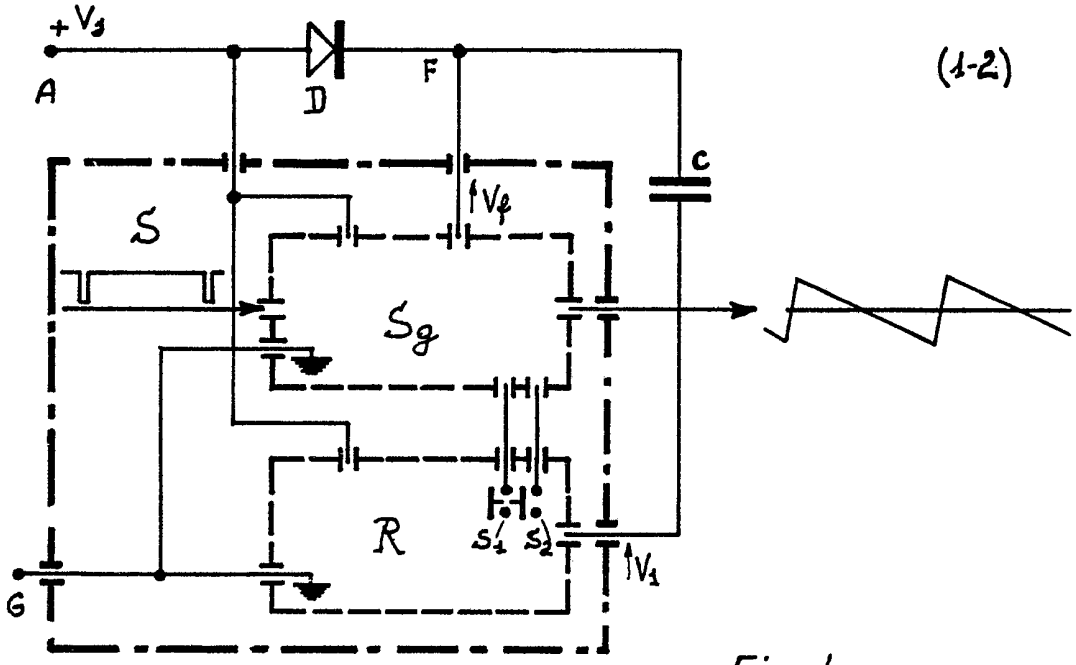

+Vs
A
D
F
C
S
Vf
Sg
R
S1
S2
V1
G

Fig. 1

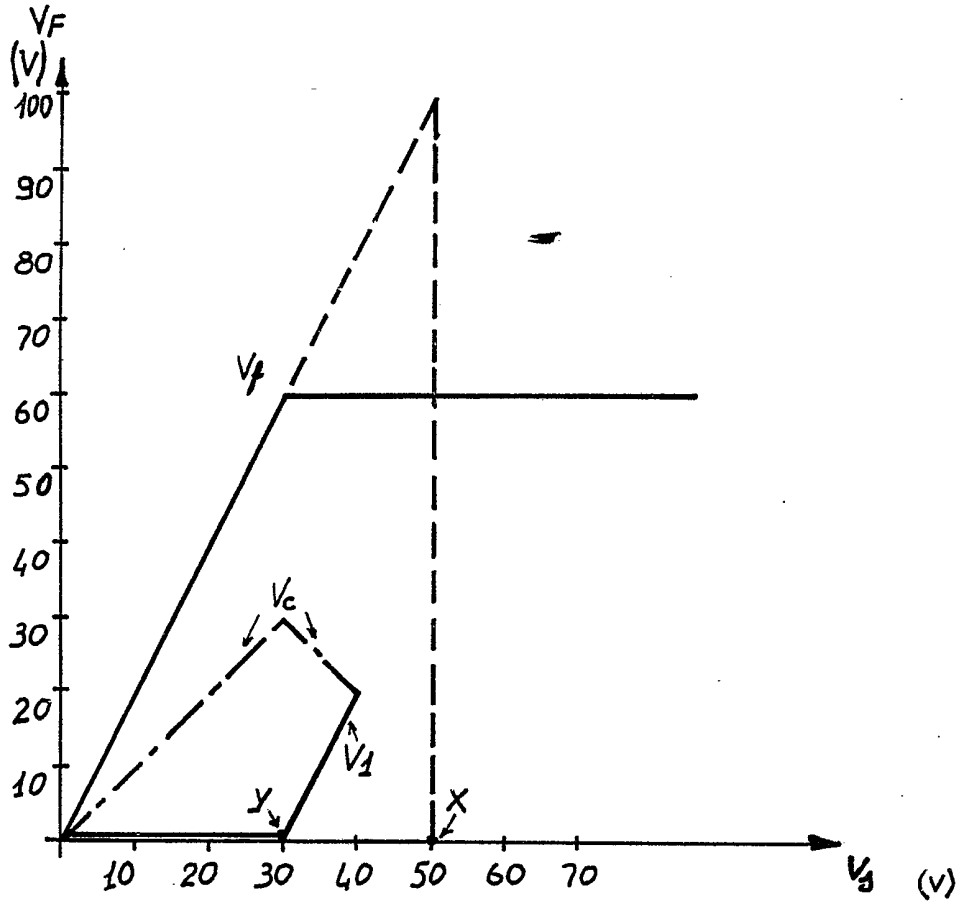

VF
(V)
100
90
80
70
60
50
40
30
20
10
Vf
Vc
V1
Y
X
10
20
30
40
50
60
70
Vs
(V)

Fig. 2

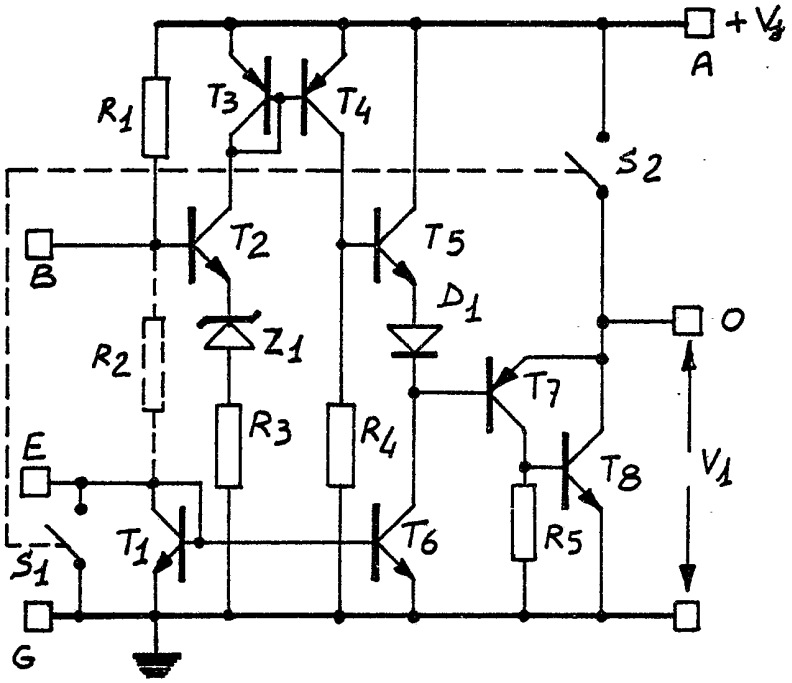


Fig. 3

SPECIFICATION

A Retrace Voltage Blocking Circuit

This invention relates to a circuit for blocking the retrace voltage when the direct current supply voltage of an electronic scanning generator increases beyond a predetermined level, where this scanning generator is of the type in which a trace time is followed sequentially by a retrace time, and during the retrace a retrace voltage is formed on a reactive element which accumulates energy supplied during the trace.

Scanning circuits are already known in which the retrace voltage is limited, by opposition, to a value which is double the actual direct current supply voltage of the scanning circuit, but in these systems there is no limit to the increase in the retrace voltage unless a supply voltage stabiliser is also connected, and this has necessarily to be sized in order to supply the power required during the trace time. In addition to this first drawback, there is also the fact that the retrace limiting voltage has only one value, i.e. double the actual scanning supply voltage.

An object of the present invention is to limit the retrace voltage to a blocked maximum value which is equal to double the value of a set scanning supply voltage, independently of the actual value of the scanning supply voltage. This fact means in practice that the actual supply voltage can be greater than the set blocking supply voltage.

According to the present invention there is provided a retrace voltage blocking circuit for association with an electronic scanning generator of the type in which the retrace voltage is formed across a reactive element which accumulates energy supplied during the trace and is limited in value by a voltage doubler dependent on the supply voltage of the scanning generator, said doubler comprising a diode, a doubling capacitor and switches for the alternate series-parallel connection of the capacitor, and means dependent on the supply voltage for blocking the voltage doubler at a limiting value equal to double a settable threshold voltage.

The blocking circuit according to the invention can be constructed in integrated form for combination on a single semiconductor plate with the integrated circuit of the scanning generator.

In a preferred embodiment of the present invention it is possible to set different values for the set blocking supply voltage by adjusting the value of a single resistor, while maintaining the other parts of the circuit fixed.

An embodiment of this invention will now be described by way of example, with reference to the accompanying drawings in which:—

Figure 1 is a block diagram of a circuit according to the invention, associated with a conventional scanning generator.

Figure 2 is a diagram showing the variation of the most significant voltages during the retrace time, as a function of the supply voltage of the scanning system.

Figure 3 is a circuit diagram of one possible construction of the regulator (R) of the circuit.

Figure 1 is a block diagram showing the components and their connections relevant to the invention but the connections between a scanning generator S_g and its external component extraneous to the invention are not shown.

The scanning generator S_g, of known type, receives a suitable input control signal for producing at its output load a sawtooth current variation. S_g receives its supply V_s from points A and G, and produces the retrace voltage V_f, which is fed to the point F common to the cathode of the diode D and one plate of the capacitor C, these being connected together in known manner for doubling the voltage V_s. The diode D, the anode of which is connected to point A if this is positive with respect to G (in the case of opposite polarity, the diode electrodes are reversed), has its cathode connected to the voltage V_f and to one plate of the capacitor C. The other plate of the capacitor C is connected to point O of the regulator R. The block S_b also provides the necessary control signals for opening and closing the switches S1, S2 situated in the regulator block R; switches S_1, S_2 are closed only for the entire retrace time. The regulator block R, which will be described hereinafter with the aid of Figure 3, is supplied with the same voltage V_s from points A and G and provides the voltage V_1 at point O, which is connected to the second plate of condenser C. S_g and R with their common connections are enclosed within the area S, which represents a single integrated semiconductor chip. D and C are outside the chip. The regulator R is substantially a direct current threshold amplifier controlled by its own supply voltage V_s, which produces at point O the voltage V_1 which is a linear function of the increase in the value of V_s with respect to a set threshold value.

The voltage V_1 is almost zero when V_s is less than the threshold value. Under these conditions the capacitor C is charged to the voltage V_s through the diode D and a saturated transistor T8 of the regulator R. At the instant of closing the switch S2, which short-circuits point O to point A, i.e. at the beginning of the retrace, there is a voltage at point F given by the sum of the voltage V_s and the voltage across C, as T8 becomes blocked when S1 is closed. As point F also receives the retrace voltage V_f, this becomes limited to the value of this sum which is equal to twice V_s until the voltage V1 is formed, or as stated above, until the threshold value for V_s is exceeded. Beyond this threshold value, the voltage across capacitor C is reduced by a quantity equal to V1, and consequently the voltage at point F, which will be called V_F, is given by

$$V_F=(2\times V_s)-V1$$

V_F represents the maximum limit for the retrace voltage V_f.

Thus, when the supply voltage exceeds a set

threshold value, a voltage is introduced which is proportional to the extent of this excess, and blocks the retrace voltage at a value which is double said threshold voltage.

Figure 2 is a diagram which shows by way of example one particular case in which the scanning supply voltage V_s reaches a value of 50 V at point X. If the limiter for the corresponding retrace voltage V_f was of known type, its value would be double, i.e. 100 V, as shown by the dashed line. With the illustrated arrangement according to the invention, it can be seen that the retrace voltage V_f, represented by a continuous line, is blocked at 60 V, which is double the supply voltage of 30 V. This value, indicated by point Y, is determined by the set threshold. Besides this threshold, the regulation voltage V1 is also formed in the regulator R, as shown in the diagram. The same diagram also shows the voltage V_c across the capacitor C which when below the threshold value has the same value as the voltage V_s, whereas when it is above it is reduced by an amount equal to V1.

Figure 3 shows the circuit diagram for one of the possible constructions of the regulator R, suitable for construction in the form of an integrated circuit on a single plate of semiconductor material, preferably in association with the scanning generator S_g. The circuit is supplied by way of point A and point G at the voltage V_s which supplies the scanning system S_g, and is disposed such that the Zener Diode Z1 does not conduct when the voltage V_s is less than a voltage which will be known as the threshold voltage V_{ss}. Under these conditions, maximum conduction of T8 (saturation) is obviously ensured because it is controlled by T7 which receives current at its base from T6, which reflects the current of T1 as S1 and S2 are open, i.e. during the trace. The representation of S1, S2 as mechanical switches is a simplification of the circuit, because in reality their contacts are the collector and emitter electrodes of transistors which receive at their respective bases the control signal from the scanning generator S_g. As already stated, S1, S2 remain closed only during the retrace time. The current in T8 is supplied by way of point O, the capacitor C and the diode D indicated in Figure 1. It can easily be seen that when Z 1 does not conduct, the current in T3, T4, T5 is zero. When the voltage V_s reaches the threshold value V_{ss} and Z1 begins to conduct, there is a corresponding conduction of T2, T3, T5 which consequent reduction in the conduction of T7 and T8. This causes the voltage V1 to form between O and G. When S2 is closed together with S1, this puts the supply voltage V_s in series with the voltage existing across C, equal to $V_s - V_1$, and the resultant value gives the limits for the retrace voltage V_f. The circuit is advantageously improved by defining the value of the resistor R2 such that the required threshold volage depends only on this. In this respect, R2 is the only component which it is convenient to vary when R1 and Z1 are fixed, as can be seen from the following relationships: putting $V_{BE1}=V_{BE2}$, then for the beginning of conduction of Z1,

$$V_{ss} - R_1\left(\frac{V_{ss}-V_{BE}}{R_1+R_2}\right) = V_{BE}+V_{Z1}$$

from which:

$$V_{ss} = \frac{V_{Z1}(R_1+R_2)+V_{BE}\cdot R_2}{R_2}$$

As can be seen by way of example in Figure 3, the resistor R2 to be adjusted has its terminals accessible from the outside by way of the contacts B and E, which can be omitted if the necessary value for R2 has already been provided in manufacturing the integrated circuit.

The variation of V1 and V_s is defined by the values of R3, R4. The purpose of the diode D1 is to protest the base-emitter junction of T5 against the inverse voltage peak which would strike it when T8 is locked and the current in R4 is still zero on closing S1, S2.

Claims

1. A retrace voltage blocking circuit for association with an electronic scanning generator of the type in which the retrace voltage is formed across a reactive element which accumulates energy supplied during the trace and is limited in value by a voltage doubler dependent on the supply voltage of the scanning generator, said doubler comprising a diode, a doubling capacitor and switches for the alternate series-parallel connection of the capacitor, and means dependent on the supply voltage for blocking the voltage doubler at a limiting value equal to double a settable threshold voltage.

2. A blocking circuit as claimed in Claim 1, wherein the means for blocking the voltage doubler at the set limiting value comprise a direct current amplifier which supplies a current in proportion to the difference between the actual supply voltage and a set threshold voltage in order to develop a voltage proportional to this current between the collector and emitter of a transistor stage connected in series with the doubling capacitor.

3. A retrace volttage blocking circuit substantially as hereinbefore described with reference to the accompanying drawings.

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