

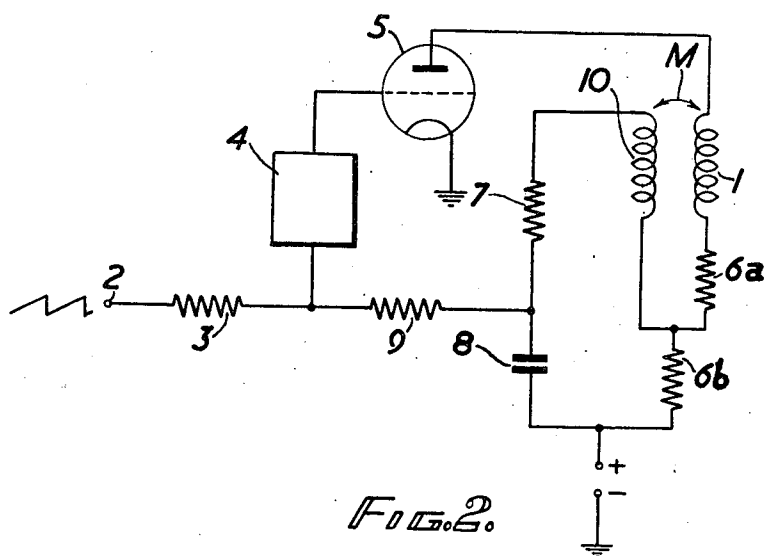
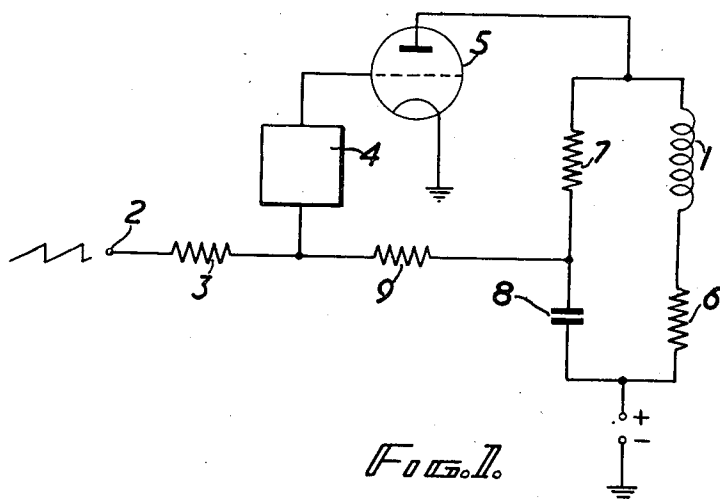
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CATHODE RAY TUBE DEFLECTION SYSTEMS

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## CATHODE RAY TUBE DEFLECTION SYSTEMS

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3 Claims. (Cl. 315—27)

This invention relates to cathode ray tube deflection systems and more specifically to electro-magnetic deflection systems of the kind in which a feedback circuit is provided in association with a deflection amplifier in order to ensure that the current through a deflection coil shall be substantially proportional to the voltage input to the deflection amplifier—usually, though not necessarily, a saw tooth voltage wave input.

The invention is illustrated in and explained in connection with the accompanying diagrammatic drawings in which Fig. 1 is a diagram of a known arrangement and is provided for the purposes of explanation, and Fig. 2 is a diagram of an embodiment of this invention.

Referring to Fig. 1, 1 is a deflection coil of a cathode ray tube (not shown) through which is required to flow a saw tooth current wave form corresponding to a saw tooth voltage wave form applied at an input terminal 2. The voltage wave form at 2 is applied through a resistance 3 and any known convenient linear amplifier 4 to the control grid of a driving deflection amplifier valve 5, exemplified as a triode. The coil 1 is in the anode circuit of the valve 5 and in some cases there is included in series with it an additional external resistance. In any event the internal resistance of the coil 1 may be represented as a series resistance and in Fig. 1 the resistance 6 is intended to represent the internal resistance of the coil 1 and that of any external resistance provided. Across the coil-resistance circuit 1—6 is a resistance-capacity time constant circuit consisting of a resistance 7 and a condenser 8 and the junction between these elements is connected back to the input of the amplifier 4 through a resistance 9. The elements 7 and 8 are so dimensioned that the time constant provided thereby is substantially equal to the time constant of the coil branch (1—6) of the anode circuit network. With this arrangement it can be shown that the voltage developed across the condenser 8 is substantially equal to the voltage developed across the resistance 6. This voltage is fed back through the resistance 9 to the amplifier 4 and thence to the grid of the valve 5. In this way it is ensured that the current through the coil 1 is substantially proportional to the voltage applied at the terminal 2.

The well known system of Fig. 1 has, however, a serious defect, namely that the internal resistance of the coil 1 (which is normally made of copper) varies considerably with variations in temperature (especially during the "starting up" period when the coil is first brought into use) and such variations cause variations in feedback and accordingly failure to maintain the required fidelity of coil current wave form to input voltage wave form.

The object of the present invention is to avoid this defect.

According to this invention a deflection system for a cathode ray tube deflection coil comprises a driving deflection amplifier, an external resistance in series with said deflection coil in the output circuit of said amplifier, a second coil tightly coupled magnetically to said deflec-

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tion coil and connected at one end to a point between said external resistance and said deflection coil, a time constant resistance-capacity circuit, the product of whose resistance and capacity is substantially equal to the quotient of the mutual inductance of the two coils divided by the resistance of said external resistance, and means for feeding back voltage built up across said capacity to the input of said driving amplifier.

Preferably the two tightly coupled coils are constituted by a single coil structure wound in bifilar fashion. In other words the deflection coil and the second coil may be arranged to constitute in effect a 1:1 transformer.

An embodiment of the invention is illustrated in Fig. 2 in which like references indicate the same parts as in Fig. 1.

Referring to Fig. 2 the deflection coil proper 1 which is in the anode circuit of the final valve 5 of the driving deflection amplifier 4—5, forms part of a bifilar coil structure of which the other part is constituted by a second coil 10 tightly coupled to said deflection coil. The resistance 6a represents the total effective internal resistance of the coil 1. In series with the coil 1 is an external resistance 6b. The coil 10 is connected at one end to the junction point of 6a with 6b, i.e. between the actual coil 1 and the external resistance 6b. Across the series circuit thus constituted is a time constant circuit 7—8 which is so dimensioned that the product of the resistance of element 7 into the capacity of element 8 is substantially equal to  $M/R$  where  $M$  is the mutual inductance between the coils 1 and 10 and  $R$  is the resistance of the external resistance 6b. The mutual inductance between coils 1 and 10 is represented conventionally in Fig. 2 by a double ended curved arrow  $M$ . It may be shown that with the parts thus dimensioned the voltage across the condenser 8 will be substantially equal to the voltage developed across the external resistance element 6b. It will be seen, therefore, that the internal resistance of the coil 1, namely the resistance represented in Fig. 2 by 6a, is no longer included in the main feedback path across the valve 5 so that the undesired effects of temperature variations of the coil 1 are reduced very greatly. In practice they may be so reduced as to be negligible. Although temperature variations in the external resistance 6b will have some undesired effects in the way of causing undesired variations of feedback, this resistance can in practice be made of very much higher temperature stability than the (normally) copper coil 1, with the result that the improved circuit of Fig. 2 is practically insensitive to temperature variations.

We claim:

1. A deflection system for a cathode ray tube deflection coil comprising a driving deflection amplifier, an external resistance in series with said deflection coil in the output circuit of said amplifier, a second coil tightly coupled magnetically to said deflection coil and connected at one end to a point between said external resistance and said deflection coil, and at the other end to the resistance end of a time constant resistance-capacity circuit, the product of whose resistance and capacity is substantially equal to the quotient of the mutual inductance of the two coils divided by the resistance of said external resistance, and whose capacity end is connected to the end of said external resistance opposite to that by which said external resistance is connected to said deflection coil, and means for feeding back voltage built up across said capacity to the input of said driving amplifier.

2. A deflection system for a cathode ray tube deflection coil as set forth in claim 1 wherein the two tightly coupled coils are constituted by a single coil structure wound in bifilar fashion, to constitute in effect a 1:1 transformer.

3. In combination, in a deflective system for a cathode ray tube deflection coil, a thermionic valve amplifier,

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means for applying a pre-determined voltage wave form to the input circuit of said amplifier, a circuit extending from the output anode point of said amplifier to a source of anode potential therefor and including, in the order stated, the deflection coil and an external resistance, an inductance coil wound bifilar with said deflection coil and connected at one end to the junction point of said deflection coil with said external resistance, the other end of said inductance coil being connected through a further resistance and thence through a condenser to said anode potential source, the product of the value of said further resistance into that of said condenser being substantially

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equal to the quotient of the value of the material inductance between said deflection coil and said inductance coil divided by the value of said external resistance, and a connection between the junction point of said further resistance with said condenser and the input circuit of said amplifier.

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