

[54] **COLOR PURITY ADJUSTING DEVICE FOR A COLOR PICTURE TUBE**

[75] Inventor: **Eiichi Yamazaki**, Ichihara, Japan

[73] Assignee: **Hitachi, Ltd.**, Japan

[22] Filed: **May 27, 1970**

[21] Appl. No.: **40,827**

3,290,532	12/1966	Lemke et al.	335/212
3,296,570	1/1967	Uetake et al.	335/212
3,375,389	3/1968	Hughes	335/213
3,588,583	6/1971	Ciecierski	335/210

Primary Examiner—Maynard R. Wilbur

Assistant Examiner—J. M. Potenza

Attorney, Agent, or Firm—Craig & Antonelli

[30] Foreign Application Priority Data

June 16, 1969 Japan..... 44-46870

[52] U.S. Cl..... **315/13 C; 335/213; 315/8**

[51] Int. Cl..... **H01j 29/70**

[58] Field of Search..... 315/31 TV, 27 XY, 13 C; 335/210-213

[56] References Cited

UNITED STATES PATENTS

2,719,249	9/1955	Friend	315/27 XY
2,903,689	12/1959	Scanlon	335/212
3,106,658	10/1963	Chandler et al.	335/210

[57]

ABSTRACT

A color purity adjusting device for a color picture tube, provided with one or more types of correcting coils which are wound on the outer periphery of the color picture tube in order to correct any mislanding of an electron beam due to deformation which might take place during the manufacturing process of the color picture tube, such as, a distortion of a shadow mask or of a glass bulb and to correct any mislanding of the same due to the influence of same external magnetic field such as the earth's magnetism, thereby to obtain a picture of improved color purity.

7 Claims, 9 Drawing Figures

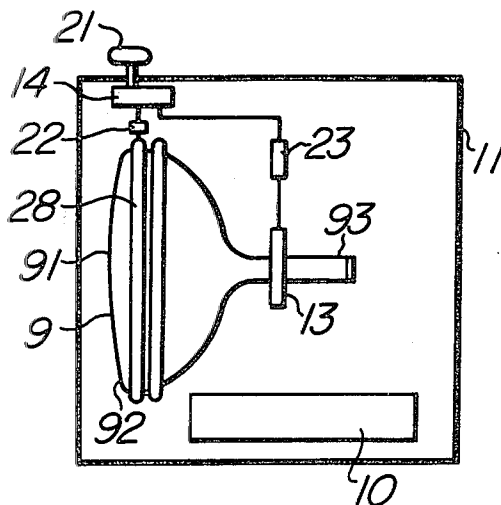


FIG. 1

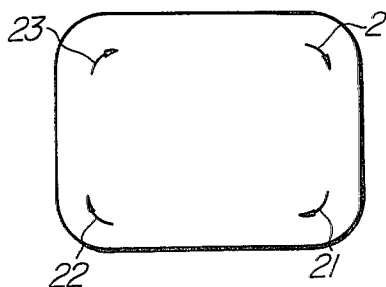


FIG. 2

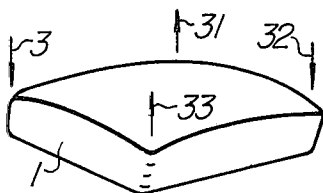


FIG. 3

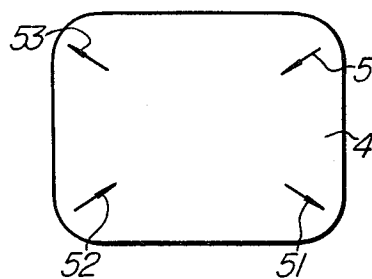


FIG. 4

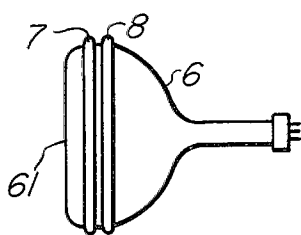


FIG. 5

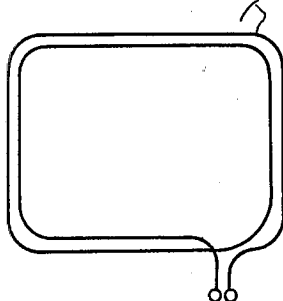


FIG. 6

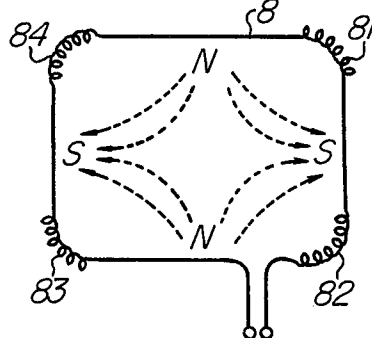


FIG. 7

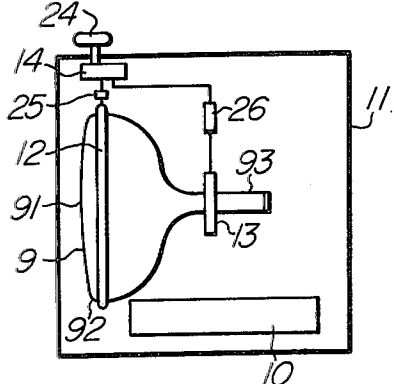


FIG. 9

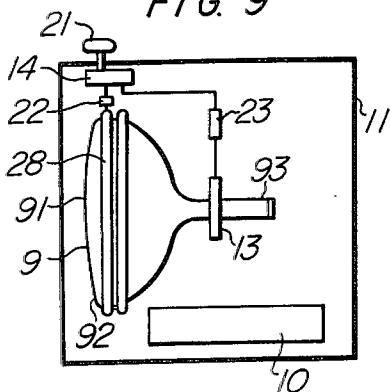
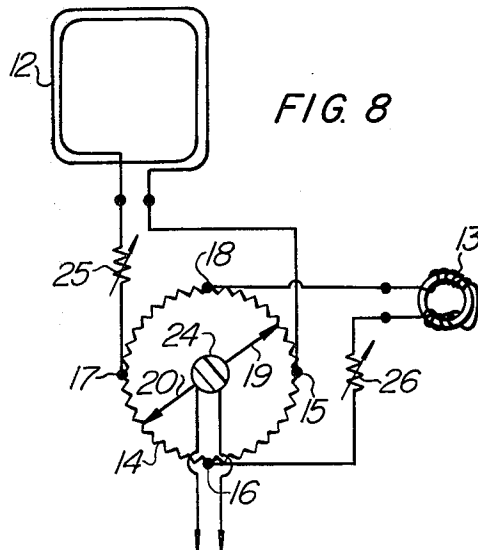


FIG. 8



INVENTOR

EIICHI YAMAZAKI

BY Craig, Antonelli, Stewart & Hill

ATTORNEYS

COLOR PURITY ADJUSTING DEVICE FOR A COLOR PICTURE TUBE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a color purity adjusting device for use in a color picture tube.

Deterioration in color purity occurs due to the so-called "mislanding" which in turn appears because an electron beam produced by an electron gun is not correctly projected onto each color phosphor dot, and the invention is concerned with a color purity adjusting device for a color picture tube, for removal of the particular mislanding of an electron beam because the shadow mask has been subjected to distortion during the manufacturing process of the color picture tube. The device of the invention further removes a mislanding due to an external magnetic field such as the earth's magnetism, thereby making a satisfactory adjustment of the color purity in the color picture tube.

2. Description of the Prior Art

As is well known, a color picture tube is subjected to a temperature of about 400°C or so during the manufacturing process thereof, e.g., in the baking or evacuation step. Consequently, the glass bulb or shadow mask may become thermally distorted, and an electron beam passing through the shadow mask is prevented from being correctly bombarding the phosphor dot or the so-called mislanding takes place with the result that the color purity is deteriorated.

In order to prevent such mislanding due to thermal deformation of the bulb or mask, it is sufficient to lower the temperature in the baking, exhausting or the like step to avoid the thermal distortion of the glass bulb or the shadow mask. On the other hand, however, this is disadvantageous in that degassing from the interior of the tube will become insufficient and thereby undesirably shorten the life of the picture tube. Therefore, prevention of thermal distortion is extremely difficult under the present circumstances.

Accordingly, corrections have been made, for example, in such a manner that an additional means as will be described later, the so-called guard ring for example, with which an aperture in the shadow mask is made smaller than the size of a phosphor dot, to prevent the beam from missing the phosphor dot or from bombarding a phosphor dot of a different color, even if occurrence of some mislanding due to thermal distortion be seen, and/or that a purity adjusting device consisting of a coil which is wound around a phosphor screen, is used to produce a magnetic flux in the direction of the tube axis, thereby to correct a rotational deviation (as will be described later). However, the former measure or that one in which the mask aperture is made smaller in diameter than the beam has had a drawback in that the reduction in size of the aperture of the shadow mask will naturally result in lowering the brightness of the phosphor screen by that amount, while the latter measure or with a purity adjusting device consisting of a coil winding has permitted correction to be carried out to some extent for the rotational deviation, but it has exhibited a drawback in that it has no effect on other deviations such as a radial one (as will be described later) thus allowing for no satisfactory corrections to be expected.

Furthermore, in a color TV receiver using such a color picture tube taking advantage of parallax as the

shadow mask type color picture tube, there is noted a phenomenon in which the color purity of a picture deteriorates under the influence of the earth's magnetism. More specifically, when the installed direction of the receiver is changed, the angle at which the horizontal component of the earth's magnetism crosses the receiver will vary so that the passage of an electron beam will change, thus resulting in an incorrect landing of the beam onto the phosphor dot, consequently bringing about a deterioration in the color purity.

In order to obviate such a defect, although a magnetic shield has heretofore been installed in a color picture tube and means in which a degaussing coil is added thereto has been widely employed, these are not complete either and merely reduce the influence of the external magnetic field to one-second that when no such magnetic shield is used. Accordingly, the so-called guard ring is provided by means of which the diameter of a beam (the diameter of a mask aperture) is made smaller relative to the diameter of a phosphor dot of a color picture tube so that even when some landing errors exist, the beam may be prevented from coming out of line with the phosphor dot or from striking a dot of a different color. With such a measure, however, it is inevitable that the brightness of a picture will be lowered by that amount corresponding to the reduction of the diameter of the mask aperture.

In addition, any prior art adjusting devices as suggested have been impractical in that they are complicated in handling and that they have a number of portions requiring adjustment.

SUMMARY OF THE INVENTION:

It is accordingly an object of the invention to provide a color purity adjusting device for a color picture tube, which is free from the above-mentioned defects.

Another object of the invention is to provide a color purity adjusting device to compensate for any deterioration in the color purity due to mislanding caused by a distortion of a shadow mask of a color picture tube.

Still another object of the invention is to provide a color purity adjusting device for compensation of deterioration in the color purity due to mislanding caused by the adverse influence of an external magnetic field such as the earth's magnetism.

According to the present invention, a variety of color purity adjusting devices for a color picture tube may be obtained by combining, dependent upon the result of manufacture of the individual color picture tubes or upon the type thereof the presence or absence of the aforementioned magnetic shield, a first coil which is connected so as to form magnetic poles in the vicinity of the four corners of a phosphor screen of a color picture tube thus forming quadripole magnetic poles in all, a second coil which is constituted by winding a conductive wire on the outer periphery of the color picture tube and which produces a magnetic field in the direction of the tube axis, and a third coil which is wound on the outer periphery of the color picture tube and which produces a magnetic field for correcting the magnetic field on a horizontal plane at right angles to the axis of the tube. Then, mislandings as mentioned may be prevented through the adjustment of the currents flowing through the respective coils, whereby a picture of improved color purity may be obtained.

Furthermore, according to the present invention, a particular color purity adjusting device may be ob-

tained which, in a color purity adjusting device including the above-mentioned second and third coils, is provided with a potentiometer connected to these second and third coils and with a single knob joined to sliding terminals of the potentiometer and adjusting currents flowing through the second and third coils, whereby there may be made easier the adjustment for correcting mislanding which occurs dependent upon the installed direction of a color TV receiver and thereby preventing the color purity from being lowered.

BRIEF DESCRIPTION OF THE DRAWINGS:

FIGS. 1 and 2 are diagrammatic views showing the thermal distortion of a shadow mask;

FIG. 3 is a diagrammatic view showing a deviation of landing due to torsion of the shadow mask;

FIG. 4 is a schematic front view showing a color purity adjusting device for a color picture tube, embodying the present invention;

FIG. 5 is a view showing an example of an adjusting coil for correction of a rotational deviation of landing, which coil is used in the purity adjusting device of the invention;

FIG. 6 is a view showing an example of an adjusting coil for correction of a deviation due to torsion of the mask, which coil is likewise used in the purity adjusting device of the invention;

FIG. 7 is a schematic front view showing an embodiment of the purity adjusting device in a color TV receiver, of the invention;

FIG. 8 is a diagram of electrical connection in the purity adjusting device shown in FIG. 7; and

FIG. 9 is a similar view to FIG. 7, showing another embodiment of the purity adjusting device of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

A color picture tube is subjected to a temperature of about 400°C or so during the manufacturing process, i.e., either in the baking or evacuation step. Therefore a glass bulb or a shadow mask undergoes thermal deformation, with the result that the phenomenon of so-called "mislanding" is observed in which an electron beam having passed through the shadow mask does not strike the desired phosphor dot. This phenomenon will now be described with reference to the drawings. The above-mentioned thermal deformations of the glass bulb and the shadow mask are extremely irregular, but they may, when broadly classified, be practically represented by a rotation of a shadow mask 1 into the directions shown by arrows 2, 21, 22 and 23 as illustrated in FIG. 1, and by a torsion of the shadow mask 1 into the directions shown by the arrows 3, 31, 32 and 33 as illustrated in FIG. 2. The rotation actually appears in the form of movements of pins for holding the mask which are embedded in the side wall of a glass bulb (not shown). The landing deviations accompanied by the deformations or distortions may be a rotational deviation in the same directions as those of the arrows 2, 21, 22 and 23 (hereinbelow termed the "rotational deviation") as shown in FIG. 1 and/or a deviation in the directions represented by arrows 5, 51, 52 and 53 on a phosphor screen 4 (hereinafter termed the "radial deviation") as shown in FIG. 3 (due to the torsion as shown in FIG. 2).

FIG. 4 is a view showing an embodiment of a purity adjusting device of the invention, with those other than the essential parts omitted. In FIG. 4, numeral 6 designates a color picture tube, and numeral 7 an adjusting coil which is wound around and disposed on a phosphor screen 61. The adjusting coil 7 has an example of the structure thereof illustrated in FIG. 5, and through such an adjusting coil 7 is caused to flow D.C. current thus providing a magnetic flux in the direction of the axis of the tube to adjust the rotational deviation. The adjusting coil 7 may, of course, effectively also correct any rotational deviation which occurs when the tube axis (not shown) of the color picture tube 6 is directed to the north or south. Numeral 8 represents an adjusting coil which is disposed so as to provide quadripole magnetic poles on the periphery of the phosphor screen. The adjusting coil 8 has an example of the structure thereof depicted in FIG. 6, and by adjusting the polarity and strength of current of the coil 8 in a similar manner to the adjusting coil 7 for adjustment of the rotational deviation, it is imparted with a polarity, e.g., as shown by the dotted lines in FIG. 6 whereby it makes adjustments to such radial deviation as shown in FIG. 3. In this case, the provision of four component coils 81 - 84 in the four corners of the adjusting coil 8 and connected in series as shown in FIG. 6 to adjust currents flowing through such coils by means of only one adjusting knob is usually sufficient to achieve the object of the invention. In addition, adjustment is easier by using this coil than with the two former measures. Furthermore, the adjusting coil 8 may be formed integrally with, but electrically independent of the aforementioned adjusting coil 7.

In operation, when first the color picture tube starts, there will appear on the phosphor screen simultaneously both or either one of the rotational deviation and the radial one as shown in FIG. 3, with the result that the color purity will be lowered. These deviations will sometimes occur simultaneously and sometimes separately, and in any cases, the corresponding adjusting coil or coils are respectively selected dependent upon the conditions and types of the deviations produced. More specifically, in case both the deviations appear simultaneously, the adjusting coils 7 and 8 are selected, and in case either one appears, the adjusting coil 7 is chosen for the rotational deviation while the adjusting coil 8 for the radial deviation as shown in FIG. 3. Then, the selected coil or coils have currents caused to flow therethrough and the polarity as well as the strength of the currents are adjusted, whereby the deviations are corrected to prevent the color purity from being deteriorated.

In the embodiment thus far described, where it is apparent in the manufacturing process of the color picture tube, especially at the stage when all the heat-treatment steps have been completed, such as at the inspection step, that only one of the above described rotational and radial deviations appears or would possibly occur or that even when both deviations are produced, either one will be very small and negligible, then omission of either one of the adjusting coils 7 and 8 will cause no inconvenience.

As described above, the purity adjusting device of this embodiment is provided with two coils, one of which forms quadripole magnetic poles on the periphery of the color picture tube in order to correct the radial deviation, and the other of which comprises a con-

ductive wire wound around and disposed on the outer periphery of the color picture tube and produces a magnetic field along the axis of the tube in order to correct for rotational deviation. Accordingly, the adjustment of currents will enable the greater part of mis-

landing due to thermal deformation of the color picture tube to be corrected, and hence a bright color picture of good purity is obtainable without the need for disposing an unnecessarily large guard ring as in the prior art.

FIG. 7 shows another embodiment of the invention or a purity adjusting device for correcting the lowering of the color purity, especially due to an external magnetic field such as the earth's magnetism. The figure illustrates the device when assembled into a color TV receiver, and those other than the essential parts are omitted therefrom.

Referring to FIG. 7, numeral 9 designates a color picture tube, numeral 10 a chassis, numeral 11 a cabinet, and numeral 12 a correcting coil for correction of an external magnetic field along the tube axis (not shown) of the color picture tube 9. The correcting coil 12 is wound and disposed in the vicinity of the periphery 92 of an image screen 91 of the color picture tube 9 so that a magnetic flux may be produced along the axis of the tube 9. Numeral 13 designates a correcting coil for correction of an external magnetic field being in the horizontal direction and at right angles to the tube axis, and the correcting coil 13 is disposed at a necked portion 93 of the color picture tube 9 so that a magnetic flux may be produced in the horizontal direction and at right angles to the tube's axis. At 14 is shown a potentiometer, an example of which is illustrated in FIG. 8. More particularly, the potentiometer 14 in FIG. 8 is a ring-shaped one, and includes terminals 15 - 18 at intervals of 90° and two sliding terminals 19 and 20 which are interlocked and rotated, while maintaining an interval of 180° to each other. To the sliding terminals 19 and 20 is joined a knob 24, and they are adapted to be simultaneously slid by moving the knob 24. Numerals 25 and 26 represent semi-fixed resistors, which adjust currents flowing through the correcting coils 12 and 13 respectively, thereby making appropriate corrections.

Now description will be made of the operation of this embodiment. Firstly, the polarity of the correcting coil 12 is previously connected so that it will make corrections for a TV receiver facing north when the sliding terminal 19 is set into the direction of the terminal 15 (i.e., the other sliding terminal 20 is set at the terminal 17), while the polarity of the correcting coil 13 is connected so that it will provide corrections for a TV receiver facing east when the sliding terminal 19 is set in the direction of the terminal 16 (i.e., the other sliding terminal 20 is set at the terminal 18). In case the color TV receiver having been adjusted to be normal under such conditions is changed in direction, it will be lowered in color purity under the influence of an external magnetic field. In order to counteract this lowering, first the knob 24 is turned to move the sliding terminals 19 and 20. The slide of the sliding terminals 19 and 20 will cause current to flow through the correcting coil 12 and/or the correcting coil 13 thereby to produce a magnetic flux to cancel the external magnetic field, with the result that the influence of the external magnetic field is removed whereby the TV receiver is reset to the normal state with no lowering in color purity. In this case, it is also possible that whenever the knob is

faced to the north (This is a mere instance, and any one direction of the east, south, west, north and any intermediate ones therebetween, etc. may be previously determined.) irrespective of the installed direction of the receiving set, a suitable correction may be made. With such a setting, the adjustment may be very easily performed. In addition, it is more convenient to previously assemble a magnet into the receiver set in order to know directions. Yet in addition, although not shown, the correcting coils may of course be provided with means with which D.C. bias currents are caused to flow as may be needed, whereby stationary corrections are made, and therefor any inherent faults in a cathode ray tube used due to distortion having been brought about during the manufacturing process, are corrected. Of course, it presents no problem to jointly use these correcting coils with a coil employed for the usual degaussing coil.

As described above, the purity adjusting device according to this embodiment comprises a skillful combination of correcting coils and a potentiometer. Accordingly, the correction in case of installing the TV receiver into an optional direction and for the influence of an external magnetic field may be easily performed by causing the single knob which is joined to the sliding terminals of the potentiometer, to face any one of the north, south, east and west as set on a dial, in accordance with the installed direction of the TV receiver. Therefore no lowering in the color purity occurs, and it is not required as in the embodiment described with reference to FIGS. 4 to 6, to make the guard ring for the phosphor dots unnecessarily large. As result, a bright color picture is obtainable.

This embodiment may, of course, be jointly used with a magnetic shield which has hitherto been employed. In this case, when the shielding effect is particularly effective either in the direction of the tube's axis or in the direction at right angles therewith, then either one of the correcting coils may be omitted.

Although in the above description only one potentiometer was included, the combined use of two or more will also be able to provide the same effect.

In addition, although in this embodiment no reference was made to the correction of an external magnetic field in the vertical direction, the magnetic field in the vertical direction is always constant irrespective of the installed direction of the TV receiver, and hence this correction may be sufficiently attained with the usual purity magnet.

Although, in the foregoing, description was separately made of the first embodiment with reference to FIGS. 4 to 6 and the second embodiment with reference to FIGS. 7 and 8, these are not necessarily used individually but may also be combined to provide a purity adjusting device which is expanded in function. More specifically, the adjusting coil 7 in FIG. 4 and the correcting coil 12 in FIG. 7 may be joined to constitute a correcting coil 28 as shown in FIG. 9. In this case, as previously described, a D.C. current is caused to flow through the correcting coil 28 for correction of mislanding due to inherent faults of a cathode-ray tube as caused by a deformation having appeared during the manufacturing process thereof, in addition to a current producing a magnetic field for correction of an external magnetic field along the axis of the tube. This latter current, however, is also a D.C. current, and hence supplying the D.C. bias current is actually for varying the

magnitude of the D.C. current value of the correcting coil 28 in accordance with the addition of difference between the current values required for the corrections of mislanding due to the external magnetic field and that due to the deformation. These variations may, therefore be easily carried out, such as by previously changing the positions of the terminals 15 - 18 in FIG. 8 according to the correction of mislanding caused by a deformation.

I claim:

1. A color purity adjusting device for a color picture tube having a phosphor screen, comprising a first coil formed of component magnetic coils connected to form magnetic poles in the vicinity of the four corners of the phosphor screen of said color picture tube to provide a quadripole magnetic pole arrangement, each of said component magnetic coils being disposed to produce a magnetic field in a plane perpendicular to the axis of said color picture tube.

2. A color purity adjusting device for a color picture tube according to claim 1, further comprising a second coil which is disposed on the neck portion of said color picture tube and which produces a magnetic field for correction of magnetic field effects in a horizontal direction perpendicular to the axis of said color picture tube.

3. A color purity adjusting device for a color picture tube, comprising a first coil formed of component magnetic elements connected to form magnetic poles in the vicinity of the four corners of the phosphor screen of said color picture tube to provide a quadripole magnetic pole arrangement, each of said component magnetic elements being disposed to produce a magnetic field in a plane perpendicular to the axis of said color picture tube, and a second coil which is constituted by

winding a conductive wire on the outer periphery of said color picture tube adjacent said first coil.

4. A color purity adjusting device for a color picture tube according to claim 3, further comprising a third coil which is disposed on the neck portion of said color picture tube and which produces a magnetic field for correction of magnetic field effects in a horizontal direction perpendicular to the axis of said color picture tube.

5. A color purity adjusting device for a color picture tube according to claim 4, further comprising a potentiometer connected to said second and said third coils, and a single knob joined to sliding terminals of said potentiometer for adjustment of currents caused to flow through said second and said third coils.

6. A color purity adjusting device for a color picture tube, comprising a first coil which is disposed on the neck portion of said color picture tube and which produces a magnetic field for compensation of magnetic field effects in a direction perpendicular to the axis of said color picture tube, and a second coil which is constituted by winding a conductive wire on the outer periphery of said color picture tube substantially in the plane of the phosphor screen and which produces a magnetic field for compensation of magnetic field effects along the direction of the axis of said color picture tube.

7. A color purity adjusting device for a color picture tube according to claim 6, further comprising a potentiometer connected to said first and said second coils, and a single knob joined to sliding terminals of said potentiometer and for adjustment of currents caused to flow through said first and second coils.

* * * * *

40

45

50

55

60

65