

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Colour Television Degaussing Apparatus

We, RADIO CORPORATION OF AMERICA, a Corporation organized under the laws of the State of Delaware, United States of America, of 30, Rockefeller Plaza, City and State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to colour television degaussing apparatus, and particularly relates to degaussing apparatus for a colour television picture tube of the type energized periodically by alternating current of a magnitude which is sufficiently large to demagnetize the screen structure of the tube and which diminishes effectively to zero in a short time commensurate with the warm-up of the receiver embodying said tube, said receiver including in series with the alternating current supply therefor a thermistor having a relatively high resistance and large voltage drop thereacross when cool and a relatively low resistance and small voltage drop thereacross when hot.

The metallic mask and its supporting structure together with other metal parts used in conjunction with a shadow mask type of colour television picture tube are subject to becoming magnetized both in shipment to, and continued use, in a consumer's home. Such magnetization is effected by bringing the picture tube into proximity with magnetizing structures such as trucks, elevators and the like and also by exposure during use to influences such as the earth's magnetic field. The resultant magnetic field from such random or other magnetization often adversely effects the performance of the colour television receiver in which the picture tube is embodied. Previously, a remedy for such magnetization has included a manual degaussing of the receiver, an operation usually performed

by a serviceman. It also has been the experience of users of such a colour television receiver that the relocation or re-orientation of the apparatus frequently required another degaussing in order to effect optimum performance in the new position.

It has been proposed previously to effect automatic degaussing of a colour television picture tube by using the field neutralizing coil with which some prior art receivers were provided. Such a coil is wound around the picture tube in close proximity to the shadow mask and its supporting structure. When used for field neutralization purposes such a coil was energized with sufficient direct current to produce a magnetic field having a direction substantially parallel to the longitudinal axis of the tube. The magnitude and direction of the neutralization field was adjusted to be substantially equal and opposite to that component of the earth's magnetic field also extending substantially parallel to the longitudinal tube axis.

In order to effect automatic degaussing of the picture tube screen structure it has been proposed to energize the field neutralization coil with alternating current which initially had a substantial magnitude but which has gradually decreased to zero. While such a device and technique has been effective for practical purposes for the accomplishment of degaussing with smaller picture tubes, it has been found that, with the size of colour picture tubes presently in use, the apparatus is often not satisfactory for the reason that it is difficult to produce a degaussing field of sufficient strength ~~throughout~~ the entire area which it is desired to demagnetize.

It is, therefore, an object of the present invention to provide a relatively simple, inexpensive, efficiently operating, and effective apparatus which, when energized, automati-

[Price 4s. 6d.]

80 throughout.

cally degausses a colour picture tube of the type above referred to.

According to the present invention we provide a degaussing apparatus for a colour television picture tube of the type above referred to and which apparatus comprises a member of magnetic material in a closed path around at least a part of the frusto-conical portion of said tube, and a plurality of coils located around said member of magnetic material and positioned thereabout so that they are in substantially diametrically disposed relationship, said coils being connected in series with a varistor having a relatively low resistance when subjected to high voltage and a relatively high resistance when subjected to low voltage, said series connection of said coils and varistor being connected across said thermistor.

The invention will now be more fully described with reference to the accompanying drawing, in which:

FIGURE 1 is a top view of a shadow mask type colour picture tube showing the structure for mounting the tube in a cabinet and also showing the colour purity shield;

FIGURE 2 is the rear view of the colour purity shield showing the coils mounted thereon together with an energizing circuit for effecting the automatic degaussing of the picture tube; and

FIGURES 3a, 3b, 3c and 3d are explanatory diagrams of the operation of the apparatus embodying this invention.

A colour picture tube 11 (FIGURE 1), which is of the shadow mask type such as a 21FJP22 tube manufactured by the Radio Corporation of America, United States of America, is encircled by a mounting strap 12 adjacent to the face plate 13. The mounting strap 12 is securely fastened to the picture tube and is provided with four mounting brackets such as 14 and 15 and two similar ones at the bottom of the tube. The mounting brackets which are riveted, or otherwise securely attached, to the strap 12 are provided with lugs at both ends for mounting purposes. The forwardly extending lugs 16 and 17 respectively of the brackets 14 and 15, together with corresponding lugs on the lower two brackets, are used to attach the tube and its supporting structure to the front wall of the cabinet in which the apparatus is installed. The brackets 14 and 15 also are provided respectively with rearwardly extending lugs 18 and 19 and, together with corresponding lugs on the lower two brackets, serve to mount a colour purity shield 21. The mounting structure including the purity shield 21 described up to this point is used in colour television receivers manufactured by said Radio Corporation of America.

The colour purity shield 21 may be a single layer of magnetic material as indicated in FIGURE 1 or preferably it may consist of a laminated structure of several thinner sheets

of metal for the purpose of minimizing eddy current losses and improving shielding effectiveness. The mounting strap 12 is made so that the top portion 22 and a corresponding bottom portion may be of non-magnetic material to avoid magnetic "short circuiting" of the flux from flux generating coils which will be described subsequently herein. The side portions 23 and 24 of the mounting strap, the brackets 14 and 15, their corresponding brackets on the under side of the tube and the purity shield 21 are all of magnetic materials.

As shown in FIGURE 2, the colour purity shield 21, in one practical version, consists of four similar sections 25, 26, 27 and 28. These sections are joined together by overlapping their respective ends substantially as shown and securing them by means of rivets 29 or equivalent devices. In the present instance, the configuration of the colour purity shield has been modified slightly to adapt the shield for the additional function of providing a relatively low reluctance magnetic circuit for degaussing purposes.

A plurality of flux generating coils are mounted on the purity shield 21 at spaced points thereabout in order to effect the desired degaussing of the colour picture tube structure and associated magnetic elements. Four such flux generating coils 31, 32, 33 and 34 are shown. These coils are identical so that only one of them will be described. The coil 31, for example, is formed by winding a plurality of turns 35 (e.g. 200 turns) of copper magnet wire around a relatively flat supporting tube or bobbin 36. The internal dimensions of this coil tube 36 are such as to enable the coil to be mounted on the shield section 25 by slipping it over one end of the section before it is joined to its adjacent sections 26 and 28.

The flux generating coils 31, 32, 33 and 34 for the degaussing electromagnetic apparatus are connected in series to an alternating current source so that the upper coils 31 and 32 aid one another in producing flux flowing at a given instant counterclockwise (as viewed in FIGURE 2) in the upper half of the purity shield and the coils 33 and 34 aid one another in the production of flux flowing at the same instant clockwise in the lower half of the purity shield as indicated by the arrows. As a result, at that instant a field is produced within the picture tube in which the flux direction is from left to right as indicated by the arrows. It will be understood that at a succeeding instant when the direction of the alternating current flow through the flux generating coils is in the opposite direction, the described flux patterns will have the opposite polarity.

The flux generating coils 31, 32, 33 and 34 are energized by alternating current derived from terminals 37 upon the closure of



a switch 38. Such switch closure energizes the primary winding 39 of a transformer 41 so as to produce alternating current in the secondary winding 42 of the transformer. The secondary winding is connected to the power supply 43 for the television receiver by means of a circuit including a thermistor 44. The thermistor is a device which, when cool, has a relatively high resistance but, when hot, has a relatively low resistance. The coils 31, 32, 33 and 34 are energized by the voltage drop across the thermistor in a circuit which includes a voltage dependent resistor 45. The voltage dependent resistor is a device which has a relatively low resistance when a high voltage is impressed across it and a relatively high resistance when the impressed voltage is low. It will be observed that the resistive properties of the thermistor 44 and the voltage dependent resistor 45 are of a reciprocal nature.

The energization of the degaussing apparatus is as follows, assuming that the thermistor 44 is cold, i.e. at room temperature. Immediately upon closure of the switch 38, which conveniently is the on-off switch of the television receiver, the current flow through the thermistor 44 to the power supply 43 produces a relatively large voltage drop across the thermistor. At this time the resistance of the voltage dependent resistor is low so that the alternating current flows through the flux generating coils 31, 32, 33 and 34 of the degaussing apparatus at considerable amplitude. As a consequence, a relatively strong alternating magnetic field is produced within the picture tube 11 by the degaussing apparatus including the coils 31, 32, 33 and 34 and the purity shield 21. As the thermistor 44 warms in response to current flow there-through its resistance decreases, thereby decreasing the voltage drop thereacross and the amplitude of the alternating current applied to the flux generating coils. As a result of the decreased voltage the resistance of the voltage dependent resistor 45 increases, thereby decreasing the current flow through the flux generating coils. As a consequence, the strength of the alternating magnetic field produced by the degaussing apparatus decreases at a rate determined by the characteristics of the thermistor 44, the voltage dependent resistor 45, the alternating current voltage and the receiver load. The thermistor 44 ultimately heats sufficiently that its resistance and the voltage drop thereacross are very small. The resultant voltage applied to the voltage dependent resistor 45 is so small that the current through it and the flux generating coils is of negligible value. Full alternating current voltage is applied to the receiver power supply 43 enabling it to supply the direct current for the operation of the television receiver. The coils 31, 32, 33 and 34, being effectively de-energized, produce no further

significant magnetic field within the picture tube. At this point the metallic structures of the colour picture tube 11 and associated magnetic elements are effectively demagnetized. The colour purity shield 21, thereafter, functions only to provide a shielding effect from the earth's and other undesired magnetic fields.

In order to better understand the manner in which the present arrangement functions to produce the beneficial results of rendering the electron beams of the colour picture tube relatively immune from effects of the earth's and other undesired magnetic fields, reference is now made to FIGURES 3a to 3d. In FIGURE 3a there is represented a ring 46 of high permeability magnetic material. This ring is comparable to the colour purity shield 21 previously referred to. If such a ring is thoroughly degaussed while in a uniform magnetic field such as represented by the lines of force 47 polarized as indicated by the symbols N and S, the ring is magnetized by this field in the polarity indicated by the symbols N' and S'. The magnetic flux of this external field then flows freely through the ring 46 as indicated, leaving a comparatively field-free region inside of the ring. The electron beams of a colour picture tube are located in this field-free region and they are not influenced by the external field.

If now the external field represented in FIGURE 3a were to be removed, the magnetic situation would be as illustrated in FIGURE 3b. By virtue of its having been degaussed while exposed to the external field shown in FIGURE 3a the ring 46 is magnetized, as indicated by the symbols N' and S' in FIGURES 3a and 3b. In such a situation in the absence of an external field, a residual field indicated by the lines 48 would be produced within the ring and have a polarity as indicated by the arrows.

Now assume that the ring 46 with the described residual magnetism is placed in an external field such as represented by the lines 49 of FIGURE 3c having a polarity as indicated by the arrows opposite to the polarity of the field represented by the lines 47 of FIGURE 3a. Now, the residual magnetism of the ring 46 is oriented in a direction to aid or reinforce the externally applied field in the space surrounded by the ring 46, but opposes the externally applied field within the magnetic material of the ring, so that the ring provides a less effective shunt for the externally applied field around the space surrounded by the ring 46. As a result an undesired portion of the externally applied field exists in the space inside of the ring and affects the electron beams.

FIGURE 3d illustrates the shunting effect produced by the ring 46 of FIGURE 3c after it has been degaussed again while immersed in the same externally applied field as illus-

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trated in FIGURE 3c. Even though the externally applied field is of a polarity opposite to that shown in FIGURE 3a, it is effectively shunted by the ring around the space within the ring in which the electron beams of the picture tube are located.

To illustrate more concretely the described functioning of this apparatus, the situation illustrated in FIGURE 3a is that encountered when the television picture tube is facing in an eastward direction, for example. The externally applied field represented by the lines 47 then is the horizontal component of the earth's magnetic field which is substantially at right angles to the longitudinal axis of the picture tube. The situation represented in FIGURE 3c is that encountered when the television receiver having been degaussed while facing east is placed so that the picture tube faces in a westward direction. Again, the externally applied field represented by the lines 49 is the same horizontal component of the earth's magnetic field which, by virtue of the re-orientation of the television set, again is at right angles to the longitudinal axis of the picture tube but is in the opposite direction with respect to the tube.

For reasons apparent from the foregoing discussion, it is desirable that facilities for automatically degaussing a television receiver be provided so that the beams will be shielded from the influence of the earth's magnetic field and any other field producing objects regardless of its orientation.

The shield 21 and the flux generating coils 31, 32, 33 and 34 during the initial stages of operation of the television receiver provide an alternating field-producing electromagnet which is made effective within the desired portion of the colour picture tube 11 not only by means of the purity shield itself but also by means of the mounting brackets 14 and 15 and their corresponding lower brackets together with the side portions 23 and 24 of the mounting strap 12 acting as pole pieces. By means of the described electromagnetic structure acting as such pole pieces the shadow mask and the supporting structure for it and other metallic components in the screen region of the colour picture tube 11, the colour purity shield 21, the picture tube mounting strap 12, and associated structures such as brackets 14 and 15 are automatically degaussed each time that the receiver is turned on and kept in operation for at least a short time such as a minute.

The illustrative embodiment of the invention discloses the use of four flux producing coils mounted on the purity shield 21 and connected in the manner described. Other arrangements come within the scope of the claimed invention. For example, other numbers of coils may be employed so long as they are properly wound and connected for energization to produce the type of flux pattern shown in

FIGURE 2. In this example the two pole structure providing a horizontally directed flux in the area of the picture tube was chosen to provide a maximum degaussing effect for changes in the horizontal component of any external field. Other orientations or additional poles may be utilized for other applications. Also, although the connection illustrated is preferred, for example, for reasons of simplicity, the degaussing coils, voltage dependent resistor and thermistor may be connected to a source of alternating current which is separate from the one shown and which may include the transformer for the low voltage power supply of the receiver. For example, the coils such as 31, 32, 33 and 34, voltage dependent resistor 45 and thermistor 44 may be connected to the alternating current mains or they may be connected to the secondary of a separate transformer. Furthermore, a cylindrical annular member of magnetic material (of which the illustrated shield 21 may be considered a transverse section) may be mounted so as to surround at least part of the conical section of the picture tube and serve as a low reluctance circumferential path for magnetic flux produced by coils suitably wound thereon.

The degaussing apparatus embodying the present invention is one which requires no special adjustment by the operator of the receiver nor any special activation other than the operation of turning the receiver on and off. Also, the apparatus is such that it operates every time that the set is turned on and left in such condition for a relatively short period of time such as that ordinarily required for the electron tubes of the receiver to warm up. The degaussing apparatus is effective irrespective of the position of the receiver and its orientation relative to the earth's magnetic field and other stray magnetic influences. This enables the positioning of the receiver in substantially any location in the user's home and also permits colour television receivers to be designed for swivel operation much in the same manner as many black and white receivers are presently designed. The nature of the apparatus is such that essentially no losses are introduced in the system after the initial warm up period and relatively little heat is generated in its operation.

WHAT WE CLAIM IS:—

1. Degaussing apparatus for a colour television picture tube of the type referred to, which apparatus comprises a member of magnetic material in a closed path around at least a part of the frusto-conical portion of said tube, and a plurality of coils located around said member of magnetic material and positioned thereabout so that they are in substantially diametrically disposed relationship, said coils being connected in series with a varistor having a relatively low resistance when



trated in FIGURE 3c. Even though the externally applied field is of a polarity opposite to that shown in FIGURE 3a, it is effectively shunted by the ring around the space within the ring in which the electron beams of the picture tube are located.

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WHAT WE CLAIM IS:—

1. Degaussing apparatus for a colour television picture tube of the type referred to, which apparatus comprises a member of magnetic material in a closed path around at least a part of the frusto-conical portion of said tube, and a plurality of coils located around said member of magnetic material and positioned thereabout so that they are in substantially diametrically disposed relationship, said coils being connected in series with a varistor having a relatively low resistance when



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subjected to high voltage and a relatively high resistance when subjected to low voltage, said series connection of said coils and varistor being connected across said thermistor.

5 2. Apparatus according to Claim 1, wherein said member of magnetic material comprises the colour purity shield for said tube.

3. Apparatus according to Claim 1, wherein said plurality of coils are four in number
10 and are spaced equidistantly around the frusto-conical portion of said tube, said coils being connected in series so that two adjacent coils, at a given instant, produce a flux flowing in one direction in one half of said member of
15 magnetic material and the remaining two coils, at the same instant, produce a flux flowing in the opposite direction in the other half of said member of magnetic material.

4. Apparatus according to Claim 1, wherein
20 said member of magnetic material is supported

by brackets of magnetic material extending from a mounting strap which is adapted to clamp around and support said tube in said receiver, said mounting strap having side portions which are of magnetic material and top
25 and bottom portions which are of non-magnetic material, said mounting brackets and the magnetic side sections of said mounting strap serving as pole pieces for creating an alternating magnetic field within said tube in
30 the vicinity of the screen portion of said tube.

5. Degaussing apparatus substantially as herein described with reference to FIGURES
1 and 2 of the accompanying drawings. 35

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