June 4, 1968 C. R. CORPEW 3,387,242

ELECTROMAGNETIC DEFLECTION WINDING CONFIGURATION

Filed June 22, 1966

FIG. 1.

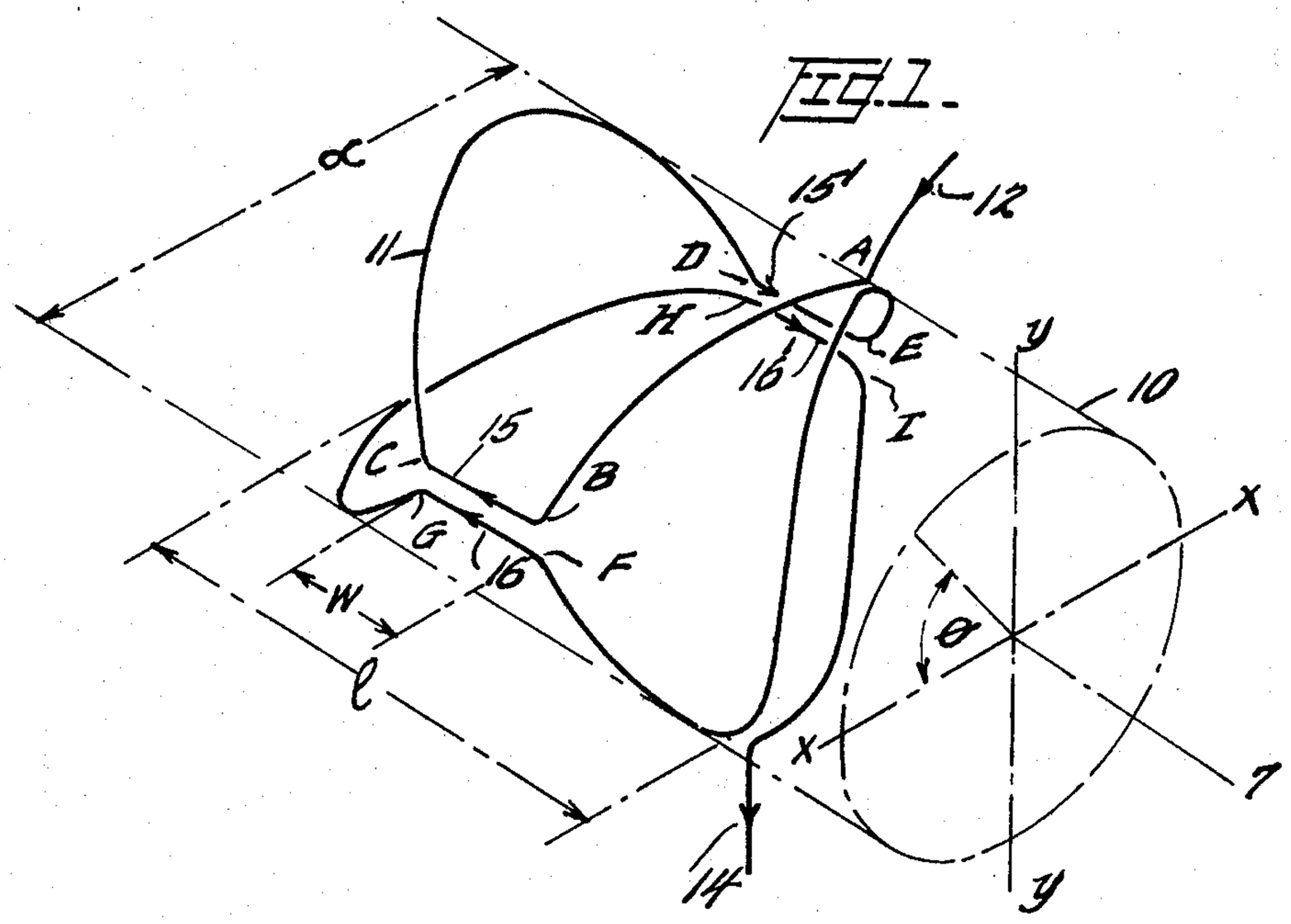


FIG. 2.

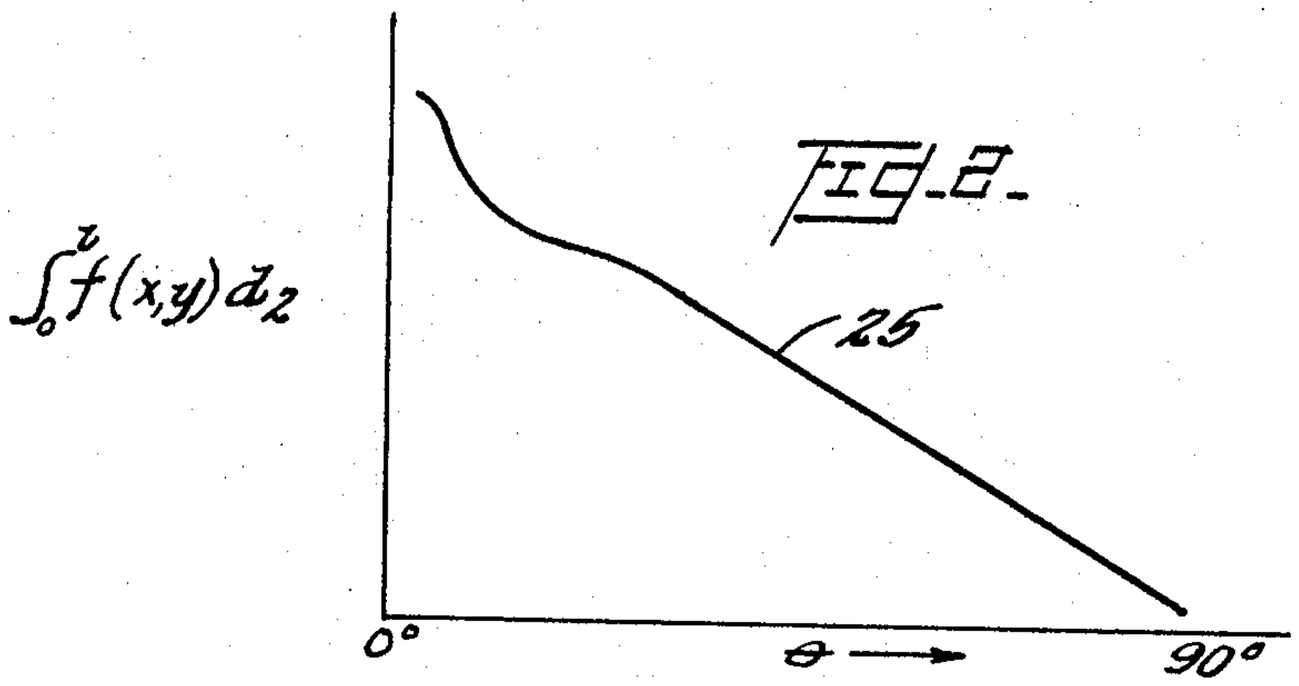
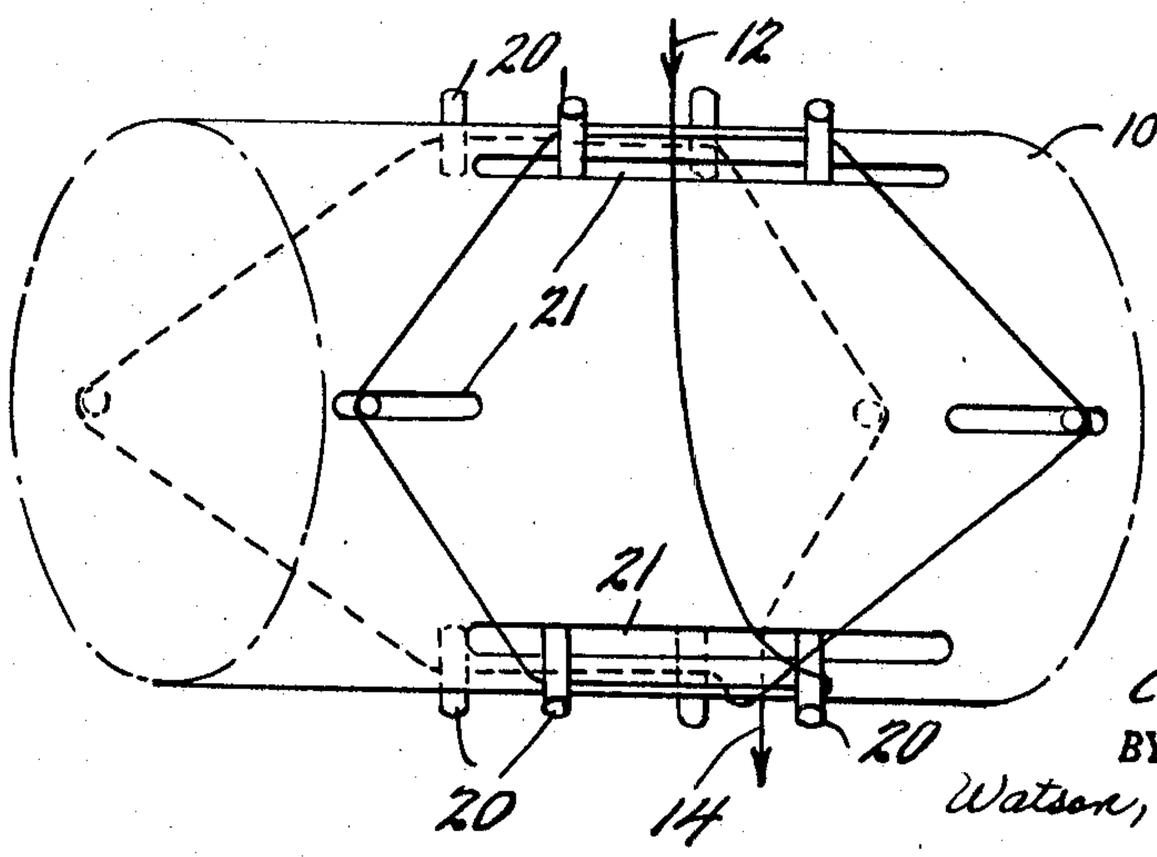


FIG. 3.



INVENTOR.
Charles R. Corpew
BY
Watson, Cole, Grindle & Watson
ATTORNEYS

United States Patent Office

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ELECTROMAGNETIC DEFLECTION WINDING CONFIGURATION

Charles R. Corpew, La Mesa, Calif., assignor to Stromberg-Carlson Corporation, Rochester, N.Y., a corporation of Delaware

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ABSTRACT OF THE DISCLOSURE

A deflection winding for cathode ray tubes has a continuous winding with the crossover portions not normal to the cathode ray beam but continuously curved preferably with the relationship yielding incremental lengths along the beam axis which integrated as a function in the plane of deflection for increments along the beam axis approximate a $\cos^2$ distribution for an angle θ about the beam axis.

This invention relates to electromagnetic control of electron streams and, more particularly, it relates to deflection coil windings for cathode ray tubes.

Various configurations have been developed in the prior art for air core electromagnetic deflection coils placed about the neck of a cathode ray tube to deflect the electron stream. Several such configurations are shown in the Hanlet Patent 2,831,136. Prior art deflection winding configurations may be categorized as (1) those with parallel deflection winding components along the axis of the beam interconnected by arcuate connections normal to the beam path and therefore not contributing to beam deflection; (2) those which employ elliptical windings or the like to derive the deflection flux components acting on the electron stream along the entire length of the wire; and (3) those distributing windings over a large portion of the surface of the neck of the tube such as, for example, single layer windings distributed as a printed circuit on a carrier sheet coiled about the neck of the tube. In general, it is desirable to provide electromagnetic deflection windings which can be driven in push-pull by appropriate current drivers.

Critical parameters in the deflection winding are inductance versus deflection efficiency and distributed capacity, since these factors decrease the efficiency of driver circuits. Both inductance and capacitance are high when these aforementioned winding techniques are employed to dispose unused components of the winding normal the beam axis whereupon additional deflection errors may likewise be imposed. Similarly, the wire is used inefficiently in many cases where distributed windings are employed.

Thus, one objective of the invention is to provide a deflection winding configuration efficiently using wire and disposed to provide low inductance and capacitance with efficient beam deflection properties.

In many prior art configurations two or separate windings are provided for matching and interconnecting externally on opposite sides of the cathode ray beam where different wire spacings may affect deflection efficiency and performance. Some configurations are likewise hard to form and require complex winding forms since different turns have to be placed in different positions.

Thus, another object of the invention is to provide a reproducible winding, symmetrically formed about the beam axis in a cathode ray tube.

A further object of the invention is to provide a push-pull deflection winding constructed of a single continuous winding.

A still further object of the invention is to provide a

winding configuration formed about simplified winding jigs.

There is provided in accordance with this invention therefore an improved deflection winding formed symmetrically about the beam axis of a cathode ray tube with a single continuous winding in a pattern readily wound about a set of pegs extending through a cylindrical form to produce linear deflection portions of the winding along the beam axis which are interconnected by crossover connections yielding incremental lengths along the beam axis which integrated as a function in the plane of deflection for increments along the beam axis approximate a $\cos^2$ distribution for an angle θ about the beam axis. The deflection winding may comprise one or more complete turns which are spaced about the beam axis either inside or outside the cathode ray tube. When placed inside the tube or at a reduced portion of the neck, greater deflection efficiency is realized because of the distance from the wires to the electron stream is decreased. The winding may be wound directly on the neck of the tube, if desired.

The foregoing and further features, objectives, and details of the invention are described in the following specification with reference to the accompanying drawing, wherein:

FIGURE 1 is a sketch showing the winding configuration embodying the invention as formed about a cylinder disposed along the axis of an electron stream;

FIGURE 2 is a diagram showing the effective winding configuration of the deflection winding; and

FIGURE 3 shows a form upon which the deflection configuration provided by this invention may be formed.

Referring now to FIGURE 1, the phantom lines **10** represent a cylindrical surface of diameter d about which the single continuous wire deflection coil **11** is formed when passed through the path signified by arrows from terminal **12** to the terminal **14**. Two sets of adjacent portions of wire **15**, **16** and **15'**, **16'** extend along the cylinder or beam axis z for a length w on opposite sides of the cylinder to pass current in opposite directions as shown by the arrowheads. The interlinking crossover connections extend about the surface of the cyinler over a length l greater than w along the beam axis. As may be seen a simple symmetrical continuous winding path extends through bending points A through I as the deflection coil is formed. This permits a simple winding jig to be constructed as shown in FIGURE 3 where pegs **20** may be extended through slots **21** in the cylindrical form **10'** to be retracted after the coil is wound.

Considering the diagram of FIGURE 2, it may be seen that the ordinate is a function of the integral

$$\int_0^1 f(x, y)dz$$

taken over the angle θ about the beam axis z extending from the deflection plane x—x (or y—y). For deflection in the plane x—x, the conductor portions **15**, **16** lie substantially in the plane x—x passing through the axis z. It is seen by inspection of the curve **25** that this function obtained by integrating the wire increments dz along the beam axis over the length l produces a function similar to a $\cos^2$ distribution about an angle θ extending about the beam axis from the plane of deflection (x—x).

It is noted that the winding of FIGURE 3 is simply constructed for a single deflection axis x—x or y—y with the crossover connections extending about the cylindrical plane coaxial with the beam. The windings are simply wound in a generally hexagonal shape about an upper and lower set of pegs such that two such windings may be interleaved to produce normal deflection components if desired by adding a further set of pegs rotated by 180° about which a similar winding may be formed.

It is therefore to be seen from the foregoing description that this invention affords a novel deflection winding configuration that performs efficiently in deflecting a cathode ray beam and is simple to construct. It is of such nature that fewer turns may be necessary than with conventional prior art deflection coils, thus producing less inductance and distributed capacity. Thus, the deflection coil is readily adaptable to be placed either within or without the glass neck of a cathode ray tube.

Having therefore described the essential and critical features of the invention, those features of novelty believed descriptive of the scope and nature of the invention are defined with particularity in the appended claims.

What is claimed is:

1. A deflection winding comprising, a single continuous wire forming a symmetrical pattern about the axis of a cathode ray beam with two sets of adjacent portions extending along the beam axis on opposite sides a length w to pass current sent through the wire in the same direction in the adjacent portions on each side and in opposite directions in the portions on opposite sides of the beam with said portions interconnected by crossover connections extending about a cylindrical plane coaxial with the beam and extending over a length l greater than w along the beam axis and with said crossover connections being generally disposed along a smooth curve extending about a cylindrical surface without any significant portion disposed in a plane normal to the beam axis.

2. A deflection winding as defined in claim 1 on a cylindrical form including a set of pegs removably extending through slots in said cylindrical form.

3. A deflection winding for producing deflection of a cathode ray beam in one plane comprising a single continuous wire disposed in a pattern providing portions of length w along the beam axis z and substantially in said plane with interconnection links extending over a greater length l along the axis and passing over a path producing incremental lengths along the beam axis z producing an integral distribution

$$\int_0^1 f(x, y)dz$$

substantially equal to a $\cos^2$ distribution over an angle θ extending about the axis z from at least one of planes x—x and y—y passed through the axis.

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BERNARD A. GILHEANY, *Primary Examiner.*

G. HARRIS, *Examiner.*