

April 1, 1958

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2,829,291

MULTI-GUN CATHODE RAY TUBE

Filed Nov. 1, 1956

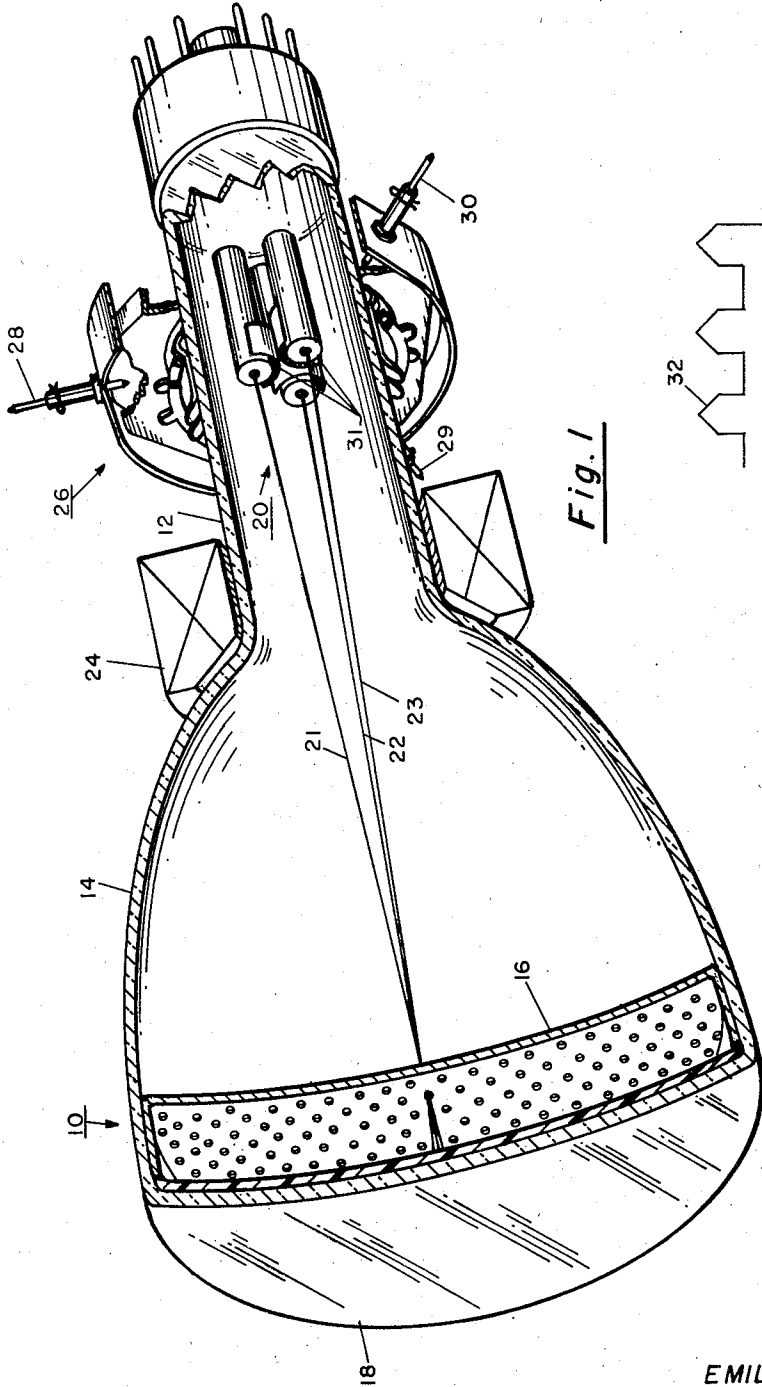


Fig. 1

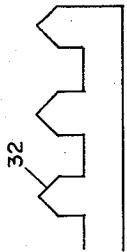


Fig. 2

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MULTI-GUN CATHODE RAY TUBE

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Application November 1, 1956, Serial No. 619,713

1 Claim. (Cl. 313—70)

This invention relates to multi-gun cathode ray tubes, and more particularly to a three-gun cathode ray tube for color television presentations.

One form of color television tube utilizes three electron guns which are positioned at the apices of an equilateral triangle. Since for static (undeflected) conditions the separate beams from the three guns must converge at a point on the aperture mask, the beams are caused to converge by mechanical positioning of the guns. Ideally, the three beams converge perfectly at the same point. However, in actuality, this result is difficult to achieve, and it is desirable that each beam should be independently positionable to achieve precise convergence. Individual control of the position of each beam may be readily accomplished by a magnetic field which is ordinarily produced by a "beam-positioning" permanent magnet or electromagnetic coil. In prior art tubes, each beam positioning magnetic field influenced the other beams, thus causing an interaction which was undesirable.

Prior art tubes exhibited another disadvantage in that they were susceptible to filament burn-out, due either to accidental arcing within the tube, or to surges in the filament voltage.

Therefore, the principal object of my invention is to provide an improved multi-gun cathode ray tube.

Another object of my invention is to provide a multi-gun cathode ray tube which provides truly independent positioning of each individual beam.

A further object of my invention is to provide a multi-gun cathode ray tube which provides greater safety against filament burn-out.

The achievement of these objects and others will be realized from the following specification, taken in conjunction with the drawings, in which,

Fig. 1 is a cutaway presentation of a cathode ray tube utilizing my invention; and

Fig. 2 illustrates a wiring arrangement for the filaments which obviates prior burn-out difficulties.

Referring now to Fig. 1, there is illustrated in cutaway form a cathode ray tube 10 having a tubular neck portion 12, a funnel portion 14, an apertured mask 16, and a faceplate 18. Within the neck portion is a three-gun assembly 20 which produces electron beams 21, 22 and 23, which are used for producing color television images. A deflection coil 24 is mounted on neck portion 12 adjacent the funnel portion of the tube, while a color purity device 26 is mounted on the neck portion adjacent the gun structure.

The operation of the color purity device is more fully described in my copending application entitled "Cathode Ray Tube," Serial No. 606,001, filed August 24, 1956. As described in the above mentioned application, the color purity device assures that the converged beams will strike the proper portion of the apertured mask. As has been previously stated however, a situation is frequently encountered in which two beams may strike the convergent point, while the third beam does not. In this case, the third beam is separately positioned by a

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beam positioning magnetic field which may be obtained either by a permanent magnet or by an electromagnet. Since there are three beams, three beam positioning fields are ordinarily used. Fig. 1 shows these permanent magnets 28, 29 and 30 positioned 120 degrees apart. As is well known, electromagnetic coils may alternatively be utilized. For convenience of adjustment, the permanent magnet is generally in the form of a bar which is held in a mating opening either by threads or by friction clips. Since the magnetized bar will have a north pole and a south pole, the magnet may be inserted into the opening so that either end may be in proximity with the gun structure. Either end of each magnet may therefore be positioned to bring the desired pole into the required position to achieve the optimum beam positioning effect. If electromagnets are used, the same effects are obtained by reversing and controlling the current there-through.

It may be seen from Fig. 1 that magnet 28 is positioned so that one of its poles affects beam 21. However, leakage of its magnetic field tends to affect beams 22 and 23 also, thus producing the undesirable interaction previously mentioned. A similar situation exists for the other beam positioning magnets (or coils).

In order to minimize this undesired interaction of the beam positioning devices on the electron beams, I introduce shields 31 of magnetic material between the various guns. As shown in Fig. 1, these shields may take the form of arcuate semicylinders which fit together like a three pointed star. These shields may be welded to each other, or to suitable portions of the gun structure or both. They serve to confine the magnetic flux to the desired electron beam, while reducing leakage that would affect the others.

Ideally, the color purity device 26, and the beam positioning magnets should be located to affect the electrons after they have left the guns. However, due to spatial limitations, other elements occupy this location, so the beam positioning takes place within the gun. Since the actual beam movement is extremely small this location is satisfactory, and incidentally affords a convenient method of mounting the magnetic shielding material.

In prior art multi-gun cathode ray tubes, the failure of any one gun seriously impaired the operation of the tube. Thus, in the case of a color television tube, should one gun become inoperative, it would become impossible to produce that particular color or any other color of which that color is a component. One of the weaknesses of these guns is their filaments, which are frequently accidentally exposed to electrical surges due to arcing, and are always susceptible to mechanical shock. In the past, the filament of each gun was separately connected across a 6.3 volt source, thus requiring a thin, fragile filament.

Referring now to Fig. 2, it will be seen that I propose to connect the filaments 32 of the electron guns in series. In this way, each filament is designed to operate at a voltage of 2.1 volts, and may be of heavier cross section. Each filament is therefore stronger and more resistive to mechanical shock. In addition, a voltage surge is less liable to cause burnout, since it is divided among three heavier filaments instead of exposing each filament to the surge.

It may be seen that my improved gun structure has several advantages. Having described the principles of my invention, I desire to be limited only by the claim granted to me.

What is claimed is:

1. In a multi-gun cathode ray tube, the combination comprising: three electron guns positioned at the apices of an equilateral triangle—whereby three electron beams are

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produced; means to produce magnetic fields which primarily affect the position of a single electron beam but inherently affect other beams, said magnetic-field producing means comprising needle-like permanent magnets positioned with the axis thereof perpendicular to the axis of said tube, each said magnet being individually reversible and positionable—whereby the pole of each magnet may assume a desired spacing from said tube axis; a shield of magnetic material separating each said electron beam from the others, said shield comprising three arcuate elements of magnetic material positioned at the ends of said electron guns, said arcuate elements be-

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ing positioned between a selected electron gun and said other electron guns; and filaments for each said electron gun, said filaments being connected in series—whereby a more rugged filament structure to better withstand voltage surges and mechanical shock is provided.

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