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L. A. SHANAFELT

3,379,912

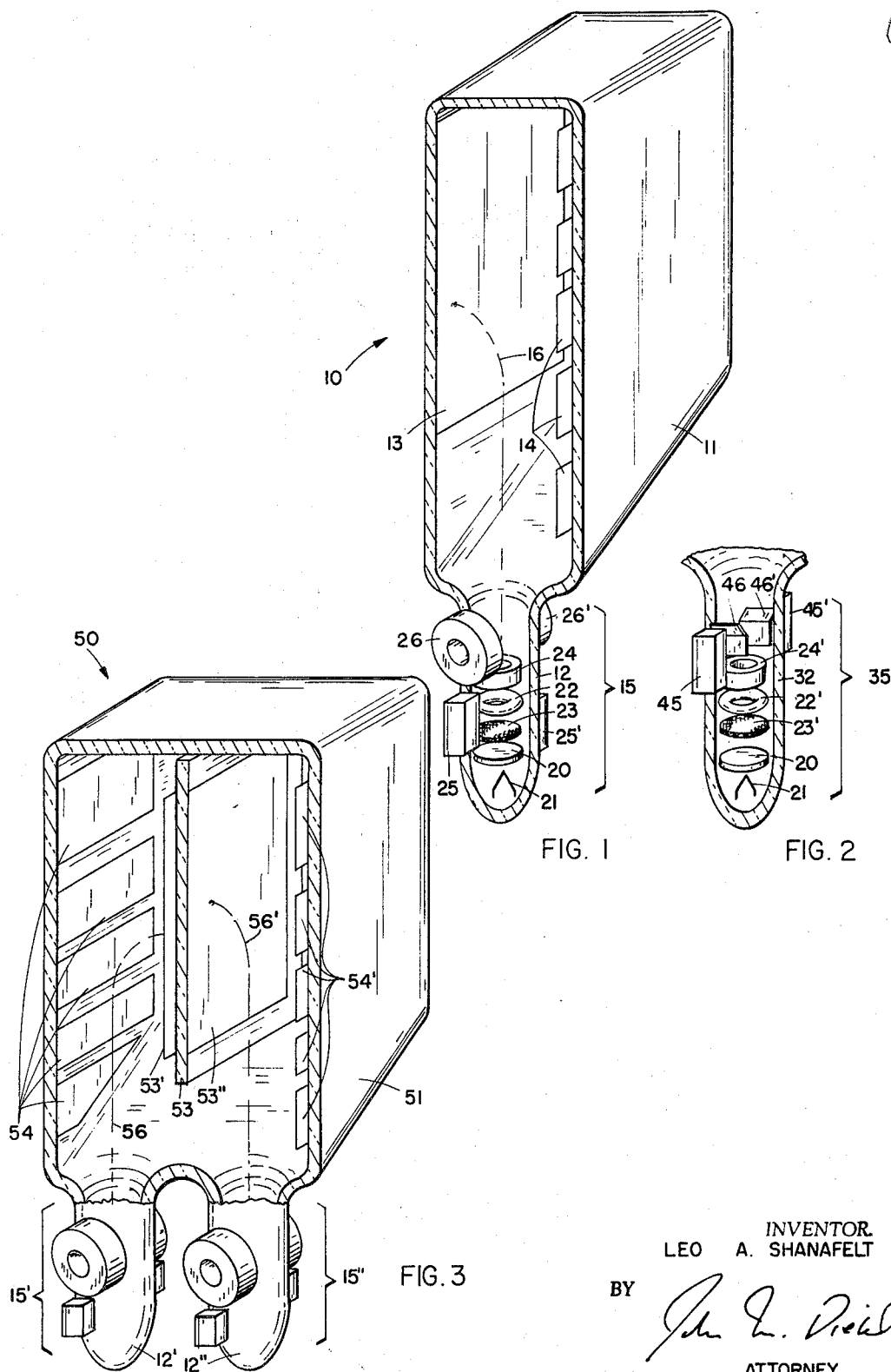
BEAM AND RASTER LOCATING MEANS FOR THIN CATHODE RAY TUBE

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2 Sheets-Sheet 1

Flat
Tube

6380

INVENTOR
LEO A. SHANAFELT

BY

John L. Pross

ATTORNEY

April 23, 1968

L. A. SHANAFELT

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2 Sheets-Sheet 2

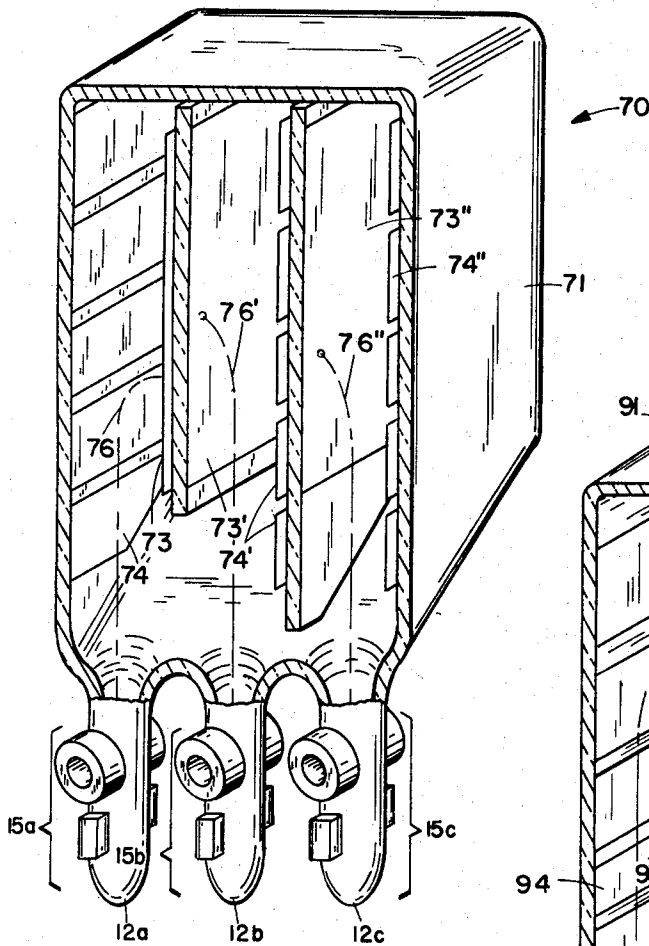


FIG. 4

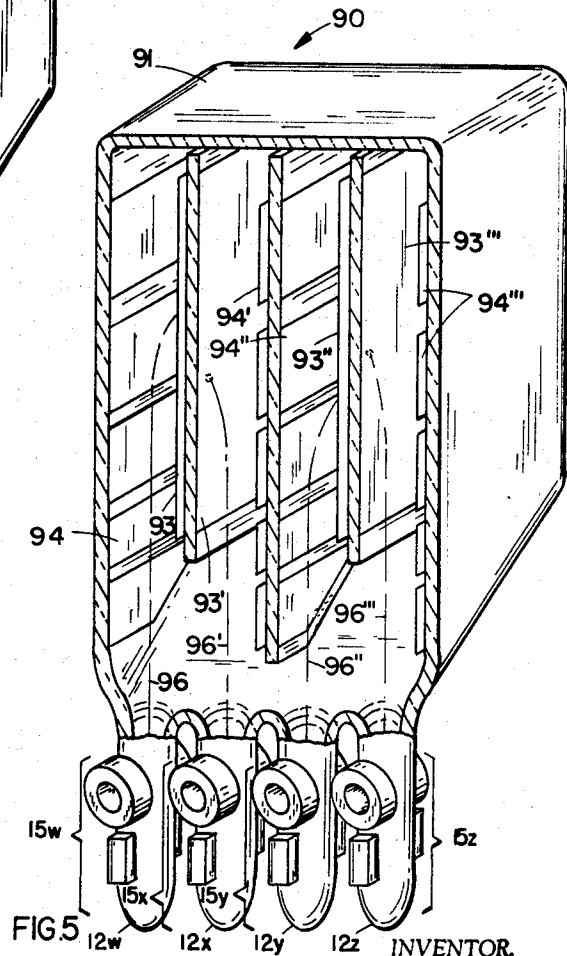


FIG. 5

LEO A. SHANAFELT

BY

John L. Vick

ATTORNEY

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3,379,912

BEAM AND RASTER LOCATING MEANS FOR THIN CATHODE RAY TUBE

Leo A. Shanafelt, Woodland Hills, Calif.
(416 Carnation Ave., Corona Del Mar, Calif. 92625)
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This invention relates to a cathode ray tube of the type described in Aiken Patent 2,795,731 and more particularly to an improvement in the electron gun structure and arrangement for guns used in such tubes, both those wherein a single beam is utilized and those in which more than one beam is utilized. The improvement is applicable to such tubes in which horizontal sweep is provided in the conventional manner and vertical sweep is provided with an array of electrostatic deflection elements such as shown in FIGURES 24 and 25 of said patent.

Heretofore tubes in accordance with the disclosure of said patent have been constructed with an electron gun rigidly affixed to the tube envelope and with the deflection elements associated with the gun located within the evacuated space defined by the envelope and the housing of the gun. For example, as shown in connection with the gun described in Patent 2,879,443, in particular, tubes have been constructed in accordance with FIGURES 24 and 25 of the first above mentioned patent with the guns being disposed within the envelope with the deflection elements thereof also disposed within the envelope as shown in the second above mentioned patent.

Because of the criticality of the spacing and location of the deflection elements associated with the gun it has been necessary to provide such deflection elements which are machined and otherwise constructed to extremely high tolerances and are located within the envelope to extremely high tolerances, the tolerance required often being no greater than $\pm 0.001''$ in several directions. The cost of producing such tubes has been very high, and the difficulty in providing a rectangular raster which properly fills the screen and is properly located with respect to the target screen in both vertical and horizontal directions has been considered so severe as to make it impractical to construct a tube in which two images are provided by two separate guns and in which horizontal sweep for each of the beams is provided in the conventional manner and vertical deflection is provided by vertical arrays of electrostatic deflection elements to cause the two beams to impinge on opposite sides of a common target plate. This impracticability has arisen because of the difficulties involved in properly positioning within the envelope the deflection elements which provide for horizontal sweep.

Due to the difficulty of providing a solution to this problem, all of the prior art which relates to positioning of guns in tubes of the aforesaid type and which contains any teaching relating to the positioning of deflection elements with respect to the envelope has uniformly and unanimously disclosed placing of such deflection elements within the envelope as exemplified by Patents 2,879,446, 2,850,670, 2,879,443, 2,795,729, 2,809,324, 2,837,691, 2,830,226, 2,928,014, 2,864,033, 2,821,656, 2,978,601, 2,930,930, 2,885,595, 2,926,274 and 2,896,111.

Applicant has provided as described hereinafter, a solution to the problem of suitably locating the horizontal sweep deflection elements and the focusing elements in such a manner that it is possible to rapidly and accurately adjust them to provide for accurate proper focusing and proper registration of the raster with the screen without any increase in either the cost of the elements themselves or in the cost of the circuitry, while at the same time

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enormously reducing effort and care needed in designing and constructing the tube.

In essence, applicant has accomplished this by providing within an extending neck portion of the envelope, only the beam generating and, if necessary, rough focusing elements of the gun and providing in an adjustable manner, adjacent said neck portion and outside it, the necessary magnetic elements for controlling horizontal positions of the raster, for controlling positioning of the beam between the screen and an array of vertical deflection elements and for controlling horizontal sweep of the beam.

Thus the object of the invention which is thus attained is to provide for improved facility in controlling the position of the beam, for example, to prevent "warping" of the focal plane, and to control horizontal adjustment of the edges of the raster and location and orientation of horizontal sweep.

The invention is described in greater detail in connection with the drawings in which it is intended to illustrate the applicability of the invention without thereby limiting its scope to less than that of all equivalents which will be apparent to one skilled in the art. In the drawings like reference numerals refer to like parts and:

FIGURE 1 is a partially cross-sectional partially cut-away perspective view of a tube according to the invention;

FIGURE 2 is a cross-sectional perspective fragmentary view of a modification of the embodiment of FIGURE 1;

FIGURE 3 is a partially cross-sectional partially cut-away perspective view of another embodiment of the invention;

FIGURE 4 is a partially cross-sectional partially cut-away perspective view of another embodiment of the invention;

FIGURE 5 is a partially cross-sectional partially cut-away perspective view of another embodiment of the invention.

Referring now to FIGURE 1, there is shown a cathode ray tube indicated generally as 10 comprising an envelope 11 having a projecting neck portion 12. On one interior substantially flat surface of envelope 11 there is coated a suitable cathode ray tube or television tube target screen 13 which may be any suitable conventional phosphor material and on another substantially flat interior surface of envelope 11, parallel to and spaced from screen 13, there is provided a plurality of vertical deflection elements 14 which may be conductive plates but each of which is preferably provided by a coating of conductive material on an interior surface of envelope 11. Preferably elements 14 are transparent so that the target screen 13 may be viewed from either side of tube 11.

In connection with projection 12 of envelope 11 there is provided an electron gun indicated generally as 15 to provide electron beam 16. Gun 15 preferably comprises beam-emitting element or cathode 20, heater or filament 21 to heat cathode 20, anode 22 to control grid 23 and focusing screen 24, all of which are located in the evacuated interior of the envelope provided within the interior of projecting portion 12.

Exterior to projecting envelope portion 12, there is provided as an essential and critical feature of the invention, positioning magnets 25 and 25' which are preferably located in the ambient atmosphere, adjustably with respect to the elements contained in the interior of projecting portion 12 and are preferably disposed adjacent to the outer surface of projecting portion 12. Also provided in the ambient atmosphere adjacent the exterior of portion 12 there are provided magnetic coils 26, 26' disposed opposite each other and in a manner to provide horizontal sweep of beam 16 with respect to target 13. Beam 16 emitted by gun 15 is projected from the gun in

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a plane substantially parallel to the planes of both target 13 and elements 14 in the space between target 13 and elements 14. It is caused to bend near its end and to impinge on target 13 by electrostatic force applied on elements 14 in a progressive manner to cause a lowered voltage to appear on each of the elements successively in the manner described in the patents above set forth. The manner in which said lowering of voltage is caused to appear successively on elements 14 forms no part of the present invention and may be accomplished in any of several manners set forth in the prior art.

To accomplish the objects of the invention, elements 25 and 25' may be adjusted or moved with respect to projecting portion 12 in order to cause the sweep of beam 16 to begin and end at suitable places on target screen 13 and to cause the beam as it is emitted from gun 15 to lie within a plane having the desired orientation with respect to target 13. Likewise, yoke magnets 26 and 26' may be suitably adjusted to provide suitable adjustment of the position of the beam.

Referring now to FIGURE 2, projecting portion 32 of an envelope such as envelope 11 may be provided with a gun 35 in the same manner as indicated in connection with FIGURE 1 with the exception that electrostatic horizontal deflection plates 46 and 46' are provided in place of electromagnetic deflection elements 26 and 26'. Positioning magnets 45 and 45' are located in the same manner as set forth above in connection with magnets 25 and 25' and may suitably be adjusted in position to accomplish the objects of the invention by providing suitable horizontal adjustment of the raster and controlling position of the beam between the screen and the array of vertical deflection elements.

As shown in FIGURE 3, there may be provided an envelope indicated generally as 50 which may have two projecting portions 12' and 12'' which may be provided respectively with electron guns 15' and 15''. The cathode ray tube indicated generally as 15 may comprise envelope 51 having central target plate 53 which may have a suitable target screen 53' and 53'' coated respectively on each side thereof. The vertical deflection elements 54 and 54' are preferably provided as transparent coatings on flat interior surfaces of envelope 51 and preferably lie in planes parallel respectively to targets 53' and 53'' so that beams 56 and 56' emitted by guns 15' and 15'' may sweep horizontally in planes parallel to targets 53' and 53''. Deflection at the ends of beams into impingement with target 53' and 53'' to provide vertical sweep is provided by deflection elements 54 and 54' in the manner described in connection with elements 14 of FIGURE 1 and successive electrostatic voltage drops may be applied to the elements in the manner described in connection with FIGURE 1.

In the embodiment of FIGURE 3, the material of target screen 53' is preferably of a suitable phosphor to provide for an image of one color and the phosphor material of target 53'' is preferably a phosphor selected to provide an image of a different color when struck with the electron beam.

In a preferred embodiment of the invention, the colors are chosen such that a composite picture provided by the two screens, when proper registration of the two beams is provided, shows to the eye the appearance of three-color image in accordance with the theory developed by Dr. Land of Polaroid Corporation whereby a colored image registered in the brain of a human by a human eye comprises only two colors viewed by the human eye and that realistically multi-colored image will be observed by such brain if a suitable image having only two color components is provided on a screen which may be observed by the eye.

In FIGURES 4 and 5 there is shown the application of the invention to tubes according to the invention wherein three-color and four-color images respectively are provided.

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As shown in FIGURE 4 there may be provided a cathode ray tube indicated generally as 70 which may have an envelope 71 having projecting neck portions 12a, 12b and 12c projecting therefrom. Electron guns 15a, 15b and 15c which may be substantially identical with electron gun 15 of FIGURE 1 may be provided in conjunction with said projecting portions respectively.

Within the interior of envelope 71, there may be provided three target screens 73, 73' and 73'' and three arrays of vertical deflection elements 74, 74' and 74'', these elements preferably being all parallel to one another and all coated on interior portions of envelope 71 or partitions or plates located therewithin.

Array 74 is preferably located to provide vertical sweep of beam 76 on target 73, array 74' to provide vertical sweep of beam 76' on target 73' and array 74'' to provide vertical sweep of beam 76'' on target 73'', said beams being emitted respectively by guns 15a, 15b and 15c. Preferably all of the elements 73, 73', 73'', 74, 74' and 74'' are transparent. Each of targets 73, 73' and 73'' may be of phosphors of different compositions to provide preferably images of the three primary colors so that when the tube is viewed either through array 74 or array 74'', the eye may combine the images on the three target screens to receive a composite multiple colored image provided by images on the screens when beams 76, 76' and 76'' are in proper registration.

It is a critical feature of the invention that in order to provide such suitable registration there be provided adjustable positioning magnets on the external or outside of projecting neck portions of the envelope wherein there are located other elements of the electron guns to provide the beams.

Referring now to FIGURE 5, there is shown a cathode ray tube indicated generally as 90 comprising envelope 91 having projecting portions 12w, 12x, 12y and 12z with which there may be associated electron guns 15w, 15x, 15y and 15z which may emit respectively beams 96, 96', 96'' and 96''', which may impinge respectively on target screens 93, 93', 93'' and 93''' in response to electrostatic fields provided respectively by arrays 94, 94', 94'' and 94''' of vertical deflection elements. Each of such arrays and each of such target screens preferably lies in a plane and each of said beams preferably sweeps horizontally in a plane and preferably all of said planes are parallel to one another but it is generally essential to the invention that all of the arrays and all of the targets be parallel to one another. Electrostatic voltage drops are provided on the arrays in accordance with the discussion above in order to provide vertical sweep of the beams on the targets respectively.

It is critical to the invention that there be provided suitable registration of the screens and of the sweep of the beams with respect to each other in order to provide a suitable multiple colored composite image if suitable phosphors are provided for each of the targets. This critical need is met by providing positioning magnets in accordance with the invention. Different colored images provide a four-colored composite image when viewed by the eye through either array 94 or array 94'''. The elements may be supported as described in connection with other embodiments and beams are controlled in accordance with the discussions of other embodiments above.

It may thus be seen that the invention is broad in scope and includes such modifications as will be apparent to those skilled in the art and is to be limited only by the claims.

Having thus described my invention, I claim:

1. In a thin cathode ray tube having a single envelope, a target screen, an electron gun and an array of vertical deflection plates to provide for vertical sweep, with said gun located to produce a beam which sweeps in a plane parallel to and spaced apart from said screen, a necked portion of said envelope extending outwardly from said

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envelope and containing therein a beam emitting cathode, at least one beam attracting anode, a beam focusing ring and a control grid, said necked portion having adjacent the outer surface thereof a pair of positionally adjustable magnets to control lateral location of the raster and to control positioning of the beam between said screen and said array.

2. The tube of claim 1 wherein said necked portion is also provided with a pair of electromagnets adjacent its outer surface to provide and control horizontal sweep of said beam.

3. In a cathode ray tube having a single envelope and within said envelope two target screens and two arrays of vertical deflection elements to provide respectively for vertical sweep of each of two electron beams with respect to each of said target screens, two necked portions of said envelope extending outwardly from said envelope, the interior of each of said necked portions communicating with the interior of said envelope, each of said necked portions containing in its interior a beam emitting cathode, at least one beam attracting anode, a beam focusing ring and a control grid, whereby two beams are provided each substantially parallel to one of said target screens and one of said arrays, each of said necked portions having adjacent the outer surface thereof a pair of positionally adjustable magnets to control lateral location of the raster and to control positioning of the beam between said screen and said array.

4. The tube of claim 3 wherein each of said necked portions is also provided with a pair of electromagnets adjacent its outer surface to provide and control horizontal sweep of the beam produced by the elements there within.

5. In a cathode ray tube having a single envelope and within said envelope three target screens and three arrays of vertical deflection elements to provide respectively for vertical sweep of each of three electron beams with respect to each of said target screens, three necked portions of said envelope extending outwardly from said envelope, the interior of each of said necked portions communicating with the interior of said envelope, each of said necked portions containing in its interior a beam emitting cathode, at least one beam attracting anode, a

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beam focusing ring and a control grid, whereby three beams are provided each substantially parallel to one of said target screens and one of said arrays, each of said necked portions having adjacent the outer surface thereof a pair of positionally adjustable magnets to control lateral location of the raster and to control positioning of the beam between said screen and said array.

6. The tube of claim 5 wherein each of said necked portions is also provided with a pair of electromagnets adjacent its outer surface to provide and control horizontal sweep of the beam produced by the elements there within.

7. In a cathode ray tube having a single envelope and within said envelope four target screens and four arrays of vertical deflection elements to provide respectively for vertical sweep of each of four electron beams with respect to each of said target screens, four necked portions of said envelope extending outwardly from said envelope, the interior of each of said necked portions communicating with the interior of said envelope, each of said necked portions containing in its interior a beam emitting cathode, at least one beam attracting anode, a beam focusing ring and a control grid, whereby four beams are provided each substantially parallel to one of said target screens and one of said arrays, each of said necked portions having adjacent the outer surface thereof a pair of positionally adjustable magnets to control lateral location of the raster and to control positioning of the beam between said screen and said array.

8. The tube of claim 7 wherein each of said necked portions is also provided with a pair of electromagnets adjacent its outer surface to provide and control horizontal sweep of the beam produced by the elements therewithin.

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JAMES W. LAWRENCE, *Primary Examiner.*

V. LAFRANCHI, *Assistant Examiner.*