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PHOSPHOR COATING PROCESS

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Fig. 1.

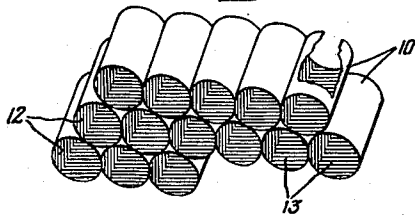


Fig. 2.

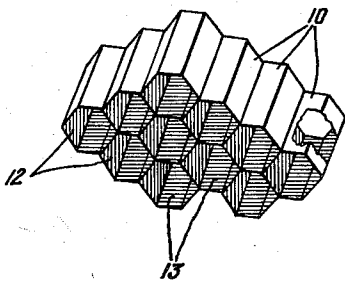


Fig. 3.

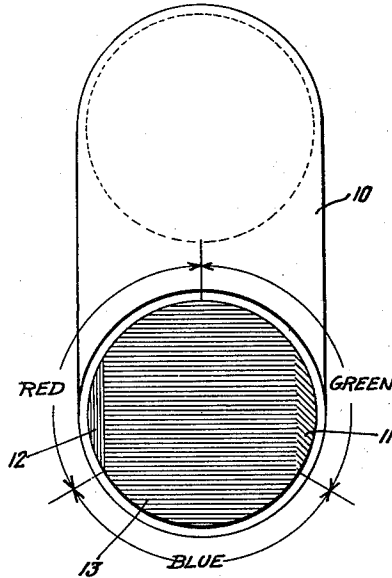
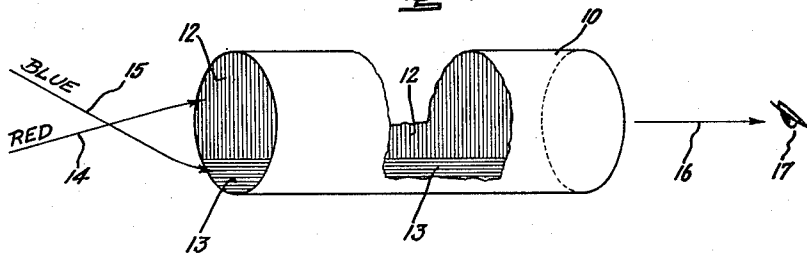


Fig. 4.



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# UNITED STATES PATENT OFFICE

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## PHOSPHOR COATING PROCESS

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5 Claims. (Cl. 117—33.5)

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This invention relates to a process for coating the interior of each of a plurality of parallel or nearly parallel cells gathered together to form a multicell. More particularly, the invention relates to a method for coating an inside strip portion of each of a plurality of cells forming a multicell.

One of the methods of producing color in television picture tubes is by direction selection. In this system, the color is changed by altering the angle at which the beam is incident on the fluorescent screen. One method of accomplishing this is to pass the beam into a cellular structure with the axes of the cells lined up normal to the tube face. Each cell is coated on the inside with a strip of each of three different phosphors along its length. The width of each strip is one-third the circumference of the cell. The electron beam is directed at the cell wall at an angle so that by proper choice of beam direction any one of the three phosphors may be excited to emit any one of three colors.

Each cell forming a unit of the multicell structure described above must of necessity have a small diameter and be rather short. A large cell would be about 0.07 inch in diameter and about one-half inch in length. A small cell would be 0.02 inch in diameter and less than one-quarter inch in length. A single multicell may be comprised of many thousands of such cell units.

A difficult problem has been encountered in finding a way to coat different longitudinal portions of the interior of each cell unit with a different phosphor coating. Not only must each coating occupy a particular circumferential segment of the cell but the same coating in all cells comprising the multicell must have the same angular orientation.

Accordingly, it is an object of this invention to provide a method whereby a plurality of coatings may be applied to the interior surface of each cell comprising a multicell with each coating occupying a different circumferential segment of the cell.

It is another object of the invention to provide a plurality of spaced luminescent coatings on the interior of a cell of very small diameter.

Other objects will become apparent and the invention better understood from a consideration of the following description taken in conjunction with the accompanying drawing, in which:

Fig. 1 is a perspective view of a portion of the cells comprising a multicell of the type referred to herein;

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Fig. 2 is a perspective view showing a few of the cells of the "honeycomb" type comprising a multicell;

Fig. 3 is an enlarged perspective view of one of the cells of the type shown in Fig. 1 illustrating the application of three different types of coating material on the interior walls thereof; and

Fig. 4 is a broken perspective view illustrating the manner in which a color television system employs a multicell having different types of coatings in spaced positions on the interior of the individual cells thereof.

As best shown in Fig. 3 a cell 10 has longitudinal circumferential segments of its interior coated with a green emitting phosphor 11, a red emitting phosphor 12 and a blue emitting phosphor 13. A satisfactory phosphor for green emission is zinc silicate with a manganese activator; a satisfactory phosphor for red emission is zinc phosphate or zinc cadmium sulfide with silver as an activator; and a satisfactory phosphor for blue emission is zinc sulfide with silver as an activator.

Fig. 4 shows electron beams 14 and 15 striking the interior coating of the cell 10 from two different angles. The beam 14 strikes only the phosphor 12 which emits red, resulting in a red emission 16 reaching the eye of an observer 17. The beam 15 strikes only the phosphor 13 which emits blue. The beam (not shown) for the green emitting phosphor 11 would come from still a third angle. The proper synchronization of the three beams produces colored television for the observer 17.

I employ a liquid settling process to coat the interiors of the individual cells comprising a multicell with the positional orientation necessary to achieve the emission characteristics described above. My process comprises a series of steps for each coating, the series being repeated for each additional coat. Each phosphor is suspended in a solution containing about 6% of a binder such as potassium silicate or sodium silicate. A satisfactory binder may be of the type known to the trade as Kasil. I prefer to use coatings having a particle size of less than 6 microns in an aqueous solution comprising about 4 grams of coating material per 500 cc. of solution.

The multicell to be coated is preferably placed in a flat sided vessel (not shown) just wide enough to hold the unit since this is the most economical form with regard to the amount of suspension used. The suspension is then poured

into the vessel completely covering the unit. A rough vacuum is then applied to the container for about a minute in order to remove the air from the cells and permit the liquid to fill them. The suspension is then allowed to stand for about one-half hour until most of the phosphor coating material has settled out. In this way the lower side of each cell making up the multicell becomes coated with phosphor. After a sufficient quantity of the phosphor coating material has settled on the cells, the multicell is placed in an oven and mildly heated (about 70° C.) for one hour to precipitate the silicate binder. The solution is then siphoned out of the container and the water extracted from the cells by placing the unit between pads of blotting paper. Final drying may be speeded up by the use of an oven.

In order to obtain proper positioning on the cell walls of a different phosphor, the multicell unit is rotated through 120° and the above series of steps repeated except that the phosphor suspension contains a different phosphor. For a third phosphor coating the multicell unit is again rotated 120° and the above series of steps repeated again.

When three phosphor coatings have been applied in the manner described above, they are symmetrically spaced around the cell axes and each phosphor coating has the same orientation in all of the cells. However, the exact proportion of the cell wall covered depends upon such factors as the roughness of the surface and the nature of the phosphor, which determine the angle at which slip occurs. Thus, a smooth surface on the cell interior results in a small angle of repose. In order for the multicell to function satisfactorily in a color television apparatus it is not necessary that the entire inner surface of each cell be covered by phosphor.

My method of coating a longitudinal strip of the interior of a small-sized cell produces a smooth uniform coating. Obviously, many of the conditions recited above may be varied considerably without interfering with the quality of the final product. Accordingly, my invention is not limited specifically to the method described but rather it is limited only by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The method of placing a different phosphor coating on each of three interior surfaces of a multicell screen which method comprises immersing the multicell with the longitudinal axes of the cells in horizontal position in an aqueous suspension of a first phosphor and a binder, allowing the particles of first phosphor in suspension to settle on the lower portions of the cell walls, mildly heating to fix the phosphor in position, removing the liquid from the cells, rotating the multicell about 120° around the axes of the cells, immersing the multicell in an aqueous suspension of a second phosphor and a binder, allowing the particles of second phosphor to settle on the lower portions of the cell walls, heating to fix the phosphor in position, removing the liquid from the cells, rotating the multicell an additional 120°, immersing the multicell in an aqueous suspension containing a third phosphor

and a binder, allowing the particles of third phosphor to settle on the lower portions of the cell walls, heating to fix the phosphor in position, and removing the liquid from the cells.

2. The method of coating the interior surface of each cell wall of a multicell screen with a different phosphor which method comprises immersing the multicell with the longitudinal axes of the cells in horizontal position in an aqueous suspension of a first phosphor and a binder, allowing the particles of phosphor to settle on the interior surfaces of the cells, heating to fix the phosphor in position, removing the liquid from the cells, rotating the multicell through an angle around the longitudinal axes of the cells, and repeating the above series of steps at least once using a different phosphor.

3. The method of placing a different phosphor coating on each of three interior surfaces of a multicell screen which method comprises immersing the multicell with the longitudinal axes of the cells in horizontal position in an aqueous suspension of a first phosphor and a binder, allowing the particles of first phosphor in suspension to settle on the lower portions of the cell walls, mildly heating to fix the phosphor in position, contacting the cells with an absorbent to remove the liquid, rotating the multicell about 120° around the axes of the cells, immersing the multicell in an aqueous suspension of a second phosphor and a binder, allowing the particles of second phosphor to settle on the lower portions of the cell walls, heating to fix the phosphor in position, contacting the cells with an absorbent to remove the liquid, rotating the multicell an additional 120°, immersing the multicell in an aqueous suspension containing a third phosphor and a binder, allowing the particles of third phosphor to settle on the lower portions of the cell walls, heating to fix the phosphor in position, and contacting the cells with an absorbent to remove the liquid.

4. The method of claim 3 wherein the binder used is potassium silicate.

5. The method of coating the interior surface of each cell wall of a multicell screen with at least two phosphors which comprises immersing the multicell with the longitudinal axes of the cells in horizontal position in an aqueous suspension of a first phosphor and a binder, allowing the particles of phosphor to settle on the interior surfaces of the cells, heating to fix the phosphor in position, contacting the cells with an absorbent to remove the liquid therefrom, rotating the multicell through an angle around the longitudinal axes of the cells, and repeating the above series of steps using an aqueous suspension of a second phosphor material.

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