

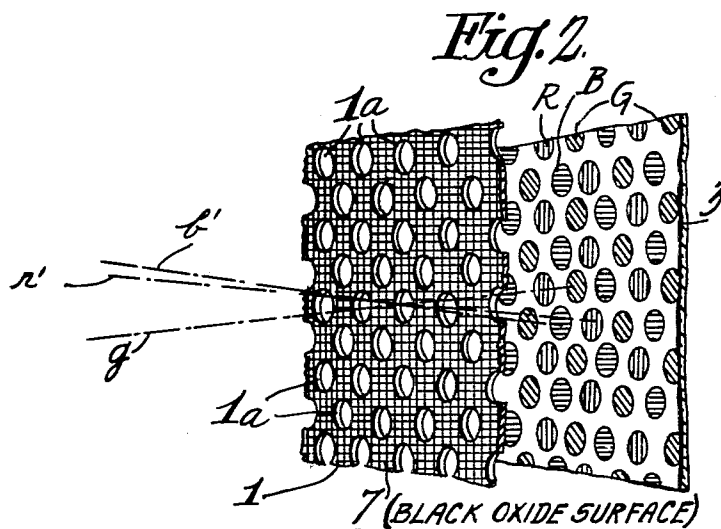
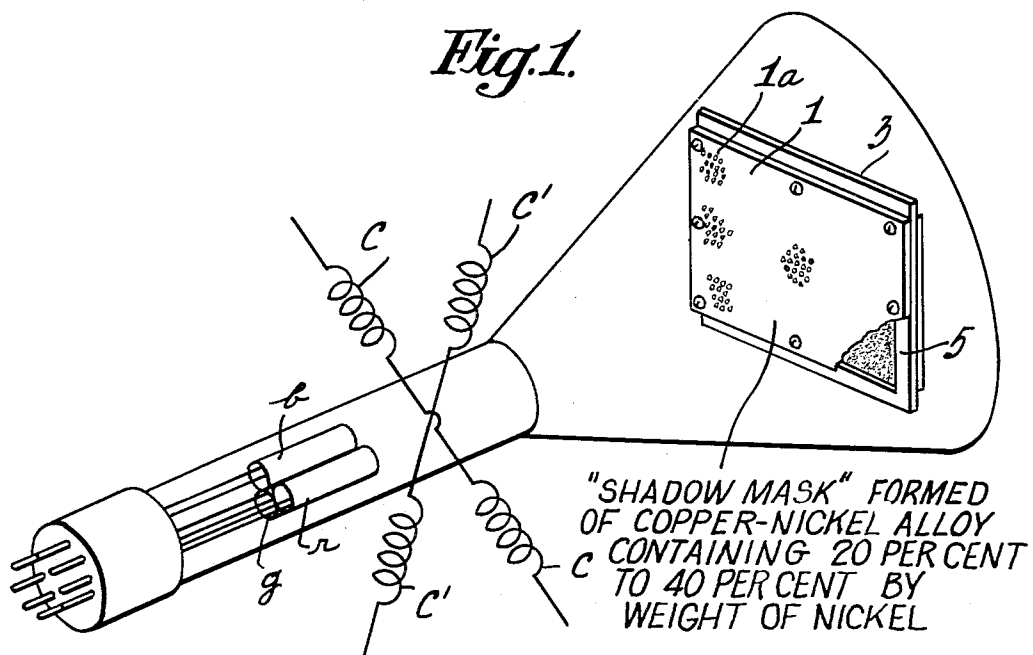
Dec. 20, 1955

D. G. BURNSIDE

2,728,008

COLOR-KINESCOPES ETC.

Filed April 21, 1953



INVENTOR.

Don G. Burnside

BY *Roderick Malcolm*

ATTORNEY

1

2

2,728,008

COLOR-KINESCOPES, ETC.

Don G. Burnside, Princeton, N. J., assignor to Radio Corporation of America, a corporation of Delaware

Application April 21, 1953, Serial No. 350,057

2 Claims. (Cl. 313—85)

This invention relates to improvements in color-kinescopes and other cathode-ray tubes of the kind containing a taut thin-metal electrode having a multiplicity of systematically arranged apertures therein through which electrons pass in their transit to a nearby screen. While the invention is herein described as applied to a color-kinescope of the "shadow-mask" variety claimed by Alfred N. Goldsmith in U. S. Patent No. 2,630,542, it will be apparent as the description proceeds that it is equally applicable to other varieties of C. R. tubes such, for example, as the ones shown in Rajchman 2,619,608, Rosenberg et al. 2,584,814 and Epstein 2,315,367.

The "shadow-mask" used in the screen-unit of the Goldsmith color-kinescope usually contains 200,000 or more systematically arranged apertures. Such masks are ordinarily made by the photoengraving etching technique described in detail by Harold B. Law in U. S. Patent No. 2,625,734.

Because of the customary use of copper for photoengravers' plates it was natural to adopt copper for the mask material in color television picture tubes. That is to say the similarity in processing led to the use of copper in early experimental and development work on such tubes. The chief difference in making a "shadow mask" and a "photoengraver's plate" lies in the etching. The mask, which must be very thin is etched all the way through to provide a multiplicity of openings therein of the desired number, shape and size, whereas the engraver's plate has only a photographic image etched on its surface.

Unfortunately a copper "mask" made by conventional photoengraving etching techniques is quite fragile. This is so because, (a) the "mask" must be very thin (e. g., of the order of two to four mils) in order to minimize the emission of secondary-electrons from the walls of its apertures, and (b) the annealing and brazing operations which are necessarily employed in the fabrication of the mask render the copper soft and easily distortable. As will be appreciated by those skilled in the art, even the slightest unsymmetrical stretching of the mask distorts its pattern of apertures and gives rise to image defects such, for example, as color-dilution and loss of resolution.

Accordingly, the principal object of the present invention is to obviate the foregoing and other disadvantages of cathode-ray tubes of the general character described and, more specifically, to provide an improved color-screen unit of the so-called "masked-target" variety.

Stated generally, the foregoing and related objects are achieved in accordance with the invention by making the mask of a cupro-nickel alloy that exhibits all of the following characteristics: (a) enhanced toughness, strength and ability to be worked into very thin sheets, (b) ability to accept a surface coating of photographic emulsion, as required by the photoengraving process, and of being readily and cleanly etchable, (c) ability to accept a heat-dissipating surface coating, and (d) freedom from impurities which would contaminate an electron tube.

The invention is described in greater detail in connection with the accompanying single sheet of drawings wherein:

Fig. 1 is a partly diagrammatic view in perspective of a 3-gun color-kinescope of the "shadow-mask" variety and wherein said mask is constructed, in accordance with the invention of a cupro-nickel alloy;

Fig. 2 is an enlarged fragmentary view in perspective of the color-screen unit of the tube of Fig. 1.

Fig. 1 shows the invention as applied to a color-kinescope of the "3-gun, shadow-masked, dot-screen" variety disclosed and claimed by Dr. Alfred N. Goldsmith in U. S. Patent 2,630,542. The three electron guns *r*, *b* and *g* are individual to the different color-phosphors R (red), B (blue) and G (green) on the screen and here shown arranged delta (Δ) fashion, with common horizontal and vertical beam-deflecting coils *C*₁ *C*' in the manner claimed by Alfred C. Schroeder in U. S. Patent 2,595,548.

Here the screen-unit comprises a "shadow-mask" 1, a screenplate 3 and a metal frame 5 upon which said mask and plate are supported in spaced apart planes in a position to be scanned by electron-beams from the 3-guns. The shadow mask 1 is provided with a multiplicity, say 200,000, apertures 1a and there is a group of three phosphor dots R, B and G for each of said mask apertures. As indicated in Fig. 2, because of the different angles of approach of the three electron-beams, *r*', *b*' and *g*', each phosphor dot is accessible only to the beam which is allotted to a particular color. As is conventional, the mask apertures 1a and the phosphor dots R, B and G have a hexagonal pattern of distribution, that is to say each aperture is surrounded by six apertures and each phosphor dot is surrounded by six other dots.

The shadow mask is constructed, in accordance with the present invention, of a copper alloy. There are many copper alloys but those that contain any metal that would react disastrously in an electron tube cannot be used. Thus, although brass lends itself readily to the etching process, it cannot be used since it contains zinc. Nor can copper alloys containing cadmium, lead or tellurium be used.

Of the other alloys, those of copper and nickel, and especially those containing 20% to 40% nickel, by weight, exhibit the requisite toughness, strength, and ability to be worked in thin-sheets. Furthermore, such alloys accept a surface coating of photographic emulsion and can be blackened to enhance the radiation of heat. They also lend themselves readily to standard cleansing and etching techniques. Thus, either ferric chloride or a solution of ammonium persulfate activated by hydrogen peroxide may be used as the etching agent, the latter as claimed in copending application Serial No. 202,827 to the same inventor now U. S. Patent No. 2,678,876. Removing the emulsion with formic acid leaves the alloy unaffected.

In agreement with the mounting technique described in the Law patent the thin metal mask 1 is preferably given a "shrink-fit" on its frame 5. When thus mounted the mask may be set-up in front of a photographic plate (not shown) in a "lighthouse" and used in laying out the pattern of phosphor dots on the screenplate 3, as also taught in the Law patent.

Prior to mounting the screen-unit in the tube the cupro-nickel mask is preferably blackened as indicated at 7, Fig. 2, to reduce its operating temperature when it is subjected to bombardment by the beams from the three guns *r*, *b* and *g*. The blackening operation may be effected in a number of ways. Preferably, however, it is immersed in a tank containing a bath of sodium dichromate at a temperature of 385° C. $\pm$ 5° C. and thereafter rinsed by agitation in both cold and hot water until all soluble salts have been removed, leaving an adherent, dense, black coating of unknown composition on the surface of the

mask. Alternatively, the mask may be blackened by the well known "platinum-black" electroplating operation.

What is claimed is:

1. A C. R. tube comprising an electron-gun and a screen unit mounted in a position to be scanned by an electron-beam from said gun, said screen-unit including a thin-metal plate constituted essentially of a copper-nickel alloy containing from 20 per cent to 40 per cent by weight of nickel mounted adjacent to the target surface of the screen of said unit, said thin copper-nickel plate containing a multiplicity of systematically arranged electron-permeable areas through which electrons pass in their transit from said gun to said screen.

2. The invention as set forth in claim 1 and wherein the surface of said thin-metal plate is provided with a

black surface coating constituted essentially of the reaction product produced by contacting a solution of sodium dichromate to said alloy at about 385° C.

References Cited in the file of this patent

UNITED STATES PATENTS

1,601,066	Harris -----	Sept. 28, 1926
1,981,620	Giard -----	Nov. 20, 1934
2,167,128	Skelton -----	July 25, 1939
2,611,099	Jenny -----	Sept. 16, 1952
2,619,608	Rajchman -----	Nov. 25, 1952
2,625,734	Law -----	Jan. 20, 1953
2,630,542	Goldsmith -----	Mar. 3, 1953
2,659,026	Epstein -----	Nov. 10, 1953