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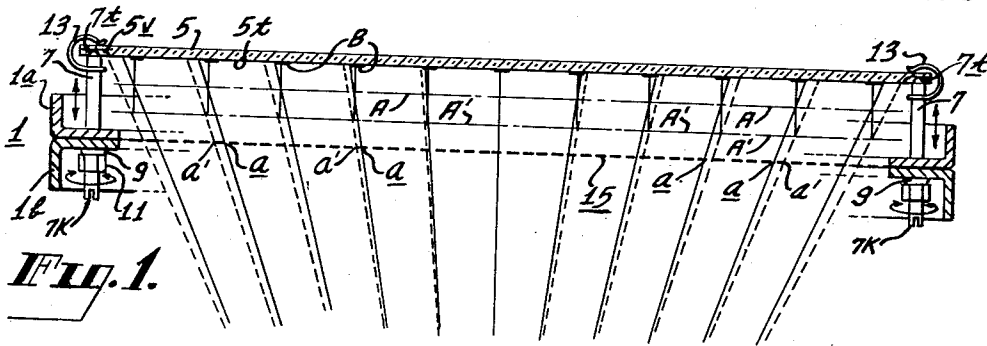
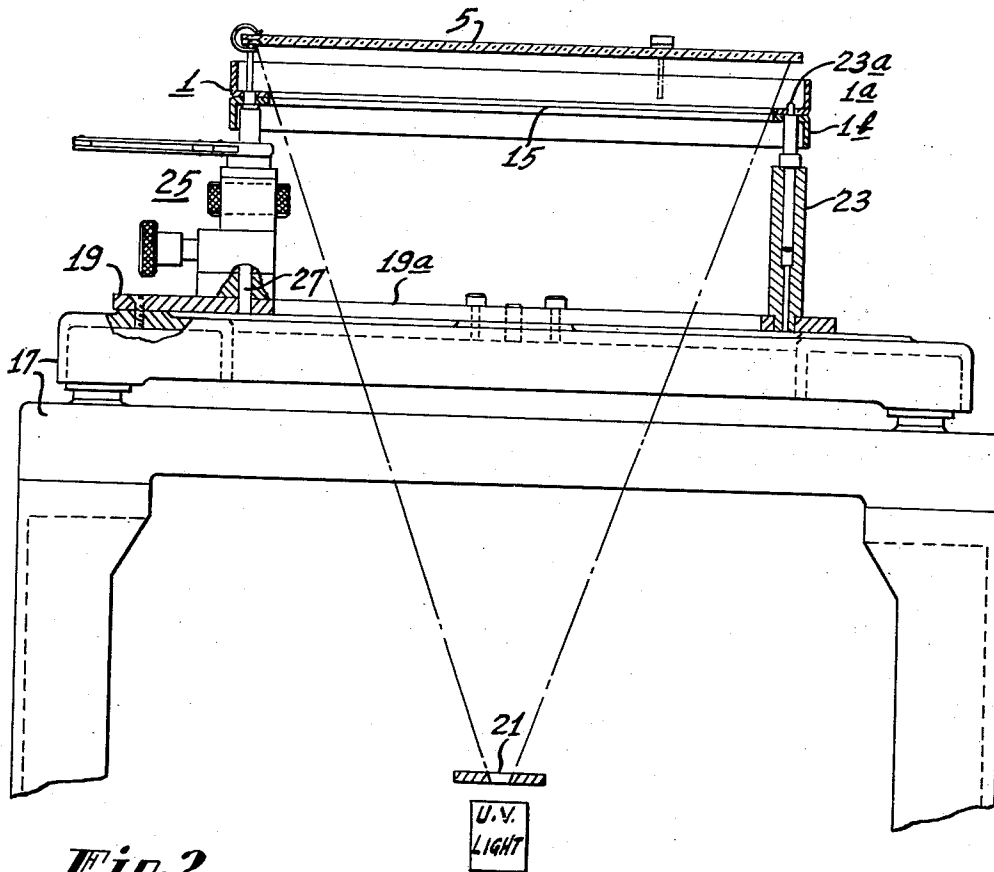
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ALIGNMENT-LIGHTHOUSE FOR COLOR-SCREENS, ETC

Filed July 15, 1953

3 Sheets-Sheet 1



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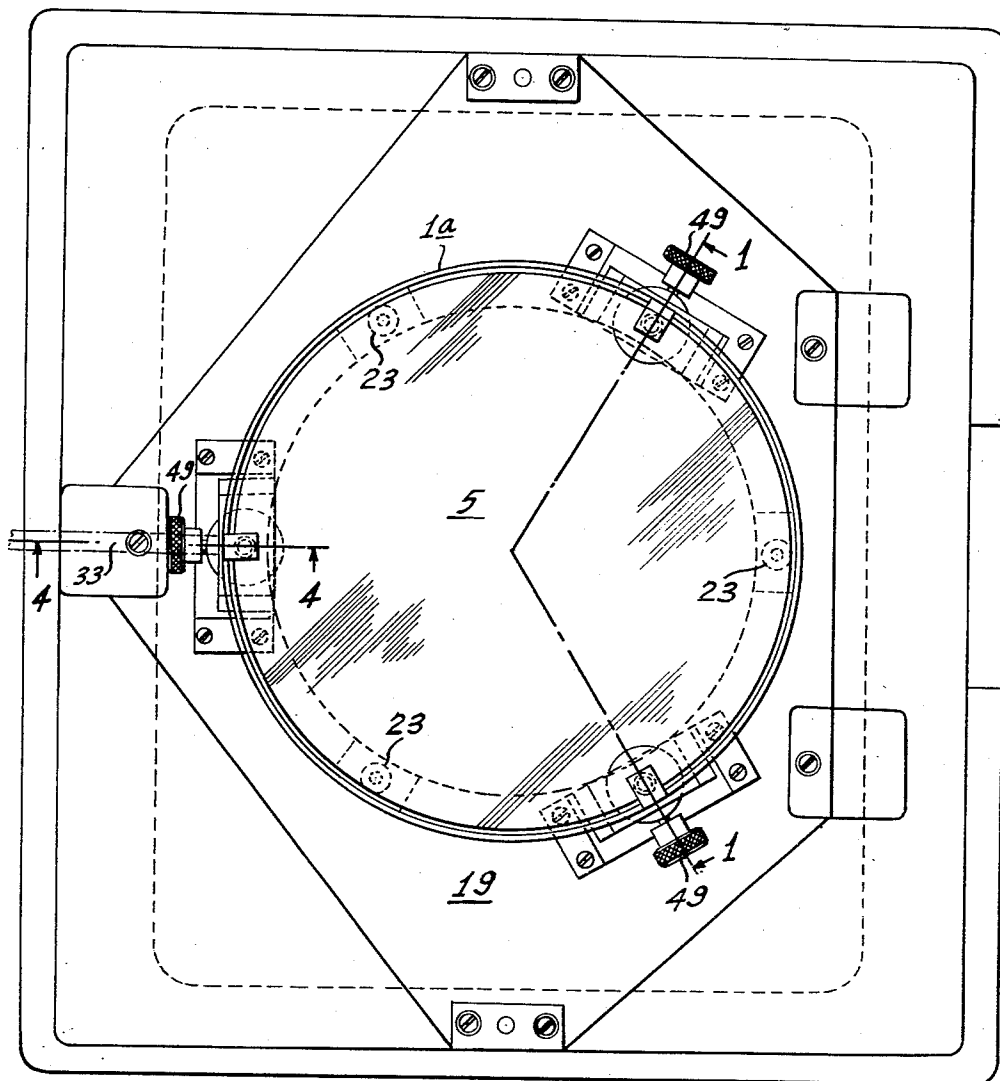
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Fig. 3.



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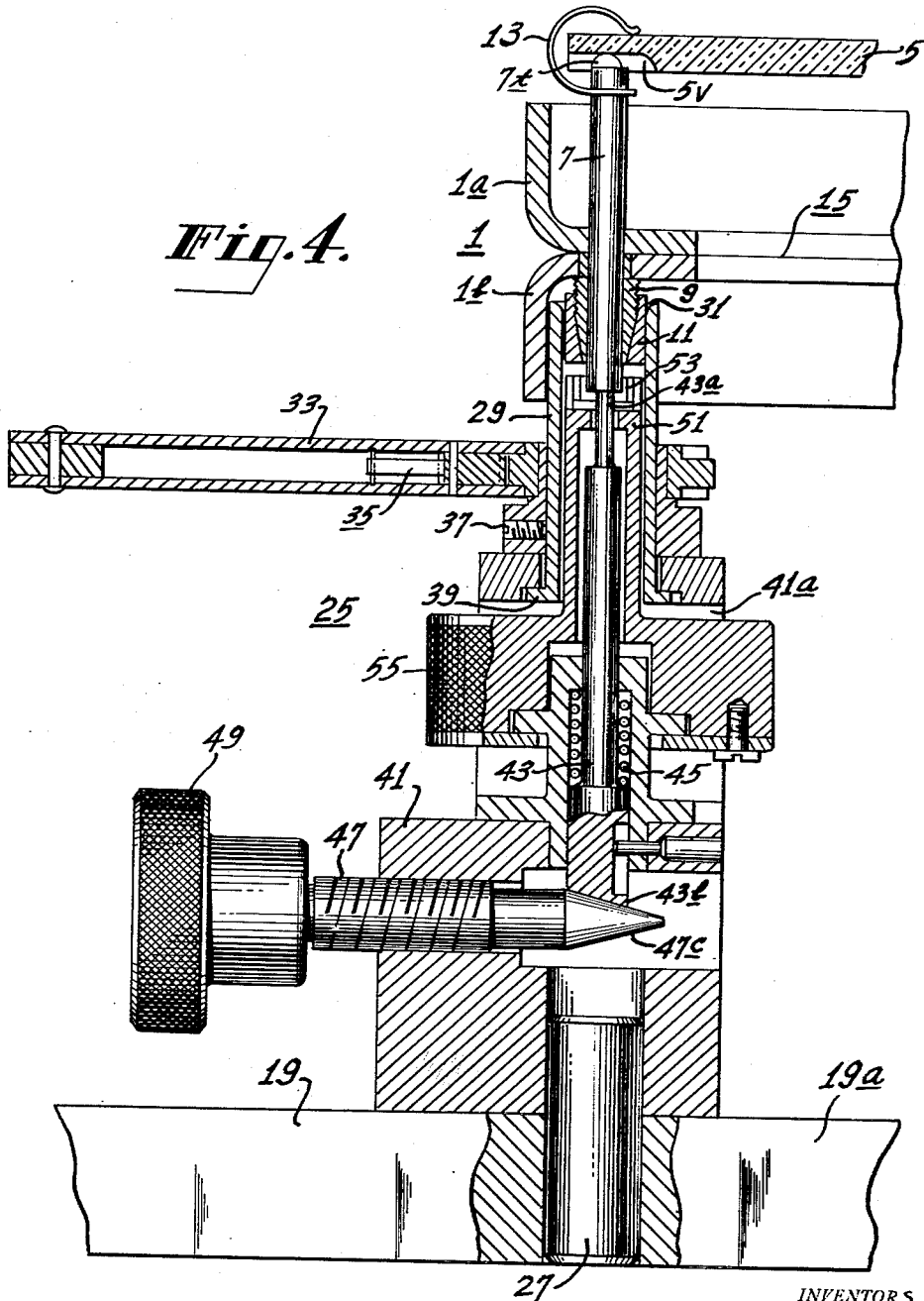
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UNITED STATES PATENT OFFICE

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ALIGNMENT-LIGHTHOUSE FOR
COLOR-SCREENS, ETC.Albert C. Grimm, Lancaster, and Milton J.
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Application July 15, 1953, Serial No. 368,198

6 Claims. (Cl. 316—29)

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This invention relates to apparatus for use in the inspection and alignment of television color-screen units of the "adjustable-screen" variety such, for example, as the ones described and claimed by the same inventors in copending application Serial No. 318,984, filed November 6, 1952.

The principal object of the present invention is to facilitate the rapid and accurate adjustment of color-screen units of the general character described and thus to facilitate the mass-production of color-kinescopes and analogous (e. g., "camera" and "stereoscopic") cathode-ray tubes.

The foregoing and related objects are achieved in accordance with the invention by the provision of an "alignment lighthouse" comprising a pedestal or table upon which the screen-unit is supported in a position whereat the adjusting-mechanism of the screen-unit is engaged by a plurality of tools for selectively applying to said mechanism independent forces capable of moving the screen-plate in any of three coordinate directions as may be required to bring the sub-elemental ray-sensitive color-areas thereon into register with the pattern of apertures in the foraminous electrode or "mask" with which said screen is to be used.

The invention is described in greater detail in connection with the accompanying three sheets of drawings, wherein:

Fig. 1 is a sectional view taken on the line 1—1 of Fig. 3 of an adjustable color-screen unit of the type claimed in application Serial No. 318,984; the drawing being marked with lines indicative of different adjustments in its mask-to-screen spacing;

Fig. 2 is an elevational view, partly in section, of an "alignment lighthouse" constructed in accordance with the principle of the invention and showing the adjustable screen-unit of Fig. 1 set-up thereon in position for adjustment;

Fig. 3 is a plan view of the lighthouse of Fig. 2; and

Fig. 4 is a vertical section taken on the line 4—4 of Fig. 3 showing one (of the three) duplicate tools for actuating the adjusting mechanism of the screen-unit.

The Grimm and Grimes screen-unit shown in Fig. 1 comprises a circular frame 1 consisting of two metal rings 1a and 1b of L-shaped cross-section. The rings 1a and 1b are arranged back-to-back and are welded or otherwise connected so that they exert a substantially isotropic clamping force upon the periphery of a tautly stretched foraminous electrode or "mask" 15. In the

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kinescope or other cathode-ray tube (not shown) in which the screen-unit is to be used the beam-electrons normally pass through the apertures in the mask 15, along different angularly related paths, in their transit to the sub-elemental phosphor covered areas indicated at B, which make-up the mosaic (or "Paget") pattern on the target surface 5t of a glass screen-plate 5.

The screen-plate 5 is adjustably supported on the frame 1 by a contrivance which includes three (see Fig. 3) individually adjustable rod-like supports 7 disposed 120° apart about the periphery of the screen-plate 5. The three places at which the screen-plate 5 is supported are defined by three radially extending V-shaped grooves 5v in the target surface thereof. Each V-groove comprises a self-leveling support for an eccentrically disposed hemispherical terminal 7t on the end of each of the adjustable rods 7. Each of the three rods 7 is mounted to permit of independent axial and rotatable movements in the bore of a split stud or collet 9 which is welded onto the lower section 1b of the supporting frame 1. The collet 9 has a conical outer surface (see Fig. 4) which is threaded to receive the threaded inner surface of a complementary nut 11. Screwing the nut 11 up on the split body of the collet 9 causes the latter to exert a clamping force on the rod 7 and thus to maintain it in any selected position. The other or free end of each rod 7 terminates in kerf 7k (or in a "flat") which when turned by a screwdriver (as later described) urges the eccentric head 7t on the upper end of the rod against a side wall of its grooved seat 5v and moves the screen-plate 5 in whatever plane has been fixed by the axial adjustment of the rods 7. Hold-down brackets or springs 12, which may be supported either by the rods 7 or on the frame 1, serve to maintain the grooved screen-plate 5 on its supporting rods 7.

As explained in greater detail in the earlier filed Grimm and Grimes application, where mass-production is involved it is very seldom that the foraminous electrode or mask 15 in any two screen-units will be subjected to isotropic tensioning forces of exactly the same intensity. Thus, referring still to Fig. 1, if the mask 15 is subjected to an isotropic tensioning force of an intensity such that the dot-like apertures therein are at the locations indicated by reference characters a, the color-dots B on the "target" 5t can be brought into register with said apertures only if the screen-plate 5 is moved into a plane or position indicated by the line A. Similarly, if the isotropic tension-

ing force applied to the apertured mask 15 is of an intensity such that its apertures are at locations indicated by reference characters a' , the color dots B can be brought into register with the locations a' only if the screen-plate 5 is moved into the plane or position indicated by the line A' .

As previously brought out, and as indicated in Fig. 1 by the straight and curved arrows adjacent to the screen-supporting rods 7, the adjusting mechanism of the screen-unit is capable of moving the screen-plate 5 toward and away from its apertured mask 15 and can also move said plate about, and tilt it with respect to, an axis normal to the plane of said mask. The "alignment-light-house" of the present invention is designed to apply any or all of the adjusting and locking forces required to align the color-areas B on the screen-plate 5 with respect to the pattern of apertures in the foraminous electrode or mask 15.

As shown in Figs. 2, 3 and 4 the alignment-lighthouse of the present invention comprises a pedestal or table 17 having a removable top or upper base 19 containing a large central opening 19a therein to permit the projection therethrough of light-rays from a point 21 beneath the table. Three up-standing posts 23 spaced 120° apart about the opening 19a serve to hold the screen-unit in a level position whereat its apertured mask 15 and its translucent screen-plate 5 are illuminated by the light-rays. The plane of the apertured mask 15 is the reference plane of the lighthouse. To ensure that this plane is the same for all screen-units, each of the three rigid supporting posts 23 terminates in a locating pin 23a which passes through a hole in the lower ring 1b of the mask-supporting frame 1. The shoulder of this pin 23a seats exactly in the plane of the mask 15 and its head extends through a smaller hole in the upper ring 1a of the frame 1. When, as in the instant case, the screen-unit is to be aligned for use in a color-kinescope the distance between the light-source 21 and the plane of the apertured mask 15 should, ordinarily, correspond to the spacing between said mask and the plane-of-deflection (or "virtual source of electrons") in the kinescope in which the screen unit is to be used.

Referring now to Figs. 2, 3 and 4: Three multipurpose tools, indicated generally by reference numeral 25, which are fixed, as by dowels 27, 120° apart on the table-top 19 supply all necessary adjusting forces for the screen-adjusting mechanism of the screen-unit. Stated generally, these fixtures 25, which are of duplicate construction, comprise: (i) a wrench for actuating the nut 11 on the collet 9 of the adjusting rod 7 (ii) a jack for applying a lifting force to said rod thereby to alter the spacing between the screen-plate 5 and its mask 15 and (iii) a screwdriver for turning the rod 7 and hence the screen-plate 5 in whatever plane has been set by the jack.

As brought out in the following description of Fig. 4, the wrench, the jack and the screwdriver in each fixture 25 are arranged about a common vertical axis in a position to engage the appropriate parts of the screen-adjusting mechanism when the screen-unit is seated upon the supporting posts 23 for said unit.

The wrench in each of the fixtures 25 is preferably of the ratchet variety. As shown in Fig. 4 it comprises a vertically arranged hollow metal cylinder or tube 29 through which certain elements of the jack and screwdriver extend. This tube 29 terminates at its upper end in a non-

circular opening 31 for receiving the collet nut 11 on the adjusting rod 7 of the screen-unit. A hollow handle 33 containing a ratchet mechanism, indicated generally at 35, is affixed to the outer surface of the tube 29 as by a set-screw 37. The lower end of the tube or cylinder 29 of the wrench terminates in a flange 39 which has a bearing fit on an upper part 41a of the immovable base 41 of the fixture 25 so that the wrench may be turned without disturbing the setting of the other two tools in the fixture.

The jack portion of the fixture 25 comprises a vertical rod-like plunger 43 which bears at its upper end 43a against the adjusting rod 7 of the screen-unit. The plunger 43 has a tapered lower end 43b which is biased, by a spring 45, to bear against a cone 47c on the inner end of an horizontally extending screw 47 in the base 41 of the fixture. The screw 47 terminates at its outer end in a knurled knob 49 which, when turned clockwise exerts a lifting force upon the plunger 43, through the cone 47c, and thus lifts the rod 7 and raises the screen-plate 5 with respect to its apertured mask 15.

The screwdriver portion of the fixture 25 shown in Fig. 4 comprises a hollow shank 51 which surrounds the plunger 43 of the jack and extends through the cylindrical body 29 of the wrench. A male blade 53 (or female slot) on the upper end of the shank 51 engages the kerf 7k on the lower end of the rod 7 upon which the screen-plate 5 is supported. A knurled knob 55 on the lower end of the shank 51 serves to turn it about its vertical axis. As previously set forth the turning force is converted by the ball-and-groove contrivance at the upper end of the adjusting rod 7 of the screen-unit into a force capable of turning the screen-plate 5 (with respect to its apertured mask 15) either clockwise or counterclockwise in whatever plane said plate has been placed by the lifting force applied thereto through the plunger 43 of the jack.

The present invention is not especially concerned with the technique employed by the operator in determining the direction or directions of movement required to bring the mosaic pattern of the dots (or lines) on the screen-plate 5 into register with the array of apertures in the foraminous electrode or mask 15. Three such techniques or methods are described by Grimm and Grimes in their earlier filed disclosure. Accordingly, it is sufficient here to state that the light-rays emanating from the point 21 may be derived from an ultra-violet lamp if the phosphor-dots (or lines) on the screen-plate 5 are to glow in their natural color or colors, as is required when the so-called color-dilution inspection method is employed, and that monochromatic light (e. g., from a sodium vapor bulb) should, preferably, be used when the direct observation method or the interference-ring method is used.

What is claimed is:

1. Apparatus for aligning the mosaic pattern on a screen-plate with the apertures of a foraminous element in a television screen-unit of the kind containing a plurality of adjustable supports capable of adjusting the position of said screen-plate with respect to said foraminous element, said apparatus comprising a base having an opening therein to permit the passage therethrough of light rays emanating from a point behind said opening, means disposed on said base about said opening for holding said screen-unit in a position whereat its foraminous ele-

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ment is caused to lie in a reference plane spaced a predetermined distance from said point and its screen-plate is illuminated by the pattern of light with which said light-rays are endowed by the presence of said foraminous element in their path, and means disposed on said base about said opening in a position to engage said adjustable screen-supports for selectively applying thereto independent forces capable of altering the spacing of said screen-plate with respect to said reference plane and the orientation of said screen-plate with respect to said pattern of light.

2. Apparatus in accordance with claim 1 and wherein said last mentioned means comprises a jack for altering the spacing of said screen-plate with respect to said reference plane and a turning-tool for changing the orientation of said screen-plate with respect to said pattern of light.

3. The invention as set forth in claim 2 and wherein said turning tool comprises a hollow shank and said jack comprises a plunger concentrically disposed within said hollow shank.

4. Apparatus for aligning the mosaic pattern on a screen-plate with the apertures of a foraminous element in a television screen-unit of the kind containing a plurality of adjustable supports capable of moving said screen in any of three coordinate directions with respect to said foraminous element; said apparatus comprising a base having an opening therein to permit the

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passage therethrough of light-rays projected from a point behind said opening, means disposed on said base about said opening for holding said screen-unit in a position whereat its foraminous element is caused to the lie in a reference plane spaced a predetermined distance from said point and its screen-plate is illuminated by the pattern of light with which said light-rays are endowed by the presence of said foraminous element in their path, and means disposed on said base about said opening in a position to engage said adjustable screen-supports for selectively applying thereto independent adjusting forces capable of moving said screen-plate in any of said three coordinate directions as may be required to bring its mosaic pattern into register with said pattern of light.

5. The invention as set forth in claim 4 and wherein said last mentioned means comprises a jack for altering the spacing between said screen-plate and said foraminous electrode, a tool for turning said screen-plate about an axis normal thereto, and a wrench for applying a locking force to said adjustable screen-plate supports.

6. The invention as set forth in claim 5 and wherein said jack, said turning-tool and said wrench are disposed about a common axis substantially normal to said reference plane.

No references cited.