

Dec. 12, 1967

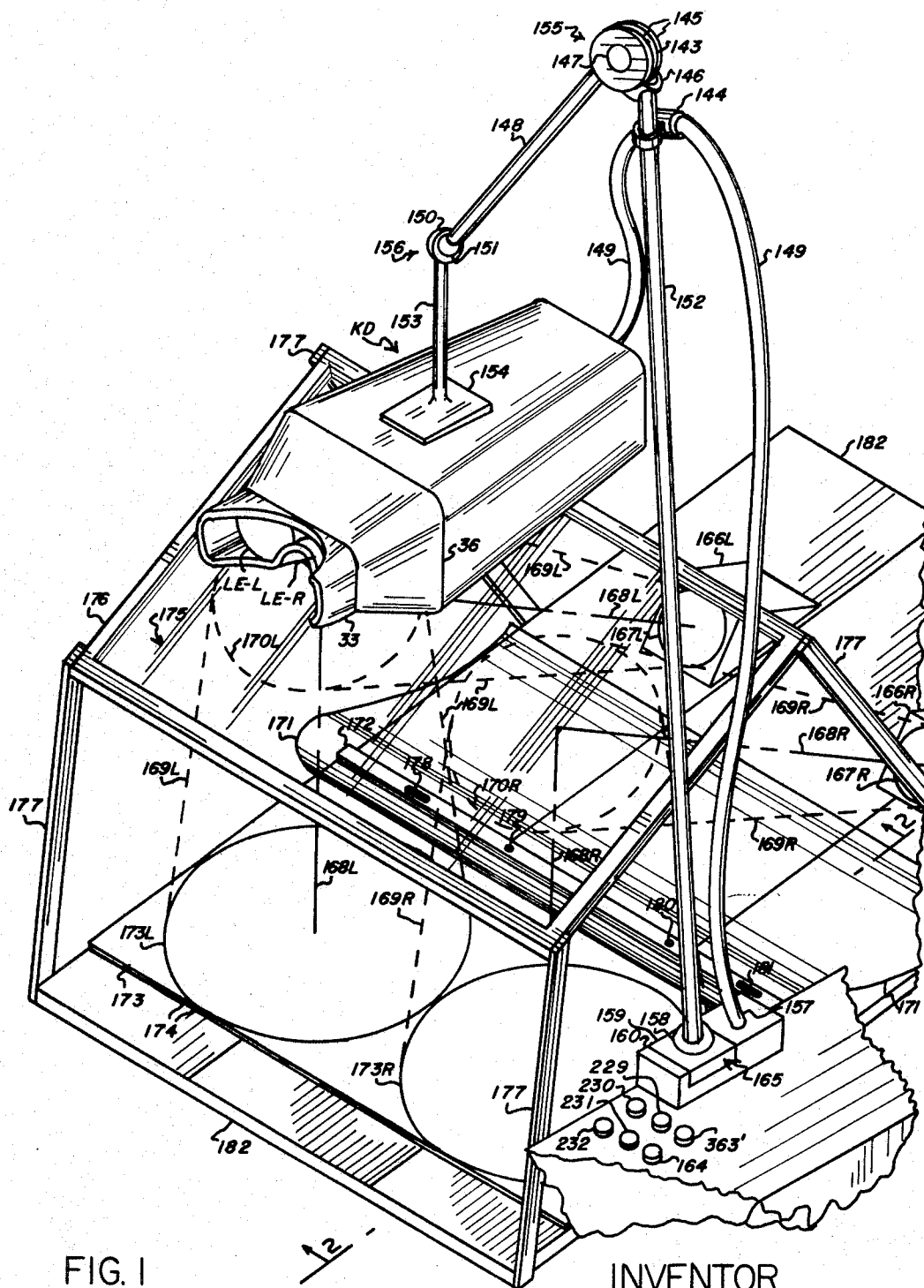
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3,358,078

APPARATUS FOR MAKING WIDE-ANGLE STEREOSCOPIC CARTOONS

Filed June 27, 1963

6 Sheets-Sheet 1



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APPARATUS FOR MAKING WIDE-ANGLE STEREOSCOPIC CARTOONS

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6 Sheets-Sheet 2

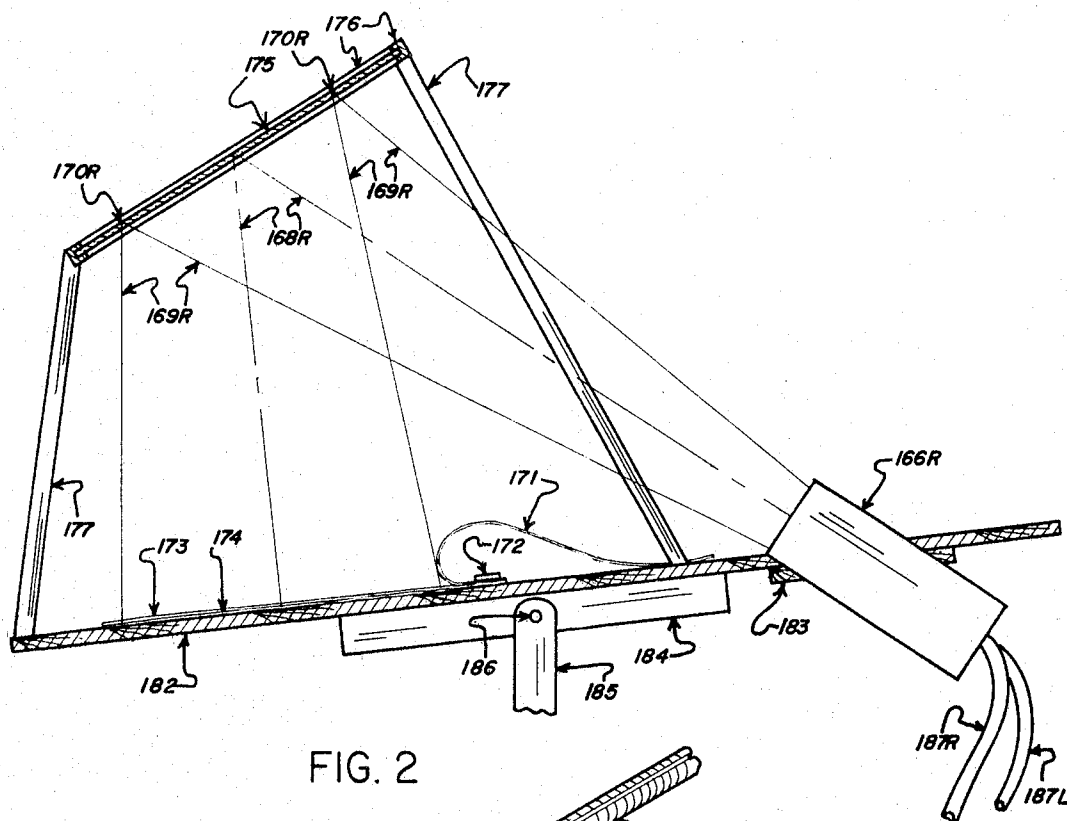


FIG. 2

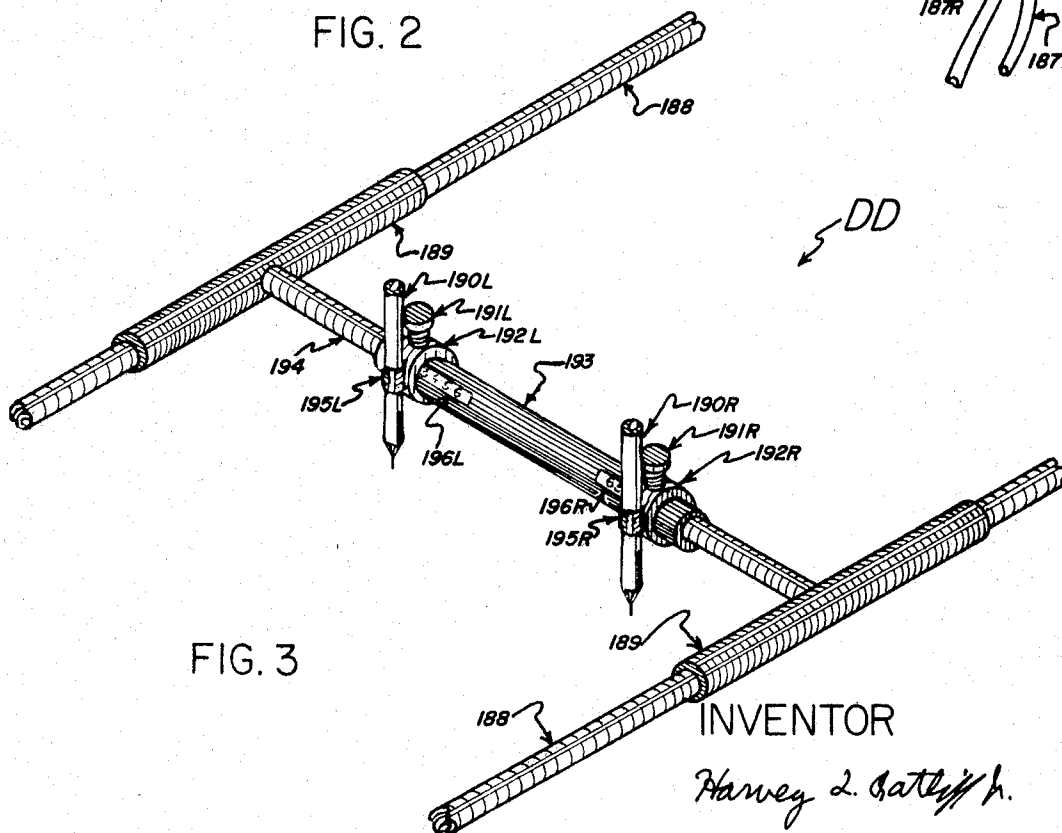


FIG. 3

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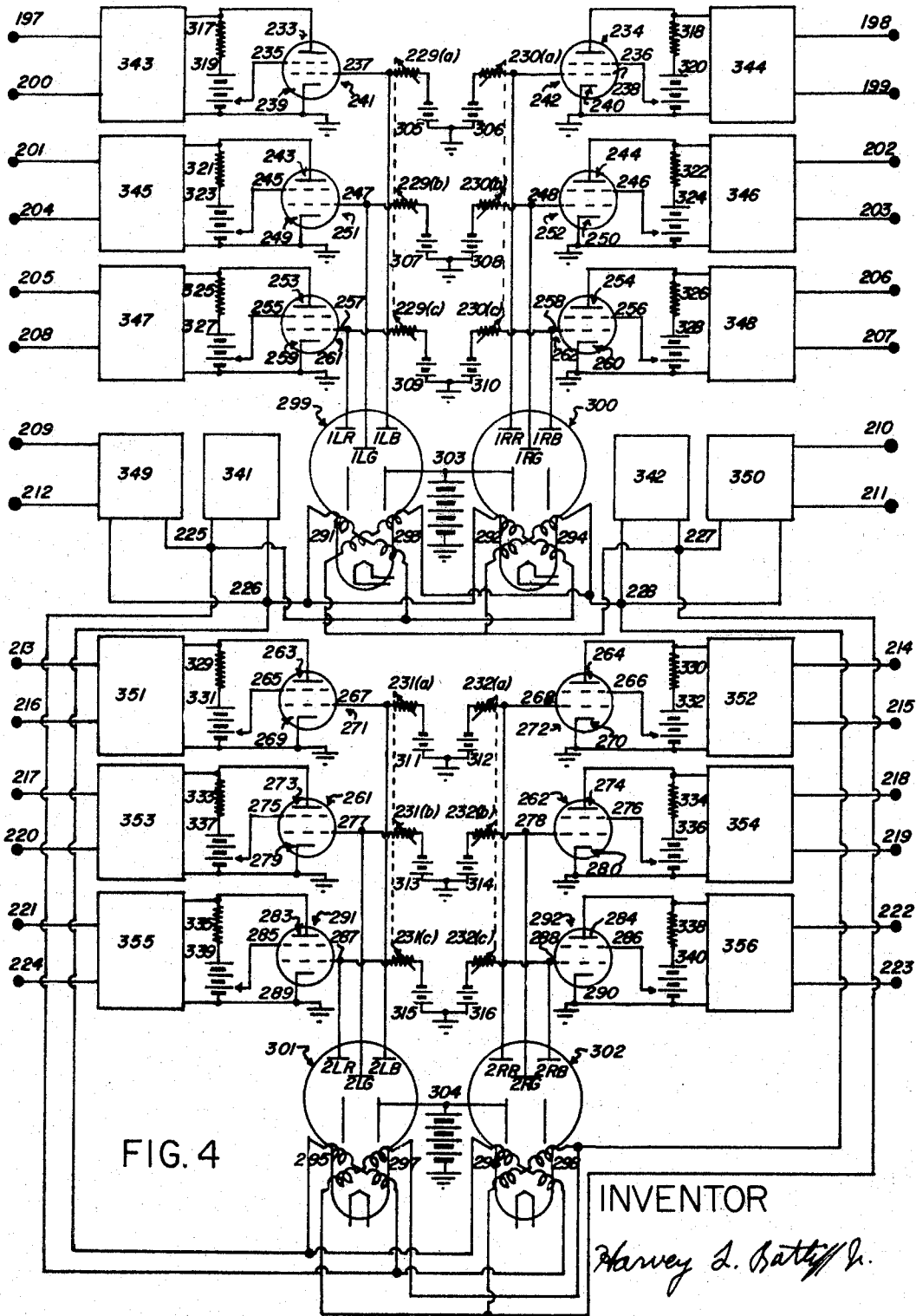
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Filed June 27, 1963

6 Sheets-Sheet 3



Dec. 12, 1967

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6 Sheets-Sheet 4

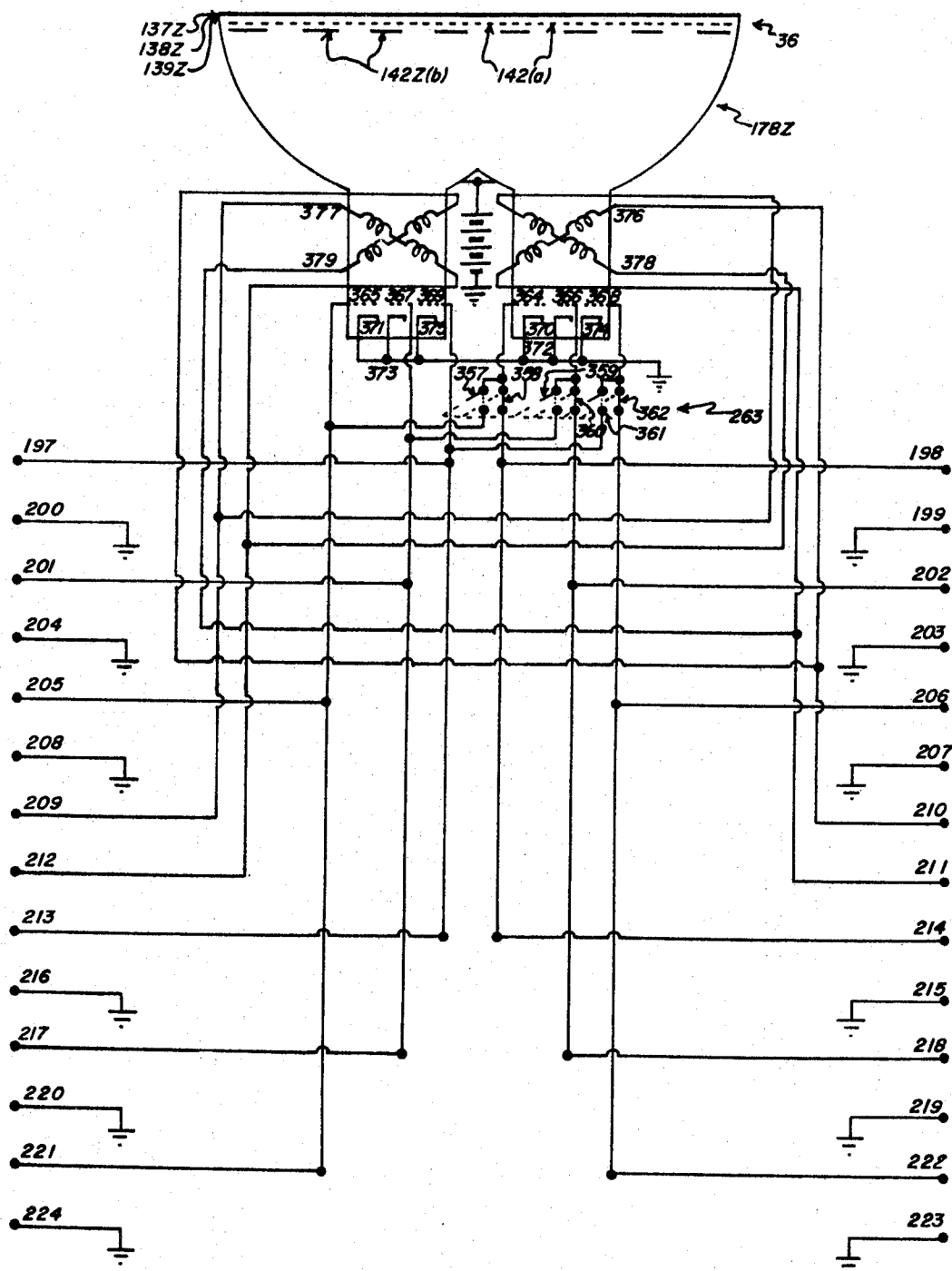


FIG. 5

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3,358,078

APPARATUS FOR MAKING WIDE-ANGLE STEREOSCOPIC CARTOONS

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6 Sheets-Sheet 5

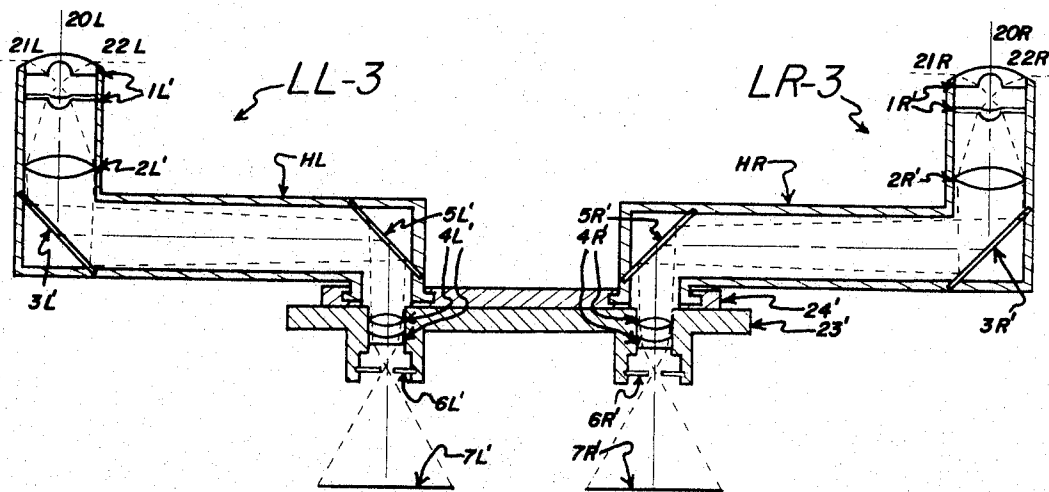


FIG. 6

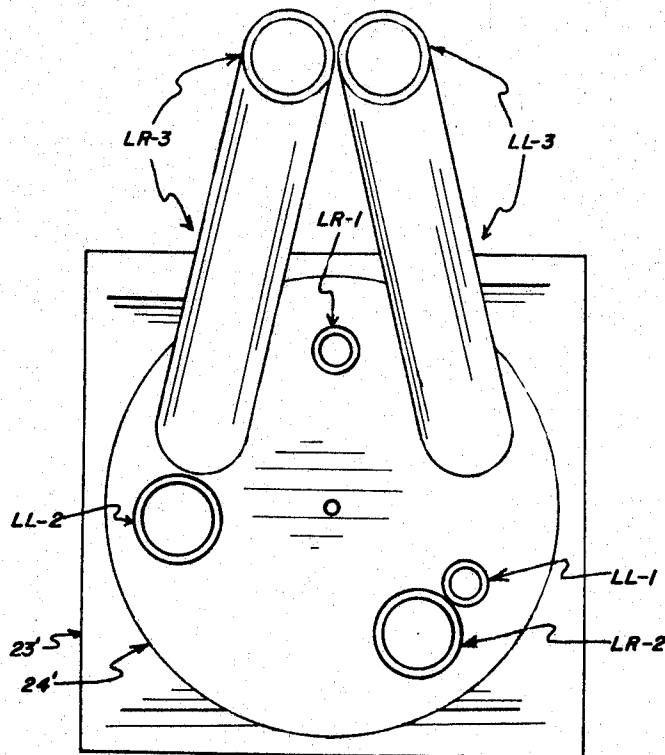


FIG. 7

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APPARATUS FOR MAKING WIDE-ANGLE STEREOSCOPIC CARTOONS

Filed June 27, 1963

6 Sheets-Sheet 6

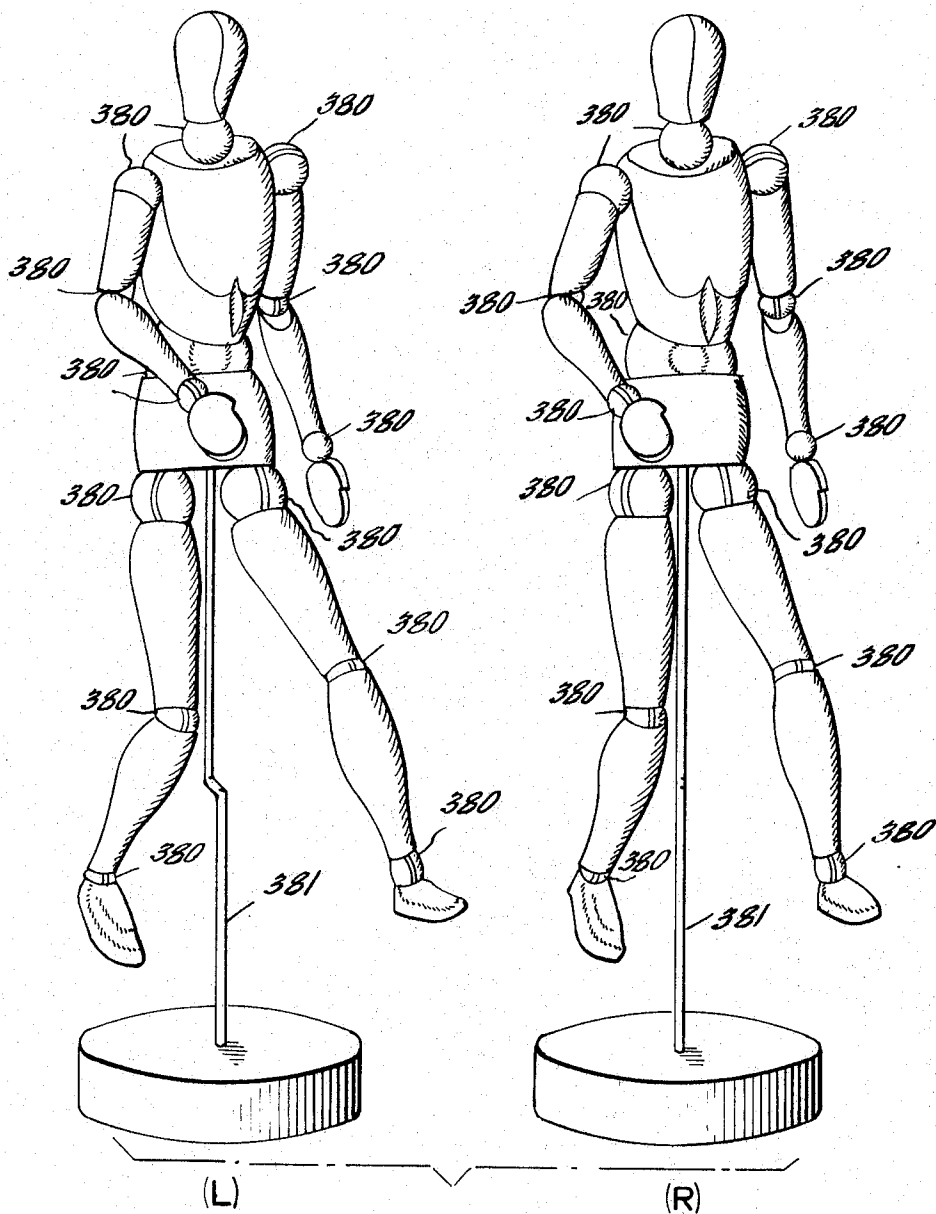


FIG. 8

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APPARATUS FOR MAKING WIDE-ANGLE STEREOSCOPIC CARTOONS

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one hundred percent to Jetru Inc., Amarillo, Tex.
Filed June 27, 1963, Ser. No. 291,198
7 Claims. (Cl. 178—6.5)

The present invention pertains to processes and apparatus whereby wide-angle stereoscopic and stereophonic animated cartoons may be created. The term wide-angle as herein referred to means an angle of view between 120° and 180°.

Understanding of the present invention is facilitated by first considering existing methods and comparing them with the methods of the present invention. Heretofore, in the production of animated cartoons, which had an angle of view of some 30°, artists or animator(s) made sketches, each sketch showing the extreme positions of a character whose movement was to be depicted in the form of an animated cartoon photoplay. Occasionally the artists or animator(s) made one or two sketches intermediate the extreme positions for the purpose of indicating the manner in which the character moved from one extreme to the other. These sketches are sometimes termed "rough" and include construction lines, false lines and the other nebulous indications from which the artist derived the final representation of the character shown on the rough. This step is ordinarily followed by the production of what are known as "clean-up drawings." Clean-up drawings are generally made by tracing on a separate sheet of paper the final lines of the character, thereby eliminating the construction and false lines existing on the rough drawing. These clean-up drawings are then utilized by the "in-betweeners" who draw "in-between" sketches showing the character in positions between the extremes originally drawn by the artist or animator. The number of these in-between drawings depends upon the amplitude of movement of the character and the rapidity with which the character moves.

Each of the drawings thus made (including the clean-up drawings and in-between drawings) is then either laboriously traced upon or mechanically transferred to transparent sheets generally made from cellulose nitrate or other cellulose derivatives.

After the "tracings" or "transfers" are made, paints, generally opaque and of an appropriate color, are applied to the drawings (which have in the meantime been inked or affixed). The finished sheet of transparent material bearing the ink or affixed drawings and the opaque paints is customarily referred to in the art as a cell. These cells are successively placed in front of appropriate background paintings (which have been created by a "background painter") and are then successively photographed, the resulting film being known as an animated cartoon photoplay. It is to be understood that the simplified description hereinabove given may be modified and amplified in actual practice.

In order for a wide-angle, stereoscopic animated cartoon to appear natural to a viewing observer as defined in my prior applications Ser. Nos. 275,411, (now abandoned), 250,562, (now U.S. Patent 3,293,358) and 287,338 filed Apr. 24, 1963, Jan. 10, 1963, and June 12, 1963 respectively, each right eye view and left eye view cell must necessarily appear very distorted to the naked eye because the angular disposition of the rays leaving the images represented within 173L and 173R undergoes a great deal of expansion when viewed through LE-L and LE-R of KD. It would be extremely difficult for an "animator," "in-betweeners," or "background painter" to accurately distort his drawings correctly enough to appear

2

natural to a viewing observer without the use of special apparatus and methods.

Accordingly it is the primary object of this invention to teach processes and apparatus which makes it relatively easy for the "animator," "in-betweeners," and "background painter" to each create his part of naturally appearing wide-angle, stereoscopic cartoons. Heretofore it has not been practical to create action scenes of cartoon characters which make the characters appear to be only from one to seven feet away from the viewing observer.

Accordingly it is another object of this invention to teach processes and apparatus which make it relatively simple for an "animator," or "in-betweeners," to create cartoon characters in action which appear to be only from less than one to seven feet away from and panoramically stereoscopic to a viewing observer.

It is also an object of this invention to teach processes and apparatus which make it relatively simple for a "background painter" to create the sensation that each viewing observer is viewing characters within a room which is as small or even smaller than 1 foot by 1 foot by 1 foot and which has stereoscopic relief and is of course shown in a wide-angle of view. Of course in this situation the characters would have to be closer to the viewing observer than one foot.

Other objects and advantages of my invention will become more apparent from a study of the following description taken with the accompanying drawings wherein:

FIG. 1 is an elevational view of the drawing board equipment and the kinescopic optical viewing device which are used to carry out the invention.

FIG. 2 is a side sectional view of the drawing board equipment taken along 2—2 as viewed in the direction of the arrows.

FIG. 3 is an elevational view of device DD which may be used to carry out the drawing of the invention when the characters or objects drawn are to appear further than seven feet from the eyes of a viewer.

FIGS. 4 and 5 are partially schematic and partially block diagrams of the electronic circuitry used to carry out the invention.

FIG. 6 is a sectional view of a lens system used to make objects appear larger, smaller, nearer, or further than the model (i.e. FIG. 8) and to thereby aid to carry out the invention.

FIG. 7 is a front view of the lens system of FIG. 6 with lens systems LL-3 and LR-3 arranged differently.

FIGS. 8 are left and right eye views of a model used to carry out the present invention.

Referring more particularly to FIGS. 1 and 2, drawing table 182 may be any well known form of drawing table which is adjustable (in a well known manner) up and down and about a horizontal axis which is in a plane which is perpendicular to the axis of view of the person sitting behind table 182. Kinescopic optical viewing device KD is preferable of the type described in my co-pending prior patent application No. 275,411 filed Apr. 24, 1963, and is mounted as taught in my co-pending prior patent application No. 287,338 filed June 12, 1963, however, KD could be the type taught by M. L. Heilig in Patent No. 2,955,156 issued Oct. 4, 1960 for example.

Within hulls 166L and 166R are left and right eye view pick up tubes respectively which are preferably the type of simultaneous color pick-up tubes described in my co-pending above cited application 275,411. Lenses 167L and 167R are operative well known narrow angle lenses such as that shown in FIG. 1 of Patent No. 2,898,389 issued to P. K. Weimer Aug. 4, 1959.

"Roughs," "tracings," "cells" etc. may be hereinafter referred to as "cells" and are designated by 171, 173, and 174. The cell in point is 173. The peripheral edges

of the left and right eye view cells respectively are designated by 173L and 173R respectively. Cells 171, 173, and 174 are secured to table 182 by element 172 which is secured by pins and pinholes 178, 179, 180, and 181.

Semitransparent mirror 175 is secured to frame 176. Semitransparent mirror 175 is preferably the well known type which is primarily reflective on its bottom and primarily transparent on its top. Frame 176 is rigidly secured to table 182 by legs 177 such that semitransparent mirror 175 reflects an image of the left eye view drawing within 173L to lens 167L which focuses it (in nonexpanded form, i.e. as the cell appears to the naked eye) on the target of a pick up tube within hull 166L and reflects an image of the right eye view drawing within 173R to lens 167R which focuses it (in nonexpanded form, i.e. as the cell appears to the naked eye) on the target of a pick up tube within hull 166R. Frame 176 is secured such that axis 168L and 168R respectively pass through the center of 167L and 167R respectively. The pick up tubes, lenses 167L and 167R, hulls 166L and 166R, table 182, and support 183 are secured together such that the targets of the pick up tubes are parallel to lenses 167L and 167R respectively and such that lenses 167L and 167R respectively are perpendicular to axis 168L and 168R respectively. It is here pointed out that the relative position of 175 to 182, 167L, and 167R is always the same no matter how much 182 is tilted relative to legs 185 and no matter how high up or low down table 182 is. Table 182 is supported by 184 which is made tiltably adjustable by thumb screw 186 or in a well known manner. Legs 185 are made adjustable up and down in a well known manner.

The peripheral rays which leave left and right eye view edges 173L and 173R respectively to be focused on the targets within hulls 166L and 166R respectively are 169L and 169R respectively. The circles of reflection of peripheral rays 169L and 169R respectively are 170L and 170R respectively. As indicated above the axis of the images focused on the targets within hulls 166L and 166R respectively and of peripheral rays 169L and 169R respectively are 168L and 168R respectively.

The image picked up by the tubes within hulls 166L and 166R is electronically conveyed to screen 36 of KD in a manner which will be described in greater detail later.

The "animator," "artist," "in-betweenner," "background painter," etc. will hereinafter be referred to as "artist" unless otherwise indicated.

The artist sits in the well known position relative to table 182 and uses his various tools to draw, paint, or trace on cells 171, 173, and 174. The numeral 174 indicates several cells. In order to observe his drawings, the artist places the KD set in a comfortable position and correctly views into the KD-set as described in my above cited co-pending patent application No. 287,338. In this manner the artist may view his drawings in the exact form they will appear to a viewing observer later. That is he sees the images after the angular disposition of the rays leaving therefrom has undergone a great deal of expansion because of LE-L and LE-R. He may therefore easily distort the drawings on cells 171, 173, and 174 such that they will appear correctly to viewing observers later viewing through LE-L and LE-R or the like. After the artist completes a cell (say within 173R), when viewed with the normal naked eye (because it is in compressed form) it will appear to have a large degree of barrel distortion (as defined in my above cited application No. 275,411).

Reference is now made to FIG. 3. Device DD (which is used for drawing characters or objects to appear more than 7 feet from the eyes as described in more detail later) of FIG. 3 consists of pins 190L and 190R which are rigidly secured to elements 192L and 192R respectively by elements 195L and 195R respectively. When set screws 191L and 191R respectively are loosened ele-

ments 192L and 192R respectively may be slid along element 193 in either direction but elements 192L and 192R are held from rotation relative to element 193 in a known manner. When set screws 191L and 191R respectively are tightened elements 192L and 192R respectively are rigidly secured to element 193. Scales 196L and 196R respectively indicate how far apart pins 190L and 190R respectively are apart and therefore, how far the character or object drawn or traced with pins 190L and 190R will appear to be from a viewing observer viewing properly into a KD set. Element 193 is free to move in either direction along or to rotate about element 194. Element 194 is rigidly secured to elements 189. Elements 189 are free to move in either direction along elements 188. Elements 188 are made in a well known manner such that they may be rigidly secured to and removed from table 182, at will, such that, when secured to 182, element 194 is parallel to the rear edge of table 182.

Reference is now made to FIG. 4. As stated hereinabove the pick up tubes within hulls 166L and 166R respectively (of FIGS. 1 and 2) are preferably of the simultaneous color pick up tube type indicated by 299 and 300 respectively and described in the description of FIGS. 4, 5, 9, 10, 11, 12, 13, 14, 15, and 16 of my hereinabove cited application No. 275,411. The signal picked up by left eye view red sensitive bus bar 11LR (corresponding to 43L of 275,411) is applied to control grid 257 of the first stage 261 of amplifier system 347. The signal picked up by left eye view green sensitive bus bar 11LG (corresponding to 42L of 275,411) is applied to control grid 247 of the first stage 251 of amplifier system 345. The signal picked up by left eye view blue sensitive bus bar 11LB (corresponding to 41L of 275,411) is applied to control grid 237 of the first stage 241 of amplifier system 343. The signal picked up by right eye view red sensitive bus bar 11RR (corresponding to 43R of 275,411) is applied to control grid 238 of the first stage 242 of amplifier system 344. The signal picked up by right eye view green sensitive bus bar 11RG (corresponding to 42R of 275,411) is applied to control grid 248 of the first stage 252 of amplifier system 346. The signal picked up by right eye view blue sensitive bus bar 11RB (corresponding to 41R of 275,411) is applied to control grid 258 of the first stage 262 of amplifier system 348. A steady negative D.C. bias 309 is applied to grid 257 through control 229(c) (which is ganged with 229(a) and 229(b), all three being controlled by knob 229 of FIG. 1 in a well known manner). Steady negative biasing voltages 307 and 305 respectively are applied to grids 247 and 237 respectively through controls 229(b) and 229(a) respectively. The parameters are such that controls 229(a), 229(b), and 229(c) may be varied such by knob 229 (of FIG. 1) that tubes 241, 251, and 261 respectively are biased at the plate current cut off to thereby pass no picture signal to amplifier systems 343, 345, and 347 respectively. Controls 229(a), 229(b), and 229(c) may also be varied such by knob 229 that tubes 241, 251, and 261 respectively pass very faint picture signals or strong picture signals. It is here pointed out that other methods of causing knob 229 to have the capacity to reduce or eliminate the left eye view picture signal from passing from tube 299 to screen 36 are considered within the scope of this invention.

Steady negative D.C. biasing voltages 306, 308, and 310 are applied to grids 238, 248, and 258 respectively through controls 230(a), 230(b), and 230(c) respectively (which are all three ganged together and controlled by knob 230 in a well known manner). The parameters are such that controls 230(a), 230(b), and 230(c) may be varied such by knob 230 that tubes 242, 252, and 262 respectively are biased at the plate current cut off to thereby pass no picture signal to amplifier systems 344, 346, and 348 respectively. Controls 230(a), 230(b), and 230(c) may also be varied such by knob 230 that

tubes 242, 252, and 262 respectively pass very faint picture signals or strong picture signals. It is also pointed out that other methods of causing knob 230 to have the capacity to reduce or eliminate the right eye view picture signal from passing from tube 300 to screen 36 are considered within the scope of this invention. The plate electrodes 233, 234, 243, 244, 253, and 254 are connected to suitable source of steady plate potential 319, 320, 323, 324, 327, and 328 respectively through resistors 317, 318, 321, 322, 325, and 326 respectively. The shield-grids 235, 236, 245, 246, 255, and 256 are connected to an intermediate point of D.C. supplies 319, 320, 323, 324, 327, and 328 respectively in a well known manner. The outputs of stages 241, 242, 251, 252, 261, and 262 are applied to the other stages of amplifier systems 343, 344, 345, 346, 347, and 348 respectively.

A vertical scanning signal is generated by system 341 and applied to terminals 225 and 226. The output of terminals 225 and 226 is applied to deflection coils 291 and 292 in a well known manner. The output of terminals 225 and 226 is also applied to amplifier system 349.

A horizontal scanning signal is generated by system 342 and applied to terminals 227 and 228. The output of terminals 227 and 228 is applied to deflection coils 293 and 294 in a well known manner. The output of terminals 227 and 228 is also applied to amplifier system 350.

Reference is now made to FIGS. 6 and 7 which show lens systems which make objects look nearer, further, larger, or smaller than the model (i.e. of FIG. 8) in a manner which will be described in more detail later. There are one or more auxiliary systems. Each auxiliary system has two wide angle lens systems such as 1L' and 1R' (which are of the type described in the above cited 275, 411). In each auxiliary system the rays within peripheral rays 21L and 21R respectively and 22L and 22R respectively, including central rays 20L and 20R respectively pass through wide angle lens systems 1L' and 1R' respectively, through collector lens systems 2L' and 2R' respectively and are reflected by reflectors 3L' and 3R' respectively to then be reflected by 5L' and 5R' respectively such as to be parallel to the corresponding rays before reflection from 3L' and 3R' respectively. From 5L' and 5R' respectively the rays pass through lens systems 4L' and 4R' respectively which focus them on targets 7L' and 7R' respectively after passing through controllable diaphragms 6L' and 6R' respectively. Targets such as 7L' and 7R' are preferably in each auxiliary system and are for simultaneous color pick up tubes such as 301 and 302 respectively which are identical to tubes 299 and 300 described hereinabove (refer also to 275, 411). In each auxiliary system optical elements 1L', 2L', 3L', and 5L' are supported by housing means HL to make up wide angle lens system LL-3 and optical elements 1R', 2R', 3R', and 5R' are supported by housing means HR to make up wide angle lens system LR-3. Housings HL and HR are made such as to be rotatable in turret 24' to be secured in various positions so that the centers of lenses 1L' and 1R' may be far apart (for example 3.5 times the interpupillary distance) ($3.5 \times 2\frac{1}{16}$ "') thus making objects appear closer or smaller or close together (for example $\frac{1}{3}$ the interpupillary distance) ($\frac{1}{3} \times 2\frac{1}{16}$ "') thus making objects further or larger. This is done in a well known manner which will not be described here. It is contemplated that turret 24' is mounted on the turret support 23' of a housing means which is suitable to house two simultaneous color pick up tubes with their associated electronic equipment. It is here pointed out however that turret 24' containing lens systems LL-3 and LR-3 could easily be mounted on turret support 23 of MR of FIGS. 1, 2, 3, and 4 of my co-pending application No. 275,411 cited above for the purposes of "trick photography."

The images focused on targets 7L' and 7R' of each auxiliary system are converted into red picture signal impulses on bus bars 2LR and 2RR respectively (cor-

sponding to 43L and 43R respectively of 275, 411), green picture signal impulses on bus bars 2LG and 2RG respectively (corresponding to 42L and 42R respectively of 275, 411), and blue picture signal impulses on bus bars 2LB and 2RB respectively (corresponding to 43L and 43R respectively of 275, 411) in a manner described in 275, 411.

In each auxiliary system the signals picked up by left eye view red sensitive bus bars 2LR, left eye view green sensitive bus bars 2LG, left eye view blue sensitive bus bars 2LB, right eye view red sensitive bus bars 2RR, right eye view green sensitive bus bars 2RG, and right eye view blue sensitive bus bars 2RB are applied to control grids 287, 277, 267, 268, 278, and 288 respectively of the first stages 291, 281, 271, 272, 282, and 292 respectively of amplifier systems 355, 353, 351, 352, 354, and 356 respectively. Steady negative D.C. biasing voltages 315, 313, 311, 312, 314, and 316 are applied to grids 287, 277, 267, 268, 278, and 288 respectively through ganged controls 231(c), 231(b), 231(a), 232(a), 232(b), and 232(c). Controls 231(c), 231(b), and 231(a) are controlled by knob 231 of FIG. 1 in a well known manner. Controls 232(a), 232(b), and 232(c) are controlled by knob 232 of FIG. 1 in a well known manner. The parameters are such that controls 231(a), 231(b), and 231(c) may be varied such by knob 231 that tubes 271, 281, and 291 respectively are biased at the plate current cut off to thereby pass no picture signal to amplifier system 351, 353, and 355 respectively. Controls 231(a), 231(b), and 231(c) may also be varied such by knob 231 that tubes 271, 281, and 291 respectively pass very faint picture signals or strong picture signals. It is here pointed out that other methods of causing knob 231 to have the capacity to reduce or eliminate the left eye view picture signal from passing from tube 301 to screen 36 are considered within the scope of this invention. The parameters are also such that controls 232(a), 232(b), and 232(c) may be varied such by knob 232 (of FIG. 1) that tubes 272, 282, and 292 respectively are biased at the plate current cut off to thereby pass no picture signal to amplifier systems 352, 354, and 356 respectively. Controls 232(a), 232(b), and 232(c) may also be varied such by knob 232 that tubes 272, 282, and 292 respectively pass very faint picture signals or strong picture signals. It is here pointed out that other methods of causing knob 232 to have the capacity to reduce or eliminate the right eye view picture signal from passing from tube 302 to screen 36 are considered within the scope of this invention. The plate electrodes (of each auxiliary system) 263, 264, 273, 274, 283, and 284 are connected to a suitable source of steady D.C. plate potential 331, 332, 337, 336, 339, and 340 respectively through resistors 329, 330, 333, 334, 335 and 338 respectively. The shield-grids 265, 266, 275, 276, 285, and 286 are connected to an intermediate point of D.C. supplies 331, 332, 337, 336, 339, and 340 respectively in a well known manner. In each auxiliary system the outputs of stages such as 271, 272, 281, 282, 291, and 292 are applied to the other stages of amplifier systems such as 351, 352, 353, 354, 355, and 356 respectively.

The output of terminals 225 and 226 is also applied to the vertical deflection coils of each auxiliary system such as coils 295 and 296 of tubes 301 and 302 respectively in a well known manner. The output of terminals 227 and 228 is also applied to the horizontal deflection coils of each auxiliary system such as coils 297 and 298 of tubes 301 and 302 respectively in a well known manner.

Reference is now made to FIG. 5. Tube 178Z is the same as tube 178 of FIG. 27 of my above cited co-pending application No. 275,411; mask 142Z corresponds to mask 142 of FIG. 27 of 275,411 and as in 275,411 mask 142Z allows the red gun beams to strike only red phosphor elements, green gun beams to strike only green phosphor elements, and blue gun beams to strike only blue phosphor elements (because of 142Z(a)). Also as in

275,411 mask 142Z allows the beams from the right eye view red, blue and green guns to strike only the elements the right eye sees and the beams from the left eye view red, blue, and green guns to strike only the elements the left eye sees (because of 142Z(b)). This is accomplished by the well known principle of parallax. Also elements 137Z, 138Z, and 139Z of screen 36 of the present invention correspond to elements 137, 138, and 139 of screen 36 of 275,411 and are described therein. Deflection coils 377 and 379 of the present invention correspond to deflection yoke 176L of 275,411, and deflection coils 376 and 378 of the present invention correspond to deflection yoke 176R of 275,411. Control grid 365 of the present invention corresponds to control grid 172L of the red gun of 275,411. Likewise control grids 367, 369, 364, 366, and 368 of the present invention correspond to control grids 172L of the green gun, 172L of the blue gun, 172R of the red gun, 172R of the green gun, and 172R of the blue gun respectively of 275,411. The other elements shown in FIG. 27 of 275,411 are left out of FIG. 5 of the present invention because they are mostly well known in the art (except 177L and 177R of 275,411) and are considered unnecessary to describe the present invention.

The output from amplifier systems 343, 345, 347, and 349 respectively is applied through terminals (197 and 200), (201 and 204), (205 and 208), and (209 and 212) respectively across control grids and cathodes (369 and 375 respectively), (367 and 373 respectively), (365 and 371 respectively), and deflection coil 377 respectively in a well known operative manner.

From each auxiliary system the output from each three left eye view amplifier systems such as 351, 353, and 355 is applied through terminals such as (213 and 216), (217 and 220), and (221 and 224) respectively across control grids and cathodes (369 and 375 respectively), (367 and 373 respectively) and (365 and 371 respectively) respectively in a well known operative manner.

The output from amplifier systems 344, 346, and 348 respectively is applied through terminals (198 and 199), (202 and 203), and (206 and 207) respectively, through ganged switches 358, 360, and 362 respectively across control grids and cathodes (364 and 370 respectively), (366 and 372 respectively), and (368 and 374 respectively) respectively in a well known operative manner. Terminals (197 and 200), (201 and 204), and (205 and 208) which carry the output from 343, 345, and 347 respectively are also connected across control grids and cathodes (368 and 374 respectively), (366 and 372 respectively), and (364 and 370 respectively) respectively through ganged switches 361, 359, and 357 respectively. Switches 358, 360, and 362 are also ganged with 361, 359, and 357 to form switch 363 which is controlled by knob 363' of FIG. 1 such that when switches 358, 360, and 362 are closed by a first position of 363', switches 361, 359, and 357 are opened and when switches 358, 360, and 362 are opened by a second position of 363', switches 361, 359, 357 are closed.

From each auxiliary system the output from each three right eye view amplifier systems such as 352, 354, and 356 is applied through terminals such as (214 and 215), (218 and 219), and (222 and 223) respectively through ganged switches 358, 360, and 362 respectively across control grids and cathodes (364 and 370 respectively), (366 and 372 respectively), and (368 and 374 respectively) respectively, in a well known operative manner. Terminals such as (213 and 216), (217 and 220), and (221 and 224), which carry the output from 351, 353, and 355 respectively are also connected across control grids and cathodes (368 and 374 respectively), (366 and 372 respectively), and (364 and 370 respectively) respectively through ganged switches 361, 359, and 357 respectively.

The output from amplifier system 350 is applied through terminals 210 and 211 across horizontal deflection coils 376 and 379 in a well known operative manner. When

the artist is confronted with creating a character or object which is to appear to be greater than some 7 feet from the viewing observers viewing into KD sets later, he has a relatively simple problem in that said character or object would appear virtually the same to the left eye as it would to the right. The difference under these conditions between the right-eye view picture and the left eye view picture would be only in the relationship between the various characters and background objects not in the characters themselves.

In other words by way of example if an image of an object is placed before the right eye on a screen which is 3 inches away from and perpendicular to the optical axis of the right and left eye of a viewing observer and an identical image of the same object is placed before the left eye on said screen in a plane parallel to a plane which includes two corresponding points on said left and right eye, and if optical means are provided to bring these respective images into clear focus before said left and right eyes, the following is true if said two images are to appear as the same object a specific distance away:

$$I/D_1 = d/D_2$$

where I is the interpupillary distance and D_1 is the distance the object will appear to be from the eyes, D_2 is the distance the object will appear to be from the screen, and d is the distance between the image before the right eye expanded from that on the screen and the image before the left eye expanded from that on the screen. If D_1 is 84 inches (7 feet) or greater, the right eye view image of the object or character may be identical to the left eye view image of the object or character with negligible loss in realism after expansion of the image. If for example D_1 is to be 84 inches, then D_2 is 81 inches, and of course I is always $2\frac{9}{16}$ " or 2.562 inches; therefore d is some 2.471 inches. However if D_1 is less than 84 inches, say for example 18 inches, the right eye view image of the object or character may not be identical to the left eye image if realism is to be maintained. If D_1 is to be 18 inches, the D_2 is 15 inches, and of course I is always 2.562 inches; therefore d is some 2.14 inches and the right eye view image (for example see FIG. 8(R)) must appear correctly different from the left eye view image (for example see FIG. 8(L)).

The contemplated mode of carrying out the invention (when the characters or objects are to appear more than seven feet away from viewing observers viewing into KD sets later) will now be set forth:

The electronic equipment is turned on by on-off switch 164 (which operates in a well known manner). Second knob 363' is turned such that ganged switches 357, 359, and 361 are closed thereby opening ganged switches 358, 360, and 362 (this throws an image of everything within 173L before both eyes; the right eye image being $2\frac{9}{16}$ " away from the left eye image to thereby make the object or character appear an infinite distance away. This is not uncomfortable because the eyes are preferably focused at infinity anyway, see 275,411 or my U.S. Patent 3,298,771). Third the hereinabove described auxiliary lens and electronic systems may, if desired, be placed to pick up any desired foreground character, foreground objects, or background characters or objects. Knobs such as 231 are regulated as desired to make the images picked up by the auxiliary systems as faint or clear as desired at different instants of time. Knob 229 is regulated as desired to make the image picked up of the drawing within 173L as faint or clear as desired at different instants of time. In the third step the "rough" drawings are made either from memory or by tracing the various desirable images picked up by the auxiliary equipment. It is understood, of course, that the drawings and images picked up by the auxiliary equipment is observed through the KD set and therefore, do not appear distorted to the artist although the drawings within 173L appear to have a lot of barrel distortion to the naked eye because they are in compressed

form. Fourth device DD is used to trace two pictures of the "rough" drawings (because the two images occupy substantially the same relative position, i.e. $d > 2.471$ and $d < 2.562$, one within 173L and one within 173R) after knob 363' is turned such that ganged switches 357, 359, and 361 are opened thereby closing ganged switches 358, 360, and 362 to thereby throw the right eye view images picked up by 300 and the right eye view auxiliary pick up tubes such as 302 before the artists' right eye and the left eye view images picked up by 299 and the left eye view auxiliary pick up tubes such as 301 before the artists' left eye. In the fourth step pins 190L and 190R are set on scale 196L and 196R respectively such that (d) as described hereinabove is the proper distance to make D_1 as desired. In the fourth step the "clean up drawings" are made. Fifth the "in-between" drawings are made in the same manner set forth in steps three and four. Sixth the paints of proper opacity and color are applied. After step six the techniques which are well known in the art are used to produce a wide-angle stereoscopic stereophonic cartoon photoplay. The techniques described in my co-pending above cited prior application No. 287,338 may be used to produce the stereophonic sound associated with the cartoon. As an alternative method of producing the stereoscopic effect produced by the use of DD is the manipulation of pins and pin holes such as 178, 179, 180, and 181 and cells such as 171, 173, and 174 as taught by W. E. Garity in Patent No. 2,776,594. Of course Garity teaches nothing about correctly distorting the pictures for wide-angle viewing, also Garity's technique will only be realistic when D_1 (as hereinabove described) is more than some seven feet.

The contemplated mode of carrying out the invention (when the characters or objects are to appear less than seven feet away from viewing observers viewing into KD set later) will be now set forth.

The electronic equipment is turned on by the on-off switch 164. Second knob 363' is turned such that ganged switches 357, 359, and 361 are opened thereby closing ganged switches 358, 360, and 362 (this throws the left eye view image within 173L and various auxiliary left eye view images properly before only the left eye and the right eye view image within 173R and various corresponding auxiliary right eye view images properly before only the right eye).

In order to explain step three more completely reference is again made to FIGS. 6, 7, and 8. As indicated above each auxiliary system has a wide-angle lens system such as that shown in FIGS. 6 and 7. In order to aid the artist in creating realistically appearing characters, he may choose to use a manikin or model such as shown in FIG. 8. Because of joints such as the thirteen joints 380, the manikins or models can assume virtually every position of action. The manikin of FIG. 8 is a model of a man however it is obvious that a model with joints such as 380 could be made for any desired cartoon character, and said model could be placed in and whence drawn and painted in the successive positions needed to create a wide-angle stereoscopic cartoon photoplay.

Lens systems LL-3 and LR-3 could be placed such that 20L and 20R (in other words the centers of 1L' and 1R') are the proper distance apart to make the manikin or model (and thereby the cartoon character) appear to be the proper size (i.e. larger or smaller than it is in fact) and the proper distance (i.e. nearer or further than it is in fact) away from the artist and thereby viewing observers later. If, for example, 20L and 20R are the interpupillary distance apart ($2\frac{9}{16}$ "") and a 16" tall manikin is some 18 inches from each lens 1L' and 1R', the left eye image would appear approximately as FIG. 8(L) before only the left eye of the artist and the right eye image would appear approximately as FIG. 8(R) before only the right eye of the artist. Of course the drawings of FIG. 8 are not perfect. When the artist placed lines

within 173L such as to reproduce the image of FIG. 8(L), the drawing within 173L would have a great deal of barrel distortion when viewed with the naked eye, and when the artist placed lines within 173R such as to reproduce the image of FIG. 8(R), the drawing within 173R would also have a great deal of barrel distortion when viewed with the naked eye. Of course a face, hands, feet and clothes having the various desired characteristics could be placed on a manikin or model having joints similar to 380 such that the manikin or model could assume all the positions of action. After this is done it is only a small problem for the artist to draw in the proper facial expressions and hand and foot positions when he is aided with the equipment of the present invention.

In step three of the present "close up drawing method," the left eye view of each wide angle cell (the "extreme position," "in-between position," and "background") is almost traced within 173L while the artist views his work (and what he is almost tracing into KD and regulates knob 229 to make the image of his work within 173L as faint or clear as desired and regulates knobs such as 231 to make the image of the characters, objects or background objects (such as objects within a small room a mouse would live in 1 foot x 1 foot x 1 foot for example) which he is almost tracing as faint or clear as desired.

Also in step three of the "close up drawing method," the right eye view of each wide-angle cell is almost traced within 173R while the artist views his work (and what he is almost tracing) into KD and regulates knob 230 to make the image of his work within 173R as faint or as clear as desired and regulates knobs such as 232 to make the image of the character, object, or background objects which he is almost tracing as faint or clear as desired.

For the reasons (i.e., to make objects appear larger, smaller, nearer, or further than the actual model) pointed out in my co-pending prior application Ser. No. 237,795, now abandoned, it is desirable to place lenses 1L' and 1R' different distances apart in the manner set forth hereinabove in the performance of step three of the "close up drawing method."

Fourth, the paints of proper opacity and color are applied while still using the equipment set forth in the present specification. After step four the techniques which are well known in the art are used to produce a wide-angle stereoscopic stereophonic cartoon photoplay. The hereinabove described "distant drawing method" including steps 1-6, the hereinabove described "close up drawing method" including steps 1-4, the hereinabove indicated steps that are well known in the art, and the stereophonic system of 287,338 are applied as needed to produce a wide-angle stereoscopic, stereophonic cartoon photoplay which will appear realistic when the objects appear less than one foot away or up to an infinite distance away from viewing observers viewing properly into KD sets. It is here pointed out that among the techniques of the prior art which could be used with small alterations as a great benefit to the performance of the present invention (a finished wide-angle stereoscopic, stereophonic cartoon photoplay which will appear realistic at substantially every depth) are: W. E. Disney's No. 2,201,689, L. B. Pickley's No. 2,314,629 and No. 2,260,092, W. B. Justice's No. 2,348,983, W. E. Garity's No. 2,312,158, F. W. Jackman's No. 2,147,038, and of course others.

While the invention has been disclosed and described in some detail in the drawings and foregoing description, they are to be considered as illustrative and not restrictive in character, as other modifications may readily suggest themselves to persons skilled in the art and within the broad scope of the invention, reference being had to the appended claims.

What I claim is:

1. In apparatus for hand rendering, in compressed and therefore distorted form, wide angle stereoscopic pictures

upon flat surfaces with the angle of view exceeding 120° in the horizontal plane and 100° in the vertical plane:

at least one right eye view and at least one left eye view picture surface within corresponding cells for retaining hand rendered images thereupon, said images being hand rendered in compressed and therefore distorted form;

first means of supporting the picture surfaces;

wide angle stereoscopic viewing apparatus which expands the angular disposition of rays of light which are representative of the distorted images on said picture surfaces from a compressed angular disposition to an expanded wide angle disposition substantially free of distortion whereby the rays which are representative of the peripheral areas of said picture surfaces enter the eyes to create the sensation of a view greater than said 120° in said horizontal plane and said 100° in said vertical plane;

second means of supporting said wide angle stereoscopic viewing apparatus in position to be looked into by the eyes of an observer;

thus enabling said observer to hand render flat wide angle stereoscopic pictures within said picture surfaces in compressed form and therefore, necessarily very distorted to the naked eye.

2. In combination with the apparatus of claim 1:

auxiliary wide angle stereoscopic apparatus which compresses the angular disposition of rays from a real life scene into a compressed narrow angle disposition and focuses them in compressed, and therefore, necessarily very distorted form upon an auxiliary surface;

third means of alternately causing said viewing apparatus to expand the angular disposition of the rays which are representative of images on the surfaces within said cells and those on said auxiliary surface;

thus enabling said observer viewing into said viewing apparatus to alternately observe said picture surfaces after they are in expanded form and said real life scene from said auxiliary surface as said scene naturally appears.

3. The apparatus of claim 1 wherein said wide angle stereoscopic viewing apparatus comprises:

a semitransparent mirror which reflects the rays from said surfaces while allowing said observer to see therethrough;

two video pick up means supported in the path of the rays reflected from said mirror to focus the rays of said surfaces received from said mirror upon the targets of said pick up means in substantially the same compressed distorted form as each appears to the naked eye when viewed alone and converting the images focused upon the respective said targets into respective electronic signals;

means of communicating said signals to a wide-angle kinescopic optical viewing device which is supported by said second means in position to be looked into by said observer;

said wide angle kinescopic optical viewing device con-

verting said signals into visual images and expanding said images from said compressed, distorted form into a wide angle non-distorted, non-compressed form whereby the rays from said images enter the eyes of said observer at angles greater than said 120° in the horizontal plane and said angles greater than said 100° in the vertical plane.

4. The apparatus of claim 1 wherein said first means comprises:

a desk with a cell supporting table which is fixedly rotatable about an axis which is horizontal and substantially perpendicular to the axis of view of said observer and which is fixedly movable up and down to allow adjustment for different angular dispositions of said table and for different heights respectively.

5. The apparatus of claim 3 wherein said second means comprises:

structural framework which rigidly secures said semi-transparent mirror to said first means and structural framework which supports said kinescopic optical viewing device such that said observer may move said viewing device into a comfortable viewing position.

6. The apparatus of claim 5 wherein said first means comprises:

a desk with a cell supporting table which is fixedly rotatable about an axis which is horizontal and substantially perpendicular to the axis of view of said observer and which is fixedly movable up and down to allow adjustment for different angular dispositions of said table and for different heights respectively.

7. In combination with the apparatus of claim 6:

auxiliary wide angle stereoscopic apparatus which compresses the angular disposition of rays from a real life scene into a compressed narrow angle disposition and focuses them in compressed, and therefore, necessarily very distorted form upon an auxiliary surface;

means of alternately causing said viewing device to expand the angular disposition of the rays which are representative of images on the surfaces within said cells and those on said auxiliary surface;

thus enabling said observer viewing into said viewing apparatus to alternately observe said picture surfaces after they are in expanded form and said real life scene from said auxiliary surface as said scene naturally appears.

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