

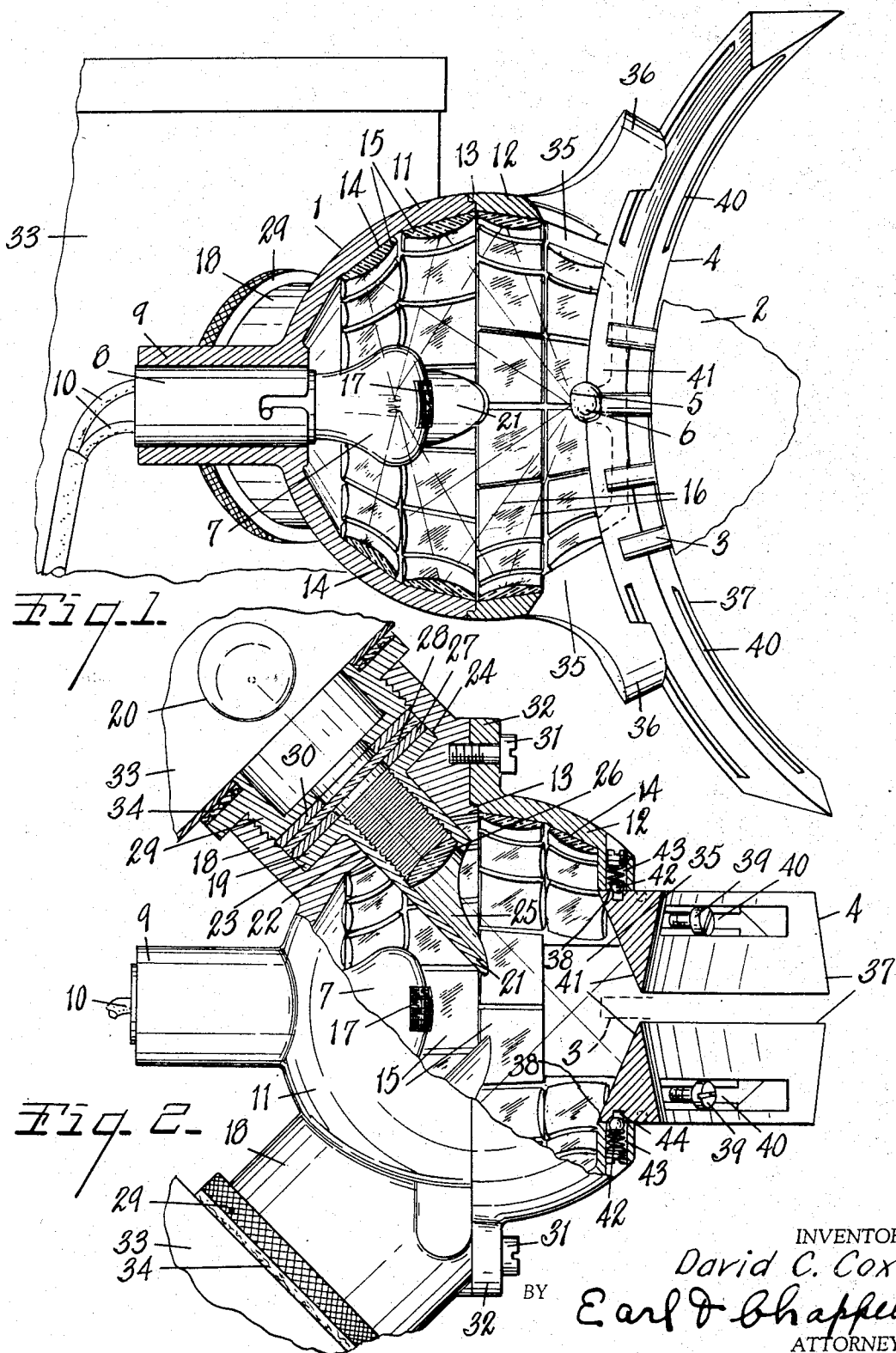
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LAMP HOUSING FOR SORTING MACHINES

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LAMP HOUSING FOR SORTING MACHINES

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16 Claims. (Cl. 88-14)

This invention relates to improvements in lamp housings for sorting machines.

The main objects of my invention are:

First, to provide a new and improved lamp housing for use in an electric sorting machine to illuminate articles to be sorted.

Second, to provide a housing of the type described having provision for mounting an illuminating lamp and a pair of photoelectric viewing devices.

Third, to provide a lamp housing of the type described having provision for uniformly and effectively illuminating articles at a viewing and judging station and provided with reference background means of novel and improved construction.

Fourth, to provide a lamp housing which is internally in the form of an ellipsoid having a viewing station at one focus thereof and illuminating means at the other focus thereof, there being means for causing light emanating from said illuminating means to be uniformly spread over an article at the viewing station.

Fifth, to provide a lamp housing having a viewing station and a reference background adjacent the viewing station, the said background being adjustable for a purpose to be described.

Sixth, to provide an illuminating and judging device having improved provisions for focusing light on an article to be judged and improved instrumentalities for focusing and filtering light reflected from said articles prior to impingement of the reflected light on light sensitive viewing means.

Further objects relating to details and economies of my invention will definitely appear from the description to follow. The invention is defined in the claims.

A structure embodying the features of my invention is illustrated in the accompanying drawing, wherein:

Fig. 1 is fragmentary view of the improved housing and reference background of my invention, the housing being partially broken away and in section to illustrate details of construction thereof.

Fig. 2 is a fragmentary view partially broken away and in section, further illustrating details of construction of my device.

The present invention is a continuation in part of my Letters Patent No. 2,190,935, issued February 20, 1940, for Sorting machines. In particular, this application relates to apparatus for illuminating a series of moving articles at a viewing point in the most effective manner and for

photoelectrically viewing the said articles at that point. Broadly considered, the invention consists of a lamp housing which is generally ellipsoidal in internal outline having a light source at one focus thereof and having the other focus located in the line of movement of said series of articles. I have found that by forming the internal wall of the housing ellipsoidal as described it is possible to illuminate the articles very effectively. I have further found that when the shape is that of a perfect ellipsoid the rays of light emanating from the light source and reflected from the housing wall converge onto the article, impinging the near surface of the later in the form of converging small points or dots of light, resulting in a very intense illumination of the surface of the article on the side adjacent the light source. A more satisfactory type of illumination is secured when the reflected rays are in the form of parallel sided beams impinging the article to produce areas of light, overlapping one another on the surface of the article. This causes the article to be more uniformly illuminated and results in elimination of objectionable shadows cast on a reference background when the light rays are focused sharply and impinge the article at a point. Such shadows tend to affect the operation of the photoelectric viewing means, causing the same in some instances to record as a dark or imperfect article what is in fact a perfect one. Moreover, a too intense illumination of the surface of the article is to be avoided, since it tends to overcome the effect produced on a photo-tube by a small dark spot on the article.

The invention also includes the provision of a reference background immediately adjacent and to the rear of the articles being sorted with reference to the source of illumination, this reference background being in the form of opposed inclined surfaces of suitable color and being spaced from one another only sufficiently to provide room for the passage of article seats on a conveyor wheel. Said members are arcuate in shape and have provision thereon for adjusting the same lengthwise.

Referring to the drawing, the reference numeral 1 in general indicates the lamp housing of my invention which is situated adjacent the periphery of a vacuum operated article carrying or conveyor wheel 2, the said wheel being chambered and provided with a plurality of elongated article carrying seats 3 which are in the form of hollow tubes communicating with the interior of the wheel. This wheel is connected to a source of vacuum (not shown) for the purpose of pick-

ing up articles by suction from a suitable hopper (not shown) and transporting the same to and through housing 1. Adjacent the periphery of wheel 2 I provide the reference backgrounds which are generally indicated by the reference numeral 4 and will be more particularly described hereinafter.

The housing 1 is generally ellipsoidal in shape internally thereof having one focus of the ellipsoid located at an article viewing station 5 in the path of movement of the articles 6, in this case beans. The axis of the ellipsoid is normal to the periphery of wheel 2. At the other focus I locate a suitable lamp 7 in a fitting 8 which is disposed in an elongated tubular holder or socket member 9 integral with the housing. The leads 10 supply current for illuminating the lamp.

The housing 1 consists of a pair of shells 11, 12 preferably formed by a die casting operation, the annular meeting edges of which are stepped as indicated at 13 so as to form a close light-sealing fit between the shells in operative assembled position. By reference to Figs. 1 and 2, it will be seen that the interior of housing 1 is not perfectly ellipsoidal in nature, but is only roughly so, inasmuch as throughout its inner surface housing 1 has a number of flat internal facets 14 in circumferentially and axially spaced arrangement, each of the facets having secured thereto, as by cementing, a reflecting member or mirror 15. These mirrors have the outer lens convex surface thereof preferably parabolic in form to cause light to be reflected back on the article 6 in the form of a parallel-sided beam. In Fig. 1 the broken lines 16 illustrate the manner in which the center elements of these beams are reflected from the mirrors onto the article. However, it will be understood that in actuality the said beams overlap one another considerably and bathe the entire surface of the article, except that portion in contact with the seat 3, with a uniform illumination, thus eliminating both shadows on the reference background and unduly intense illumination on the near side of the bean, either of which might cause error in the photoelectric judging of the bean, as explained above. A suitable opaque mask 17 is disposed across the inner side of lamp 7 to shield the article from direct illumination by the lamp.

Housing 1 is provided on either side of the lamp receiving member 9 with an integral counterbored viewing holder 18 wherein is disposed focusing and filtering means, generally indicated 19, for the light reflected from the articles to the photo-tube 20. This last named means consists of an elongated cylindrical tube 21 extending through bore 22 in holder 18 and having an annular flange 23 fitting in the counterbored portion 24 of the holder. Tube 21 is provided with an elongated lid 25 on the side thereof adjacent lamp 7 to prevent entry of direct light from the lamp into the tube. A suitable double convex lens 26 is disposed in the viewing tube. It will be understood that the said viewing tube and lens are in alignment with the articles 6 at the viewing station and the photo-sensitive device 20.

Within the counterbore 24 and spaced from flange 23 by a gasket 27, I mount a suitable color filter 28 and I secure the same in mounted position by means of an externally threaded thimble 29 threadedly engaging the interior of holder 18, the said thimble being apertured centrally. A second gasket 30 is interposed between the same and the filter.

As stated, there are two focusing and filter-

ing means 19, one on either side of the lamp. The filters 28 thereof are preferably different in color from one another whereby the relative color reflectivity of the articles may be analyzed on the basis of a plurality of color components if desired. In my copending application, Serial No. 222,787, filed August 3, 1938, I disclose a machine for performing a sorting operation on the basis of the relative intensity of a plurality of color constituents. If such operation is not desired, filters 28 may be of the same color, in which case the presence of a pair of viewing means directed at the article from opposite sides thereof assures that the whole surface of the article is scrutinized. The choice of the color of the filters of course depends upon which color constituents of the light reflected from the articles it is desired to intercept.

The shells 11, 12 of housing 1 are secured together by screws 31 extending through ears 32 on shell 12 and into shell 11, and the said housing, at the holders 18 thereof, is in communication with the usual light-tight enclosure or box 33 for the photo-tube 20, a gasket 34 being interposed.

In the side of housing 1 adjacent conveyor wheel 2 I provide a pair of aligned openings 35 constituting a passageway for the articles 6 on the wheel. These openings are located between the outspread bosses or feet 36 integral with shell 12 and curved in conformity with the convex outline of the reference background 4.

The reference background 4 consists of a pair of arcuate members 37 which are triangular in section and are adapted to be positioned relative to housing 1 in the manner indicated in the drawing, i. e., with the outer side and convex surfaces thereof disposed against the housing, which housing is cut away at 38 to receive members 37. The members are adjustably secured to the housing feet 36 by means of set screws 39 extending through elongated countersunk slots 40 in the members and threadedly engaging the feet. The inner or convex side 41 of the background members which is adjacent the inside of the housing is painted a suitable shade such as white or gray, depending on the type of articles being sorted. These colored or reference background surfaces 41 are in angled relation as illustrated in Fig. 2, being inclined radially relative to wheel 2 and inwardly of the sides thereof. The theoretical meeting line of the surfaces constitutes a plane in which the illuminating means 7 is substantially disposed. By adjustably mounting members 37 in the manner described, it is possible to shift the same circumferentially a considerable distance, which is helpful in the event a certain portion thereof becomes discolored or dirty and it is desired to remove the discolored portion from immediately adjacent the viewing station 5 or in the event it is desired to have selected reference backgrounds of different colors. To facilitate such repositioning of the members, I provide a plurality of spring urged ball detents generally indicated 42 in recesses 43 in housing 1, the said detents cooperating with depressions 44 in the outer sides of the background members so that the latter may be shifted a predetermined distance if desired and then locked in adjusted position. In practice, I provide three such recesses or depressions 44.

It will be appreciated that if it is desired to change from a reference background of one shade or color used in sorting one type of article

to a background of another shade or color better suited for use in sorting a different type of article, it is only necessary to loosen set screws 39 holding the arcuate members 37 in position and to displace them one way or another. The detents 42 enable the operator to ascertain when the desired background is fully exposed within the housing. This greatly simplifies the procedure of changing over the machine.

The illuminating and viewing structure above described provides for a very uniform illumination of articles. This, it should be noted, is made possible in part by the use of the hollow elongated tubular article carrying seats 3 which transport the articles in substantially spaced relation to the conveyor wheel, i. e., sufficiently above the surfaces 41 of the reference background that the production of shadows is eliminated. This result is in turn furthered by the manner in which the beams of light from the reflecting surfaces 15 are focused on the articles. It is desirable that the effect viewed by the phototube should be one of a series of unsupported, uniformly illuminated articles traversing a predetermined path and not be affected by dark spots or shadows, such as are sometimes occasioned by the article supporting means or by shadows from the articles on the reference background. The elongated tubular article seats are very satisfactory for this purpose. If desired, the seats may be painted the same color as the reference background to still further insure against a factor likely to cause an erroneous judgment of the articles by the phototubes. What is more, the arcuate background members 37 are spaced from one another only sufficiently to permit passage of seats 3, thus extending the desired background behind the articles as much as possible and avoiding variables likely to affect the operation of the photo-tube viewing means.

I desire to call attention to the fact that in my structure the housing 1 and reference background 4 are in operative relation fixedly though adjustably mounted relative to one another. They constitute a viewing unit which is the entire judging instrumentality of my invention. By providing such a unitary construction, I obviate the difficulty of assembling a separate viewing housing with a separate background means and the attendant difficulties of locating and maintaining the same in proper position relative to one another. Moreover, the parts are simple in nature and readily assembled and mounted on a sorting machine and do not require constant checking and adjusting of the optical accuracy thereof.

I have illustrated and described my improvements in an embodiment which is very practical. I have not attempted to illustrate or describe other embodiments or adaptations as it is believed this disclosure will enable those skilled in the art to embody or adapt my improvements as may be desired.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An illuminating housing for a photoelectric article sorting machine comprising a housing having a passage adapted to permit articles to be transported therethrough, a pair of arcuate reference background members adjustably connected to said housing adjacent said passage and extending into the housing on either side of the path of travel of articles therethrough, the arcuate outline of said members conforming to the

periphery of an article carrying wheel disposed adjacent the same to transport articles in an arcuate path through the housing passage, means for shifting said members lengthwise whereby to alter the surface thereof exposed within the housing, said members having inclined background surfaces converging toward and terminating closely adjacent the path of travel of the articles on the side thereof, illuminating means in the housing, a plurality of mirrors secured to the interior of the housing for reflecting light from said illuminating means on the articles and said inclined surfaces in the form of overlapping substantially parallel-sided beams, whereby to uniformly illuminate said reference background members and a large proportion of the surface of said articles, and means in said housing for viewing the so illuminated articles and reference background members.

2. An illuminating housing for a photoelectric article sorting machine comprising a housing having a passage adapted to permit articles to be transported therethrough, a pair of arcuate reference background members connected to said housing adjacent said passage and extending into the housing on either side of the path of travel of articles therethrough, the arcuate outline of said members conforming to the periphery of an article carrying wheel disposed adjacent the same to transport articles in an arcuate path through the housing passage, said members having inclined background surfaces converging toward and terminating closely adjacent the path of travel of the articles on the side thereof, illuminating means in the housing, and means in the housing for reflecting light from said illuminating means on the articles and said inclined surfaces in the form of overlapping substantially parallel-sided beams, whereby to uniformly illuminate said reference background members and a large proportion of the surface of said articles, and means in said housing for viewing the so illuminated articles and reference background members.

3. An illuminating housing for a photoelectric article sorting machine comprising a housing having a passage adapted to permit articles to be transported therethrough in an arcuate path, an arcuate reference background member adjustably connected to said housing adjacent said passage and disposed adjacent one side of said path, the arcuate outline of said member conforming to the arcuate path of travel of the articles, means in said housing for illuminating articles transported therethrough and said reference background member, means in the housing arranged to view said articles and said member, and means for shifting said member lengthwise whereby to alter the surface thereof exposed within the housing, said member having an inclined background surface disposed at an angle to the line of view of said viewing means.

4. In a photoelectric sorting machine, a rotary article conveying wheel having a plurality of elongated radially disposed article carrying seats, an article illuminating and viewing housing adjacent said wheel having a passage therein through which the articles are conveyed on said seats, article illuminating and viewing means in said housing, arcuate reference background members in the housing conforming to the periphery of said wheel and located closely adjacent the seats on opposite sides of the path of travel of the articles through said passage, means for connecting said background members to said

housing for longitudinal adjustment thereof, and means in said housing for reflecting a plurality of converging, parallel-sided, overlapping beams of light from said illuminating means on said articles and background members, said elongated seats spacing the articles from the reference background members whereby the articles and members are uniformly illuminated by said beams, said viewing means being arranged in said housing to view said articles and reference background members from different angles.

5. In a photoelectric sorting machine, a rotary article conveying wheel having a plurality of article carrying seats, an article illuminating and viewing housing adjacent said wheel having a passage therein through which the articles are conveyed on said seats, arcuate reference background members spaced from and conforming to the periphery of said wheel and located closely adjacent the same in the housing and closely adjacent and on opposite sides of the path of travel of the articles in the housing, illuminating and viewing means disposed in said housing for simultaneously illuminating and viewing the articles and background members, and means for connecting said background members to said housing for longitudinal adjustment thereof.

6. An article illuminating and viewing housing having the interior thereof substantially in the form of an ellipsoid, means for transporting articles through one focus of said ellipsoid, and illuminating means at the other focus thereof, said housing having a plurality of reflecting members having convex lenses secured thereto in circumferential and axially spaced arrangement whereby to reflect light from said illuminating means toward said articles in the form of a plurality of substantially parallel-sided overlapping beams.

7. An illuminating and viewing device for a photoelectric sorting machine comprising a housing having a source of illumination therein and the interior surface thereof being provided with a plurality of reflecting members adapted to reflect light emanating from the source of illumination toward a viewing station in the housing in the form of parallel-sided beams, a pair of reference background members adjacent said station disposed on opposite sides of articles at said station and adapted to be illuminated with said articles by light from said source of illumination, means in said housing arranged to view articles at the station and said background members, and means for adjustably securing said background members to said housing for longitudinal adjustment relative thereto, said members having mutually inclined faces converging toward the stations whereby to furnish suitable backgrounds for viewing articles at the viewing station from a plurality of angles.

8. An illuminating and viewing device for a photoelectric sorting machine comprising a lamp housing having a source of illumination, said housing being provided with an interior reflecting surface adapted to reflect light emanating from the source of illumination in the housing toward an article at a viewing station therein, a reference background member in the housing adjacent said station illuminated by light reflected from said reflecting surface, means for viewing said background member and an article adjacent the same, and means for adjustably securing said background member to said housing for longitudinal adjustment of a portion of its surface in the housing relative to the latter.

9. In combination, a lamp housing having article illuminating means and article viewing means therein for illuminating and viewing articles at an illuminating station in the housing, and a pair of reference background members adjustably secured to and extending into said housing for longitudinal movement relative thereto, said members being disposed adjacent said station and being illuminated and viewed with said articles by said means, each of said members having a surface provided with predetermined differently colored areas arranged longitudinally of the members whereby selective longitudinal adjusting movement of the members exposes said areas selectively to the interior of said housing, said surfaces being inclined and disposed in converging relation on opposite sides of the articles whereby to expose the surfaces to viewing by said viewing means from different points at different angles.

10. In combination, a lamp housing having article illuminating and viewing means therein for illuminating and viewing an article in a predetermined station in the housing, and reference background members adjustably secured to and extending into said housing for longitudinal movement relative thereto, said members being disposed on opposite sides of said station and having a background surface provided with predetermined differently colored areas arranged longitudinally of the members whereby selective longitudinal adjusting movement of the members selectively exposes said areas to be illuminated and viewed with an article at the station by said illuminating and viewing means.

11. An article illuminating and viewing housing having the interior thereof provided with a reflecting surface substantially in the form of an ellipsoid, article illuminating means at one focus of said ellipsoid, means for transporting articles to be viewed through the other focus of the ellipsoid, article viewing means disposed uniformly at either side of said illuminating means and arranged to view articles illuminated by said illuminating means, each of said viewing means comprising a photo-sensitive element, and a lens for focusing light reflected from said articles on said element, and differently colored filters for said photo-sensitive elements disposed between said lenses and said elements.

12. An article illuminating and viewing housing having article illuminating means therein, means for transporting articles to be viewed through the housing, article viewing means disposed in said housing and arranged to view articles illuminated by the illuminating means, said viewing means comprising a plurality of photo-sensitive elements, a means for focusing light reflected from said articles on said elements, and differently colored filters for said photo-sensitive elements.

13. An article illuminating and viewing housing having the interior thereof substantially in the form of an ellipsoid and provided with a plurality of reflecting members having convex lens surfaces adapted to reflect light impinging the same in the form of a plurality of parallel-sided beams, article illuminating means at one focus of the housing, means for transporting articles to be viewed through another focus of the ellipsoid, and viewing means in the housing arranged to view articles so illuminated at said other focus.

14. An article illuminating and viewing housing having the interior thereof substantially in the form of an ellipsoid and provided with a re-

flecting surface, article illuminating means at one focus of said ellipsoid, means for supporting articles to be viewed at the other focus of the ellipsoid, article viewing means disposed in said housing and arranged to view articles illuminated at said other focus, said viewing means comprising a pair of light-sensitive elements, means for focusing light reflected from said articles on said elements, and differently colored filters for said light-sensitive elements.

15. An illuminating housing for a photoelectric sorting machine, comprising a housing having a passage permitting articles to be translated there-through, illuminating and viewing means in the housing, a rotary article transporting member mounted adjacent the housing and having means for holding articles on the peripheral surface thereof, and a reference background comprising a pair of members disposed in the housing on opposite sides of the path of travel of the article through the housing, said members having inclined background surfaces converging toward one another in the direction of said surface and from the sides of the transporting member, said

surfaces terminating adjacent said path of travel and adapted to be illuminated by said illuminating means and viewed with said articles by said viewing means, said illuminating means being disposed substantially in the plane including the meeting line of said surfaces.

16. In combination, a lamp housing having article illuminating means and article viewing means therein for illuminating and viewing articles at a station in the housing, and a reference background member adjustably secured to and extending into said housing for longitudinal movement therein, said member having a surface provided with areas of different color arranged longitudinally of the member and adapted to be selectively exposed interiorly of the housing by longitudinal adjustment of the member, and article transporting means adapted to transport articles through the housing adjacent said member to be illuminated and viewed with the latter at said station in the housing by said illuminating and viewing means.

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