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HOUSING FOR PHOTOELECTRIC SENSING UNIT

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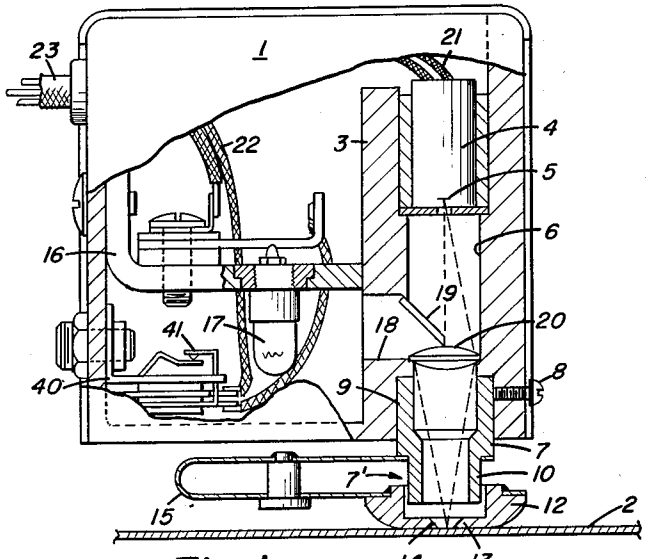


Fig. 1

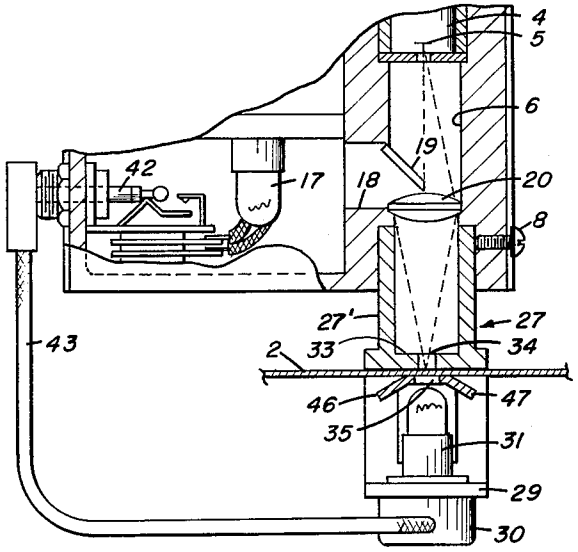


Fig. 2

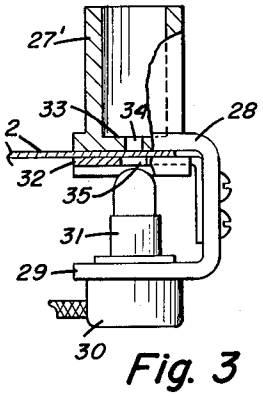


Fig. 3

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HOUSING FOR PHOTOELECTRIC SENSING UNIT

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This invention relates to a photoelectric sensing unit especially intended for sensing marks on a web either by reflected or transmitted light depending upon the character of the web and/or the mark.

In the processing of photographic prints it is customary to handle the prints in the form of long strips and, after processing to cut the individual pictures from one another. To facilitate the cutting operation, it is usual to provide marks near the edge of the strip, which may be utilized to cause actuation of the cutting mechanism. In order to perform this entire operation automatically it is necessary to provide a sensing unit for sensing the marks along the edge of the strip and to use the output of this unit to trigger the cutting mechanism at the appropriate time. Photoelectric sensing units can, of course, be used for this purpose. However in the use of such photoelectric sensing units problems arise due to the fact that various types and/or locations of marks may be employed, some of which may be more readily sensed by transmitted light while, for others, reflected light more efficiently senses the mark. Moreover, in either case stray light may so lower the sensitivity of the sensing unit, that it will fail to respond properly to the marks and thereby cause improper cutting action.

It is therefore an object of this invention to provide a photoelectric sensing unit which is readily adapted for use in sensing marks on a moving web, either by transmitted or by reflected light.

A further object of this invention is to provide a unit which includes its own light source and is arranged to effectively eliminate any stray light so as to insure that the only light reaching the photoelectric unit comes from such source.

It is a further object to provide such an apparatus which is of relatively simple construction and yet which is very effective for the intended purpose.

Further objects will become apparent from the following description and claims particularly when considered in the light of the accompanying drawings wherein:

FIG. 1 is a side view of the sensing unit with parts broken away better to show the internal construction thereof;

FIG. 2 is a fragmentary view showing the lower portion of the unit provided with a modified head of the type used for sensing marks by transmitted, rather than reflected, light; and

FIG. 3 is a view of the sensing head used in the form shown in FIG. 2.

Considering first the form of the invention shown in FIG. 1, the sensing unit comprises a main housing **1**, preferably of light-tight construction, spaced slightly above the plane of movement of the web or strip **2** bearing the marks to be sensed. Mounted within the portion **3** of housing **1** at one end thereof, is a photocell **4**, the cathode **5** of which is diagrammatically represented. The portion **3** of housing **1** includes a passageway **6** extending axially downwardly toward the plane of the web. A tubular member **7** forming the upper portion of a head unit **7'** is secured, as by a set screw **8**, in a mating socket **9** formed in the lower wall of the housing **1** and extends downwardly toward the plane of the web **2** with its hollow interior axially aligned with the passageway **6**, thereby affording a passageway for light from the exterior of

the housing to the cathode **5** of photocell **4**. Resiliently supported from the lower end **10** of tubular member **7** is a presser-foot or button **12**, preferably formed of a low-friction material, such as Teflon, and which is arranged to loosely, telescopically receive the lower portion **10** of the tubular member **7**. The lower wall **13** of presser-foot **12** is provided with an opening **14** axially aligned with the passageway **6** and which effectively determines the inspection area on the web **2**. The button or presser-foot **12** may conveniently be supported for limited resilient movement toward and away from the main housing **1** by means of a suitable leaf spring as indicated at **15**.

Mounted within the housing **1** by means of a suitable bracket **16** is a small lamp or light source **17**, the interior walls forming portion **3** of housing **1** serving to effectively shield the photocell **4** from direct rays from light source **17**. Light from this source **17** is arranged to pass through a suitable opening **18** in housing portion **3** and impinge upon a small mirror **19** located within the passageway **6** and arranged to reflect light from the source **17** downwardly through the tubular member **7** and the opening **14** in the presser foot so as to illuminate the inspection area of web **2**. Light reflected from the surface of the web **2** is then reflected upwardly through the tubular member **7** and passageway **6** to cathode **5** of photocell **4**. As can be readily seen in FIG. 1 a suitable lens **20** is provided in the passageway **6** to direct the rays of light from lamp **17** into an approximate focus at the plane of the web **2** and to concentrate the reflected rays at the cathode **5** of photocell **4**. As can be seen in FIG. 1 the mirror **19** is arranged so that it effectively masks one-half of the lens so that with this arrangement the single lens **20** can serve to thus focus both the outgoing and the reflected rays of light. The electrical leads for supplying current to the light source **17** and the photocell **4** may be arranged as indicated at **21** and **22** and cabled together where they exit from the housing **1** as indicated at **23**.

With the arrangement shown in FIG. 1 light from source **17** will be reflected by the optical system including mirror **19** and lens **20** onto the moving surface of the web **2**. Light reflected from this surface will be redirected by lens **20** onto the cathode **5** of photocell **4**. Whenever a mark of a distinctive character passes by the opening **14** in presser-foot **12**, the amount of light reaching the photocell **4** will be increased or diminished, as the case may be, and a corresponding output signal will be produced across the photocell, which may be amplified by conventional means, not shown, and used to trigger print cutting machinery or for any other purpose desired. The arrangement of the presser-foot **12** is such that it effectively defines the inspection area, by means of the opening **14**, and, at the same time, effectively prevents extraneous light from getting into the interior of tubular member **7** and/or passageway **6** and thereby affecting the sensitivity of the photocell. Spring **15** tends to urge the presser-foot into firm sliding contact with the web **2** thereby removing any wrinkles which might be in the general area being inspected and which might otherwise cause a misfunction of the unit. However, by virtue of the resilience of the spring **15**, variations in the thickness of the film at splices or for other reasons may be readily accommodated. Since the presser-foot is preferably made of low-friction material, it will not produce any undesirable scratching or marking of the web surface nor produce an undue amount of friction drag on the web or strip.

When it is desired to sense marks by means of transmitted, rather than reflected light, an alternative head arrangement is utilized as shown in FIGS. 2 and 3. To

this end, the head unit 7' formed by sleeve 7 and the associated presser-foot 12 is removed from the socket 9 of housing 1, and the head unit sleeve 27 is inserted in its stead. Head unit 27 includes a tubular portion 27' carrying at its lower end a generally C-shaped bracket member 28, the lower leg 29 of which carries a socket 30 for a lamp or light source 31. A guide member 32 is secured to bracket 28 in generally parallel, closely spaced relationship to the bottom wall 33 of tubular portion 27'. Both the bottom wall 33 and guide member 32 are provided with aligned openings 34 and 35 respectively which provide for passage of light from the light source 31 through the hollow interior of tubular portion 27' and via lens 20 and passageway 6 to the cathode 5 of photocell 4. As shown in FIGS. 2 and 3, the spacing between guide member 32 and bottom wall 33 is such as to fairly closely receive the web 2 to be inspected, the C-shaped bracket 28 providing clearance for the edge of the web so that the light source may be properly supported in the desired location.

When sensing head 27 is to be utilized, it is necessary that the internal light source 17 be extinguished so that light from this latter source will not interfere with that provided by source 31. In order to accomplish this result, a suitable closed circuit switching jack is mounted in the end wall of housing 1. This jack is so connected that its normally closed switching points 41 complete the electrical circuit to lamp 17 when operation with head 7 is involved as shown in FIG. 1. However, when it is desired to use the alternative head 27, a plug 42 carried on the end of the supply cable 43 for lamp 31 is inserted in jack 40 so as to bring the electrical connections from the supply leads 22 to lamp 31 and, at the same time, to open the normally closed connections at 41 so as to extinguish lamp 17. This result is produced merely by inserting the plug 42 into the jack as indicated in FIG. 2.

Operation of the FIG. 2 embodiment is, of course, quite similar to that of the previously described embodiment except that the light reaching the photocell cathode 5 is light which has been transmitted through the web 2 rather than reflected from the surface thereof. Guide member 32 with its depending flanges 46 and 47 serves not only as a means to guide the web into proper position past the inspection apparatus but also serves to prevent extraneous light from passing through the opening 34 and thence to the photocell 4.

As will be readily apparent to those skilled in the art, the specific units shown are merely representative of the invention, and many variations and modifications can be made without departing from the spirit and scope of the invention as defined by the appended claims.

We claim:

1. A photoelectric unit for sensing the light reflecting properties of a surface to be inspected comprising a generally light-tight housing, a light source and a photocell mounted within said housing with said photocell shielded from direct light from said source, means including a tubular member providing a passageway for light through one wall of said housing, a presser foot and means resiliently mounting said presser foot adjacent the outer end portion of said tubular member for limited movement axially thereof, said presser foot having a portion loosely telescopically receiving said outer end portion of said

tubular member and having an opening through its end wall in substantially axial alignment with said passageway, said presser foot mounting means resiliently biasing said presser foot in an axial outward direction relative to said tubular member and means for directing light from said source outwardly through said passageway and opening onto a surface to be inspected and such of said light as is reflected by said surface back through said opening and said passageway and onto said photocell.

2. A photoelectric unit as in claim 1 wherein said light directing means includes a single lens common to both the outgoing and reflected light paths.

3. A photoelectric unit comprising a housing, a light source and a photocell carried within said housing, said photocell being shielded from direct light from said source, means including a generally tubular member projecting outwardly beyond one wall of said housing and providing a passageway for light through said wall, a presser foot having a portion arranged to loosely telescopically receive the outer end of said tubular member and having an end wall provided with an opening therethrough, means resiliently mounting said presser foot for limited telescopic movement relative to said tubular member and with said opening in axial alignment with said passageway, said presser foot mounting means resiliently biasing said presser foot in an axial outward direction relative to said tubular member and means for directing light from said source outwardly through said passageway and opening and to direct light from said source which is reflected back through said opening and said passageway onto said photocell.

4. A photoelectric unit for sensing the optical properties of a web and comprising a housing, a photocell mounted within said housing, a head member carried by said housing and protruding outwardly beyond one wall of said housing, said housing and said head member being provided with aligned passageways forming a light path from the outer end of said head member to said photocell, said head member comprising means including a wall extending transversely of the passageway in and forming said outer end of said head member and adapted to be positioned substantially against a web to be inspected and provided with an opening therethrough in axial alignment with said passageway for restricting the light reaching said photocell to light passing through said opening from the web, said head member further comprising resilient means mounting said transverse wall for limited movement relative to said housing substantially axially of the passageway in said head member, said mounting means resiliently urging said transverse wall in an outward direction relative to said housing and means including a light source for illuminating that portion of the web in the area of said opening.

References Cited in the file of this patent

UNITED STATES PATENTS

2,226,677	Vikhman	Dec. 31, 1940
2,458,926	Bassett	Jan. 11, 1949
2,688,099	Bickley	Aug. 31, 1954
2,712,611	Nyman	July 5, 1955
2,916,624	Angel et al.	Dec. 8, 1959
2,920,209	Asten	Jan. 5, 1960