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3,512,894

COLOR DENSITY COMPARATOR

Filed Sept. 27, 1965

FIG. 6

FIG. 1

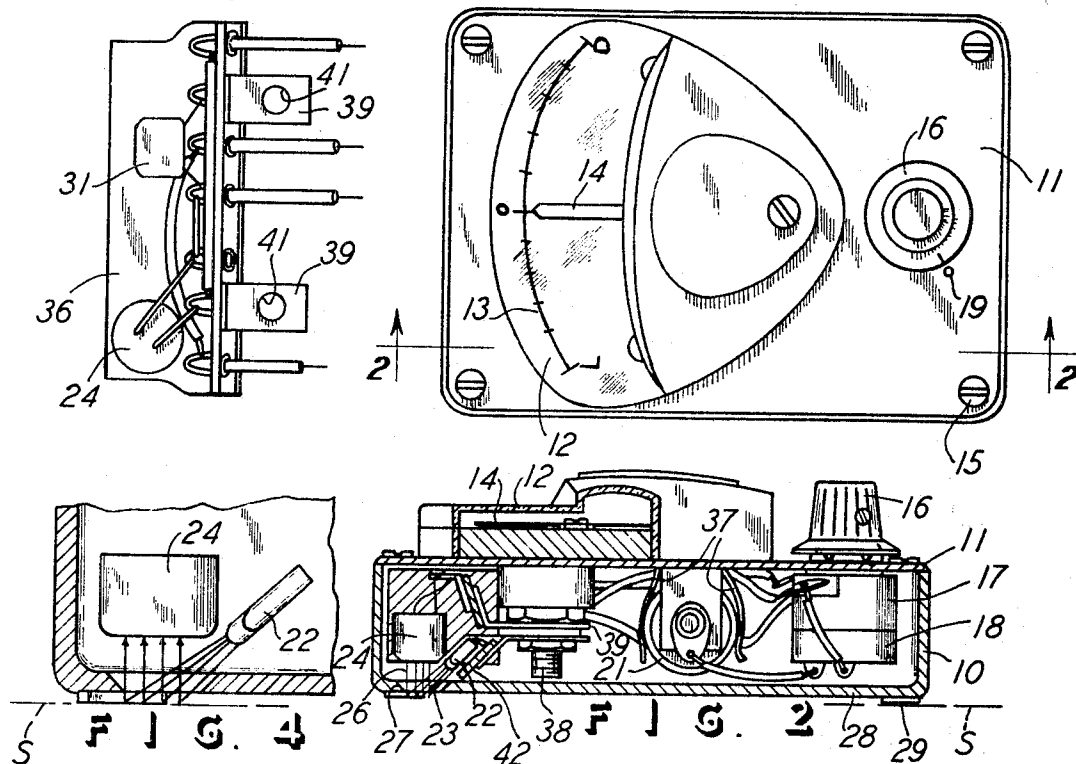


FIG. 7

FIG. 3

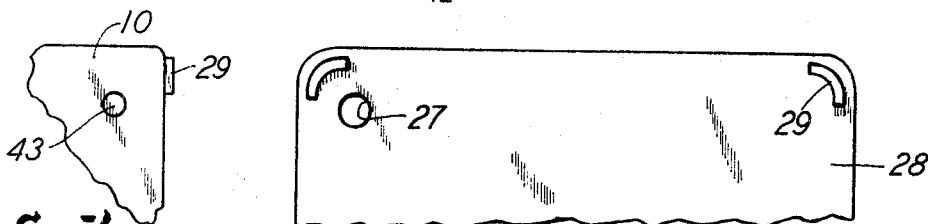
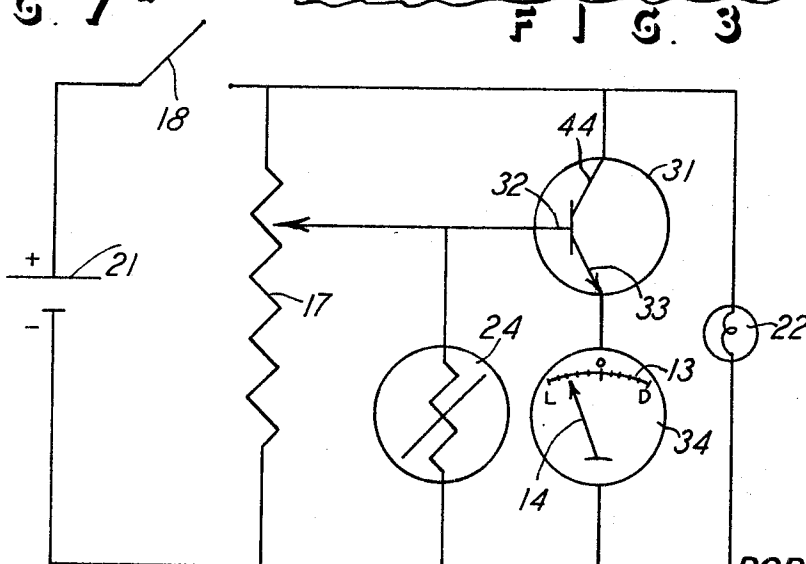


FIG. 5

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3,512,894

COLOR DENSITY COMPARATOR
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1 Claim

ABSTRACT OF THE DISCLOSURE

A color density comparator having a portable casing enclosing a photo conductor, an ammeter, a potentiometer, and a battery, all electrically connected together. The ammeter indicates the amount of light ray reflection from a piece being inspected. The photo-conductor is exposed to the opening in the casing, which opening is in one wall of the casing and feet are affixed to that wall for setting the casing on the piece being inspected. A lamp is in the casing for passing light through the opening and onto the piece, and a transistor is electrically connected to the potentiometer and the photo-conductor and the ammeter which indicates the current flowing therethrough in accordance with the light being reflected from the piece.

This invention relates to a color density comparator of the type useful in comparing the relative density of colors.

Devices of this type are used to compare colors by their light reflection characteristics. Some presently known devices are utilized to compare the density of color on a sheet of paper with the density of color on a standard or master sheet. In this way, one can determine whether or not the color being applied to the first sheet of paper, as mentioned above, is satisfactory in density with respect to the color density on the master sheet. Devices which have been utilized for this purpose have serious drawbacks and limitation in use. These devices are very cumbersome, usually are constructed of two or more separate units which are interconnected, and they require elaborate, heavy, and cumbersome means for providing a stable voltage source when they are electrically powered. Of course where they are powered from the alternating current commercial power lines, the voltage source is not sufficiently stable. Further, a number of controls, optical elements, and adjustments in presently available units make their cost high and their maintenance, operation, and operator training complicated.

It is a general object of this invention to provide a device which overcomes the aforementioned problems of the presently known devices and which provides a device which is self-contained, rapid in its operation, devoid of optics, and simple to keep in proper repair.

A further object of this invention is to provide a device which is simple and easy to operate, is small so that it can be carried in a shirt pocket, if so desired, and which can be manufactured at a low cost.

Still a further object of this invention is to provide a device which is effective and sensitive to small differences of light reflection such that it is useful in comparing color densities for control of ink-film thickness on paper coming from a printing press.

Still a further object of this invention is to provide a device which is highly portable, can be placed on a work piece to be examined, without having disturbance or interference from ambient light. Further, the device can be placed upon relatively fresh ink on paper coming from a printing press so that the press operator can adjust the color as desired.

Other objects and advantages become apparent upon reading the following description in light of the accompanying drawings, wherein:

FIG. 1 is a top plan view of a preferred embodiment of this invention.

FIG. 2 is a sectional view taken on line 2—2 of FIG. 1.

FIG. 3 is a bottom plan view of a fragment of FIG. 2.

FIG. 4 is an enlarged sectional view of a fragment of FIG. 2.

FIG. 5 is a schematic view of the electrical wiring and components.

FIG. 6 is a top view of a portion of the device as shown in FIG. 2, and FIG. 7 is a left side elevational view of FIG. 3.

The drawings show the preferred embodiment of the device includes a case or housing 10 with a removable cover 11 secured by means of screws 15 which suitably extend into the case 10 in any well known manner. The top of the unit has a transparent window 12 extending over a portion thereof to expose a scale 13 across which an indicating pointer 14 is pivotal. The scale is shown to have a left hand marking "L" and a right hand marking "D" to signify light and dark respectively, and there is a center marking "O." Thus the basic function of the device is that the pointer 14 will be suitably actuated in response to the reflection of light from a work piece or color sample, and the pointer will respond by assuming a position along the scale 13. The pointer may be set from a standard or master piece by setting the pointer on the center or "O" setting, and this may be done by adjustment of the rotatably mounted knob 16 which controls both a potentiometer 17 and a switch 18, both connected to the knob 16 in any suitable manner which is well known. The knob 16 has an Off position, or "O" position designated 19, as shown.

Thus the pointer 14 may be set on the scale center position mentioned, and then when the instrument is placed over a work piece, the pointer will respond to the amount of light reflected from the work piece and may hold the center position or the pointer may move to the left or right, that is, to the indication of either "light" or "dark," depending upon the density of color on the sample with respect to the standard color setting mentioned.

To actuate the pointer 14 in the manner described, a small battery 21 is shown mounted in the casing 10 and it operates a subminiature incandescent lamp 22 which is also suitably mounted in the casing 10 and connected to the battery 21. The lamp 22 projects a light beam, as indicated by the lines designated 23, and the beam would strike the surface designated S, and the beam would then be reflected upwardly to a photocell 24 which is suitably mounted in the casing 10 and electrically connected to the elements described. The angle of incidence of the light beam 23 is 45 degrees with respect to the surface S, and this is the standard angle utilized for color comparison for analysis. Of course the indication of the light reflection through the lines designated 26 extending from the surface S to the sensor 24 is simply the indication of the exposure of the illuminated area of the work piece below an opening 27 in the casing lower wall 28, and this opening 27 of course permits the passage of the light beam 23 to the work piece on the surface S. The lines 26 then simply designate that the sensor 24 is responsive to the illumination of the work piece by the lamp 22.

At this time it will also be noted that the casing lower wall 28 has feet 29 secured thereto so that the wall 28 is spaced a very slight distance above the surface S. Thus the device can be placed on a color sample to be analyzed, and ambient light will not get to the area of the sample immediately below the opening 27, and also the device will be supported on say a freshly printed piece of paper without smudging the ink since only the small feet 29 rest on the paper. Further, the photo-responsive device 24 is mounted directly above the opening 27 to be parallel to

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the surface S in order to minimize specular reflectance from glossy surfaces such as exist in wet ink or paint films.

The element 24 is the photo-responsive device which is preferably of a solid state construction whose resistance varies inversely with a function of the intensity of the light being reflected to it. A typical photo-responsive device may be a photoconductor made of cadmium-sulfide with peak response between 4000 and 7000 angstrom wavelength.

The photo-conductor 24 acts as a variable resistance, and FIG. 5 shows the element 24 connected in parallel with the lower half of the potentiometer 17. As such, the combination of the potentiometer 17 and the photo-responsive device 24 make up a voltage divider network which supplies a forward bias between an NPN transistor 31 base element 32 and the emitter element 33, through the milliammeter 34 which includes the pointer 14 and scale 13 mentioned. The milliammeter may be a suppressed zero direct current milliammeter, and it is of course utilized as the indicating element or device of the unit.

While FIG. 5 shows the schematic wiring diagram of all of the elements involved, FIGS. 2 and 6 show the physical relationship of the elements within the casing 10, such as in FIG. 2, and outside of the casing 10, such as FIG. 6, where the elements are shown mounted on an encapsulated amplifier member 36. Thus the battery 21 is held in the casing by means of spring clips 37 which are suitably attached to the casing in any well known manner. Also, a stud 38 is attached to the casing cover 11, and it supports the amplifier member 36 by means of the connectors 39 which have openings through which the stud 38 extends, and it is understood that there are two studs 38 aligned with the openings 41, and the arms 39 are suitably secured as part of the amplifier 36. Also, a small terminal strip 42 is provided for the electrical connection and mounting of the lamp 22, and this strip 42 is also suitably mounted on the bolt 38 as shown in FIG. 2.

The suitable wiring for connecting the various elements is shown in FIG. 5, and the mechanical display of the elements and their respective wirings are shown in FIGS. 2 and 6 so that one skilled in the art will be fully apprized of the manner in which the device is constructed and electrically completed or connected. It will of course also be understood that the lamp 22 is mounted close to the opening 27, however it is not placed at a position where it would illuminate and activate the sensor 24, except of course by the reflectance from the work sample on the surface ends. FIG. 4 shows the enlargement of the arrangement of the lamp 22 and the sensor 24, and it will be further mentioned that the lamp 22 is of an end lens type so that it automatically focuses to give good intensity on the sample sheet, and no outside lens is needed for the focus of the lamp. FIG. 7 shows the side of the casing 10, and a marking or spot 43 is on the casing side in the vertical plane of the opening 27 so that the user will know the location of the opening 27 by the indicator mark 43.

In operation, the device is placed over a sample to be checked and the potentiometer 17 is adjusted by the knob 16 until the transistor 31 conducts current from the collector element 44 to the emitter element 33 and the indicating device 34 reads zero. The pointer 14 will of course remain on the zero position as long as the light reflected from the sample remains the same. Thus if the device is placed on another sample, with the port or opening 27 above the sample to be analyzed, and if the other sample reflects the same amount of light, it will again be zero.

Since the resistance of the photo-responsive device 24 varies inversely with a function of the light being reflected to it, its resistance will decrease if a sample is

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then examined which reflects more light or is in fact lighter in appearance. This will cause the resultant of the parallel resistances constituted of the lower portion of the potentiometer 17 and the photo-responsive elements resistance to be decreased. This decrease results in a lower forward bias being impressed between the NPN transistor base element 32 and its emitter 33. This consequently causes the collector 44 to emitter 33 current to decrease resulting in a lower current flow through the indicating meter 34. Consequently, the pointer 14 will move to the left of the scale 13 and thus indicate that the sample is lighter. Of course if the sample had been darker then the pointer 14 would have moved to the right on the scale 13, or toward the end designated "D" which may also of course be marked "dark."

Thus the device is arranged so that the darker the sample, the further the indicator pointer 14 moves to the right, this is the ordinary direction of movement of the pointer 14 for an increase in the phenomenon being measured, and as such it is an improvement or advantage in this device.

It is apparent that although the device was described and explained using the control of ink film thickness, many more applications for this device exist in other fields. For instance, the fields of leather goods manufacturing, paint making, construction of textiles, interior decoration, cosmetics and other fields in which the relative light reflectance of objects is desired to be compared.

While a specific embodiment of this invention has been shown and described, it should be obvious that certain changes could be made in the embodiment, and the invention should therefore be determined by the scope of the appended claims.

What is claimed is:

1. A color density comparator comprising a photo-conductor, an ammeter, a potentiometer, and a battery all electrically connected together for impressing upon the ammeter the magnitude of the reflection of light rays from an inked piece being inspected and with said photo-conductor and said potentiometer being electrically connected with said battery in parallel, a multi-walled casing enclosing all the aforesaid components and having an opening in one wall and with said opening having a center axis extending through said one wall, said photo-conductor in said casing being disposed on said center axis of said opening to be responsive only to light rays passing through said opening and parallel to said center axis of said opening, said casing being small to render the comparator portable such as in a person's shirt pocket, said one wall having feet to stand the comparator on the piece being inspected but without smearing the ink on the piece, and said feet being short and said photo-conductor being spaced from said opening to preclude ambient light from reaching said photo-conductor by entering said opening from a point along the face of said wall, said photo-conductor being electrically responsive in resistance inversely to the intensity of light rays passing into said casing along said center axis of said opening, a lamp in said casing offset from said center axis of said opening and being connected to said battery for passing light through said opening and onto the piece to be inspected, said transistor including a base element and an emitter element and a collector element, said photo-conductor and said potentiometer both being electrically connected to said base element to affect the electrical forward bias impressed on said base element in response to the passing of light through said opening and thereby affect current flow past said emitter element, said ammeter being electrically connected between said emitter element and said photo-conductor, an electric switch on said casing and being electrically connected between said battery and said collector element, and a control

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knob connected to said potentiometer for setting the latter.			3,221,317	11/1965	Ferrigno et al. ---- 250—206 X
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