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Ortlieb

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[54] **METHOD AND APPARATUS FOR SCANNING SURFACES**
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 [51] Int. Cl. **G01n 21/30**
 [58] Field of Search 250/219 D, 219 DR, 250/208, 217, 223 R; 240/2.18; 356/239, 240

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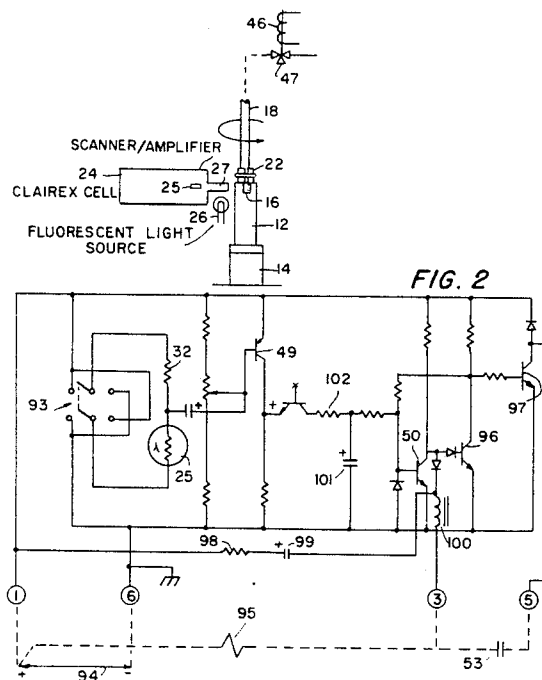
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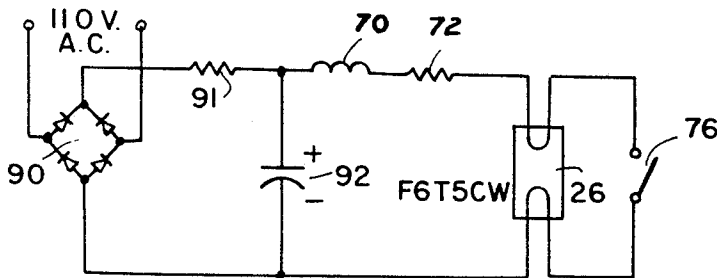
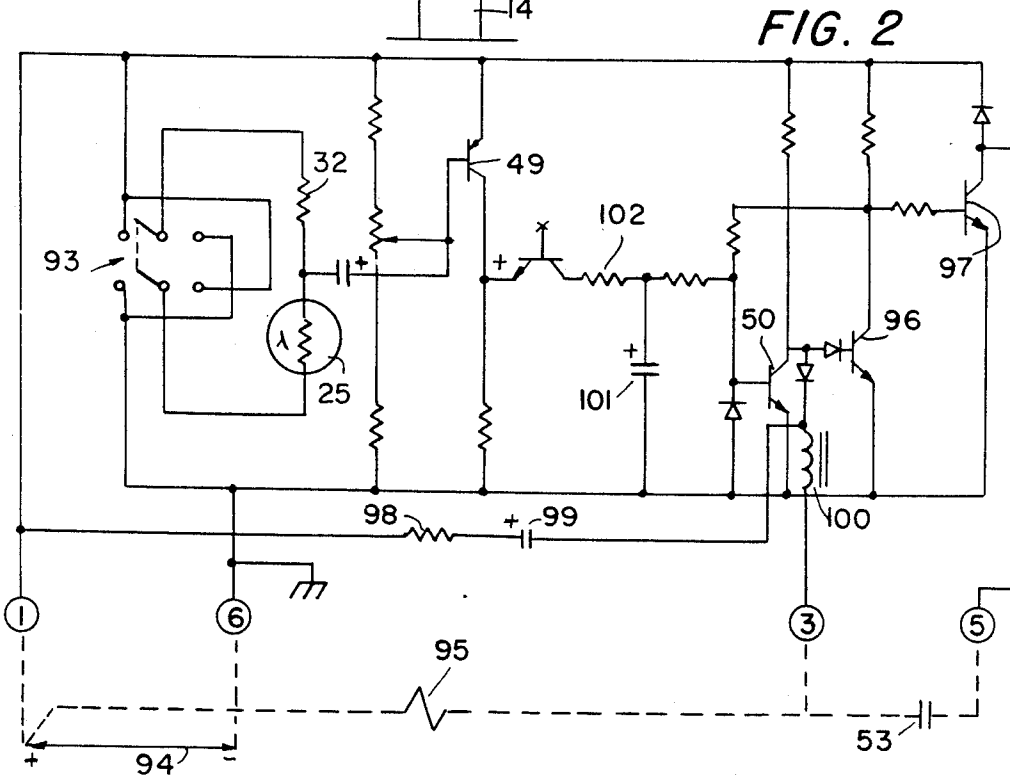
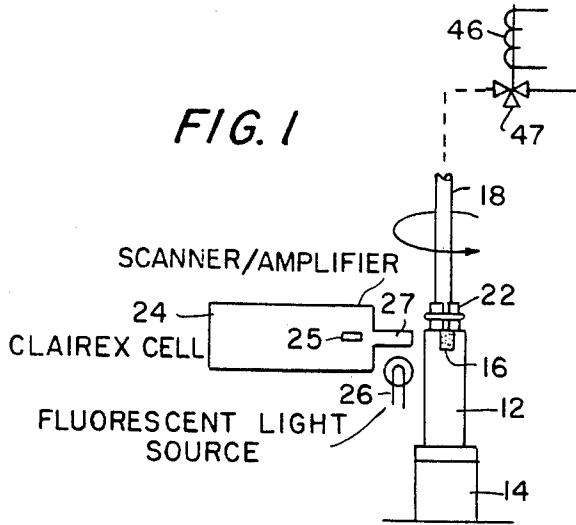
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[57] **ABSTRACT**

A method and apparatus for photo-electrically scanning surfaces having a registration mark thereon capable of reflecting light signals. Means are provided for mounting the object having the surface to be scanned, and suitable drive means are provided for controlling movement of the surface. The area of the surface to be scanned containing the registration mark is bathed with light emanating from a light source such as a fluorescent lamp excited by a filtered direct current supply. A scanner amplifier picks up the reflected light from the registration mark and uses the resulting signal to control the motion of the surface being scanned.

4 Claims, 3 Drawing Figures





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METHOD AND APPARATUS FOR SCANNING SURFACES

This application is a continuation of my copending application Ser. No. 685,543, filed on Nov. 24, 1967 and now abandoned.

This application has subject matter in common with application Ser. No. 685,458, filed Nov. 24, 1967 now U.S. Pat. No. 3,522,432.

The present invention relates generally to an apparatus for use in connection with the packaging and handling of various types of articles, and more particularly to a method and apparatus for accomplishing registration of work pieces by scanning the surfaces thereof for registration marks placed thereon.

Various types of apparatus and various methods have been used in the past for aligning containers after labels, logos or the like have been printed thereon. Exact alignment with a great degree of accuracy and uniformity is necessary for a branded well known commodity.

With the development of high speed machinery for mass production and packaging of articles for consumer use, new problems have arisen in that high speed scanning must be accomplished with a minimum of rejects occurring due to "noise" or other problems arising from the scanning system itself. The use of illuminating sources operating on alternating current with fast photo cells has produced noise signals due to light variations at a multiple of the line frequency which cannot be filtered out without also filtering the desired signal because the desired signals are in the same frequency range.

The present invention has for an object the use of a filtered direct current supply on the scanning light source thereby eliminating light frequency variations in the light intensity.

A further object of the present invention resides in the direct use of a light source such as that emanating from a fluorescent tube excited by a filtered direct current instead of the light source optically amplified to obtain a high intensity spot on the scanned surface. The direct use of a strong diffused light source such as a fluorescent tube thereby provides relatively high intensity diffused illumination of the scanned area without the disadvantage of optical amplification in that the scanned surface motion normal to the scanner is amplified by changing the desired focal plane. The use of the relatively high intensity diffused source such as a fluorescent tube provides a comparable light level to a small focused incandescent lamp making an increase in amplifier sensitivity unnecessary and there is virtually no increase in bulk and heat dissipation for the same effective diffused light level.

Yet another object of this invention resides in the provision of a scanning system employing direct use of a photocell with a light directing tube and without necessity of optical amplification of the reflected light signal, which is desirable to take full advantage of the directly used light source.

The apparatus that is utilized in connection with the invention includes a fluorescent tube type light operated on filtered direct current and arranged to bathe the scanned surface and registration mark with diffused light of non-varying or slowly varying intensity. A scanner using a photo-conductive cell or photo-voltaic cell sensitive in the reflected wave length region aimed at the bathed area is provided for receiving light signals from passage of the registration mark as the scanned

surface is moved. The registration mark will reflect light changes from the passage of the registration mark in a manner as to be sensed by the scanner. The signal from the photo-cell of the scanner is used to control the movement of the work piece and hence of the scanned surface via a self-contained amplifier and associated electro-mechanical devices.

The method carried out by the present invention comprises the steps of applying a registration mark to a work piece. Then, the work piece is moved so that the registration mark will pass within the field being sensed by the scanner. The scanning apparatus will receive light changes from the passage of the registration mark through the scanned area. The scanned area is bathed by light emanating from a fluorescent tube supplied by filtered direct current. The signal from the scanner is used to control further movement of the work piece.

It is a further object of the present invention to provide means for alignment of the work piece such as containers including tubes or the like, which registration marks are readable by automatic scanning equipment to provide for exact alignment of the container for further processing.

A further object of the invention resides in the provision of an apparatus and method of scanning registration marks on work pieces that is insensitive to relatively large variations in distance from the scanning apparatus to the work piece so as to permit for axial movement of the registration mark relative to the scanning system during the scanning operations, which was heretofore impractical with focused scanning apparatus.

A further object of the invention resides in the provision of a novel power supply arrangement for a light source used in a scanning system for eliminating power line frequency variations in the light intensity for a scanning system.

Still further objects and features of this invention reside in the provision of an apparatus and method of scanning registration marks that is simple in construction, adaptable for various use such as in the printing, packaging, labeling, filling, closing, cutting and shaping of goods, which is substantially fool proof in operation and capable of adaptation to various existing machines and products now in use.

These, together with the various ancillary objects and features of the invention, which will become apparent as the following description proceeds, are attained by this method and apparatus of scanning registration marks, a preferred embodiment of the apparatus and system utilized in the invention being disclosed in the accompanying drawing, by way of example only, wherein:

FIG. 1 is a diagrammatic illustration of an embodiment of the scanning system according to the present invention;

FIG. 2 is a schematic wiring diagram illustrating one form of circuitry capable of being employed in the present invention; and,

FIG. 3 is a schematic wiring diagram of the light source and power supply therefor.

Referring now specifically to the drawing, and more particularly to FIG. 1 thereof, there is seen a mechanical arrangement according to the present invention. In particular a tube of metal, clear or opaque plastic, or the like is held at its base in a clamp-like holder 14.

This tube holder 14 is of the type which is itself stationary during the registration cycle and frictionally grasps the tube 12 with a predetermined light pressure to stop rotation of the tube therein after release of the tube rotating means to be hereinafter defined.

A registration mark 16 of a color contrasting with the color adjacent to it, is applied in the form of an ink, paint or lacquer on the tube 12.

A rotatable spindle 18 equipped with an expanding collet 22 is adapted to be placed into the neck of the tube 12 to facilitate rotation of the tube 12 through rotation of the spindle 18 by suitable drive means.

A scanner/amplifier assembly 24, including a non-focused receiver using a photo-conductive cell 25, such as a Clairex 905HL cell, is positioned adjacent to the upper part of the tube 12. The receiver includes a light directing tube 27 aimed at the area to be scanned, to receive light signals from passage of the registration mark 16 across the scanned area.

A fluorescent tube type light source 26 operating on filtered direct current is placed at right angles to the tube 12 and spindle 18 and is adapted to bathe the scanned area with diffused light of non-varying intensity for one or a plurality of assemblies 24 placed in close proximity to the light source 26, and other tubes and mechanisms.

Refer now to FIG. 3, the filtered direct current supply is achieved by placing a bridge rectifier 90, across the alternating current line. The resistor 91 is a surge limiting means for protecting the rectifier 90, and capacitor 92 serves to filter the rectified D.C. This substantially filters out all of the power supply ripple for the fluorescent lamp to be hereinafter further described.

After a tube has been placed into the tube holder 14 and the rotating spindle 18 has been placed in the neck thereof the tube 12 is rotated by expanding the collet 22 which grips the inside of the tube 12 until the registration mark 16 is positioned directly in front of the scanner/amplifier assembly 24 and the rotation of the tube is stopped by the signal from the photo-cell 25 caused by the photo-cell being actuated by reflected light from the registration mark 16.

Referring now specifically to FIG. 2, there is seen a latching amplifier of solid state circuitry wherein the assembly 24 is connected across a D.C. power source 94 at connector terminals 1 and 6. The pulse select switch 93 connects a voltage divider formed by the photo-cell 25 and resistor 32 across the power source to form a signal. Signal polarity may be changed by the switch to provide an amplifier output from either a light increase or light decrease pulse when the cell 25 receives the light reflected from the registration mark on the scanned surface. This particular application uses an A.C. amplifier to avoid the effects of slowly varying ambient light levels and a signal as referred to above is a light change or pulse such as will be obtained from the rapid passage of a registration mark on a tube rotating at several hundred RPM.

There is also connected to the circuit extending from connection terminal 3 a relay 95 which in turn energizes (through its contacts) solenoid coil 46 and activates the armature of the solenoid connected to the ten watt solenoid valve 47 for controlling and stopping the rotation of tube 12 by expelling the air from the expanding collet 22.

The voltage change from the photocell divider circuit will be amplified through transistors 49, 50, 96, and 97 and used to energize relay 95 through the machine reset switch 53 at terminal 5. The circuit will electronically latch via positive feedback through the switch 53 to transistor 96. The reset switch 53 serves to de-energize the relay 95 and the solenoid 46, 47 by breaking the feedback loop at the end of the cycle.

Resistor 98, capacitor 99 and choke 100 serve to filter electrical noise which might be picked up by the latch line where it runs outside the shielded amplifier/scanner housing. Capacitor 101 and resistor 102 serve as a high frequency filter to limit the response of the amplifier at undesired frequencies.

The type of amplifier above described serves to provide the scanning capability for the circuit and to latch the circuit when the registration mark 16 on the tube 12 comes in front of the scanner/amplifier 24 actuating solenoid valve 47 thereby stopping rotation of the tube 12 and holding the tube 12 in alignment for the filling and closing thereupon.

Other circuitry of either solid state construction or tube amplification with latching features could be employed in accordance with the concepts of this invention.

Referring again in particular to FIG. 3 there is seen a schematic view of the fluorescent light source 20 including a ballast 70 of the type G.E. 58G690 which is connected in series to a resistor 72 of the value of 700 ohms/100 watts which in turn is connected in series to one leg of a fluorescent lamp 26 of the type F6T5CW and to a starting switch 76 for closing the lamp starting circuit.

From the foregoing description it will be apparent that there is provided means for detecting registration marks on plastic, metal tubes or the like utilizing a scanner/amplifier assembly and a fluorescent light to provide for positive registry of tubes after printing and/or labeling and prior to filling and closing. The above described device provides for accuracy and sensitivity in response to direct use of D.C. powered fluorescent light which was heretofore unknown when compared to optically amplified A.C. powered light and therefore provides a means for attaining uniformity in a degree never before available with respect to alignment of plastic, or metal tubes and the like without the necessity of using extra high sensitivity amplifiers and/or extreme precision in controlling transverse movement of the scanned surface with respect to the scanner axis.

Although there is shown and described a preferred embodiment of the present invention, it is to be understood that various changes and modifications may be made in the present invention.

I claim:

1. Apparatus comprising a tube having a registration mark thereon capable of reflecting light in a photoelectrically discernible visible portion of the light spectrum, drive means including a rotating spindle, means connecting said spindle and said tube for rotating said tube in accordance with rotation of said spindle, actuating means for controlling the movement and position of said tube, means for bathing at least the portion of said tube having said mark thereon with diffused light of non-varying intensity from a tubular fluorescent light source excited by a filtered direct current supply so that said registration mark reflects light in said photoelectrically discernible portion of the light spectrum,

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with said filtered direct current supply eliminating line frequency radiations in the light intensity, scanning means for signalling the presence of reflected light from the said registration mark, said scanning means including a light directing tube, and amplifier means connected to said scanning means for amplifying the signal from said scanning means, said amplifier means being connected to said actuating means for control thereof so that the signal from said scanning means controls the position of said tube.

2. Apparatus according to claim 1 wherein said tubular fluorescent light source extends longitudinally in a

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direction at right angles to the tube having a registration mark thereon.

3. Apparatus according to claim 1, wherein said filtered direct current supply comprises a bridge rectifier, a surge limiting means for protecting said rectifier, and a capacitor for filtering the rectified direct current.

4. Apparatus according to claim 3, wherein said surge limiting means comprises a resistor through which rectified current passes and said filtering capacitor is connected across the leads which carry the rectified, surge limited current.

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