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(54) Monitoring apparatus for colour printing press.

(57) A monitoring apparatus for use in a colour printing press comprises a head which includes a colour television camera (D) directed at a web moving through the press, a strobed source of light (H) of broad bandwidth for illuminating the web and synchronised with movement of the web, and a device (E,F) for inserting any of a plurality of different coloured filters into the light path to the camera, and a circuit for responding to the luminance output signal from the camera to monitor the ink density on the web at colours corresponding to the selected filters.

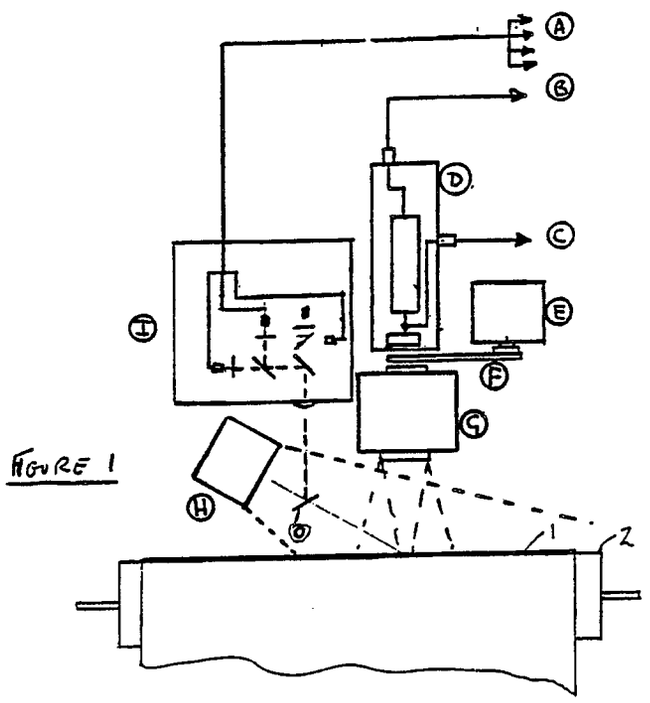

FIGURE 1

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Monitoring Apparatus for Colour Printing Press

This invention relates to colour printing in a web-fed printing press and more particularly to an apparatus which can monitor the ink density levels of different colours at selected points on the web being printed upon.

Hitherto in order to examine the ink density levels of different colour on the printed web in a web-fed printing press, it has been necessary to examine by hand copies taken from the press. It is customary to print a line of different coloured blocks or spots across the width of the web at intervals along its length, which coloured areas serve as colour references. Once copies have been taken from the press, these colour references can be observed and the ink density levels of the different colours can be measured using a hand-held densitometer. The operator can thus determine if any adjustment is needed to the ducts supplying the inks of the different colours to the ink rollers, and can effect the appropriate adjustments, to increase or decrease the flow rates of the different colour inks. However, whilst copies are being taken from the press and examined in this manner, many more copies are being printed and may have to be scrapped before the required adjustments are made to the ink ducts.

We have now devised an apparatus which enables the colour density levels of different colours to be monitored at selected points on the web whilst this is being printed and is thus moving through the press.

In accordance with this invention, there is provided a monitoring apparatus for use in a colour printing press, comprising a head which includes a colour television camera directed at a web moving through the press, a strobed source of light of broad bandwidth for illuminating the web and synchronised with the movement of the web, means for inserting any of a plurality of different coloured filters in the light path to the camera, and a circuit for responding to the luminance output signal from the camera to monitor the ink density on the web at colours corresponding to the selected filters.

Preferably the head is mounted for movement across the width of the moving web, so that the apparatus may examine the web at any selected point across its width. The timing of the strobed source of light may be adjusted for examining any selected point lengthwise of the web and therefore any selected point of the successive copies being printed on the web can be monitored. The colour television camera is preferably included in a close circuit television system, the colour monitor of which provides a visual display of the selected region of the work being printed. When none of the coloured filters is inserted in the light path to the camera, the colour monitor then provides a still display of the selected region of the work being printed, to enable an immediate visual examination of the copies as they are being printed.

When any selected colour filter is inserted into the light path to the camera, the luminance output signal from the camera gives a measure of the ink density at the corresponding colour. This signal may be used to drive a digital read-out and the reading on this can be used, by the operator to adjust manually the ink ducts for the relevant colour ink. Alternatively, the signal may be used in a closed loop feedback system to adjust the ink ducts automatically.

Preferably a zoom lens unit is positioned in front of the colour television camera, so that the camera may be focussed onto any selected size of area on the web.

An embodiment of this invention will now be described by way of example only and with reference to the accompanying drawings, in which:

FIGURE 1 is a schematic diagram of a first embodiment of monitoring apparatus in a web-fed printing press;

FIGURE 2 is more detailed diagram of an optical system of the apparatus;

FIGURE 3 is an elevation of a filter quadrant of the apparatus;

FIGURE 4 is a diagram of a circuit to which the output of the optical system and the camera luminance output signal are applied;

FIGURE 5 is a diagram showing the colour monitor display.

FIGURE 6 is a schematic diagram of a further embodiment of monitoring apparatus in a web-fed printing press; and

FIGURE 7 is an elevation of a filter quadrant of the further embodiment of the apparatus.

Referring to Figure 1, in a web-fed printing press, which may be an offset printing press, a web 1 of paper is moving lengthwise of itself through the press and over a roller 2. The monitoring apparatus in accordance with this invention includes a head which is mounted for movement across the width of the web, i.e. in a direction parallel to the axis of the roller 2. The head includes a colour television camera D which is directed at the web 1 as it passes over the roller 2, the camera D supplying a chrominance signal B and a luminance signal C in accordance with known principles. A zoom lens unit G is positioned in front of the camera D and a filter quadrant F is disposed between the zoom lens unit G and the camera D. The filter quadrant F is mounted to the

drive shaft of a stepping motor E, and comprises (Figure 3) a quadrant plate W having four windows along its outer edge, mounting blue, green, red and clear filters S,T, U and V.

The moving head of the monitoring apparatus also includes a strobe lamp H which directs white light onto the web 1 to illuminate the area viewed by the camera D through the zoom lens unit G. Further, an optical system I is included to provide reference signals with which the luminance output can be compared. The optical system I comprises a beam splitter 0 positioned in the light beam from the strobe lamp H, to project a portion of this beam into the system I through a lens N (Figure 2). The system I includes an arrangement of beam splitters M0, M1, M2 for directing portions of the received light beam onto respective photo diodes J0, J1, J2, J3. Red, green and blue filters are positioned in front of the photo diodes J1, J2 and J3. The signals from the photo diodes are passed to respective amplifiers K0 - K3 which provide output signals P0, P, Q and R representing full spectrum, red, green and blue reference levels.

As shown in Figure 4, the output luminance signal from the colour television camera is connected to one input of a comparator 3, which includes a sample and hold circuit, whilst the output signals P0, P, Q and R from the optical reference system are connected to the other input of the comparator via respective switches 4.

The colour television camera D is included in a closed circuit television system, its output signals B and C being used to drive a colour monitor 5 (Figure 5). Thus, the colour monitor 5 can display any selected area of the work being printed on the web 1 in successive copies: the required area is selected by moving the head across the web to the desired point, and altering the timing of the strobe lamp H. The size of the area being examined may be adjusted using the zoom lens unit G.

In colour printing in a web-fed press, it is customary to print a row of different colour blocks or spots across the width of the web at intervals, serving as colour references. The monitoring apparatus may be used to focus on each of these different colour regions in turn, then by driving the stopper motor E to place the appropriate colour filter in front of the television camera D, the ink density of the relevant colour ink can be measured. Thus if the red filter U is used, also the output signal P from the optical reference system is selected by the respective switch 4 and applied to the comparator 3. The luminance output signal C from the television camera is inversely proportional to the density of ink on the web 1 and is referenced by comparator 3 to the signal P and hence to the luminous intensity of the strobe lamp H.

The comparator 3 may drive a digital read out and the operator may use the reading on this to decide whether any adjustment is needed to the ink ducts providing ink of the respective colours to the ink rollers of the press. Alternatively the comparator outputs may be used in a closed loop system to adjust automatically the ink ducts for the respective colours.

In a further embodiment, the filter quadrant plate W may be extended and have four fourther similar coloured windows as shown in Figure 7.

When a particular colour filter is placed between the zoom lens and camera, a corresponding filter is placed between beam splitter 0 and photo diode Z as shown in Figure 6. The luminance output from the camera is now only compared with a reference signal from the photo diode Z, of the colour that it being viewed, thus reducing the need for the expensive optical system I shown in figure 1.

Referring to Figure 5, the colour monitor is preferably marked with a rectangular field of view 6. The zoom lens G can be adjusted so that an area on the web which is being viewed fills the field of view 6 on the colour monitor. The output from the Comparator 3 can then be gated by a signal derived from the horizontal and vertical scanning signals, so as to be passed only in respect of the field of view 6, and the output from the gate 7 can be averaged.

It will be appreciated that the monitoring apparatus which has been described enables any selected area of the work being printed to be viewed on the colour monitor whilst printing is progressing. It further enables the ink density of the different colours to be measured whilst printing is progressing and therefore enables any necessary adjustments to the respective ink flow rates to be made without delay. The apparatus may be used on printing presses printing on paper, textile or any other material.

Claims

1. A monitoring apparatus for use in a colour printing press, comprising a head which includes a colour television camera directed at a web moving through the press, a strobed source of light of broad bandwidth for illuminating the web and synchronised with the movement of the web, means for inserting any of a plurality of different coloured filters in the light path to the camera, and a circuit for responding to the luminance output signal from the camera to monitor the ink density on the web at colours corresponding to the selected filters.

2. A monitoring apparatus as claimed in claim 1, in which the head is mounted for movement across the width of the moving web, so that the

apparatus may examine the moving web at any selected point across its width.

3. A monitoring apparatus as claimed in any preceding claim, in which the timing of the strobed source of light can be adjusted for examining any selected point lengthwise of the web.

4. A monitoring apparatus as claimed in any preceding claim in which a colour monitor is connected to the television camera to give a visual display of the selected region of the work being printed.

5. A monitoring apparatus as claimed in any preceding claim in which a measurement of ink density is given visually.

6. A monitoring apparatus as claimed in any preceding claim in which a measurement of ink density is fed back to adjust ink ducts automatically as a part of a closed loop feed back system.

7. A monitoring apparatus as claimed in any preceding claim in which a zoom lens is positioned in front of the television camera, and may be focussed on any selected size of area on the web.

8. A monitoring apparatus as claimed in any preceding claim in which an optical system provides reference signals with which the output from the television camera is compared.

9. A monitoring apparatus as calimed in claim 8 in which any of a plurality of different coloured filters may be inserted in the light path to the optical system to provide a reference signal only for the colour which the television camera is viewing.

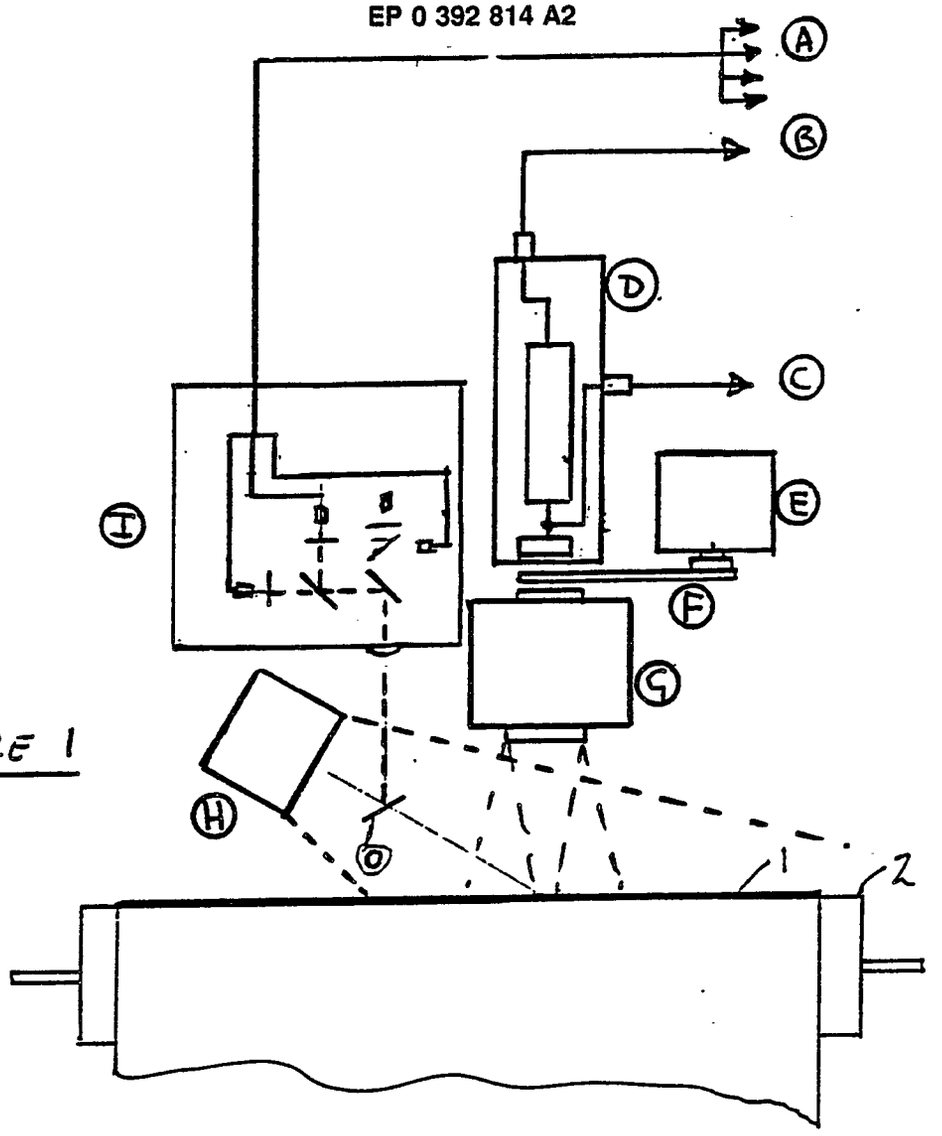


FIGURE 1

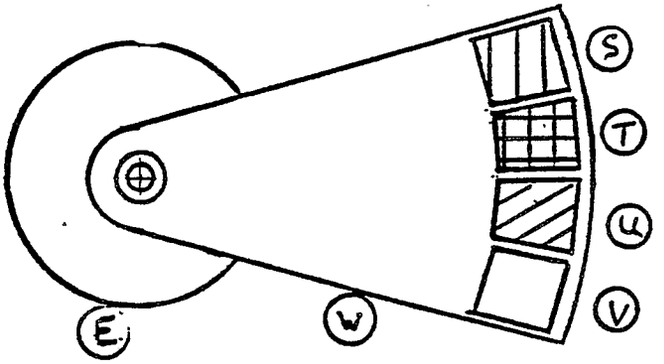


FIGURE 3

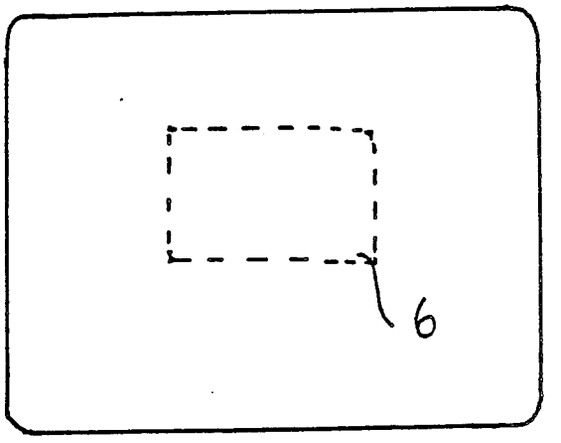


FIGURE 5

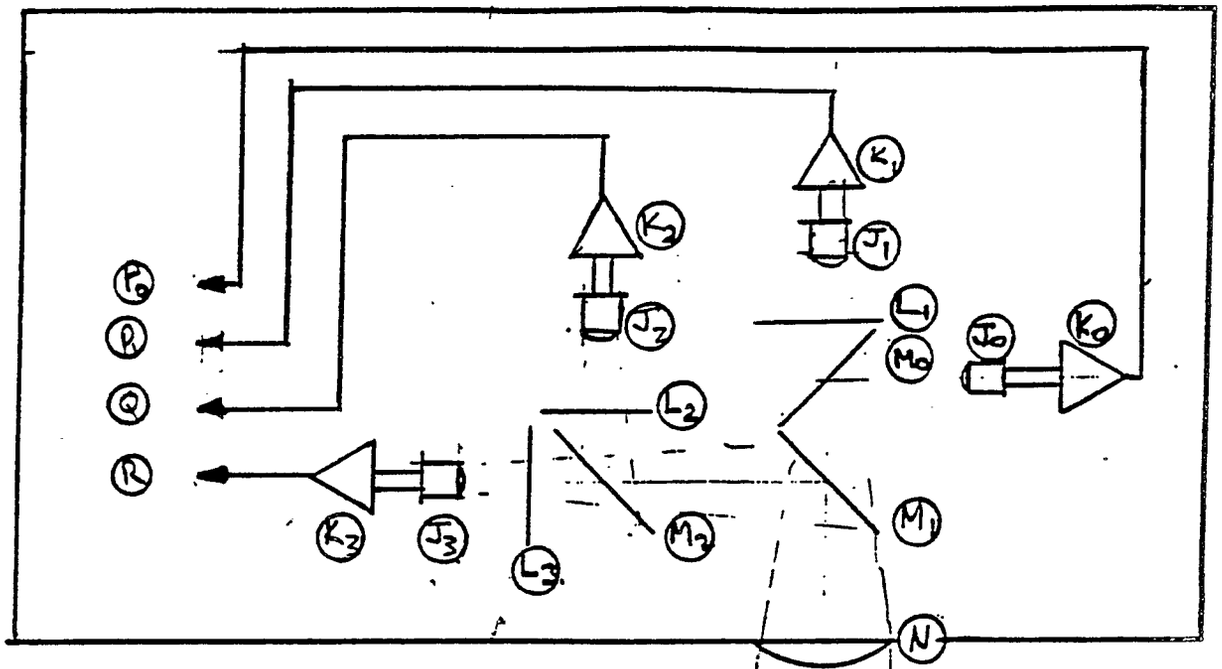
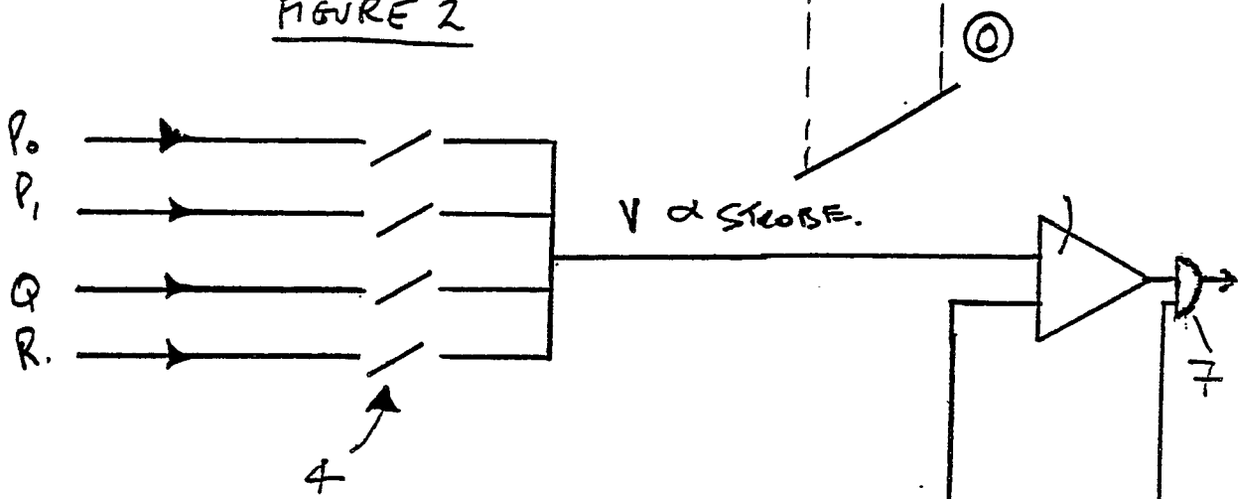
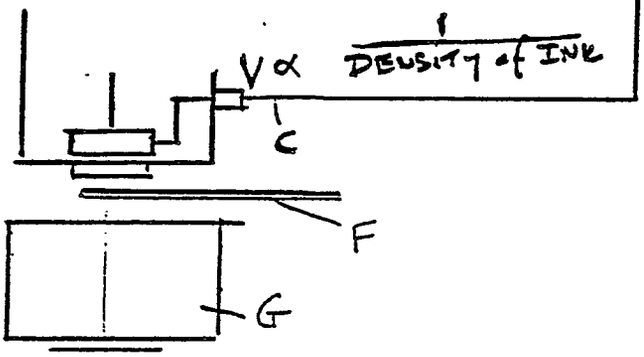


FIGURE 2





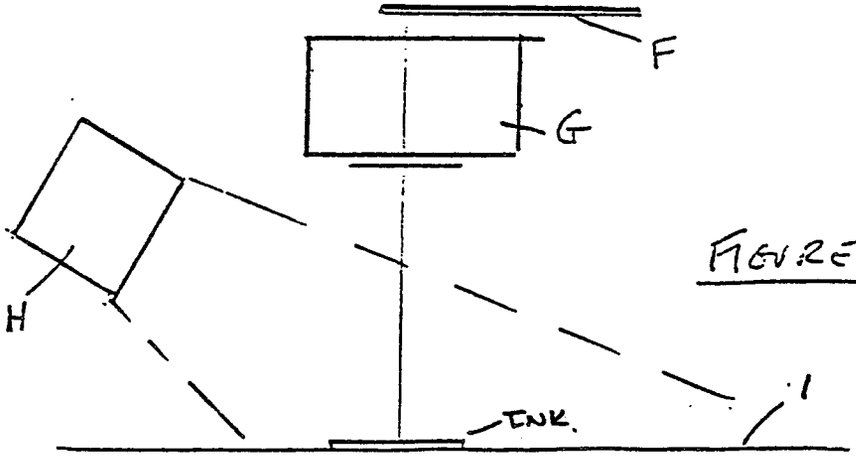


FIGURE 4

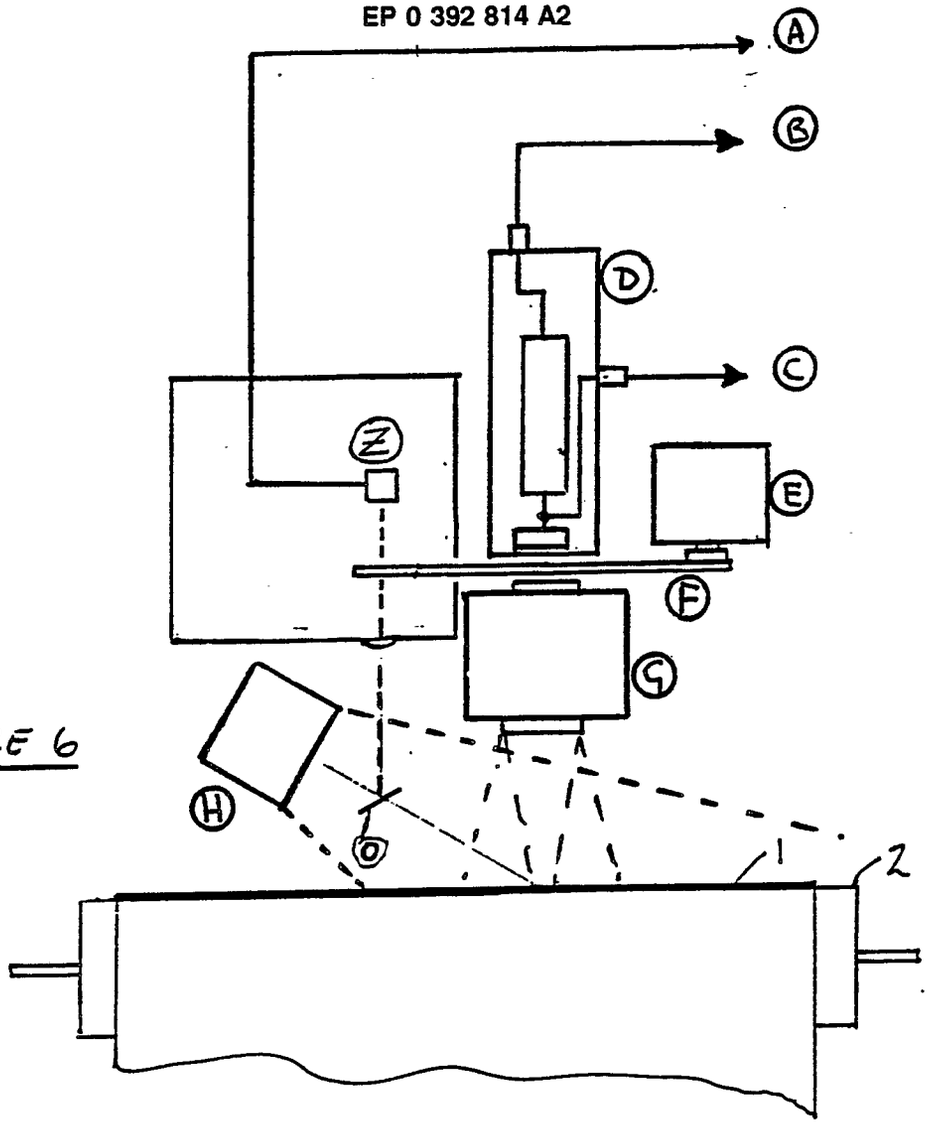


FIGURE 6

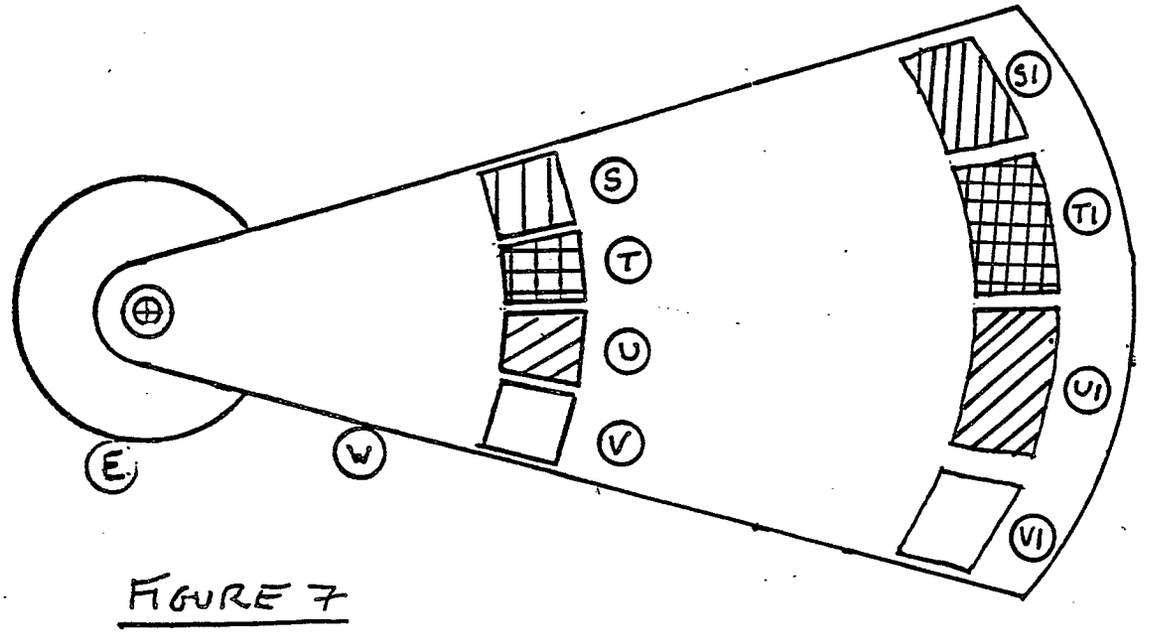


FIGURE 7