

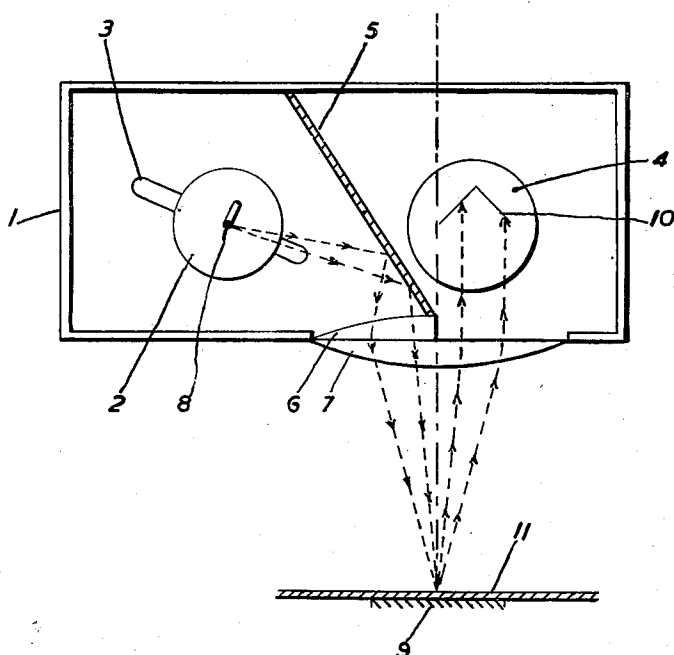
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PHOTOELECTRIC CONTROLLED DEVICE FOR KNITTING MACHINES

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PHOTOELECTRIC CONTROLLED DEVICE
FOR KNITTING MACHINES

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This invention relates to stop machines or signalling devices for knitting machines and the like and is particularly concerned with stop motions or signalling devices for warp knitting machines.

In our prior U. S. Patent No. 2,290,257 there is described a stop motion or signalling device for a knitting machine or the like which comprises a photo-electric cell, means for traversing said cell repeatedly across a fabric being made on the machine and close to the line at which said fabric is being formed, means for directing light coming from said fabric into said cell and operative means controlled by said cell and adapted to act on undue variation of the amount of light entering said cell by reason of faulty fabric. By this means the whole of the fabric may be traversed by the cell, and, if a thin or thick place should be encountered at any point in the fabric due to a missing thread or an extra thread or any other fault, the light transmitted through or reflected from the fabric, and consequently the light entering the cell, will alter in intensity and the operative means will act either to stop the machine or to give a warning signal.

The present invention relates to an improved stop motion or signalling device of the above type and comprises, in combination with a suitable light source, an optical system arranged to form an image of said light source in the vicinity of the fabric being examined, the photo-electric cell being arranged to receive light after it has passed through the fabric. Such an arrangement has a number of advantages; thus, by using a small, well-defined light source, the area of the fabric being examined at any instant may be made very small, so that high selectivity can be obtained without the loss of sensitivity which would be occasioned by using a photo-electric cell enclosed in a casing having a light-receiving slit only large enough to permit the same area to be scanned. An electric lamp with a small, straight filament is very satisfactory as light source.

It is unnecessary to place the photo-electric cell very close to the fabric and it is preferred to provide an optical system adapted to direct light onto the photo-electric cell. The light passing through the fabric and travelling toward the photo-electric cell is in the form of a divergent beam; a lens system may be used which is arranged to focus the beam to form an image of the light source and in this case it is preferred to place the photo-electric cell between the fabric and the position of the image which would thus be formed rather than to form the image on the cathode of the cell. The best arrangement, however, is to use an optical system adapted to cause a parallel beam to fall on the cathode, as by

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this means the photo-electric cell may be placed in any convenient position along the path of the light beam, while at the same time the light can be spread over the entire cathode.

The apparatus described can be employed where the light source and photo-electric cell are on the same side of the fabric and a mirror is placed on the other side of and in contact with the fabric, so that light from the source which is reflected into the photo-electric cell passes through the fabric twice, the optical system associated with the light source being arranged to form an image on the mirror face. In this case the projector, i. e. the light source and its optical system, and the receiver, i. e., the photo-electric cell and its optical system, are mounted for traversing across the fabric so that the optical axes of the projector and receiver always are in a common plane and meet on the mirror face at equal angles to its normal. To achieve this object it is convenient to mount the projector and receiver as a single unit. However, even with optical systems of short focal length and with the apparatus as near the mirror as the physical dimensions of the projector and receiver will permit, the bulk and weight of the apparatus makes difficult its mounting so that it can be traversed whilst maintaining the required accuracy of position.

An important modification of the invention, therefore, comprises an assembly in which the projector and receiver are combined into a single unit with a single optical system, half of which is used for projection and the other half for receiving. A light source is placed on the axis of a convergent optical system at a distance greater than its focus, and the mirror over which the fabric is to pass is arranged on the opposite side of the optical system with its surface perpendicular to the axis and so distant that an image of the light source is formed on its surface. With such an arrangement, light falling on the mirror is reflected back along a path symmetrical with that along which it arrived and so would be brought back to focus exactly at the source. By screening part, e. g. half, of the lens from the light source this part of the lens may be used to receive light reflected from the mirror and focus it into a photo-electric cell. Where the cell and lens are of suitable dimensions the cell can be placed directly in the path of the light travelling from the source to the lens and may itself act as screen. Generally, however, a separate screen, arranged across a diameter of the lens, is preferred.

A preferred form of this arrangement is one in which a second mirror is employed for the purpose of screening half the lens. This mirror is placed close to the lens and inclined at a suit-

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able angle to the optical axis, the light source being placed to one side so that the light travels from the source to the mirror and thence through the lens by which it is focused to produce an image of the light source on the mirror over which the fabric is to pass. With this arrangement, light reflected from the screening mirror appears to have emanated from a point on the axis of the optical system. This arrangement leaves ample room for the photo-electric cell to be mounted in the path of the convergent reflected beam. By mounting the light source on a slide so arranged that the mirror image of the source can be made to travel along the optical axis of the lens system, either the image can be formed on the cathode of the photo-electric cell, or any desired area of the cathode may be illuminated. Again the arrangement may be modified so that the photo-electric cell is illuminated by a parallel beam of light. This object can be achieved by using a bi-focal lens, the focal length of the receiving half being twice that of the transmitting half. referably the optical system used is composed of equal convergent lenses, one half of one lens on the receiving side of the assembly being omitted.

Apart from the arrangement of the projector and receiver in the manner described, the apparatus used for the purposes of the present invention may be substantially as described in our prior U. S. Patent No. 2,290,257. Thus, in conjunction with the photo-electric cell, there may be used a valve amplifier for amplifying the effect produced by change in intensity of the light falling on the cell, and the output from the amplifier may be used to operate a relay of any desired type, which in turn may be used for stopping the machine on which the fabric is being formed or for giving a required signal.

The accompanying drawing illustrates diagrammatically one form of stop motion in accordance with the invention.

Referring to the drawing, the apparatus shown comprises a casing 1 having mounted therein a lamp 2 adjustably carried in slide 3 and a photo-electric cell 4 shielded from lamp 2 by a mirror 5, the reflecting side of which faces toward the lamp 2. The mirror 5 extends across the diameter of a semi-circular convex lens 6, the plane face of which is contiguous with the plane face of a circular convex lens 7 of identical focal length; the lens 7 closing an aperture in the casing 1 provided therefor. The lamp 2 has a short straight filament 8 which is shown in the drawing in end view, the lamp being so arranged that an image of the filament 8 is formed on a mirror 9 arranged to co-operate with the components contained in the casing 1 so as to reflect the image back through lens 7 to the cathode 10 of the photo-electric cell 4.

The casing 1 is arranged to be traversed repeatedly in the manner described in prior U. S. Patent No. 2,290,257 across the face of a fabric 11 being produced on a warp-knitting machine, the casing travelling along a path parallel to the mirror 9 arranged just below and in contact with the fabric and extending across the whole width thereof. The photo-electric cell is connected via a valve amplifier with a relay which may be adapted to stop the warp-knitting machine or to give a required signal.

In operation the lamp 2 is adjusted along the slide 3 until the device is focused so that an image of the filament appears on the mirror 9. By reason of the fact that the light returning

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from the mirror 9 and falling on the cathode 10 of the photo-electric cell 4 passes through a lens system having twice the focal length of that through which it passed on its way to the mirror, it emerges from this lens system in the form of a parallel beam of light which illuminates the cathode 10 evenly, this object being achieved even though only a very small area of fabric is being examined, the area in fact being that occupied by the image of the filament. If, during the course of the knitting operation, an unduly thick or thin place in the fabric is scanned by the device, the light falling on the photo-electric cell is accordingly diminished or increased, thus causing a change in the output of the amplifier connected to the photo-electric cell, and this change may be caused to operate a relay for the purpose of stopping the knitting machine or giving a suitable signal.

Having described our invention, what we desire to secure by Letters Patent is:

1. In a stop or detector motion for a knitting machine comprising a photo-electric cell arranged to be traversed repeatedly across the fabric being formed on the machine and close to the line at which said fabric is being knitted, a first mirror on the opposite side of said fabric to said cell, means for directing light through said fabric to said first mirror and thence back through said fabric to said cell, and operative means controlled by said cell and adapted to give a warning indication of undue variation of the amount of light entering said cell by reason of faulty fabric, the improved construction which comprises a casing mounted for traversing repeatedly across the fabric, said cell being mounted within said casing together with a small, well defined light source, a second mirror situated between said cell and said light source and a lens mounted on said casing and partly shielded from direct light from said light source, said first and second mirrors and said lens together forming an optical path between said light source and said cell whereby light from said light source forms an image in the vicinity of said fabric and is reflected by said first mirror back through said fabric to illuminate a substantial area of the cathode of said cell.

2. Apparatus according to claim 1, wherein the reflecting surface of said second mirror is inclined towards the light source and the shielded portion of the lens is of twice the focal length of the unshielded portion so that the light travelling towards the cell is in the form of a beam of parallel rays.

3. Apparatus according to claim 2, wherein the light source comprises a short, straight filament of an electric light bulb.

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