United States Patent

[11] 3,555,287

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[33] **Great Britain**
[31] **No. 10480/65**

[54] **METHOD OF CHECKING THE ENDS OF CIGARETTES FOR CAVITIES IN THE TOBACCO FILLING**
1 Claim, 4 Drawing Figs.

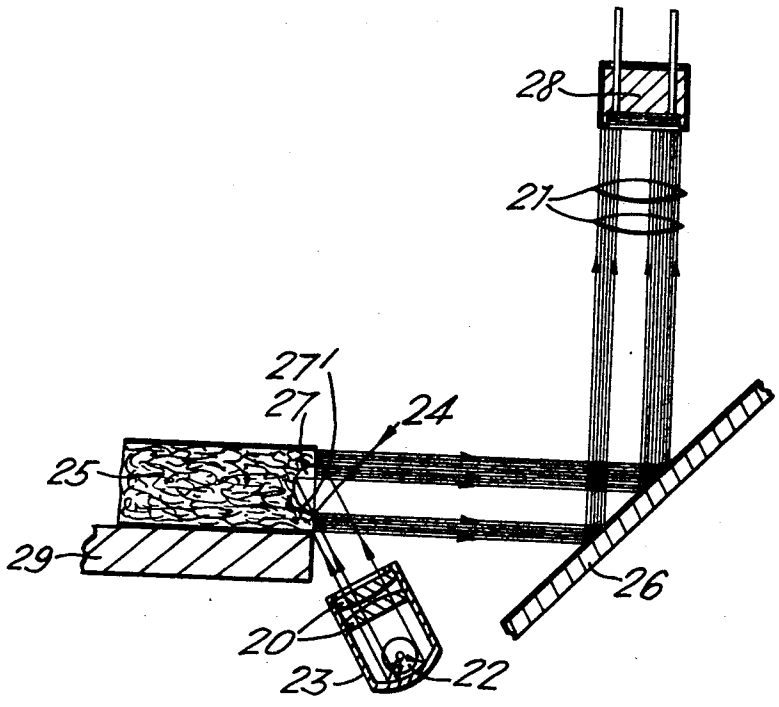
[52] **U.S. Cl.** **250/223,** 250/83.3
[51] **Int. Cl.** **G06m 7/00**
[50] **Field of Search** 250/211, 222, 223, 83.3D, 83.3VV, 83.3IR

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ABSTRACT: An arrangement for checking cigarettes comprises means for forming an image of an end of each cigarette on a photoelectric element by directing light obliquely towards the cigarette end, and electric means responsive to the illumination of said photoelectric element for creating a control effect under the control of said photoelectric element.

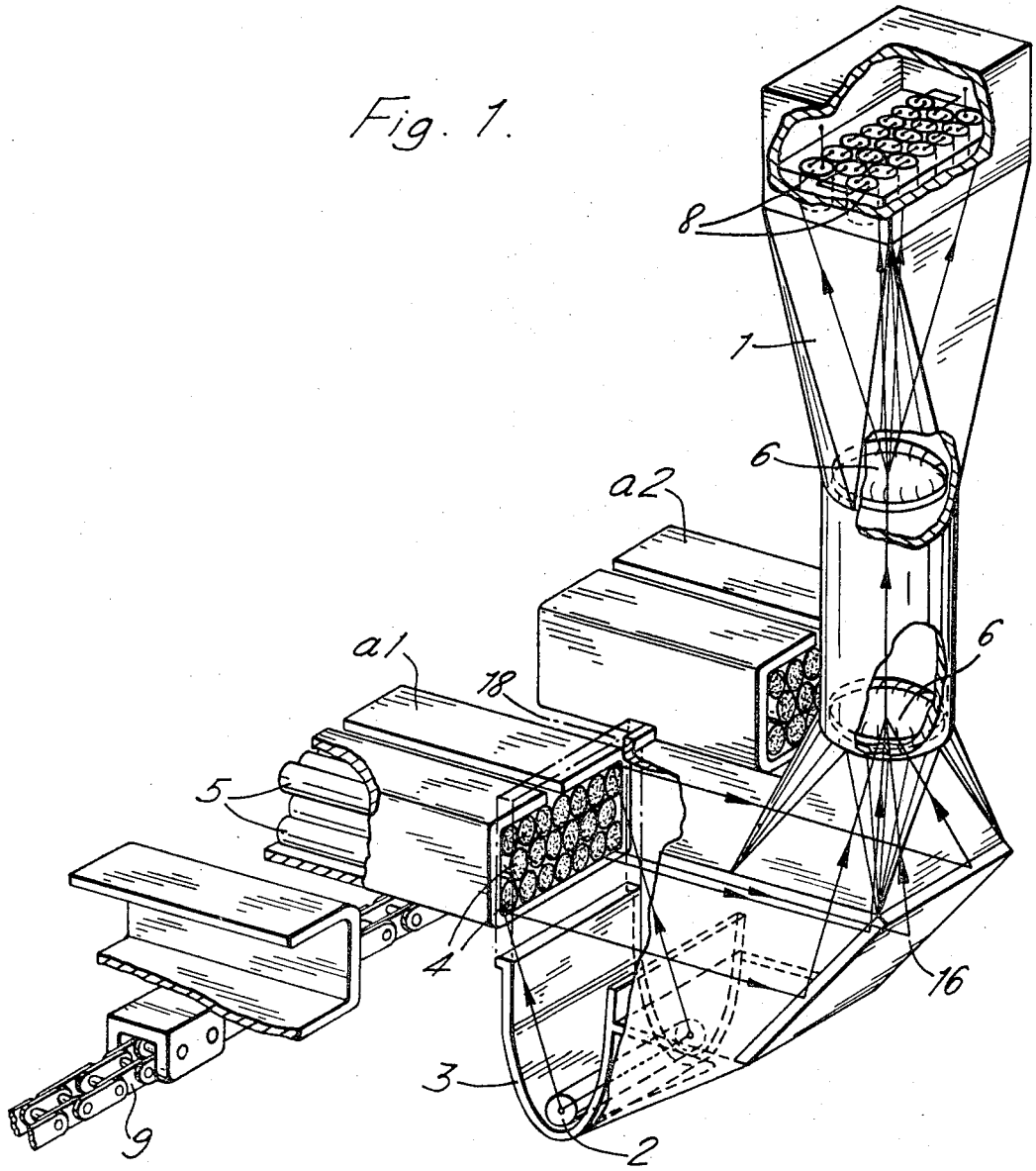


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SHEET 1 OF 2

Fig. 1.



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Fig. 2.

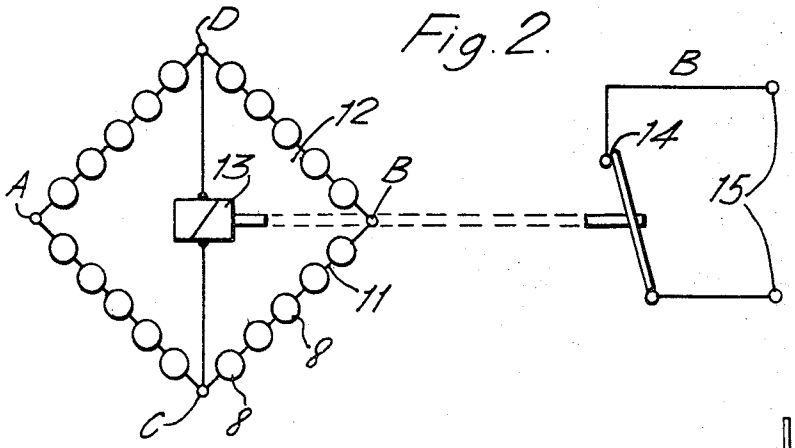


Fig. 3.

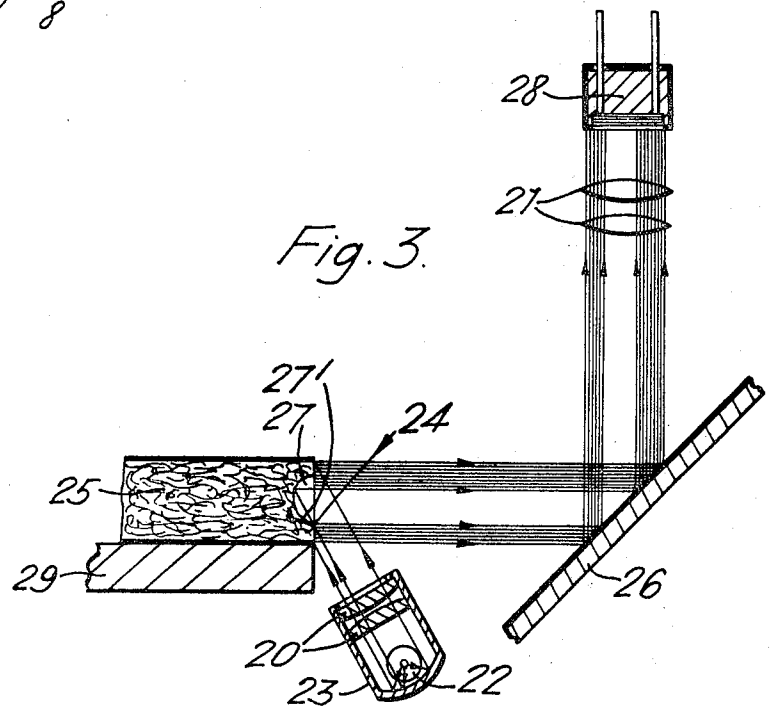
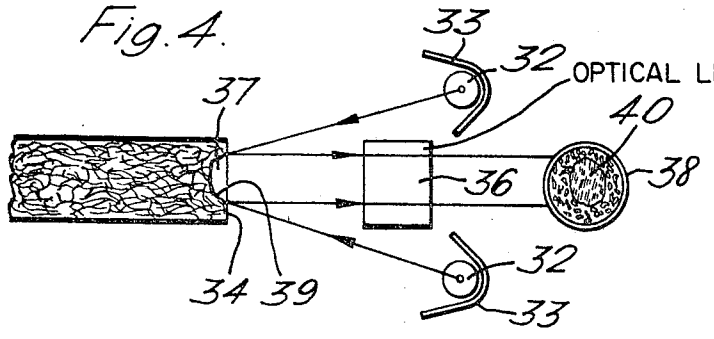


Fig. 4.



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METHOD OF CHECKING THE ENDS OF CIGARETTES FOR CAVITIES IN THE TOBACCO FILLING

CROSS-REFERENCES TO RELATED APPLICATIONS

This Application is a continuation-in-part of my copending Patent application Ser. No. 532,635, filed Mar. 8, 1966 now U.S. Pat. No. 3,473,037.

BACKGROUND OF THE INVENTION

The invention relates to arrangements for checking cigarettes and for exerting a control effect, when an end of a cigarette is faulty or when a cigarette is missing in an assembly of cigarettes such as a cigarette block.

Such devices may for example be included in cigarette packaging machines for controlling mechanisms for rejecting or diverting blocks of cigarettes in which one or more of the cigarettes is missing or is incorrectly filled.

An object of the present invention is to provide a novel and improved cigarette inspection device wherein photoelectric sensing is employed to detect faulty or missing cigarettes.

SUMMARY OF THE INVENTION

The present invention visualizes a cigarette inspection device having optical means for forming an image of ends of cigarettes on a photoelectric sensing means, and electrical means controlled by the photoelectric sensing means for performing a control function in response to sensing of faulty or missing cigarettes by the photoelectric sensing means.

BRIEF DESCRIPTION OF THE DRAWINGS

To make the invention clearly understood reference will now be made to the accompanying drawings which are given by way of example and in which:

FIG. 1 shows a perspective view, partly broken away, of parts of a cigarette inspection device;

FIG. 2 shows an electric bridge;

FIG. 3 shows a modification of parts of FIG. 1 on a larger scale; and

FIG. 4 shows a further modification of parts of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The device shown in FIG. 1 is provided in a casing 1 housing an electric light source 2. Light emitted from the light source 2 is reflected by a parabolic mirror 3 onto ends 4 of cigarettes 5 arranged in three layers of seven, six and seven cigarettes to form a block of cigarettes. Light is diffusely reflected by the ends 4 and, by means of a reflecting surface 16, reaches an optical system 6, which focuses the light to form an image of the cigarette ends in a plane in which the ends of twenty photoconductive cells 8 are provided, the cells 8 being arranged in three layers of seven, six and seven cells corresponding to the arrangement of the cigarettes. Cigarette blocks A1, A2 are carried by and fed into checking position by a conveyor 9 of any suitable known construction.

The cells 8 are connected in series to each other in one arm 11 (FIG. 2) of a Wheatstone bridge 12, to terminals A and B to which a suitable electric supply source (not shown) is connected and to terminals C and D to which a relay 13 is connected. The relay 13 controls a contact 14 which, when the relay 13 is energized, connects terminals 15 for operating a control circuit (not shown). The three other arms of the bridge 12 are shown to comprise photoelectric cells similar to those of the arm 11, which, however, may in practice be replaced in known manner by suitable resistors. The bridge 12 is so adjusted that when all the photoconductive cells 8 are uniformly illuminated no substantial current flows through the relay 13 but that if a substantial fault occurs at the cigarette ends 4, such as a cavity in one of the cigarettes or a missing cigarette, and the illumination of one of the cells 8 is consequently reduced, a current flows through the relay 13 whereby its contact 14 is closed and the control circuit connected to the terminals 15 is operated. Preferably, a glass plate 18 closes the casing 1 adjacent to cigarette ends 4 (see FIG. 1) and enables the casing 1 to be sealed in an airtight manner.

FIG. 3, in which various parts are diagrammatically shown on a larger scale, illustrates a modification of the device shown in FIG. 1, the parabolic mirror 3 of FIG. 1 being replaced by a mirror 23 for reflecting light from an elongate electric light source 22 onto a cigarette end of a single cigarette 25 fed to the checking position shown in FIG. 3 by any suitable and known conveyor 29.

Light from the light source 22 is reflected by the mirror 23, passes through a lens system 20 and reaches the end 24 of the cigarette 25, where it is reflected from the correctly filled portions of the cigarette end 24 onto a reflecting surface 26, corresponding to the reflecting surface 16 of FIG. 1, and from the reflecting surface 26 through a lens system 21 to a photoconductive cell 28. From FIG. 3 it will be seen that light coming from the light source 22 reaches the end 24 of the cigarette 25 obliquely so that the wall portion 271 of the cavity 27 (which in the drawing is the lower part of the wall of the cavity 27) is not illuminated and creates dark shadows. Therefore, less light per unit area reaches the photoconductive cell 28 from the cavity 27 than from the end of a correctly filled cigarette without any cavity. The cell 28 is connected in an arm of a Wheatstone bridge similar to that of FIG. 2, but having only a single cell in each arm. The change of resistance of the photoconductive cell 28 disturbs the balance of the bridge 12 and causes the relay 13 to operate.

FIG. 4 shows a further modification of the devices described above. In the device illustrated in FIG. 4, two light sources 32 are provided in parabolic reflectors 33 for illuminating a cigarette end 34. An optical lens system 36 is provided for focusing an image of the end surface areas of the correctly filled portions of the cigarette end 34 on a photoconductive cell 38 connected in the bridge 12, while the image of the bottom 39 of a cavity 37 in the cigarette end 34 is out of focus on the cell 38 as indicated by reference numerals 40, so that the total light intensity incident on the cell 38 is reduced and the relay 13 of FIG. 2 is operated.

It will of course be understood that the cigarette end 34 may be one of a number of ends of cigarettes in a block and that likewise the photoconductive cell 38 may be one of the corresponding number of such cells connected in the bridge circuit 12, and that for convenience only one cigarette end 34 and one photoconductive cell 38 have been shown in FIG. 4.

In order to reduce the influence of color, the light sources 2, 22 and 32 may emit ultraviolet or infrared light, in which case the reflecting surfaces 16 and 26, the mirrors 3, 23 and 33 and the optical systems 6, 21 and 36 are adapted for use with ultraviolet light or infrared light.

It should be clearly understood that the embodiments of the invention hereinbefore described are given by way of example and that various modifications may be made in the above-described constructions. For example, the cigarette inspection devices described above with reference to FIGS. 1 through 4 of the accompanying drawings can of course be readily adapted for inspecting a different number of cigarette for example a single cigarette or a block of 10, 12, 24 or more cigarettes. Many other modifications, omissions and additions are possible without departure from the spirit of this invention.

I claim:

1. A method of checking the ends of cigarettes for cavities in the tobacco filling comprising the steps of successively placing individual cigarettes with one end of the cigarette in a checking position, illuminating that cigarette end by directing light from a light source obliquely onto the cigarette end whilst in the checking position, imaging the correctly filled portion of the illuminated cigarette end on a photoelectric cell, producing an electric error signal in response to reduction of illumination incident at the photoelectric cell indicative of the presence of a cavity in the tobacco filling of said cigarette end, and applying the electric error signal to a control device.