SYSTEM FOR DETECTING LOOSE TOBACCO AT CIGARETTE ENDS

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A system is provided for detecting loose ends of cigarettes either at the discharge end of a cigarette maker or filter tip attachment machine or at the entrance of a cigarette packaging machine. This system includes a probe in the form of a split fiber optics bundle located adjacent a conveyor or other transport means for cigarettes which travel along the conveyor with their axes substantially normal to the direction of travel of the conveyor. The fibers of the bundle are divided randomly and one branch extends to a light source and the other to a detector. In this fashion, light will be directed from the probe towards the tobacco end of the traveling cigarettes. The reflected light is transmitted through the other branch to the detector which is coupled with a bridge circuit for measuring the level of intensity of the reflected light. This circuit will not respond to the higher intensity light level of an acceptable firmly packed cigarette end. However, the reflected light will be substantially reduced if the tobacco in the cigarette end is loose or cavitated. When a loose cigarette end is detected, either a memory circuit or wheel is actuated in order that the cigarette having the detected loose end will be eventually rejected by an ejection mechanism.

6 Claims, 4 Drawing Figures
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BACKGROUND OF THE INVENTION

Loose tobacco or cavitation at the ends of cigarettes are a continuous problem in cigarette manufacturing. The presence of such cigarettes obviously results in an inferior product. In addition, the presence of such cigarettes contribute greatly to waste in that present loose ends detection systems are associated with cigarette packaging machinery which require the entire pack of cigarettes to be rejected at one time. This type of detection system is also objectionable because it is mechanical in nature and does produce physical contact with the cigarettes in the package.

Ideally, a system capable of rapid detection and rejection of individual cigarettes without any physical contact would be desirable. If such a system were employed, waste would be significantly reduced since most defective cigarettes would be rejected individually.

SUMMARY OF THE INVENTION

The present invention proposes to optically examine a cigarette end. Light is directed towards the cigarette end and reflected therefrom towards a detector. The intensity of the light reflected is a function of the quality of the cigarette end. Thus, the intensity of light reflected is measured on each cigarette before packing and the defective cigarettes are individually rejected.

Thus, a principal object of the present invention is to optically examine a cigarette end without mechanical contact and if a defective cigarette is detected, it will be individually rejected.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic and fragmentary plane view of a cigarettes being transported on a conveyor either at the discharge end of a cigarette making machine or a filter tip attachment machine or the entrance end of a cigarette packaging machine or at any location therebetween with a detection system shown associated with the cigarette transport for optically measuring the intensity of light reflected from the individual cigarette ends in order that a defective cigarette may be detected and individually ejected before packaging;

FIG. 2 is an enlarged diagrammatic view showing the reflection of light from an acceptable firm cigarette end;

FIG. 3 is a similar diagrammatic view showing the reflective light from a loose or cavitated cigarette end; and

FIG. 4 is a circuit diagram of an exemplary bridge circuit which responds to the intensity of the reflected light for actuating a reject mechanism for ejecting a detected defective cigarette.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the drawings, an optical detection system 10 is shown associated with a conveyor 12 or other suitable cigarette transport means. This transport means 12 may be located at the discharge end of a cigarette making machine 14 or filter tip attachment machine or at the entrance end of a cigarette packaging machine 16 or at any suitable location therebetween. For that matter, the transport means may be part of the maker 14 or packer 16. The individual cigarettes 18 travel on the conveyor 12 substantially as shown with their longitudinal axis being disposed substantially normal to the path of travel of the conveyor. It will be assumed, for purposes of the present discussion, that the cigarettes 18 are of the filter tip variety with their tobacco ends being disposed adjacent the detection system 10. However, it should be understood that should non-filter tip cigarettes be transported for packing by the packer 16, another detection system may be utilized for detecting the condition of the other end of the traveling cigarettes.

The detection system 10 includes a probe 20 mounted alongside the conveyor 12 and adjacent the tobacco ends of the cigarettes 18. This probe comprises a fiber optics bundle which is split randomly into branches 22 and 24. A suitable light source or lamp 26 is located at the end of branch 22 and is electrically coupled with a suitable and selected power source 28.

The end of the branch 24 is adjacent a detector 30 of the type well known in the art. This detector is electrically coupled with bridge circuitry 32 which may be a typical Wheatstone circuit shown in FIG. 4. This circuit responds to the intensity of light sensed by detector 30 which may initiate any one of several actions should a defective cigarette be detected. In this connection, the presence of the defective cigarette may be recorded on the strip chart recorder 34 and/or a reject mechanism 36 may be actuated to eject the defective cigarette from the conveyor 12. This reject mechanism 36 may be of any known type which may either mechanically remove the defective cigarette from the conveyor 12 or remove it by an air blast. The operation of the reject mechanism 36 may be synchronized with the travel of the cigarettes 18 on the conveyor 12 and the location of the probe 20 by any one of known timing mechanisms or circuitry. For example, a timing wheel well known to the tobacco industry art may be employed.

A cigarette with a firm end would return a high level of light (see FIG. 2) while a loose end would return a somewhat lower level of light (see FIG. 3). This lower level was caused by the increase in distance between the probe and the tobacco and the increase in scattering caused by a more porous and uneven surface. The bridge circuit 32 which is initially placed in a balanced condition produces a measurable signal when a defective cigarette is detected. This signal is, of course, employed to trigger the reject mechanism 36. These rejection signals are generated on the basis of variations from a standard sine wave. For this reason, dark spaces between cigarettes are not critical in that the ejection mechanism will simply be operating on a blank space. It should be kept in mind that a timing mechanism or position sensor could be used to instruct the apparatus when to sample.

In a successful embodiment of the invention, the fiber optics bundle possessed a diameter approximately equal to that of the traveling cigarettes. Of course, this may be varied, particularly decreased if need be and the cross-section of the bundle may assume a configuration other than circular. Similarly, while a Y-form of split fiber optics bundle is disclosed, it is not necessarily
required and other probe forms may be employed. The Y-form probe offers the advantage of permitting both signal and detection with a single fiber bundle.

The system disclosed herein has equal applicability to detecting missing filters of filter tip cigarettes or other defects at this end.

Although several preferred embodiments of the invention have been disclosed and described in detail herein, it should be understood that this invention is in no sense limited thereby and its scope is to be determined by that of the appended claims.

I claim:

1. A system for detecting defective ends of cigarettes comprising:
   conveyor means having an axis for conveying cigarettes in a direction substantially normal to the longitudinal axis of the cigarettes thereon;
   a probe in the form of a split fiber optics bundle having one consolidated end adjacent the conveying means and cigarettes thereon and at which the fibers are divided randomly and its other end split into a pair of divergent branches, the probe consolidated end having an approximate cross sectional size in order of that of a cigarette;
   means for mounting the probe consolidated end adjacent the ends of the cigarettes traveling on the conveyor so that the fibers of the probe consolidated end are substantially parallel to the longitudinal axis of such cigarettes and normal to the axis of the conveying means;
   a light source adjacent the end of one of the fiber optics branches;
   means for connecting the light source to an electrical power supply;
   a detector adjacent the end of the other fiber optics branch; and
   response means for responding to the light intensity detected by the detector, whereby light from the light source is transmitted through the one branch to the consolidated end and is directed against the adjacent ends of the traveling cigarettes, light reflected from the ends of the traveling cigarettes is transmitted from the consolidated end to the other branch and is directed to the detector, the intensity of the light reflected and sensed by the detector causes the response means to respond thereto in such a manner that defective ends of the traveling cigarettes will be distinguished from acceptable ends of such cigarettes.

2. The invention in accordance with claim 1 wherein the conveyor is at the discharge end of a cigarette maker.

3. The invention in accordance with claim 1 wherein the conveyor is at the discharge end of a cigarette filter tip attachment machine.

4. The invention in accordance with claim 1 wherein the conveyor is at the entrance end of a cigarette packaging machine.

5. The invention in accordance with claim 1 wherein the response means includes a bridge circuit for responding to the level of intensity of the reflected light sensed by the detector.

6. The invention in accordance with claim 1 wherein the response means includes a cigarette rejection mechanism for ejecting cigarettes having defective ends.

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