

May 16, 1961

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2,984,352

CIGARETTE DENSITY MEASURING APPARATUS

Filed May 21, 1953

FIG. 1

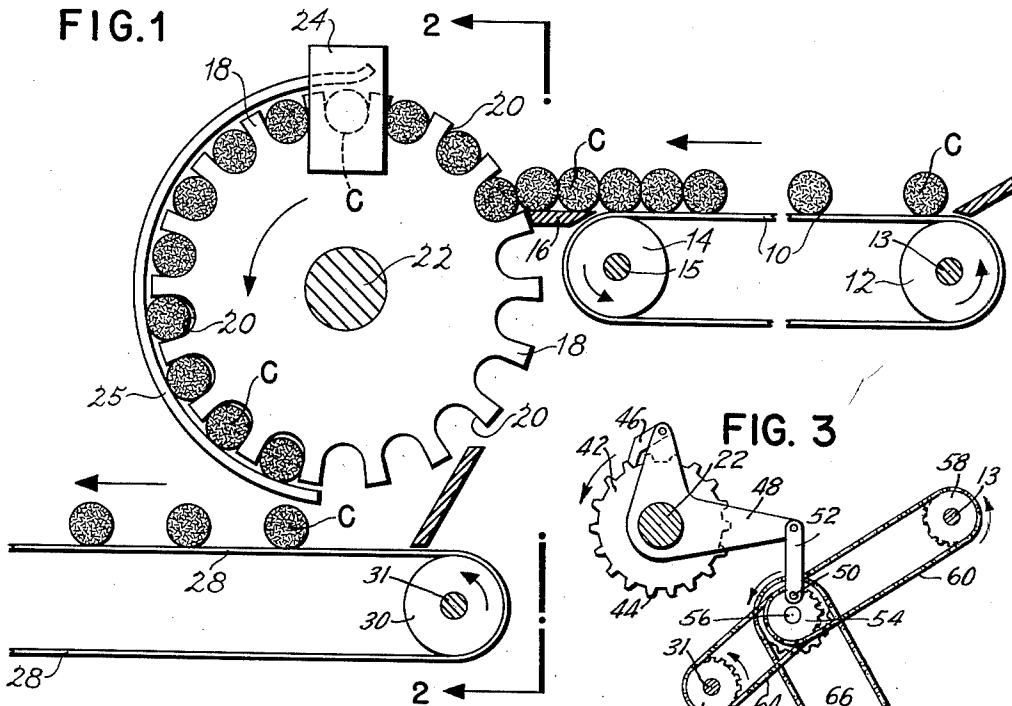


FIG. 3

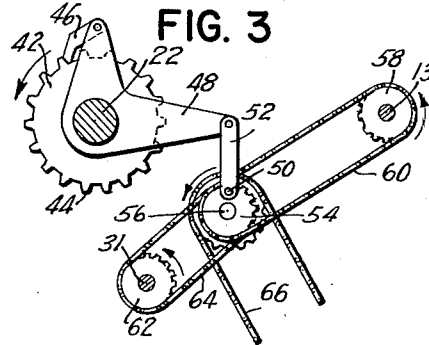
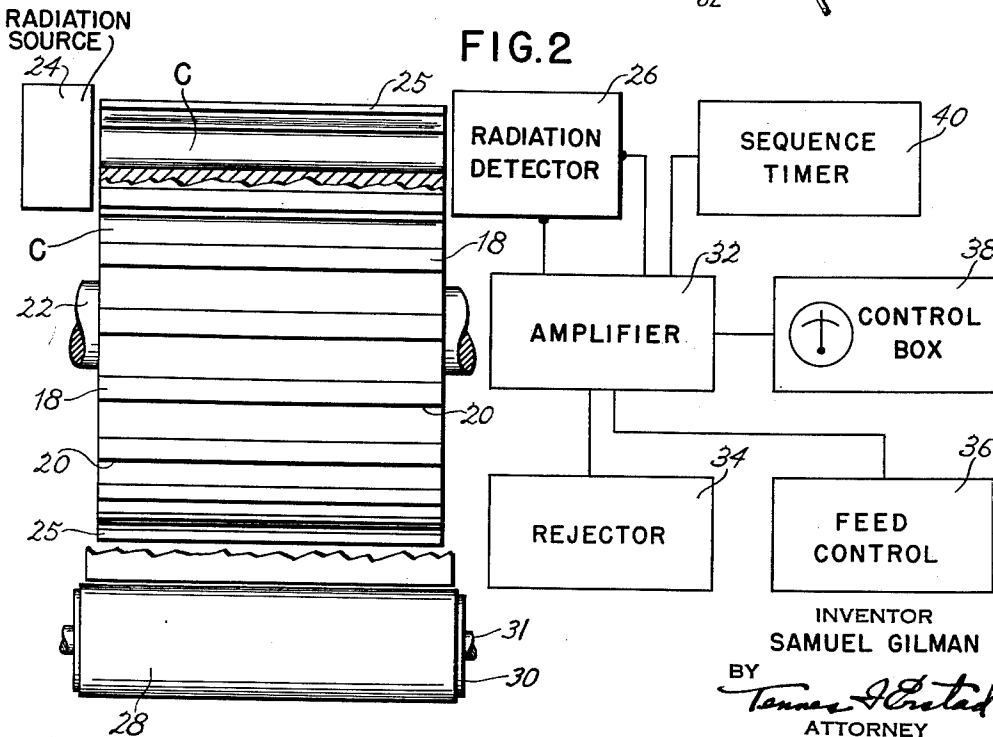


FIG. 2



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2,984,352

CIGARETTE DENSITY MEASURING APPARATUS

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Filed May 21, 1953, Ser. No. 356,513

2 Claims. (Cl. 209—111)

This invention relates to a method and an apparatus for detecting the density of elongated articles such as cigarettes and more particularly to a device for controlling the rejection of defective cigarettes and for regulating the rate at which tobacco is fed in a cigarette making machine.

It is the purpose of the present invention to provide an improved and simplified type of cigarette control apparatus using radiation to detect the condition of cigarettes, wherein the radiation is passed through a cross-sectional area of the cigarette wherein the opposite walls of the cigarette through which radiation passes are parallel to each other, so that all of the tobacco in the cigarette is measured.

Another object of the invention is to provide a device and structure which will permit beta rays to be more effectively employed in detecting the condition of cigarettes and to make possible the use of such rays in the rejection of cigarettes.

Up to the present time, detection by means of beta rays was at such a slow rate that they were not considered generally satisfactory for the rejection of cigarettes. To overcome this disadvantage applicant has found that by causing the beta radiation to pass lengthwise through a cigarette, applicant is able to keep the cigarettes at the source of radiation for a longer time without changing the rate of cigarette production, thus making the use of radiation suitable for a cigarette rejection as well as a feed control. One of the principal advantages of the present invention is that the length of time the elongated object such as a cigarette is exposed to the beta rays is increased by exposing the entire cigarette at one time and allowing it to remain in the rays until the next full cigarette is produced.

Applicant's apparatus also has the advantage that by passing radiation lengthwise through the entire cigarette, any non-uniformity of the tobacco strands with respect to the manner in which they are arranged in the cigarette is averaged out, because the entire cigarette is acted upon by the radiation at one time.

Other objects and features of the invention will appear as the description of the particular physical embodiment selected to illustrate the invention progresses. In the accompanying drawings, which form a part of this specification, like characters of reference have been applied to corresponding parts throughout the several views which make up the drawings.

Fig. 1 is a side elevation of a cigarette conveying apparatus in conjunction with a radiation measuring device in which the radiation passes lengthwise through the end of individual cigarettes,

Fig. 2 is a sectional end elevation of the same, taken on line 2—2 of Fig. 1, shown in conjunction with a diagrammatic representation of a cigarette ejecting device and a tobacco feed control activated by means of a response from the radiation measuring device, and

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Fig. 3 is a side elevation of an intermittent driving mechanism for the conveying apparatus of Fig. 1.

With reference to Fig. 1 of the drawing, the individual cigarettes C are received from a suitable source of supply such as the collector belts 10 of a conventional cigarette making machine which may be of the general type shown in U.S. Patents 2,729,214 and 2,729,213.

The collector belts 10 are constantly driven by a pair of rollers 12 and 14, mounted on suitably supported shafts 13 and 15, respectively.

The belt conveyor 10 forwards the cigarettes over a bridge plate 16 to a drum 18 which is provided with equally spaced and suitably shaped flutes or grooves 20 into each of which an individual cigarette is deposited due to the feeding action of belt 10 in conjunction with the rotation of drum 18.

It will be realized that instead of a drum 18 any other suitable conveyor could be used for carrying cigarettes such as a conveyor chain on which is mounted suitable cigarette receiving pockets. The cigarettes may be moved either sidewise or lengthwise, depending upon the type of conveyor employed and the arrangement of the source of radiation and the detection thereof.

The drum 18 is mounted on a shaft 22 which may be driven intermittently. A suitable source of radiation 24 is supported adjacent the periphery of one end of the drum 25. A radiation detector 26 is mounted on the other side of the drum 25 opposite to the source of radiation 24. Both the source of radiation and the detectors are suitably shielded so that only rays going through the cigarette are measured.

There are various types of radiation including infrared rays, X-rays, and gamma rays that can be used in practicing this invention. I have preferred to employ rays which have a greater penetrating power than light rays but which are more readily absorbed than X-rays. Rays of this type would be beta rays which can be conveniently obtained from a source such as strontium 90. I prefer beta rays because the absorption of beta rays depends primarily on the density or weight per unit volume of a material, and is not dependent on the transparency or opacity of a material as would be the case with light rays or on the chemical composition as for X-rays nor are they affected by variations of other properties of a material such as its dielectric constant.

Beta rays have more limited penetrating power than X-rays and it is very simple to prevent penetration in any but the desired location. This type of radiation also enables a very simple source, such as strontium 90, to be employed and thereby avoiding the necessity for using high voltage apparatus which is required for generating X-rays.

The source of radiation 24 and the ray detector 26 are so positioned that each cigarette carried by the drum 18 passes endwise between the radiation and detecting sources. This permits the beta rays to pass lengthwise through the end of each individual cigarette. By passing rays through the end of a cigarette, any distortion that would result from operating transversely through the side of a cigarette is avoided. Furthermore this has the additional advantage that all of the tobacco in the cigarette is being simultaneously acted upon for the entire time that the cigarette is in the region of the source of radiation.

Adjacent the periphery of the drum 18 is also mounted a stationary guard or cover plate 25 which prevents the cigarettes from dropping out of the grooves of the drum except at the desired position where the cigarettes, after having passed by the detector, drop onto another endless conveyor belt 28. The conveyor belt 28 is continuously driven by means of roller 30 mounted on a suitably sup-

ported shaft 31 and carries the measured and inspected cigarettes out of the machine.

The signal or voltage output of the beta ray detector 26 may be utilized to effect the actuation of a defective cigarette tobacco feed in a manner similar to that shown in U.S. patent application S.N. 239,975, filed by William C. Broekhuysen, on August 2, 1951, and in U.S. Patents 2,729,214 and 2,729,213, referred to above. As illustrated in Fig. 2 the beta ray detector is in this case connected to a suitable preamplifier and amplifier circuit 32 which in turn may be connected to the ejector apparatus 34 of cigarette making machine and/or the tobacco feed control mechanism 36 of a cigarette making machine. The amplifier circuit 32 is also connected to an electronic control circuit 38 which may include suitable averaging circuits. Since it is desirable to pass the radiation through the cigarette only when the end of each cigarette faces the detector 36, and as long as possible before the next cigarette is moved in place, a sequence timer circuit 40 is also connected to the amplifier. Similar synchronizing means may be utilized for ejecting any cigarettes at a more remote point which is detected. An intermittent motion may be employed to driven drum 18 so as to allow each cigarette to remain in the rays as long as possible. A suitable intermittent driving mechanism for driving drum 18 is shown in Fig. 3. Secured to shaft 22 of drum 18 is a ratchet wheel 42 which has disposed about its outer periphery a plurality of spaced teeth 44. A ratchet 46 pivotally mounted to a bell crank lever 48 engages teeth 44. Bell crank lever 48, loosely mounted on shaft 22, is connected to a crank pin 50 by means of a link 52. Crank pin 50 is mounted on a sprocket 54 which, in turn, is secured to a main drive shaft 56. A second sprocket 58 is secured to shaft 13 and is driven by sprocket 54 through a common chain 60. A third sprocket 62 is secured to shaft 31 and is driven by main driving shaft 56 and a suitable sprocket mounted thereon (not shown) by means of a common chain 64. The main driving shaft 56 may be driven by any suitable source of power through chain 66. It will be seen that when main drive shaft 56 is constantly rotated, shafts 13 and 31 and, accordingly, rollers 12 and 30, respectively, will likewise be driven at a constant speed. On the other hand, shaft 22 will be rotated intermittently through the conventional ratchet action of ratchet wheel 42 and ratchet 46. It is obvious that by selection of proper gear ratios for sprockets 54, 58 and 62 and ratchet wheel 42, the relationship between the speeds of conveyor belts 19, 28 to the time between indexing steps of ratchet 42 may be adjusted to allow the beam of radiation from radiation source 24 to fully penetrate each cigarette in a direction along its longitudinal axis. While a conventional ratchet drive is shown in order to illustrate one type of suitable intermittent drive, yet any other known intermittent driving mechanism may be used, if desired.

The rejector 34 and the feed control circuits 36 are fully illustrated and described in U.S. Patents 2,729,213 and 2,729,214, referred to above. For the purposes of this invention, the output signals of detector 26 are fed to the balanced bridge circuit described in said Patent 2,729,214 to actuate the rejecting mechanism illustrated in Fig. 1a, and described in columns 17 and 18, of said Patent 2,729,214, so as to reject cigarettes having undesired densities when the output signals deviate from a predetermined range of values.

The invention hereinabove described may be varied in construction within the scope of the claims, for the particular device selected to illustrate the invention is but one of many possible embodiments of the same. The invention, therefore, is not to be restricted to the precise details of the structure shown and described.

What is claimed is:

1. In a cigarette making machine, conveyor means for transporting cut cigarettes to a density measuring station, a movable member disposed in said density measuring station and having juxtaposed pockets for receiving cigarettes from said conveyor means said movable member being intermittently driven so as to index each cigarette through said density measuring station, a source of radiation positioned adjacent said pockets of said movable member and adapted to direct a beam of beta rays through the end and along the longitudinal axis of each cigarette as it pauses in alignment with said beam of beta rays, a radiation detector positioned in alignment with said beam of beta rays and being spaced from said source of radiation a distance substantially equal to the length of a cigarette so that said cigarettes pass between said source and said detector whereby the magnitude of the beam of beta rays after it emerges from each cigarette is detected by said radiation detector, said radiation detector producing output signals proportional to the magnitude of said beam of beta rays received, and rejector means actuated in response to output signals which deviate from a predetermined range of values for rejecting cigarettes having undesired densities.

2. In a cigarette making machine, conveyor means for transporting cut cigarettes to a density measuring station, a rotatable drum disposed in said density measuring station and having fluted portions on the outer periphery thereof for receiving cigarettes from said conveyor means, said drum being intermittently rotated so as to index each cigarette through said density measuring station, a source of radiation positioned adjacent said fluted periphery of said drum and adapted to direct a beam of beta rays through the end and along the longitudinal axis of each cigarette as it pauses in alignment with said beam of beta rays, radiation detector positioned in alignment with said beam of beta rays and being spaced from said source of radiation a distance substantially equal to the length of a cigarette so that said cigarettes pass between said source and said detector whereby the magnitude of the beam of beta rays after it emerges from each cigarette is detected by said radiation detector, said radiation detector producing output signals proportional to the magnitude of said beam of beta rays received, and rejector means actuated in response to output signals which deviate from a predetermined range of values for rejecting cigarettes having undesired densities.

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