Dec. 16, 1969 C. S. McARTHUR 3,483,970

PNEUMATIC METHOD AND APPARATUS FOR TESTING CIGARETTES TO DETECT LOOSE ENDS AND MISSING FILTER TIPS

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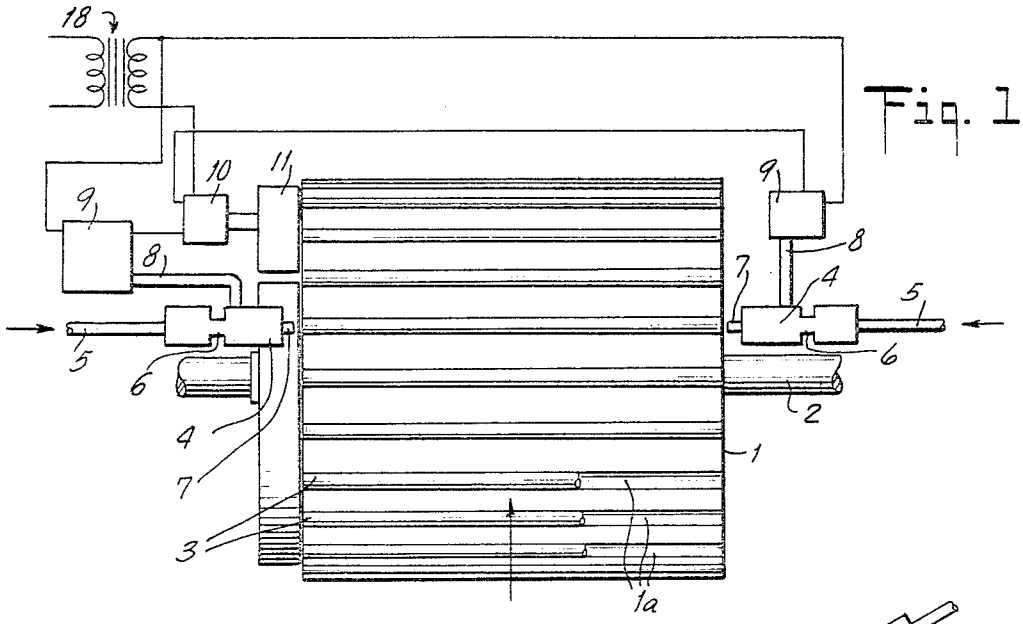


Fig. 1.

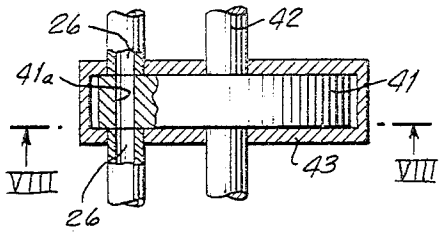


Fig. 7.

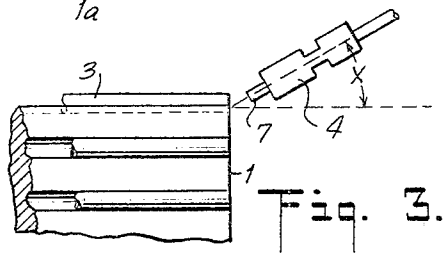


Fig. 3.

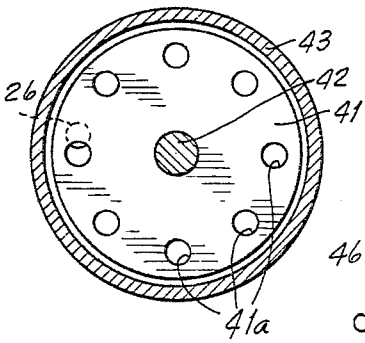
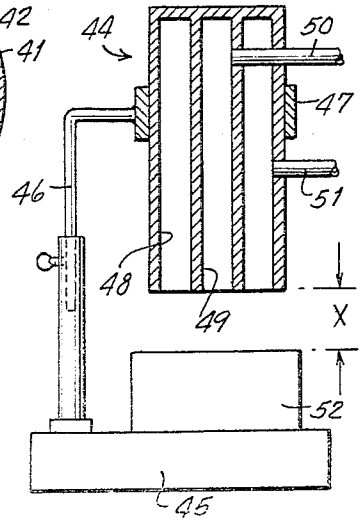


Fig. 8.

Fig. 9.



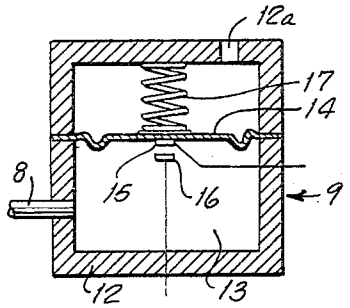


Fig. 2.

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Fig. 4.

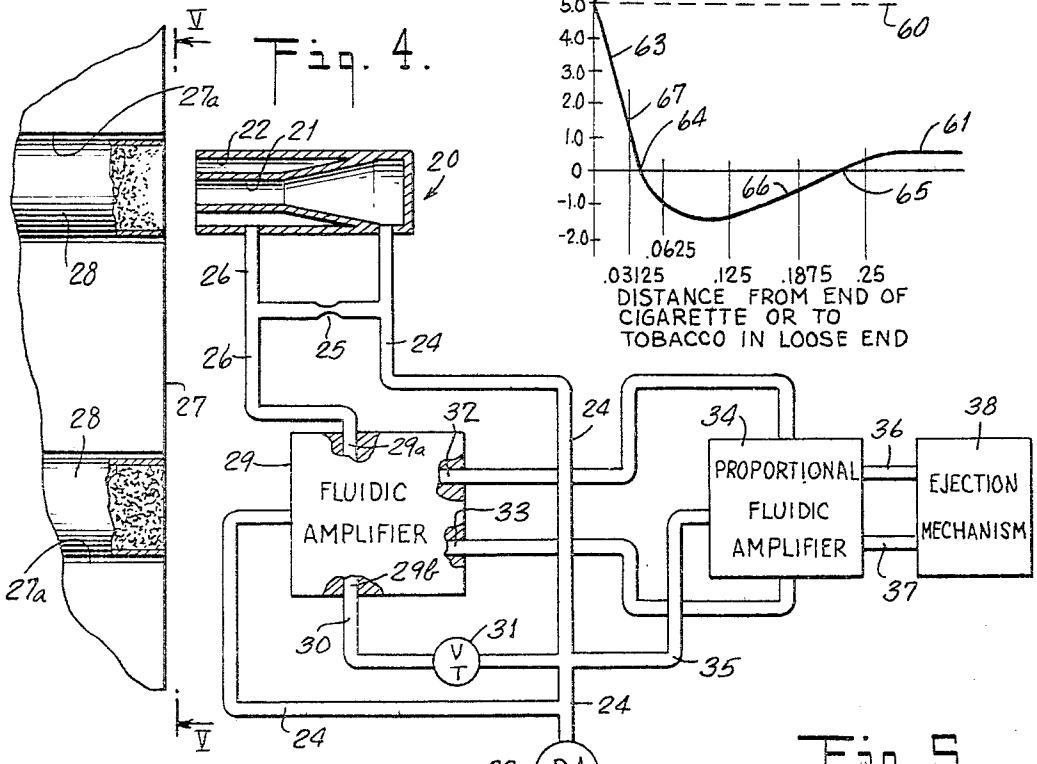


Fig. 6.

Fig. 10.

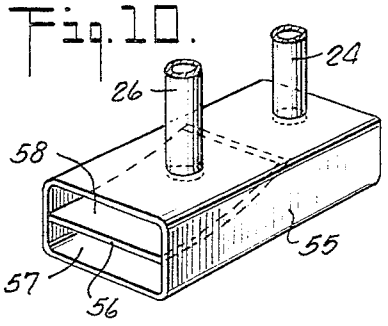
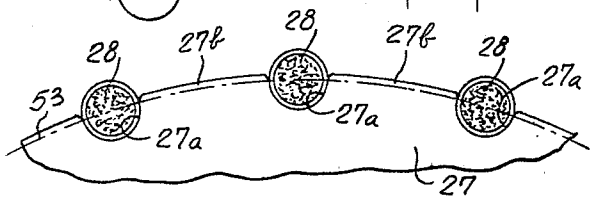


Fig. 5.



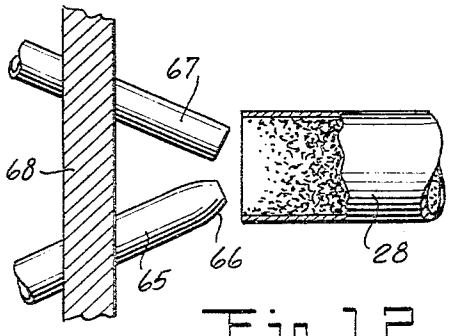


Fig. 12.

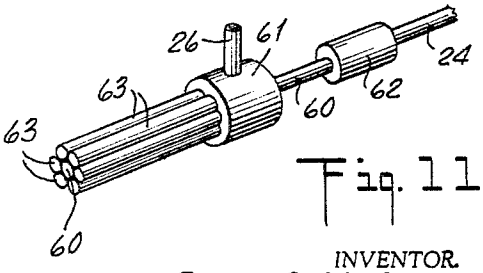


Fig. 11.

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3,483,970

PNEUMATIC METHOD AND APPARATUS FOR TESTING CIGARETTES TO DETECT LOOSE ENDS AND MISSING FILTER TIPS

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Continuation-in-part of application Ser. No. 615,878, Jan. 31, 1967. This application Nov. 13, 1967, Ser. No. 682,340

Int. Cl. B07c 5/34; G01m 3/02

U.S. Cl. 209—73 20 Claims

ABSTRACT OF THE DISCLOSURE

Method and apparatus for testing cigarettes for loose packing at either end and for loose packing at one end or the absence of a tip filter at the other end. Air jet is directed from nozzle toward cigarette end, and pressure of air is detected at a point where it is affected by the condition of the cigarette end. Pressure measurement controls ejection from conveyor of loose end-packed cigarettes or those from which a filter tip is missing. Preferably nozzle has concentric passages, one central and one peripheral. Stream at relatively high pressure flows through central passage, and another stream at lower pressure through peripheral passage. Pressure measurement made in peripheral passage. Other nozzle arrangements are described. Gating arrangements may be used to cut off measurement when no cigarette is aligned with nozzle.

Concentric passage nozzle also shown in general purpose gaging and measuring apparatus.

BACKGROUND OF THE INVENTION

The present application is a continuation-in-part of application Ser. No. 615,878, filed Jan. 31, 1967, now abandoned, entitled Pneumatic Method and Apparatus for Testing the Proximity and Density of Test Pieces, and which is assigned to the same assignee as the present application.

This invention relates to the field of cigarette making with automatic control. It is particularly concerned with detecting cigarettes which have either or both of their ends loosely packed or those from which a filter tip is missing and ejecting these cigarettes from a conveyor. Certain features of the invention have broader utility in the field of measuring and testing, particularly pneumatic gaging.

Prior art mechanisms for detecting loose ends on cigarettes have commonly incorporated mechanical feelers. For example, see the patents to Best, No. 2,284,117 and Powel, No. 3,116,478. Where a mechanical feeler is used, either the motion of the cigarette must be stopped while the feeler supporting mechanism reciprocates toward and away from the cigarette, or the feeler mechanism must travel along a path parallel to the cigarette for a considerable portion of the length of that travel, as in the Best patent, cited above. The mechanisms of the prior art have not been satisfactory, especially with the newer cigarette machines which deliver cigarettes at rates of 1500 to 3000 per minute. Thus, the mechanism must test 50 cigarettes per second, and the prior art devices are not capable of performing that many measurements accurately at that speed.

SUMMARY OF THE INVENTION

Cigarettes are tested for loose end packing or the presence of an end filter tip, both of which may be considered as generically involving an aceptable end textural fabrication of the cigarette, by directing toward the cigarette

end a jet of compressed air. A pressure measurement is made in or closely adjacent to the nozzle through which the jet issues. The tip of the nozzle is closely spaced from the end of the cigarette. The cigarette continues to move during the test and the nozzle may be stationary. The pressure within the nozzle varies depending upon the condition of the end packing of, or presence or absence of an end filter tip on, the cigarette. If the packing is loose or a filter tip is missing, the pressure at the point of pressure sensing will be different from the pressure encountered when the cigarette is tightly packed or possesses a filter tip. That different pressure is utilized to control conventional mechanism for removing from the cigarette conveyor the cigarette which produces that different pressure reading.

In the preferred embodiment, a nozzle having concentric passages is used, a high pressure stream flows through the inner passage, and a lower pressure stream through the outer pasage. The pressure is measured within the outer passage. The pressure when the cigarette is loosely packed or is missing a filter tip may be lower or higher than the pressure when the cigarette is tightly packed or possesses a filter tip, depending on the nozzle configuration used.

The concentric passage nozzle may advantageously be used in pneumatic gaging and measuring for general purposes.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a somewhat diagrammatic plan view of a cigarette handling drum equipped with testing apparatus constructed in accordance with the invention;

FIG. 2 is an enlarged view of a pressure sensitive switch utilized in the apparatus of FIG. 1;

FIG. 3 is an elevational view of a modification of the apparatus of FIG. 1;

FIG. 4 is a diagrammatic view of a more elaborate end sensing mechanism embodying the invention;

FIG. 5 is a fragmentary view taken on the line V—V of FIG. 4;

FIG. 6 is a graphical illustration of certain characteristics of the concentric nozzle of FIG. 4; and

FIG. 7 is an enlarged cross-sectional view of a modification which may be employed in either the apparatus of FIG. 1 or FIG. 4;

FIG. 8 is a cross-sectional view taken on the line VIII—VIII of FIG. 7;

FIG. 9 is a somewhat diagrammatic view illustrating the use of a concentric nozzle of the type illustrated in FIG. 4, in connection with a general purpose gaging apparatus; and

FIGS. 10–12 illustrate modified nozzle constructions suitable for use in the FIG. 4 embodiment of the invention.

DETAILED DESCRIPTION

FIGS. 1–2

FIG. 1 illustrates a simplified form of apparatus embodying the principles of the invention. A cigarette handling drum **1** of conventional construction is provided in its peripheral surface with grooves **1***a*, in each of which a cigarette unit **3** is retained by a conventional vacuum mechanism (not shown). The cigarette unit may be an individual cigarette having both ends exposed to test for loose packing or to test for loose packing at one end and the presence or absence of a filter tip at the opposite end, or it may be a double length filter cigarette with a central double length filter as is conventional in the manufacturer of filter tip cigarettes prior to center cutting them into pairs of individual cigarettes. The drum **1** rotates on a shaft **2** in the direction indicated by the arrow. As it rotates, the opposite ends of each groove

1*a* pass adjacent a pair of test heads 4. Each test head is supplied with air from a convenient source of compressed air through a conduit 5 and a fixed restriction 6. Each test head also includes a nozzle 7 downstream from the restriction 6 having its tip closely spaced from the ends of the cigarettes passing on the drum 1*a*. The pressure between the nozzle 7 and the restriction 6 is conveyed through a conduit 8 to a pressure sensitive switch 9, shown in detail in FIG. 2. The pressure sensitive switches 9 on the opposite sides of the drum 1 control a solenoid 10 which actuates pneumatic ejecting mechanism 11. The latter mechanism is effective to turn off the vacuum which is holding the cigarette in the groove, and to supply compressed air to the bottom of the groove, so that the cigarette is ejected from the surface of the drum 1. Any other suitable mechanism may be used to eject the defective cigarettes, for example, a pneumatic axial ejection mechanism.

Each of the switches 9 includes a housing 12 enclosing a chamber 13 connected to the conduit 8. One side of the chamber 13 is closed by a flexible pressure sensitive diaphragm 14 which carries at its center a switch contact 15 cooperating with a stationary contact 16. The chamber on the opposite side of diaphragm 14 is vented to the atmosphere, as at 12*a*. A coil spring 17 biases the diaphragm 14 toward contact closing position. Closure of either of the switches 9 completes a circuit, obvious in FIG. 1, from a suitable source of electrical energy, indicated as a transformer 18, to the solenoid 10. The switches 9 are in parallel with respect to the transformer 18 and the solenoid 10, so that either switch is effective to energize that solenoid.

When the cigarette end opposite the nozzle tip is tightly packed or carries a filter tip, i.e. the cigarette has acceptable end textured fabrication, the pressure in the test head 4 downstream from the restriction 6 remains within a predetermined, relatively high range, and is not greatly different from the pressure encountered when the nozzle is opposite the end of drum 1, between two of the grooves 1*a*. On the other hand, when a loosely packed cigarette or one devoid of a filter tip is encountered, the pressure drops substantially allowing the switch contacts 15, 16 to be closed by the spring 17.

Furthermore, the jet tends to remove loose particles of tobacco from the non-filtered end of cigarettes, thereby accentuating the drop in pressure. On the other hand, the mechanical feelers of the prior art may not detect a loosely packed cigarette end, since the feeler itself presses against the tobacco and tends to increase its density of packing while the test is being made. Consequently, the apparatus of the present invention detects some loosely packed cigarettes which are passed by the prior art apparatus.

Both ends of the cigarette are tested simultaneously, and if either is found to be loosely packed or one end is found to be devoid of a filter tip, the cigarette has unacceptable end textural fabrication and is ejected by energization of the solenoid 10. The time required to operate the switch 9 and energize the solenoid 10 to make the ejecting mechanism effective, must be coordinated with the time required for the movement of the cigarette on the drum surface from a position adjacent the test heads 4 to a position adjacent the ejecting mechanism 10. If necessary, suitable memory mechanisms may be used to remember which cigarettes are defective and to eject them at a subsequent point in their travel along the drum or other conveying mechanism.

It has been found that when a simple nozzle such as is illustrated in FIG. 1 is employed, it is necessary to have the nozzle spaced no farther than 1/32" from the end of the cigarette. Under such cirumstances, the pressure range than can be used in the nozzle air supply is from about 0.5 to about 5.0 pounds per square inch. A lower pressure results in a loss of sensitivity. Any greater pressure tends to blow tobacco out of the ends of even solidly packed cigarettes.

FIG. 3

This figure illustrates a modified orientation of the test head 4 with respect to the drum 1 and the cigarettes 3 retained thereon. It may be seen in FIG. 3 that the orientation of the test head 4 has been changed from FIG. 1, so that the axis of the nozzle 7, instead of being directed along a line perpendicular to the ends of the cigarettes, is directed so that it makes an acute angle x with the center line of the cigarette. The axis of the test head 4 and of the nozzle 7 is preferably located in a plane extending radially with respect to the axis of the drum 1, so that the discharge from the nozzle 7 has a component directed radially inward toward the axis of the drum 1. Such an angular mounting of the test head 4 and of the nozzle 7 compensates for the loss of fluid from the nozzle between the cigarettes 3, where the surface of the drum is approximately one cigarette radius below the outermost surface of the cigarette.

The angular mounting shown in FIG. 3 may have the axis of the test head either in a vertical plane, a horizontal plane or any plane which is radial or substantially radial with respect to the drum 1.

FIGS. 4–6

The apparatus illustrated in these figures is operable at a higher pressure input range and also permits a greater range of clearance between the end of the nozzle and the cigarettes. While the clearance between the nozzle and the end of the drum 1 does not vary substantially as the drum rotates, it will be appreciated that the cigarettes are not always placed on the drum at exactly the same position, so that the clearance between the cigarette end and the nozzle may vary.

There is shown in FIG. 4 a nozzle 20 having a central passage 21 of circular cross-section and a peripheral passage 22 of annular cross-section. Compressed filtered air at a regulated pressure, preferably between five and ten pounds per square inch, is supplied from a pump or compressor 23 through a conduit 24 to the passage 21. Air also flows from the conduit 24 through a fixed restriction 25 and a conduit 26 to the passage 22. The restriction 25 is designed to maintain the pressure in the passage 22 just high enough to keep that passage clear of tobacco particles or any other foreign materials which might tend to clog it. A pressure of about one-half pound per square inch or less is preferred. The jet of air issuing from passage 21 has a relatively high velocity, while the air flowing through passage 22 has a relatively low velocity.

Cigarettes to be tested move past the tip of the nozzle 20 on a drum 2 having grooves 27*a* in which cigarettes 28 are retained by conventional means. The conventional cigarette is approximately 5/16" in diameter. Satisfactory results have been obtained with a nozzle configuration having the following dimensions: outside diameter of nozzle, 0.200"; the largest diameter of passage 22—0.127"; smallest diameter of passage 22—0.088"; diameter of passage 21 at tip—0.050".

FIG. 6 illustrates the variation in pressure in the annular passage 22 as a fraction of the distance of the nozzle tip from a perpendicular flow blocking surface. In the particular test illustrated by way of example, pressure of the air supply to the inner nozzle was 5.0 p.s.i. gage, as illustrated by the dotted line 60. With both the nozzles completely unobstructed, the pressure measured in the passage 22 was 0.5 p.s.i. gage, as indicated at 61.

With both nozzles completely blocked, the pressure measured in both nozzles was substantially equal to the higher of the two supply pressures, namely 5.0 p.s.i., as shown at point 62. As the position of the blocking surface moves away from the nozzle, the pressure in the nozzle 22 decreases along the curve 63 and at about 0.04" from the blocking surface the pressure in passage 22 has dropped substantially to atmospheric as indicated by the point 64. As the distance from the nozzle tip to the blocking surface increases further the pressure in the passage

22 drops below the atmospheric pressure, reaching a minimum at about 0.1". The pressure in passage 22 thereafter increases gradually as the spacing from the nozzle tip to the blocking surface increases, reaching substantially atmospheric pressure again at about 0.24" from the blocking surface, and thereafter increasing gradually to the supply pressure of 0.5 p.s.i., as shown at 61.

It is desirable to operate a pressure detecting apparatus such as that shown on the steepest part of the curve, so that the sensitivity will be a maximum. This steepest part occurs between points 62 and 64. It is, of course, desirable to allow some clearance between the nozzle tip and the surface being gaged. A spacing of about 1/32" is presently preferred, making the point 67 the datum pressure, or the normal pressure encountered when the air jet impinges on a tightly packed cigarette or a filter tip. When this spacing is used with cigarettes, a drop in pressure is encountered whenever a loosely packed cigarette end or one devoid of a filter ti ppasses the nozzle. While the space between cigarettes on the drum also causes a drop in pressure, the drop is less pronounced and is readily distinguishable from a drop in pressure due to a loosely packed cigarette end. While the mechanism which loads the cigarettes onto the drum may not get every one in exactly the same axial position along the drum, nevertheless, the variation in axial position is less than that caused by loose packing or the absence of a filter tip, so that the axial position variation is of the same order of magnitude as that caused by the spaces between the cigarettes.

Other points on the curve 63 may be used as operating datums. For example, a point in the negative pressure region may be used. Some points in that region will produce two pressure changes in response to a loosely packed cigarette, i.e., a reduction in pressure followed by an increase in pressure, as the pressure moves through the minimum on the curve. Even such a system may be used, since the initial reduction in pressure serves as a defective cigarette signal and the following increase in pressure may be discarded. Alternatively, if a point such as 66 were used as the datum, the presence of a cigarette with a loose end or one devoid of a filter tip would be indicated by an increase in pressure in the passage 22, rather than a decrease. Such an increase could be used as a signal indicating that the cigarette should be rejected. The presence of the negative pressure region in the curve 63 is believed to be due to a Bernoulli effect. In other words, in that region, the air flowing through the center nozzle and deflated by the obstructing surface produces an eddy in the region of the tip of the passage 22 which effectively sucks air out of the passage 22 and reduces the pressure at that point. It may be described as an aspirating effect.

The pressure in the passage 22 is sensed by a suitable pressure level sensing device. If a cigarette having a loosely packed end or one devoid of a filter tip passes adjacent the nozzle tip, the pressure in the passage 22 drops markedly.

The pressure sensing device may be a switch such as shown at 9 in FIG. 2. More preferably, there is provided a fluid amplifier device 29 of a conventional type known as a fluidic Schmitt trigger. The Schmitt trigger 29, which may have a construction and character of operation described in "Fluidic Systems Design Guide" published by the Fluidonics Division of the Imperial-Eastman Corporation of Chciago, Ill., receives a supply of compressed air from the conduit 24 and is provided with two input ports 29*a*, 29*b*. Port 29*a* is connected to conduit 26. The port 29*b* is connected through a conduit 30 and a valve or variable restriction 31 to the compressed air supply conduit 24.

The term "Schmitt trigger" is derived from an analogous electronic device. The Schmitt trigger 29 responds to the difference in pressure at the ports 29*a* and 29*b*. When that difference in pressure falls below a predetermined value which may be adjusted by means of the valve 31, the Schmitt trigger 29 switches the flow of air from one of its output ports 32 to a second output port 33. When the pressure difference is above that value, the Schmitt trigger discharges compressed air only from its output port 32. The output ports 32 and 33 are connected to the input ports of a conventional proportional fluid amplifier 34 such as one of the type described in the aforementioned publication. The fluid amplifier 34 is supplied with compressed air from the main air conduit 24 and a branch conduit 35. The output conduits 36 and 37 of the fluid amplifier 34 are connected to an ejection mechanism actuating device 38, which may be similar to that shown at 11 in FIG. 1.

As an alternative to the Schmitt trigger, a proportional amplifier may be used, or several such amplifiers may be cascaded.

It will be understood that in any cigarette manufacturing machine, a duplicate of the apparatus shown in FIG. 4 would be provided at the opposite side of the machine to test the opposite ends of the cigarettes, and that such duplicate mechanism would also be connected to the ejection mechanism 38.

Where the cigarettes move past the test head by means of a drum 27, the end surfaces 27*b* (see FIG. 5) of the drum between the grooves 27*a* should provide a response in the pressure sensing mechanism which is equivalent to that produced by a tightly packed cigarette or one with a filter tip.

The bottom of each groove 27*a* should be semi-cylindrical so as to fit closely around the cigarette without air gaps at the sides thereof. It may be desirable to extend the sides of the groove radially outward for a very short distance beyond the semicylindrical bottom. If that is done, the surfaces 27*b* between the grooves become more effective to block the air flow from the nozzles and would thus give a pressure indication more nearly the same as that of a good cigarette. On the other hand, any such extension of the sides of the grooves outwardly beyond the semicylinder necessarily provides a small air gap on each side of each cigarette. The effect of these air gaps would be in the opposite sense. In other words, they would tend to indicate a defective cigarette when the cigarette was actually not defective. The extension of the groove sides beyond the semicylinder should therefore be very small, if used at all.

The center line of the nozzle, whose path of movement with respect to the cigarettes is indicated by the line 53 in FIG. 5, should not be located radially outwardly (away from the drum axis) from the center lines of the cigarettes, if the nozzle is aligned with the cigarettes as shown in FIGS. 1 and 4. The center line of the nozzle may possibly be inside the center lines of the cigarettes, but in that event, the largest diameter of the passage 22 should not overlap the bottom of the grooves 27*a*.

If the nozzle is angled with respect to the center line of the cigarettes, as shown in FIG. 3, then the center line of the nozzle should intersect the center lines of the cigarettes, or perhaps may intersect the ends of the cigarettes at a point slightly radially inwardly toward the drum axis from the positions of the cigarette center line.

FIGS. 7–8

Where the cigarettes are conveyed by some other type of conveying mechanism which does not have smooth surfaces between the grooves, as are encountered in the case of the drum 27, it may be necessary to provide between the nozzle and the Schmitt trigger 29 a synchronous valve mechanism such as that illustrated in FIGS. 7 and 8. The valve mechanism includes a disk 41 rotating on a shaft 42 and provided with a number of peripheral holes 41*a*. The conduit 26 is connected to directly opposed ports on the opposite sides of a housing 43 in which the disk 41 rotates. Thus, the conduit 26 is open through to the pasage 22 only during those intervals when a cigarette is passing the end of the nozzle. During the intervening intervals, the conduit 26 is effectively blocked, and

thus a high pressure reading is supplied to the port **29a** of the Schmitt trigger through the conduit portion **26a** from the restriction **25**, since the flow through that restriction is then reduced substantially and the pressure drop across it is also substantially reduced.

FIG. 9

This figure illustrates a concentric nozzle **44** used in a gaging or measuring apparatus. The apparatus is mounted on a support **45**. A post **46** projects upwardly from the support **45** and carries a ring **47** in which the nozzle **44** is mounted. The nozzle **44** is provided with an outer annular passage **48** and an inner passage of circular cross-section **49**. The inner passage is connected by means of a conduit **50** to a source of compressed air at high pressure. The outer conduit **48** is connected to a conduit **51** to a source of compressed air at a lower pressure. The conduits **50** and **51** may correspond respectively to the conduits **24** and **26** of FIG. 4. The pressure in the conduit **51** may be measured and that measurement may be taken as a determination of the distance X between the tip of the nozzle **44** and a test piece **52** resting on the support **45**.

In either of the modifications of FIG. 4 or FIG. 9, the high pressure stream may be introduced through the peripheral annular passage and the central circular passage may be used for the pressure measurement. However, when the passages are reversed in that fashion, the pressure measurement is not as sensitive, and the tip of the nozzle must be placed closer to the surface being tested.

FIGS. 10–12

FIGS. 10–12 illustrate additional nozzle constructions suitable for use in the FIG. 4 embodiment of the invention.

The nozzle of FIG. 10 is fabricated of a housing **55** of rectangular cross section and hermetically closed at its remote end. An internal curvelinear diaphragm **56** is positioned across the longer cross-sectional dimension of the housing with the edges of the diaphragm hermetically secured to the interior surfaces of the latter. The diaphragm **56** provides separate internal chambers **57** and **58**. The chamber **57** corresponds to the passage **21** of the FIG. 4 nozzle construction and is supplied with compressed air through the conduit **24**, and the chamber **58** comprises the pressure sensing chamber corresponding to the passage **22** of the FIG. 4 nozzle and receiving low pressure air through the conduit **26**. The longer cross-sectional dimension of the housing **55** is, of course, selected to be less than a diameter of cigarettes to be tested and the positioning of the diaphragm **56** within the housing is selected to provide air discharge ports of relative cross-sectional areas suitable for adequate sensing sensitivity in relation to the volume of air discharged from the chamber **57**.

FIG. 11 illustrates a nozzle construction essentially similar to that shown in FIG. 4 except that the passage **21** of the latter is provided in the FIG. 11 construction by a central hollow tube **60** which extends through a hollow closed housing **61** in hermetically isolated relation to the latter and is joined by a suitable coupling **62** to the conduit **24**. The annular passage **22** of the FIG. 4 construction is provided in the FIG. 11 arrangement by a plurality of hollow sensing tubes **63** which surround the tube **60** as shown and which communicate with the interior of the housing **61** to receive low pressure air through the conduit **26**. The tube **60** and tubes **63** are maintained in assembled relation at their exit ends by any convenient means such as soldering or brazing.

In the FIG. 12 nozzle construction, the high pressure inspection air discharge passage is provided by a hollow tube **65** preferably having an inwardly tapered nose portion **66**, and the sensing chamber is provided by a hollow tube **67**. The air discharge ends of the tubes **65** and **67** are closely spaced as shown, and the tubes are supported by a support member **68** with the tube axes forming an acute angle to each other and to the axis of the cigarettes to be inspected as illustrated in FIG. 12.

The characteristic operation of each of the FIGS. 10–12 nozzle constructions is essentially the same as the nozzle **20** of FIG. 4 and accordingly will not be further considered.

While I have shown and described certain preferred embodiments of my invention, other modifications thereof will readily occur to those skilled in the art.

I claim:

1. Apparatus for testing the texture of the ends of cigarettes comprising:

(a) means defining a path of movement for cigarettes to be tested;

(b) test head means adjacent at least one of the ends of cigarettes moving along said path; and

(c) means for removing defective cigarettes from said path;

wherein the improvement comprises:

(d) at least one nozzle in said test head means, having its open end directed toward and closely spaced from the adjacent end of cigarettes moving along said path;

(e) means for conveying a flow of gas into each said nozzle and thence out of said open nozzle end and against said adjacent cigarette end;

(f) means located adjacent each said open nozzle end for detecting a gas pressure resulting from the gas flow from each said nozzle against said adjacent cigarette end; and

(g) means responsive to a gas pressure in each said detecting means and effective to actuate said removing means whenever the pressure varies substantially from a range of values produced by acceptable end textural fabrication of the cigarette.

2. Apparatus as defined in claim **1**, in which said improvement further comprises:

(a) at least one pair of non-intercommunicating passages in each said nozzle, said passages having open ends directed toward and closely spaced from said adjacent end of said cigarette;

(b) said gas flow conveying means includes means to convey gas to said passages at different pressures; and

(c) said gas pressure responsive means is responsive to the pressure in at least one of said passages in at least one of said pairs thereof.

3. Apparatus as defined in claim **2**, in which said pairs of passages of said each nozzle are positioned in side-by-side relation to direct gas flow out of said open ends thereof along approximately parallel paths toward said adjacent cigarette end.

4. Apparatus as defined in claim **3**, in which one of said passages is provided by a central hollow tubular member and the others of said passages are provided by a group of hollow tubular members surrounding said central tubular member and having axes parallel thereto, and wherein said gas flow conveying means includes means to convey gas to said central tubular member at one pressure and to convey gas to said group of tubular members in common at another pressure.

5. Apparatus as defined in claim **2**, in which said pairs of passages of said each nozzle are provided by individual elongated generally tubular hollow members fixedly supported with their axes forming an acute angle to each other and to the axis of a cigarette moved into opposing relation to the open ends thereof.

6. Apparatus as defined in claim **2**, in which said pair of passages are comprised by an inner passage and an outer passage concentric with said inner passage and the gas flow conveying means conveys gas to the inner passage at a substantially higher pressure than to the outer passage.

7. Apparatus as defined in claim **6**, in which the outer passage is annular in cross-section and has its largest diameter at the nozzle tip smaller than the diameter of

a cigarette, and the inner passage is circular in cross-section and has a diameter at the nozzle tip from about one thirty-second to about 3/16 inch.

8. Apparatus as defined in claim 2, in which said gas flow conveying means supplies gas to one of said passages of said pair thereof at a pressure in the range from five to ten pounds per square inch gage, and to the other passage of said pair at a pressure of about one-half pound per square inch gage.

9. Apparatus as defined in claim 8, in which the nozzle is spaced from the adjacent end of the cigarettes from about one thirty-second to about one-quarter inch.

10. Apparatus as defined in claim 1, in which:

(a) said path defining means comprises a rotating drum having grooves in its outer surface, each groove being adapted to receive one cigarette to be tested;

(b) said test head means comprises a pair of test heads, one adjacent each end of the drum, each test head being adapted to test all the cigarette ends at its one end of the drum;

(c) the periphery of said drum between the grooves being effective to block the flow of gas from the nozzles in the test heads and thereby give a pressure reading corresponding to that indicative of an acceptable textured cigarette end; and

(d) the pressure responsive means at both said test heads are effective to actuate the ejecting means, so that a cigarette is ejected if either end is unacceptably textured.

11. Apparatus as defined in claim 1, including means connecting said pressure responsive means to said nozzle, said connecting means including intermittently opened valve means synchronized with the moving cigarettes and opened only when a cigarette is passing said test head means.

12. Apparatus as defined in claim 1, in which the stream of air from said each nozzle impinges substantially perpendicularly on said adjacent cigarette end.

13. Apparatus as defined in claim 1, in which:

(a) said movement path defining means comprises a rotating drum having grooves on its periphery to receive cigarettes; and

(b) said each nozzle is directed so that its stream of air is deflected radially inwardly of the drum by the adjacent cigarette end.

14. Pneumatic measuring apparatus, comprising:

(a) a support for a work piece having a dimension to be measured;

(b) test head means adjacent said support;

(c) means for conveying gas under pressure to said test head means;

wherein the improvement comprises:

(d) a nozzle on said test head means opening toward a work piece on said support, said nozzle having at least one pair of non-intercommunicating passages providing open passage ends directed toward said work piece;

(e) said gas flow conveying means conveys gas to the passages of each pair thereof at different pressures; and

(f) measuring means responsive to the gas pressure in at least one of the passages of said each pair thereof.

15. Apparatus as defined in claim 14, in which said pair of passages of said nozzle are comprised by an inner passage and an outer passage concentric with said inner passage and said gas flow conveying means conveys gas at a relatively high pressure to the inner passage of said nozzle, and said measuring means is responsive to the pressure in the outer passage of said nozzle.

16. The method of testing an end of a cigarette to determine the acceptability of end textural fabrication thereof, wherein the improvement comprises the steps of:

(a) expelling a jet of air from an open nozzle end directed toward and closely spaced from the end of a cigarette to be tested; and

(b) measuring the pressure of air, resulting from the jet striking the end of a cigarette, at a locality adjacent the nozzle opening.

17. The method defined in claim 16, comprising the further steps of:

(a) directing at least a pair of jets of air from nozzle ends directed toward and closely spaced from an end of a cigarette to be tested, the jets flowing at different velocities; and

(b) measuring the pressure of the air in the lower-velocity jet.

18. The method as defined in claim 17, in which said pair of jets have inner and outer concentric relation with one another and the inner one of said concentric jets flows at a pressure of about five to ten pounds per square inch gage and the outer of said concentric jets flows at a pressure of about one-half pound per square inch gage.

19. The method defined in claim 16, in which said jet of air is perpendicular to the end of the cigarette.

20. The method defined in claim 16, in which said cigarette is supported in a groove having a semi-cylindrical contour matching that of the cigarette, and said jet of air is directed toward the end of the cigarette along a directional axis intersecting the bottom of the groove.

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