

[54] **CIGARETTE INSPECTION SYSTEMS**

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[58] Field of Search73/38, 40, 40.5 R, 45, 45.1,
73/45.2, 37.6, 37.7; 131/21 B

[56] **References Cited**

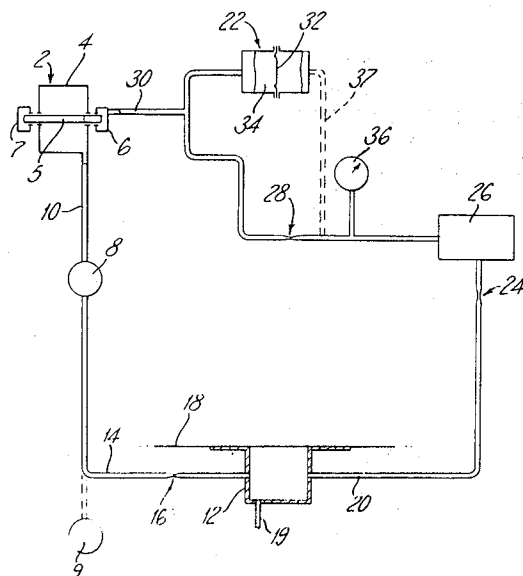
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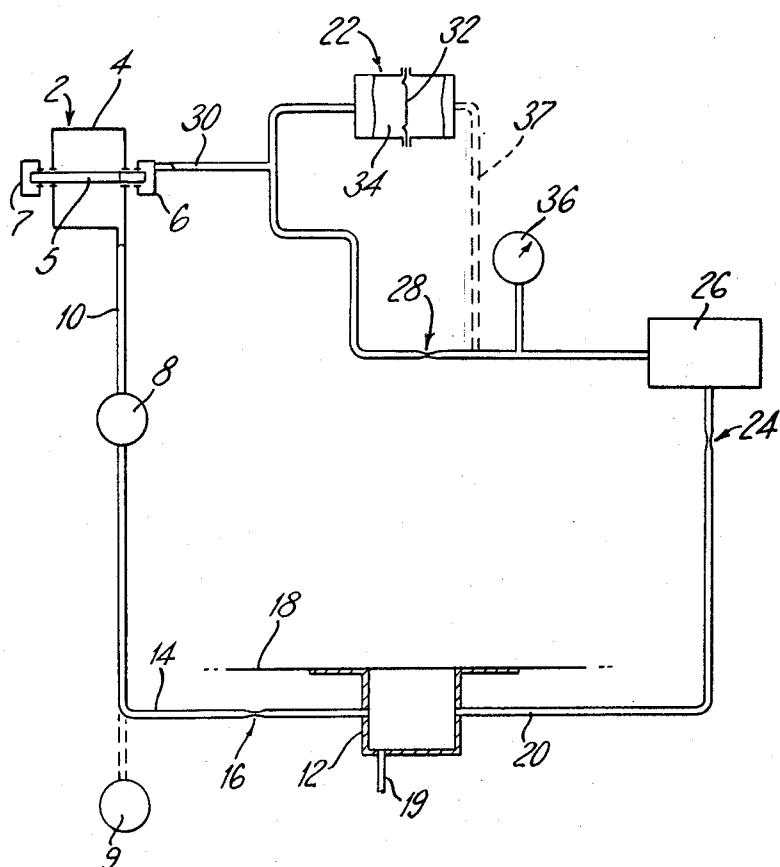
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[57] **ABSTRACT**

A cigarette testing system includes a wrapper tester for detecting leaks in the wrappers of the cigarettes, means operated by the wrapper tester for ejecting faulty cigarettes, and means for testing the porosity of the web of wrapper material before it is formed into cigarette wrappers, the porosity tester comprising means for passing air through the wrapper web to generate a pressure signal dependent upon the degree of porosity of the wrapper material, and a pipe for conveying the pressure signal via a reservoir to the wrapper leak detector to provide compensation for the varying porosity of the wrapper material.

18 Claims, 1 Drawing Figure





CIGARETTE INSPECTION SYSTEMS

This invention is concerned with cigarette testing systems in which the wrapper of each cigarette is tested pneumatically for leaks. Any wrapper which allows more than a predetermined air flow through it is regarded as faulty and the cigarette is ejected. The wrapper test may for example be as described in U.S. Pat. No. 3,266,295.

Some cigarette wrappers are of a paper of which the porosity can vary considerably. At moments when the paper porosity is unusually high, the leak test of the cigarette wrapper tends to suggest a leaky wrapper even though the wrapper is in fact properly formed. On the other hand, where the paper porosity is exceptionally low, the air flow through the wrapper during the wrapper test could still be normal even though the wrapper has a definite hole or faulty seam. Accordingly it is desirable to test the porosity of the paper to obtain a porosity signal which governs the level of air flow through the wrapper above which the wrapper should be regarded as unsatisfactory so as to warrant ejection of the cigarette. One way of doing this is described in patent application Ser. No. 765,375, filed Oct. 7, 1968.

According to the present invention the porosity tester comprises a box which is connected via a restrictor to a source of positive or negative pressure and has an opening across which the web of wrapper material is drawn so that the inside of the box communicates with atmosphere through the part of the web closing off the opening. In addition there is a pipe leading from the box to transmit a variable pressure, depending upon the paper porosity, to a pressure transducer or other device sensitive to the variable pressure. It will be appreciated that the pressure in the box at any moment depends upon the paper porosity; the greater the porosity, the lower will be the level of positive or negative pressure in the box.

An example of a suction system according to this invention is shown in solid lines in the accompanying diagrammatic drawing.

In the drawing the cigarette wrapper tester is shown generally by the reference numeral 2. The principle is similar to that described in the above patent in that suction is connected to a testing station to a chamber 4 surrounding each cigarette 5 in turn when it is at the testing station, and a pressure signal is obtained from an end space defined by closure means 6 enclosing one end of the cigarette, while the other end of the cigarette is closed by closure means 7. It is important to note, however, that the closure means 6 surrounds the cigarette end with a deliberate clearance giving a leak to atmosphere and there may in addition be a further predetermined leakage path to atmosphere, as described in patent application Ser. No. 795,279 filed Jan. 30, 1969, now U.S. Pat. No. 3,608,380.

A suction source 8 is connected to the chamber 4 by a pipe 10 so as to establish a suction pressure in the chamber 4 at a level of, for example, 13 inches of water gauge. The suction source 8 is also connected to a box 12 of a porosity testing device by means of a pipe 14 including a restrictor 16. The box has a bleed 19 to atmosphere. One side of the box has an opening (or a number of openings) across which is drawn a paper web 18 which is subsequently wrapped around a tobacco filler to form a continuous cigarette rod, for example by means of a cigarette making machine as described in

British Pat. No. 916,141. The cigarettes 5 are made by joining sections of this continuous rod to short filter sections, and the completed cigarettes are then tested in the wrapper tester 2. The web completely closes the opening or openings in the side of the box, but its porosity allows air to flow through it and into the box, the amount of flow at any particular moment being dependent on the degree of porosity of the paper.

The restrictor 16 and bleed 19 are preferably adjustable to enable the level of suction in the box to be readily varied. This facilitates the balancing of the porosity signal with the wrapper test signal.

A pipe 20 leading from the box 12 connects the inside of the box to one end of a pressure transducer 22 via a restrictor 24, a reservoir 26 and a restrictor 28; the restrictor 24 may be variable. This pressure transducer 22 is also connected by a pipe 30 to the end space in the closure means 6 of the wrapper tester. The transducer 22 includes a diaphragm 32 which is exposed to pressure in a space 34 and provides an electrical output signal in accordance with the pressure in the space 34. The pressure is determined mainly by the pressure signal from the wrapper tester via the pipe 30, but there is an additional compensating signal from the porosity tester. When the porosity of the paper is comparatively high, the suction pressure signal transmitted to the transducer by the pipe 20 is comparatively low, so that the signal from the pipe 30 must be comparatively high before the output from the transducer reaches the level at which cigarette ejection takes place. On the other hand, when the paper porosity is comparatively low, the suction pressure signal transmitted to the transducer by the pipe 20 is comparatively high, so a smaller signal from the pipe 30 will result in the transducer receiving a net pressure such as to cause the cigarette to be ejected.

In addition there is a suction pressure gauge 36 which gives a visual indication of the porosity pressure signal and facilitates the adjustment of the level of the mean porosity signal.

The reservoir 26 has the effect of providing a relatively long time constant. That is to say, it smooths out short-term variations in the porosity pressure signal. There may be a bleed to atmosphere from the reservoir, in which case the bleed 19 may be omitted.

As an alternative it is possible to use positive pressure in the box 12 instead of negative pressure. For this purpose, the pipe 14 would be disconnected from the suction source 8 and would be connected instead to a source of positive pressure 9, for example 13 inches of water gauge. The positive pressure signal transmitted from the box by the pipe 20 would then not be connected to the same end of the transducer as the wrapper tester (i.e. to the pipe 30) but would instead be connected to the opposite end of the pressure transducer, as shown by the dotted line 37. In other words, from just upstream the restrictor 28 (or from just downstream) there would be a pipe leading to the space in the transducer on the side of the diaphragm opposite to the space 34. This would provide the same compensating effect as in the case of a negative pressure signal connected to the other end of the transducer, as shown in solid outlines.

In both the examples, the side of the box 12 along which the paper web 18 is drawn may be convex in-

stead of being straight as shown. This is especially desirable in the case of positive pressure being used in the box 12; the tension in the paper web in this case is needed to hold the paper against the box and prevent the paper from being lifted from the box by the air pressure in the box, the approaching and departing lengths of web being inclined to one another so that the web is partly wrapped round the box.

The pressure or suction signal from the porosity may be transmitted as a series of pulses timed to coincide with the testing of successive cigarettes (i.e. with the emission of suction pulses from the pipe 30). This is useful particularly if the electronics circuit coupled to the transducer is an A.C. circuit. For example, the pipe transmitting the porosity pressure signal from the reservoir 26 may for example include a rotary valve with porting such that its inlet and exit ports communicate and thus transmit the porosity pressure signal for a short period once during every revolution of the valve, the speed of the valve being N times the speed of the fluted drum carrying the cigarettes during the wrapper test, where N equals the number of flutes on the fluted drum. During the part of each revolution in which the valve is not transmitting the porosity pressure signal through its exit port, the valve preferably vents its exit port to atmosphere.

What I claim as my invention and desire to secure by Letters Patent is:

1. A cigarette testing system including a wrapper tester for detecting leaks in the wrappers of the cigarettes, means operated by the wrapper tester for ejecting faulty cigarettes, and means for testing the porosity of the web of wrapper material before it is formed into cigarette wrappers, the porosity tester comprising means for passing air through the wrapper web to generate a pressure signal dependent upon the degree of porosity of the wrapper material, and a pipe for conveying the pressure signal via a reservoir to the wrapper leak detector to provide compensation for the varying porosity of the wrapper material.

2. A testing system according to claim 1 in which the wrapper tester includes a diaphragm transducer which is fed with a pressure signal from a pneumatic wrapper testing device and which produces an electrical output signal indicative of the air flow through the wrapper of each cigarette, the pressure signal generated by the porosity tester being fed also to the diaphragm transducer so as to apply a bias reinforcing the wrapper test signal.

3. A testing system according to claim 2 in which the wrapper test signal and porosity signal are of opposite senses and are applied to opposite sides of the diaphragm of the transducer.

4. A testing system according to claim 3 in which the wrapper test signal is a negative pressure signal while the porosity signal is a positive pressure signal.

5. A testing system according to claim 1 in which the pressure signal from the porosity tester is fed to the wrapper tester as a series of pulses timed to coincide with the testing of successive cigarettes by the wrapper tester.

6. A testing system according to claim 1 in which the porosity tester comprises a box which is connected via a restrictor to a source of positive or negative pressure and has an opening across which the web of wrapper

material is drawn, so that air flows between the atmosphere and the inside of the box through the part of the web which lies across the opening.

7. A testing system according to claim 6 in which the box includes a vent to atmosphere.

8. A testing system according to claim 7 in which the vent is adjustable to vary the mean stretch of the porosity signal.

9. A cigarette testing system including a wrapper tester for detecting leaks in the wrappers of the cigarettes, means operated by the wrapper tester for ejecting faulty cigarettes, and means for testing the porosity of the web of wrapper material before it is formed into cigarette wrappers, the porosity tester comprising a box which is connected via a restrictor to a source of positive or negative pressure, means defining an opening across which the web of wrapper material is drawn, so that air flows between the atmosphere and the inside of the box through the part of the web which lies across the opening and thus produces a variable pressure in the box dependent upon the porosity of the web, and pipe means for conveying this variable pressure as a porosity signal to the wrapper tester to provide compensation at the wrapper tester for the varying porosity of the wrapper material.

10. A testing system according to claim 9 in which the box includes a vent to atmosphere.

11. A testing system according to claim 10 in which the vent is adjustable to vary the mean strength of the porosity signal.

12. A testing system according to claim 9 in which the wrapper tester includes a diaphragm transducer which is fed with a pressure signal from a pneumatic wrapper testing device and which produces an electrical output signal indicative of the air flow through the wrapper of each cigarette, the pressure signal generated by the porosity tester being fed also to the diaphragm transducer so as to apply a bias reinforcing the wrapper test signal.

13. A testing system according to claim 9 in which the wrapper test signal and porosity signal are of opposite senses and are applied to opposite sides of the diaphragm of the transducer.

14. A cigarette testing system comprising a wrapper tester for detecting leaks in the wrapper of the cigarettes and including a pneumatic wrapper testing device which feeds test pressure signals to one side of the diaphragm of a diaphragm transducer which produces an electrical output signal indicative of the air flow through the wrapper of each cigarette, and a porosity tester comprising means for passing air through the wrapper web before it is formed into cigarettes to generate a porosity pressure signal dependent upon the degree of porosity of the wrapper material, the porosity pressure signal being of opposite sense to the test pressure signals produced by the pneumatic wrapper testing device, and including means for feeding said porosity pressure signal and test pressure signals to opposite sides of the diaphragm of the transducer.

15. A testing system according to claim 14 in which the wrapper test signal is a negative pressure signal while the porosity signal is a positive pressure signal.

16. A cigarette testing system including a wrapper tester for detecting leaks in the wrappers of successive

cigarettes and for producing a pressure signal indicative of the air flow through each cigarette wrapper in turn, and means for testing the porosity of the web of wrapper material before it is formed into cigarette wrappers, the porosity tester comprising means for passing air through the wrapper web to generate a pressure signal dependent upon the degree of porosity of the wrapper material, and means for conveying this pressure signal as a series of timed pulses to the wrapper tester to provide compensation for the varying porosity of the wrapper material, the timing of these pulses being arranged to coincide with the testing of successive cigarettes by the wrapper tester.

17. A method of testing cigarettes comprising pneumatically testing the wrapper of each cigarette to produce a first pneumatic test signal, feeding the first test signal to a diaphragm transducer giving an electrical output signal, pneumatically testing the porosity of

the web of material used to form the wrappers of the cigarettes before being used to form the cigarette wrappers to produce a second pneumatic test signal, and feeding the second pneumatic test signal to the diaphragm transducer so as to apply a bias reinforcing the first signal to a degree dependent upon the porosity of the web.

18. A method of testing cigarettes formed from a tobacco rod wrapped in a continuous web of wrapping material, comprising continuously testing the porosity of the web of wrapping material before it is formed into the rod wrapper, testing the cigarettes for air leaks in their wrappers, rejecting unsatisfactory cigarettes according to the results of such wrapper testing, and controlling the sensitivity of said cigarette wrapper testing in accordance with the results of said porosity test of said web of wrapping material.

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