

"EQUIPMENT AND METHOD FOR TESTING CIGARETTES"

Field of the Invention

The present invention is related to testing of cigarettes during the use thereof, and particularly refers to the form of determining the flaking generated by the cigarette while being smoked.

Description of the prior art

Lit cigarettes generate two kinds of ashes, that which is produced by the combustion of the tobacco and that which results from the burning of the paper that forms the tubular wrapping or envelope of the cigarette. The tobacco ashes are coherent and their coming apart is generally the result of light tapping provided from time to time by the smoker. The paper ashes, however, disintegrates in an independent manner. The ashes are released from the cigarette in the form of small floccules - named flakes in English - due to their reduced cohesiveness or lack thereof. The occurrence of this flaking depends on the properties of the raw material used, such as the type of paper employed to make the cigarette and the additives contained therein.

In Fig. 1, which illustrates a lit cigarette, there are depicted the two types of ash. Namely, the ash 12 resulting from the combustion of the tobacco, and the ash 13, produced by the burning of the paper 11, which involves the former and is juxtaposed thereto, without however adhering to the tobacco ash. Due to the reduced cohesiveness of some flakes of the paper and the tobacco ashes, these flakes come loose in the form of flakes 14 that fall upon clothes, home tables, work tables, floors, carpeting, etc., which is unpleasant to the consumer.

Thus, the cigarette producing companies are engaged in continuous research efforts to evaluate the influence of the raw materials on the flaking effect. Such research involves quantitative testing to determine

the amount of flakes produced by the various combinations of papers and additives, where such tests must be conducted in a standardized manner to allow an objective comparison of the effects of each variable.

There have existed for some time so-called "smoking machines" that use internationally standardized procedures to simulate the action of smoking. Such procedures include the suction of smoke in standard amounts and at standard intervals, mimicking the action of an average consumer. However, such type of equipment is static and does not simulate the motions of the smoker's hand, and thereby fails to reproduce in a realistic manner the actions of the consumer. Furthermore, it is necessary to quantify, in a safe and reliable manner, the result of the modifications introduced in the raw materials, in order to allow an objective ascertainment of the improvements eventually achieved.

Objects of the invention

In view of what has been set forth above, the first object of the present invention consists in the provision of equipment that may reproduce the motion of the cigarette during the act of smoking.

A second object of the invention consists in allowing a standardization of the actions of the smoker during the consumption of the cigarette, in order to allow a comparison between the modifications introduced while experimenting with the composition of the raw material.

A third object consists in allowing the said standardization to be adjustable in order to allow the reproduction of the actions of various categories of smokers.

A fourth object consists in the provision of means to measure, in an objective manner, the results obtained in the various tests.

Summary of the invention

The above and other objects are achieved by the provision of a

movable holder coupled to the cigarette insertion mouthpiece or nozzle, allowing the same to effect predictable and programmable motions.

According to another characteristic of the invention, the said holder is embodied as a mechanical arm coupled to drive means allowing
5 the mouthpiece where the cigarette is inserted to move both in the horizontal and the vertical directions.

According to a further characteristic of the invention, the said mouthpiece is coupled, by means of the arm itself, to a suction pump that simulates the smoker's inhaling action.

10 According to one other characteristic of the invention, the equipment is provided with a percussion device that simulates the tapping of the smoker to release the tobacco ash.

According to still another characteristic of the invention, there are provided means to program the movements of the said arm, of the said
15 pump and of the said percussion means in order to provide various cycles of operation of the equipment.

According to another characteristic of the invention, the flaking is collected separately from the tobacco ash, in order to allow the quantification thereof.

20 According to still another characteristic, the said quantification is provided by a method that comprises the collection of the flaking on a plate, the scanning of the said plate and the conveyance of the information thus obtained to data processing means for analysis.

Description of the figures

25 The advantages and characteristics of the invention will be better understood from the description of a preferred embodiment thereof, provided for illustrative purposes and not intended to be limitative, and from the figures to which it refers, wherein:

Figure 1 illustrates a lit cigarette and the two types of ash produced thereby.

Figure 2 illustrates the proposed smoking simulation equipment, according to the principles of the invention.

5 Figure 3 illustrates the simulating equipment while in use, according to the principles of the invention.

Figure 4 illustrates a flow diagram of the method used for testing, according to the principles of the invention.

Detailed description of the invention

10 Referring now in more detail to Fig. 2, the smoking action simulating equipment is comprised of a housing 20 of substantially parallelepiped shape, having attached to the lower base 21 thereof a first supporting bracket 22 to which vertical tab portion 23 there is attached the horizontal rotation device 24 that comprises a first support block 25
15 fastened by screws 28 to the said tab portion 23, having on its part a rotation driving means 26 that drives a vertical shaft 27 that causes the rotation of the arm 38 that supports the mouthpiece 39 on the horizontal plane. To the said shaft there is attached the vertical rotation device 30, which comprises a second supporting bracket 31 which vertical tab portion
20 is secured by welding 29 to the said vertical shaft 27. A second support block 32 is supported on the horizontal tab portion 33 and fastened thereto with screws (not depicted in the figure), to which is associated the rotation drive device 34 that produces the motion of the said arm on the vertical plane. The shaft 35 of this motor, which passes through the block 32, has
25 affixed to its end 36 a third block 37 for supporting the arm 38 in the shape of a hollow tube and in which distal end, which projects outside the said housing 20, is fitted the mouthpiece 39 whereinto the cigarette is inserted (not depicted in this figure) for purposes of testing.

Still according to the illustration of Figure 2 and in accordance with the principles of the invention, the proximal end 41 of the said tubular arm is coupled to a flexible pipe 42, which in turn is coupled to a suction pump (not illustrated) which action simulates the act of inhaling. The figure
5 further shows the device 47 that impacts the arm 38 to simulate the tapping of the user to release the tobacco ash, where the said device is supported by a clamp 46, which in turn is fastened to the said first support base 25 by the screw 45.

The devices used in the equipment are known in the art and do
10 not individually constitute the object of the present invention. Therefore, in the preferred embodiment of the invention, as disclosed herein, the rotation drivers 26 and 34 are pneumatically actuated. However, there may be employed other actuation means, such as hydraulic and electric drives (in stepper motors), such possibility also applying to the percussion device 47.
15 The suction pump is also of a known type, and is preferably of electrically driven type. The equipment further comprises course limit sensors, which have been omitted from the figure for purposes of clarity. The figure also shows the sensor device 43 supported by a clamp 44, which in turn is fastened to the said first support base 25 by means of a screw (not referred
20 in the figure). The function of the device 43 consists in determining the point at which the arm 38 is supposed to alternate the vertical and horizontal motions.

The operation of the arrangement of devices illustrated in Fig. 2, comprising the horizontal 26 and vertical 34 drive motors, the suction
25 pump connected to the piping 42 and the percussion device 47, is controlled by a computer provided with adequate software, associated to electrical interface devices (in the cases of the suction pump and the sensor 43) and pneumatic interface devices (in the cases of the drive means 26, 34

and the percussion device 47).

Fig. 3 illustrates the proposed equipment in the condition of use to effect tests, where the front part of the housing 20 is closed by a front cover 50, which in the present exemplary embodiment is provided with an L-shaped opening 51 through which the arm 38 protrudes.

The test is performed according to the sequence illustrated in Fig. 4: initially, an acrylic plate 48 (shown in Fig. 3) is placed on the table or workbench wherein the equipment is located, and this plate is positioned substantially below the region where the cigarette moves (step 61 of the sequence shown in Fig. 4). Subsequently, according to step 62, a cigarette 47 is inserted into the mouthpiece 39 and lit. Both the said mouthpiece 39 and the procedure used to insert the cigarette therein follow a standardized procedure, there being generally adopted the ISO 3308 standard.

The operator now checks whether any flaking has been released during this initial lighting step (step 63). In the affirmative, the acrylic plate is withdrawn, cleaned and repositioned (step 64). Thereafter, the operator initiates the operation of the sequencing means - step 65 - where the said sequencing means controls the performance of the cycle of simulation of the smoking action, comprising the L-shaped displacement, vertically and horizontally, of the arm 38, as well as the periodic aspiration of a certain volume of smoke by the suction pump, such aspiration occurring at previously specified time intervals. The percussion means that strikes the arm 38 to release the tobacco ash is actuated at every n cycles of the L-shaped motion, when the end of the arm and the respective mouthpiece are outside the acrylic plate 48, that is, in the portion 52 of the slit 51, and there may be placed below this location a receptacle 49 for collection of these ashes. The number of L-shaped motion cycles between successive actuations of the percussion means is programmable, and there

may be adopted any value in such connection, for example from 4 to 8 cycles. The arm motion speed, in both the vertical and the horizontal directions, may also be adjusted. Still in accordance with data previously obtained from practice, the amount of air aspirated by the suction pump
5 that simulates the inhaling action of the user is also adjustable, there being adopted in the present example the amount prescribed in the ISO 3308 standard, that specifies an inhaling of 35 cubic centimeters during 2 seconds, at intervals of 1 minute. The final check, step 66, takes place after a previously determined number of cycles, with subsequent removal of the
10 plate wherein was collected the flaking released during the test, step 67. This plate, which is carefully handled to avoid altering the disposition of the flaking, is taken to an optical scanning device (scanner), step 68, which will generate an image containing the information relative to the quantity of floccules detached from the cigarette during the test. This information is
15 then subjected to processing by a specific software, step 69, in order to calculate the rate of occupation of the plate by the floccules. The greater is the occupation rate, the poorer will be the quality of the cigarette. The resulting data are compared with the data obtained in previous tests involving other raw materials, for the purpose of minimizing or event
20 eliminating the flaking effect.

Although the invention has been described on the basis of a specific embodiment thereof, there may be introduced modifications in the same by technicians skilled in the art, without deviation from the spirit and the scope of the basic inventive concept. Thus, for example, the motion of
25 the mouthpiece that holds the cigarette is not restricted to an L-shaped course, as there may be adopted other configurations for the course followed by the mouthpiece.

Furthermore, constructive details may be modified, such as,

for example, the joining of the second supporting bracket 31 to the vertical shaft 27 may be provided by means other than the welding 29, as there may be employed other means such as a clamp.

5 Additionally, instead of the programmable logic controller used in the preferred embodiment described above, there may be used an electromechanical sequencing device, or even an electronic sequencing device comprised by discrete elements and programmed by dipswitch keys, obviously with a lesser number of options and variations than in the case of use of the said logic controller.

10 Therefore, the invention is described and delimited by the set of claims that follows.

CLAIMS

1. Equipment for testing of cigarettes which simulates the actions performed by a user while consuming a cigarette, comprising an arm provided with a mouthpiece for insertion of a cigarette and means for horizontal and vertical displacement of the said mouthpiece, smoke aspiration means and means for releasing the tobacco ash, characterized in that the operation of the means for horizontal displacement is independent from the one of the means for vertical displacement thereby providing at least two degrees of freedom for the mouthpiece; and

the means for releasing the tobacco ash are provided by a device for percussion of said arm.

2. Equipment, as claimed in claim 1 **characterized** by the said smoke aspiration means comprising a flexible piping coupled to the proximal end of the said tubular arm, the said piping being coupled to a suction pump.

3. Equipment, as claimed in claim 1, **characterized** by the said displacement means being provided by a first and a second rotation driving means whose axes are provided in the vertical and the horizontal directions, respectively.

4. Equipment, as claimed in claim 3, **characterized** in that the said driving means are pneumatically operated.

5. Equipment, as claimed in claim 4, **characterized** in that the said driving means are hydraulically operated.

6. Equipment, as claimed in claim 4, **characterized** in that the said driving means are electrically operated.

7. Equipment, as claimed in any one of the preceding claims, **characterized** in that the operation of the said motors, suction pump and

percussion means is controlled by a programmable logic controller.

8. Equipment, as claimed in claim 7, **characterized** in that the said programmable logic controller is associated to interface devices.

9. Equipment, as claimed in claim 8, **characterized** in that the
5 said programmable logic controller is associated to pneumatic interface devices.

10. Equipment, as claimed in claim 8, **characterized** in that the said programmable logic controller is associated to hydraulic interface devices.

10 11. Equipment, as claimed in claim 8, **characterized** in that the said programmable logic controller is associated to electric interface devices.

12. A method for testing cigarettes in an equipment provided with means to simulate the use of a cigarette by the user, comprising the
15 vertical and horizontal displacement of the cigarette, the simulation of the act of inhaling and the simulation of the tapping to release the tobacco ashes, **characterized** by comprising the following steps:

- positioning an acrylic plate on the table or workbench where the equipment is placed, substantially below the region where the cigarette
20 moves;

- insertion of a cigarette in a mouthpiece provided in the said equipment and lighting thereof;

- operation of the equipment providing one or more cycles of displacement of the said mouthpiece, under the control of a controlling
25 means;

- switching off of the equipment after a certain number of cycles;

- removal of the said acrylic plate containing the floccules

released during the test and scanning of the said plate;

- provision of the data obtained by the scanning operation to means for quantification, processing and analysis of the results.

13. A method, as claimed in claim 12, **characterized** by
5 comprising the cleaning and repositioning of the plate after lighting the cigarette and prior to the beginning of the step of operation of the equipment.

14. A method, as claimed in claim 12, **characterized** by the
said cycles comprising the vertical and horizontal displacement of the said
10 mouthpiece wherein the cigarette is inserted, as well as the periodic aspiration of a certain volume of smoke by a suction pump.

15. A method, as claimed in claims 12, 13 or 14, **characterized** in that the said operation comprises the simulation of tapping to release the ash at every n cycles.

16. A method, as claimed in claim 15, **characterized** in that
15 the said simulation is provided by the percussion of the supporting element of the said mouthpiece.

17. A method, as claimed in claims 12 or 14, **characterized** in
that there may be programmed the aspired volume, the interval between
20 aspirations and the velocity thereof, in the simulation of the act of inhaling.

18. A method, as claimed in claims 12 or 14, **characterized** in
that both the speed of displacement of the said mouthpiece and the course
followed thereby during each operating cycle may be adjusted.