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(54) Title: WAX TESTER

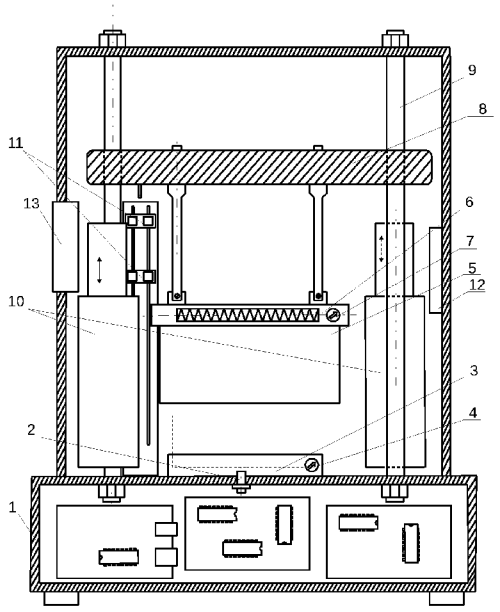

Fig. 1

(57) Abstract: The invention relates to a wax tester, in particular beeswax, cosmetic waxes or waxes used in pharmaceutical formulations and articles like all kinds of candles or grave lanterns, designed to discern between the standard wax and waxes modified by substances which reduce its quality, which is easy to operate, portable, able to be commonly used in case of need. Different physical properties of a pure wax and wax modifying substances, enable recording and directing for reading by properly programmed electronic systems co-operating with the analyzer, the times connected with the rate of passing of a penetrating element through the wax being tested, depending on the kind and content of analyzed sample components.

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Wax tester

The invention relates to a tester of beeswax, cosmetic waxes or waxes used in pharmaceutical formulations and articles like all kinds of candles or grave lanterns, designed to discern between the natural wax and waxes modified by substances altering properties thereof, easy to operate, portable, able to be commonly used in case of need.

In consideration of growing prices of the natural beeswax, one of the numerous problems of the modern bee-keeping is modifying such a wax with additives. A modified wax, in particular used by beekeepers for a low-quality foundation, produces an effect of deteriorating condition of bee families, and also reducing quality of other products made of it.

Among known and widely applied methods of assessing wax quality an organoleptic method is used, which, unfortunately, identifies its adulterations unsatisfactorily. Other methods, which enable unequivocal detection of adulteration of wax, is e.g. gas chromatography coupled with mass spectrometry (GCMS), FTIR spectroscopy, scanning calorimetry (DSC), or X-ray diffraction, however, such analyses are carried out in laboratories on a specialized equipment, restricting their availability to foundation makers and beekeepers.

The object of the invention was to provide a portable device, easy to operate and able to be commonly used in case of need, serving to discern between the natural wax and a wax doped with substances which reduce its quality, by measuring physical properties discriminating them.

A wax tester according to the invention is constructed of a base, with a display fixed on its front panel and an internal chamber, where a power unit with the microcontroller is provided to control operation of the device, to record a measurement result and send it to the display. At the upper surface of the base a holder is provided for a tested wax sample with a temperature sensor, and above it, vertically in the middle, a transverse guide is mounted with the sample-penetrating element mounted below it along with a heater and temperature sensor graduated in the range of wax softening. Tips of guide's arms are loosely mounted on two vertical rods, where two

microactuators are also installed to control sliding guide movement up to the home position, after passing the penetrating element through the wax. On the base, in addition, a panel is mounted with two transoptors for determining the time of sample penetration, and the whole is enclosed in a casing with an opening window at the front panel, to provide access to the holder provided for placing a sample.

It is preferred that the element penetrating the wax sample is in a form of a horizontally mounted heated rod, tube, plane such as, e.g. a knife or a vertical needle or a rod with a sharpened tip.

It is also preferred that holder for placing a sample is located on a rotatable axis mounted on the base, which enable cutting the same sample in various places for a more detailed analysis thereof.

It is preferred that the casing is provided with open-work walls with a fan and a Peltier module with a heater, controlled by the microcontroller for faster cooling-down the interior of the analyzer to a programmed temperature of a subsequent consecutive measurement.

An electronic circuit in a form of the properly programmed microcontroller controls advancement and retraction of the microactuators, to enable gravitational descent of the guide along with the wax penetrating element, followed by lifting it up and holding in a home position for a subsequent measurement.

Additionally, by the use of a temperature sensor, the system controls the temperature of the entire device, to bring it to the initial temperature before the start of the each subsequent measurement, and also controls the temperature and pressure force of the element penetrating the sample and time of its passage through the wax, depending on the kind and content of sample modifying components. Signals from the transoptors determine the moment when the element penetrating the sample reaches the starting and final positions in a sample. These measurements are passed to the microcontroller, differentiated and compared to the penetration time range adopted for the standard e.g. the natural wax, and then displayed on an LCD screen, in the form of two numerical values, one - the penetration time of the element through a tested sample and the other - the percent value expressing a difference from the analogous time for the standard wax, which illustrates presence of modifying substances.

Pure natural waxes of various origin are characterized by approximate physical features such as an elasticity or viscosity at the given temperature conditions, a melting point, and also a heat conduction, consequently exhibiting approximate average penetration rates. Different shorter times, even by several hundred %, are exhibited by the doped waxes.

The invention is disclosed in the following embodiment and on the drawing, wherein fig. 1 visualizes a structure of the wax tester in a cross-sectional view.

The wax tester according to the invention is constructed of a base 1, with a display fixed on its front panel in a form of an LCD screen, and an internal chamber, where a power unit with the microcontroller is provided. To control the mechanical part of the device, properly programmed Arduino Mega 2560 microcontroller was used, and controlled, stabilized DC power units were used for supplying power to the heater and actuators. At the upper surface of the base a holder 3 is provided on a rotatable axis 2 for a tested wax sample, with a temperature sensor 4, and above it vertically in the middle, a transverse guide 8 is mounted with an element 5 mounted below it in a form of a copper knife along with a heater 6 and temperature sensor 7. Loosely mounted tips of guide's arms are sliding along two vertical rods 9, where two microactuators 10 are installed. On the base, in addition, a panel is mounted with two transoptors 11, and the whole is enclosed in a casing with a shutting window at the front panel, to provide access to the holder provided for placing a sample. The whole is enclosed in a casing, and a fan 12 and a Peltier module with a heater 13, controlled by the microcontroller is mounted on the internal walls thereof, and an opening window is located at the front panel to provide access to the holder provided for placing a sample.

The invention includes the following aspects:

1. A wax tester constructed of a base with a display fixed on its front panel and an internal chamber, where a power unit with the microcontroller is provided to control operation of the device, in which at the upper surface of the base 1 a holder 3 is provided on the tested wax sample with a temperature sensor 4, and above it vertically in the middle a transverse guide 8 is mounted with an element 5 mounted below it for penetrating a sample, along with a heater 6 and temperature sensor 7, wherein tips of guide's arms are mounted on two vertical rods 9 where two microactuators are also

installed 10 to enable upward movement of the guide to a home position after passing the penetrating element through the wax, and on the base, in addition, a panel is mounted with two transoptors 11 for determining the time of sample penetration, and the whole is enclosed in a casing with a shutting window at the front panel, to provide access to the holder designed for inserting the sample.

2. The tester according to item 1, in which the element 5 penetrating the sample is in a form of a heated rod, tube or plane e.g. a knife, or a vertical needle or a rod with a sharpened tip, and is made of a material with good heat conduction.

3. The tester according to item 1, in which the holder 3 for placing a sample is located on a rotatable axis 2 mounted on the base, which enables a change the sample position and cutting it in various places for a more detailed analysis thereof.

4. The tester according to item 1, in which the casing is provided with open-work walls with a fan 12 and a Peltier module with a heater 13, controlled by the microcontroller.

Claims

1. A wax tester constructed of a base with a display fixed on its front panel and an internal chamber, where a power unit with the microcontroller is provided to control operation of the device, **characterized in that** at the upper surface of the base (1) a holder (3) is provided on the tested wax sample with a temperature sensor (4), and above it vertically in the middle a transverse guide (8) is mounted with an element (5) mounted below it for penetrating a sample, along with a heater (6) and temperature sensor (7), wherein tips of guide's arms are mounted on two vertical rods (9) where two microactuators are also installed (10) to enable upward movement of the guide to a home position after passing the penetrating element through the wax, and on the base, in addition, a panel is mounted with two transoptors (11) for determining the time of sample penetration, and the whole is enclosed in a casing with a shutting window at the front panel, to provide access to the holder designed for inserting the sample.

2. The tester according to claim 1, **characterized in that** the element (5) penetrating the sample is in a form of a heated rod, tube or plane e.g. a knife, or a vertical needle or a rod with a sharpened tip, and is made of a material with good heat conduction.

3. The tester according to claim 1, **characterized in that** the holder (3) for placing a sample is located on a rotatable axis (2) mounted on the base, which enables a change the sample position and cutting it in various places for a more detailed analysis thereof.

4. The tester according to claim 1, **characterized in that** the casing is provided with open-work walls with a fan (12) and a Peltier module with a heater (13), controlled by the microcontroller.

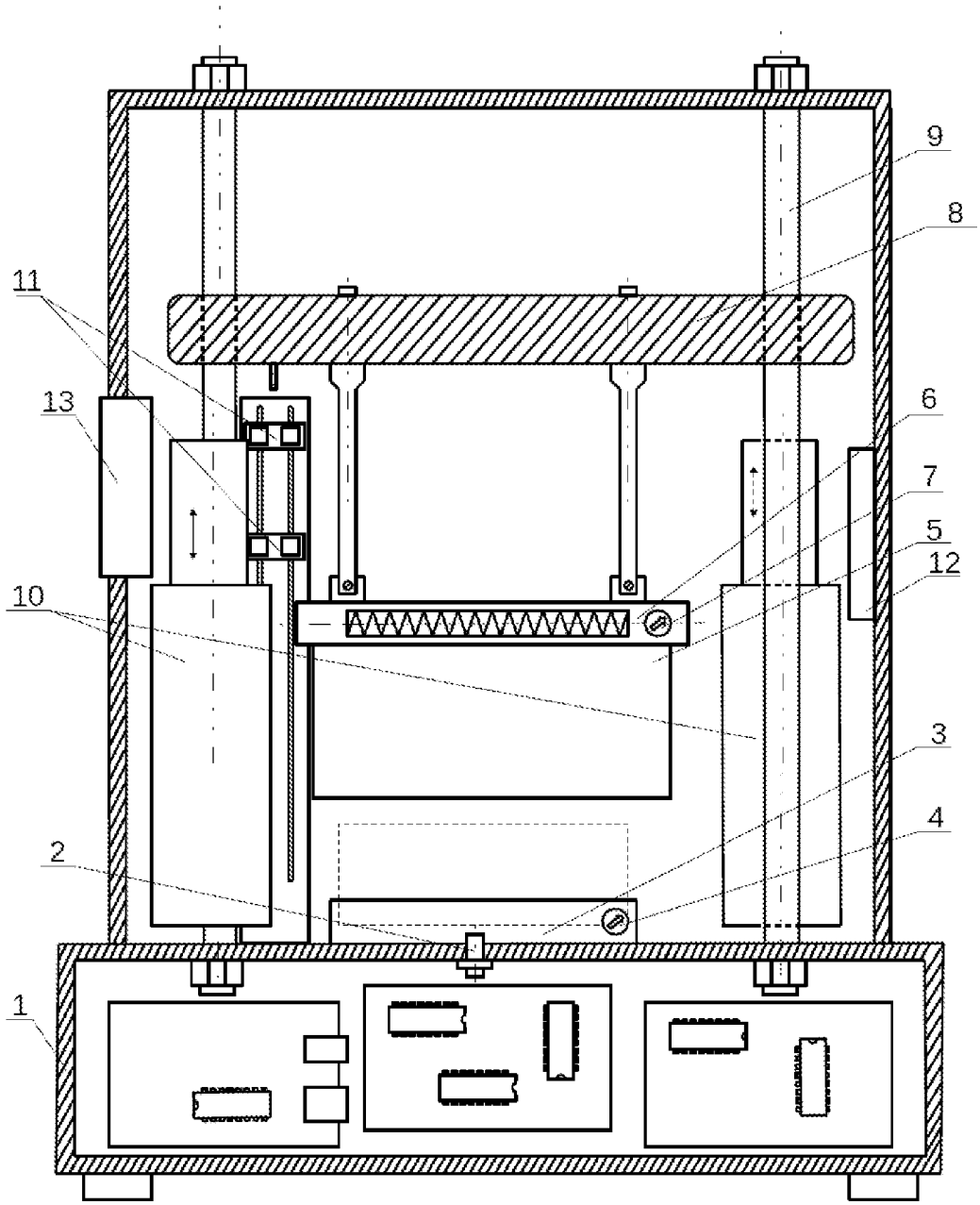

Fig. 1