Feb. 22, 1966 W. P. NEAL, JR 3,236,090

CALIBRATING DEVICE FOR RADIATION GAUGE

Filed July 9, 1963

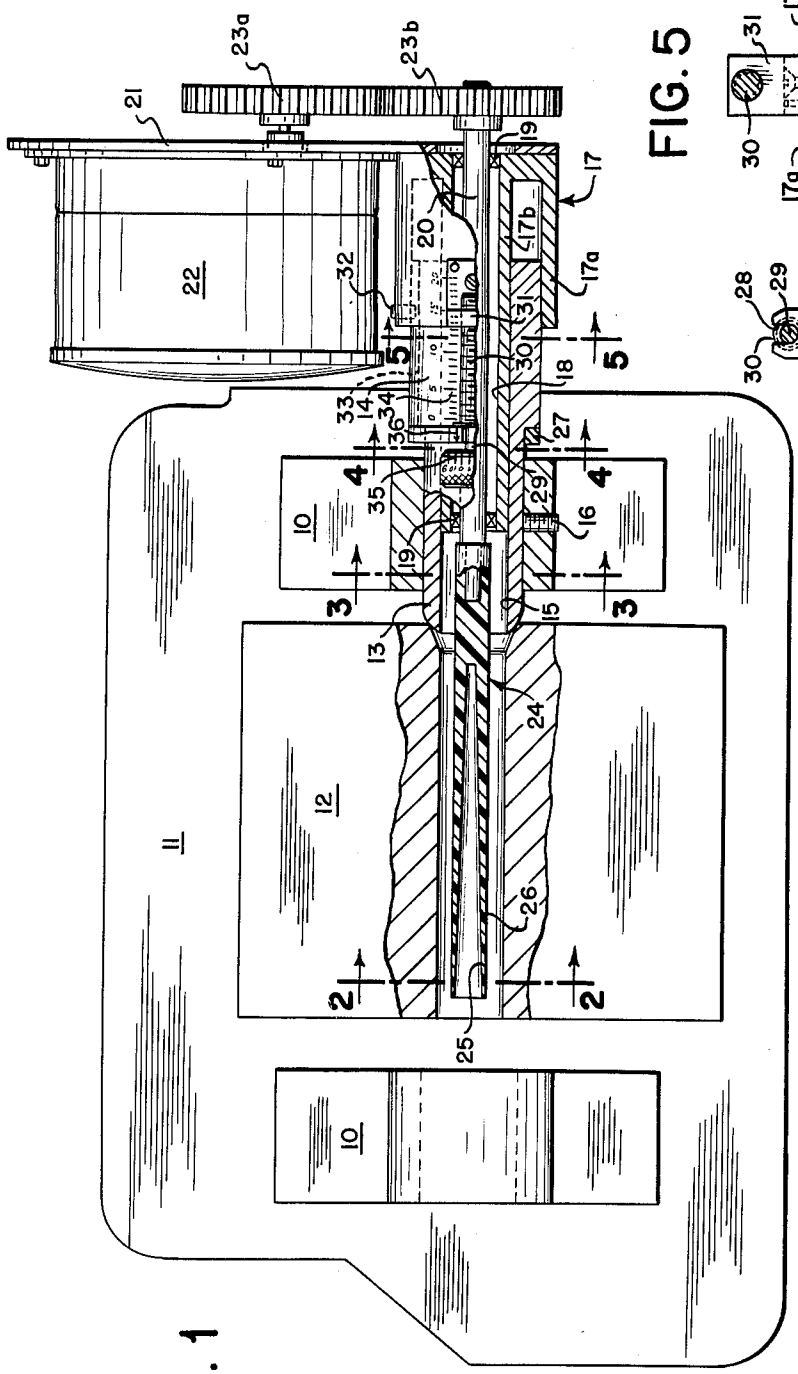


FIG. 1

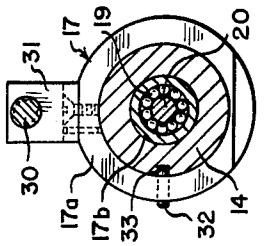


FIG. 5

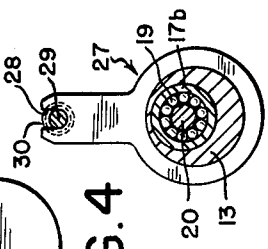


FIG. 4

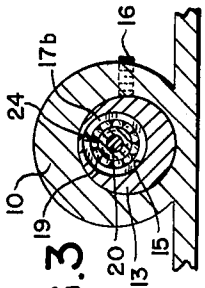


FIG. 3

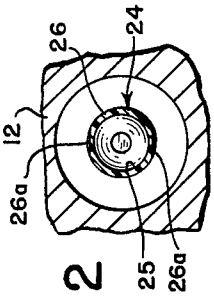


FIG. 2

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CALIBRATING DEVICE FOR RADIATION GAUGE

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This invention relates to a calibrating device for a gauge in which radiation passing through an object from a source of radiation is measured to determine the density of the object.

A gauge of this type is frequently used in cigarette making machines to control the density of tobacco in a cigarette rod. In producing the rod, tobacco is delivered at a controlled rate onto a strip of paper formed into a generally U-shaped trough, then the ends of the trough are overlapped and sealed to form a rod which is ultimately cut into cigarette lengths. In order to control the density of the cigarettes, and hence their tobacco content, the cigarettes are passed through a guide which directs their longitudinal path through a radiation gauge. The radiation, generally beta rays from a suitable source, passes through each cigarette as the cigarette moves axially through the gauge, and the radiation which is not adsorbed by the cigarette is measured by a detector. The strength of the detected radiation is thus a measure of the density of the tobacco in the cigarette, and the resulting signal is used to control the rate of feed of tobacco to the rod-forming stage.

Whenever a cigarette making machine provided with a radiation-type control gauge is shut down with a resulting upset in the control of feed tobacco for the rod-forming stage, a considerable period of the subsequent starting-up operation must be devoted to adjusting the tobacco feed for the desired tobacco density in the cigarettes. There is need, therefore, for a device for calibrating the radiation gauge of each cigarette making machine so that the gauge and the machine can be promptly re-set to assure proper tobacco density control as soon as that machine is re-started.

I have now devised a calibrating device for radiation-operated gauges that measures the amount of radiation adsorbed by the measured object. My novel calibrating device comprises a hollow tube of radiation-permeable material, the interior bore of the tube being tapered to provide tube walls of axially varying density and the exterior of the tube being provided with at least one longitudinally extending flattened surface. Axial centering means are provided for positioning the axis of the tube in a predetermined position in the gauge with the tube axis normal to the flow of radiation in the gauge, and longitudinal positioning means are provided for moving the tube along said predetermined axial position so as to obtain the desired degree of adsorption of radiation. Rotating means are further provided for rotating the tube about its axis at a predetermined speed so as to establish a standard for the gauge reading which is characteristic for the desired density measurement.

These and other novel features of the calibrating device of the invention will be more readily understood from the following description taken in conjunction with the drawings in which:

FIG. 1 is a side elevation, partly broken away and partly in section, of the calibrating device mounted in the cigarette guide holder of a maker;

FIG. 2 is a section taken along line 2—2 in FIG. 1;

FIG. 3 is a section taken along line 3—3 in FIG. 1;

FIG. 4 is a section taken along line 4—4 in FIG. 1; and

FIG. 5 is a section taken along line 5—5 in FIG. 1.

The calibrating device of the invention is shown in

FIG. 1 mounted in one of the cigarette guide holders **10** conventionally secured to a mounting plate **11** of the detector assembly. These guide holders normally hold guides which direct the path of cigarettes along an axial path between a source of radiation and a detector for the radiation that passes through the moving cigarettes. Between the cigarette guide holders **10** there is mounted on the plate **11** a conventional beta ray source-detector **12** adapted to detect beta rays from a source on the viewing side of the center line of the two holders **10**.

The calibrating device consists of two sections which are adjustably interconnected. One section is the mounting element and the other section is a tube-holding, positioning and rotating element. The mounting element section comprises a cylindrical mandrel portion **13** integrally formed with a cylindrical body portion **14** of larger diameter than the mandrel portion. The mandrel portion is eccentrically positioned with respect to the axis of the body portion, and both portions are provided with a central bore **15** which is axially positioned in the body portion and hence eccentrically positioned within the mandrel portion. Inasmuch as the cigarette guide holder **10** is conventionally provided with an eccentric bore which the mandrel portion **13** is designed to fit, rotation of the mandrel portion within the guide holder permits axial alignment of the bore of the mounting element section with the normal axis of cigarettes passing through the radiation gauge assembly. The mandrel is held in this aligned position by a set screw **16** mounted in the guide holder.

The other section of the calibrating device comprises a double sleeve body portion **17**, the outer sleeve **17***a* being adapted to fit slidingly over the outside of the body portion **14** of the mounting element section and the inner sleeve **17***b* being adapted to fit slidingly within the bore **15** of the mounting element section. The inner bore **18** of the inner sleeve **17***b* is provided at each end thereof with a bearing **19** in which is mounted a calibrating tube drive shaft **20**. The drive shaft extends rearwardly out of the double sleeve body portion **17** and through a mounting plate **21** on which both the double sleeve body portion and a synchronous electric motor **22** are mounted. The motor is connected by gears **23***a* and **23***b* to the drive shaft **20**. The inner end of the drive shaft is force-fitted into a calibrating element **24** of plastic material such as a methyl methacrylate resin. The end of the calibrating element mounted on the shaft is solid except for a recess into which the inner end of the drive shaft **20** is fitted. The major portion of the calibrating element is provided with a tapered bore **25** which thus forms a tubular portion **26** having a side wall of axially varying thickness or density. As shown in FIG. 2, at least one, and preferably two, diametrically opposite flat areas **26***a* are provided lengthwise of the tubular portion **26** so as to provide a discontinuity in the thickness or density of any selected axial portion of the tube when it is rotated about its axis.

The two sections of the calibration device of the invention are interconnected by an adjusting element which, after the mandrel portion **13** of the mounting section is positioned in the guide holder **10**, permits controlled axial movement of the tapered tube **26** so as to present any desired thickness of tube in the path of the radiation through the gauge. This adjusting element comprises an arm **27** which is force-fitted onto the inner end of the mandrel portion **13**. The end of the arm is provided with a slot **28** adapted to engage a narrow neck portion **29** of an adjusting screw **30**. The other end of the screw engages a threaded angle bracket **31** which is screw-fastened to the double sleeve body portion **17**. Thus, as the knurled knob of the screw **30** is turned, it moves the

double sleeve body portion 17 either toward or away from the mounting element section. This motion, which is purely axial as insured by a key 32 in the double sleeve body portion moving in a keyway 33 in the mandrel element body portion 14, imparts the desired axial movement to the calibrating tube 24.

In operation of the calibrating device of the invention, the object is to establish a meter reading which is characteristic of a degree of adsorption of radiation in any individual gauge that corresponds to the desired operating condition for that gauge. This meter reading is established as follows in a cigarette making machine embodying a radiation-type control gauge:

The cigarette guide is removed from its guide holder and is replaced by the mandrel portion of the calibrating device. The calibrating tube, being mounted along the axis of the mandrel, is thus axially centered in the gauge. The gear train is turned by hand until the flattened surface of the tube is normal to the flow of radiation in the gauge, as evidenced by a null in the detector meter. The knurled adjusting screw is then rotated to move the tapered tube axially along its central position until a further null is obtained on the detector meter. This ultimate null reading corresponds to the interposition in the path of radiation of a body having a density representative of the desired density of a cigarette. The motor of the calibrating device is then started, and the resulting rotation of the tube with its one or more flattened surfaces produces a variation in radiation-adsorption which produces as corresponding fluctuations in the detector meter. By rotating the tube at a constant predetermined speed, the reading of the magnitude of the fluctuation of the meter is a reproducible value which is characteristic for the gauge being calibrated. By recording this meter reading for future reference, the subsequent adjustment of the gauge to produce the desired machine operation can be readily achieved by adjusting the knurled screw so as to obtain a null reading which will produce the recorded meter reading for that gauge-machine combination when the tube is rotated at the aforesaid constant speed.

In lieu of using a meter for establishing the desired position of the calibrating tube in the gauge, one can refer to a calibrating scale 34 on the cylindrical body portion 14 of the mounting element section. The position of this body portion can be read from that portion of the scale exposed beyond the inboard edge of the outer sleeve 17*a* of the double sleeve body portion. A further vernier reading is obtained from a circumferential scale 35 on the knurled knob of the adjusting screw 30, this scale being read against a scribe mark 36 on the adjusting element arm 27.

It will be appreciated, accordingly, that the calibrating device of the invention can be readily set, either by reference to the gauge meter or to the scales on the device, or to both, as a means of double checking, so as to obtain a recordable condition which can be reproduced whenever desirable for setting up the optimum operating condition of a cigarette maker provided with a density radiation gauge.

I claim:

1. A device for calibrating a gauge in which radiation passing through an object from a source of radiation is measured to determine the density of the object, the device comprising a hollow tube of radiation-permeable material, the interior bore of the tube being tapered to provide tube walls of axially varying density and the exterior of the tube being provided with at least one longitudinally extending flattened surface, axial centering means for positioning the axis of the tube in a predetermined position in the gauge with the tube axis normal to the flow of radiation in the gauge, longitudinal positioning means for moving the tube along said predetermined axial position, and rotating means for rotating the tube about its axis at a predetermined speed.

2. A device for calibrating a gauge in which radiation passing through an object from a source of radiation is measured to determine the density of the object, the device comprising a hollow tube of radiation-permeable material, the interior bore of the tube being tapered to provide tube walls of axially varying density and the exterior of the tube being provided with two longitudinally extending flattened surfaces positioned diametrically opposite one another, axial centering means for positioning the axis of the tube in a predetermined position in the gauge with the tube axis normal to the flow of radiation in the gauge, longitudinal positioning means for moving the tube along said predetermined axial position, and rotating means for rotating the tube about its axis at a predetermined speed.

3. A device for calibrating a gauge in which radiation passing through an object from a source of radiation is measured to determine the density of the object, the device comprising a hollow tube of plastic material, the interior bore of the tube being tapered to provide tube walls of axially varying density and the exterior of the tube being provided with at least one longitudinally extending flattened surface, axial centering means for positioning the axis of the tube in a predetermined position in the gauge with the tube axis normal to the flow of radiation in the gauge, longitudinal positioning means for moving the tube along said predetermined axial position, and rotating means for rotating the tube about its axis at a predetermined speed.

4. A device for calibrating a gauge in which radiation passing through a cigarette from a source of radiation is measured to determine the density of the cigarette, the device comprising a hollow tube of radiation-permeable material, the interior bore of the tube being tapered to provide tube walls of axially varying density and the exterior of the tube being provided with at least one longitudinally extending flattened surface, rotating means for rotating the tube about its axis at a predetermined speed, axial centering means for positioning the axis of the tube in a position in the gauge corresponding to the position of a cigarette to be measured by the gauge, and longitudinal positioning means for moving the tube along said predetermined axial position.

5. A device for calibrating a gauge in which radiation from a source thereof is measured after passing through a cigarette moving through a guide held in fixed position with respect to the source of radiation in order to determine the density of the cigarette, the calibrating device comprising a hollow tube of radiation-permeable material, the interior bore of the tube being tapered to provide tube walls of axially varying density and the exterior of the tube being provided with at least one longitudinally extending flattened surface, axial centering means comprising a hollow mandrel adapted to be held by the cigarette guide holder for positioning the axis of the tube in a position in the gauge corresponding to the position of a cigarette moving through the gauge, longitudinal tube positioning means extending through the hollow mandrel, tube supporting means rotatably mounted in the tube positioning means, rotating means for rotating the tube about its axis at a predetermined speed, and adjusting means for moving the tube positioning means longitudinally of the tube so as to move the tapered tube into a position within the gauge such that the density of the tube corresponds to the density of the cigarette.

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