

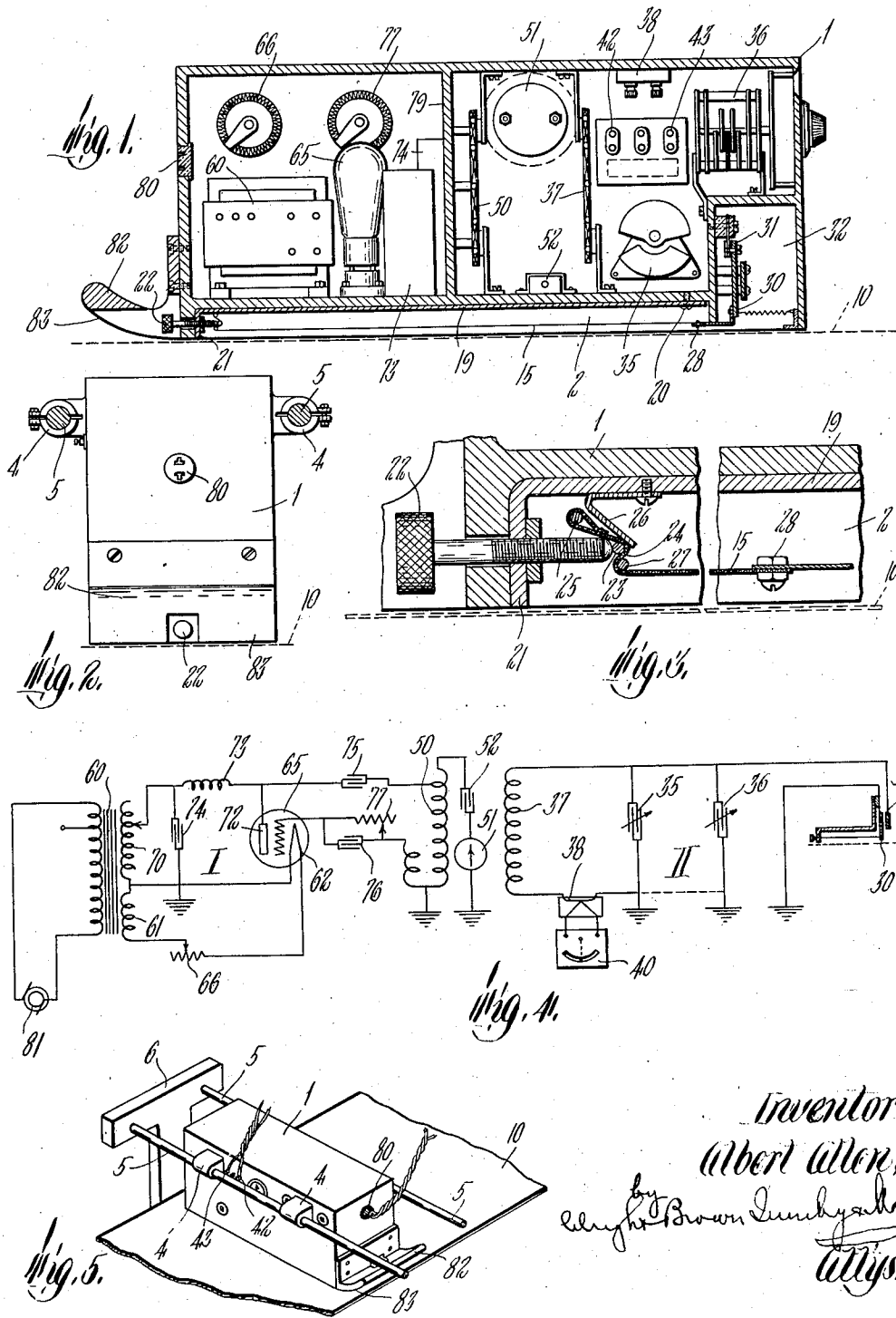
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A. ALLEN

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HYGROMETER

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Inventor:
 Albert Allen,
 by
 Wright Brown Lumbrey
 Atty.

UNITED STATES PATENT OFFICE

ALBERT ALLEN, OF WINCHESTER, MASSACHUSETTS, ASSIGNOR TO ATLANTIC PRECISION INSTRUMENT COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

HYGROMETER

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This invention relates to hygrometers of the general type illustrated and claimed in my application for patent, Serial No. 152,126, filed December 2, 1926, for hygrometer, in which is measured the moisture content of a hygrometric body held in a confined body of air with which successive portions of material, the moisture content of which is to be measured, is passed in intimate contact. The particular means there shown of measuring the moisture content of the hygrometric body takes advantage of the deformation or changes of deformation of the hygrometric body to control the nearness to resonance and the corresponding current response in the secondary of a pair of coupled primary and secondary high frequency oscillatory circuits.

The object of the present invention is to associate the hygrometric body and its partial housing, acting with the sheet material to confine the body of air, in a unitary structure with the major portion of the circuit devices, preferably excepting only from that structure the secondary current measuring means which directly indicates by the position of its indicator the desired moisture content and departures therefrom of the material being tested. To this end the various devices pertaining to the oscillatory circuits, in so far as this is desired, are enclosed within a casing, one face of which is recessed to receive the hygrometric body, the casing being so mounted that the material to be tested is passed across this face so as to substantially complete the confinement of the body of air within the recess and about the element and causes rapid circulation of the air by the movement of the material to be tested. One of the important advantages of the enclosing casing lies in the fact that it acts as a shield to protect certain of the parts, notably the high potential lead to the moisture responsive element, from the effects of machine vibration, variations in

surrounding conditions, body capacity and outside electrical disturbances, to all of which it is very sensitive.

Where the moisture content of paper or other sheet material is being tested, it is preferable to form one end portion of the casing face inclined away from the sheet material to facilitate the threading of the material through the machine therepast as when starting a run or after the material has been broken.

For a more complete understanding of this invention, reference may be had to the accompanying drawings in which

Figure 1 is a central longitudinal section through the instrument, the wiring being omitted.

Figure 2 is an end elevation thereof.

Figure 3 is a detail section drawn to a larger scale than Figures 1 and 2.

Figure 4 is a wiring diagram of the circuits.

Figure 5 is a perspective showing one manner of mounting the instrument on a machine.

Referring to these drawings, the instrument comprises a preferably elongated metal casing 1 having in one face, herein shown its lower face, a recess 2. This recess is preferably positioned substantially centrally of the width of the casing and is considerably narrower than the casing, so that on opposite sides thereof are portions of substantial width across which the material, the moisture content of which is to be tested, is passed. This casing may be mounted on the machine as shown in Figure 5. For this purpose it is shown as provided with spaced lugs 4 riding on guide bars 5 fixed to a stationary frame portion 6 of the machine, the material to be tested, as shown at 10, passing therebeneath and across the lower, preferably substantially flat, face of the casing and substantially completing the confinement of a body of air within the recess

2 which is shown as substantially trough shaped, and, as will later appear, contains the hygrometric body. As set forth in my prior application for patent hereinbefore referred to, actual contact between the material to be tested and the casing within which is positioned the hygrometric member is not necessary, though it should be passed sufficiently close thereto so as to substantially confine the body of air containing the hygrometric body. This hygrometric body, which is preferably back of the plane of the casing face and out of contact with the material passing thereacross may be of any suitable type but as shown it is of the type illustrated in my application hereinbefore referred to, comprising a ribbon 15 of suitable hygrometric material such as reverted cellulose, commonly known as artificial silk.

For the purpose of minimizing the effects of temperature change which might otherwise have to be corrected for, the hygrometric body is preferably so mounted that its supporting portions will not change their spacing materially through the expected changes of temperature to which the instrument will be subjected. For this purpose a strip of material 19 having a substantially zero temperature coefficient of expansion, such as invar steel, may be fixed at one end as at 20 within the recess 2, the other end portion being outwardly turned as at 21 and having threaded therethrough an adjustable abutment screw 22. This abutment screw is shown as bearing against a tension rod 23 about which an end portion 24 of the ribbon securing means passes, this securing means being fixed as about the stationary pin 25. A spring 26 acts to hold the pin 23 against the end of the screw 22. The securing means passes about a guide pin 27 and is secured to the end of the hygrometric ribbon in any suitable manner as at 28.

The opposite end of the hygrometric ribbon is shown as attached by any suitable means to a movable leaf 30 of a book condenser 31. This condenser 31 is shown in Figure 1 as positioned within a compartment 32 at one end of the recess 2 and is so near to the adjacent end of the strip 19 that substantially no change in ribbon length is due to temperature change. This condenser 31 is shown as one of the tuning elements of a secondary oscillatory circuit II (Figure 4), there being also in this circuit a variable condenser 35, which is preferably initially adjusted to the desired capacity and then fixed, and a supplemental condenser 36 which may be varied so that the current response in the secondary circuit may be that desired when the moisture content as determined by the position of the movable leaf 30 of the book condenser is at that point corresponding to a desired moisture content of the material being tested. The secondary

circuit II also includes an inductance 37 and a thermocouple 38, which may be a portion of a thermo-ammeter, the indicating portion of which is shown at 40 and may be positioned at any desired point, preferably outside of the casing 1. The condensers 35 and 36, the inductance 37, and the thermocouple 38 are all shown in Figure 1 as carried within the casing 1. The inductance 37 may be a spider web coil, as shown. The high voltage lead to this condenser 31 is extremely sensitive to body capacity and to any variations in its immediate surroundings such as might be caused by machine vibration or metal parts moving relative thereto. The casting 1 acts as an effective shield for this lead, being grounded through its connection to the machine frame. The indicating instrument 40 may be positioned at any desired location, there being shown at 42 and 43 terminals on the casing to which wires may be attached leading to this instrument.

The primary oscillatory circuit I by which current flow is induced in the secondary depending in amount on the nearness to resonance between these two circuits and the power and characteristics of the primary circuit are also shown as carried within the casing. At 50 is shown an inductance, which may be a spider web coil, this being in inductive relation to the coil 37, constituting the coupling between the primary and secondary oscillatory circuits. Of course any other suitable type of coupling might be employed.

At 51 is indicated a voltmeter and at 52 a condenser between which and the ground the voltmeter is positioned. While the oscillatory circuits may be of any suitable type, they are herein shown as of the type more fully described and claimed in the application for patent of Robert F. Field, Serial No. 227,694, filed October 21, 1927. As by the use of these particular circuits and choosing certain values of their electrical characteristics, power may be taken from any suitable commercial alternating current source without causing the commercial fluctuations in this voltage to have material effect on the current response in the secondary circuit. The primary circuit I may receive its power therefore through a transformer 60, the secondary of which is divided to provide an A battery portion 61 to light the filament 62 of a thermionic tube 65, this being controlled through a rheostat 66, and a B battery portion 70 furnishing plate current for the plate 72 of this tube. A choke is shown at 73, fixed condensers at 74, 75 and 76, and a variable resistance at 77. All these parts may be positioned within the casing, preferably all except the coil 50 being shielded from the secondary circuit as by the metal partition 79. At 80 is shown a plug

socket by which current may be passed to the primary of the transformer from any suitable commercial alternating source indicated diagrammatically at 81 in Figure 4.

5 It will thus be seen that the primary and secondary circuit mechanisms are carried within and shielded by the casing, the indicating mechanism 40, however, preferably being not included within the casing in order
10 that it may be positioned at any suitable point which may be at a considerable distance from the casing. Of course it could be included therein if desired.

15 In order to facilitate threading of the sheet material across the externally recessed face of the casing, it is preferable to provide a shoe portion 82, herein shown as a separate piece fixed to the casing though of course it might be formed integral if desired,
20 having one face 83 forming substantially a continuation of the recessed face, but being inclined away from the plane of this face and away from the adjacent surface of the sheet material. This acts to permit the ready insertion of the material
25 through the machine and adjacent to the recessed face of the casing, it being the usual practice to so form the entering portion of the sheet that it is longer on one edge than
30 at the other, this longer edge being threaded through and drawing the remainder of the sheet with it. This longer edge should be on that side where the shoe 81 is positioned.

35 Having thus described an embodiment of this invention it should be evident to those skilled in the art that various changes and modifications might be made therein without departing from its spirit or scope as defined by the appended claims.

40 I claim:

1. An instrument of the class described comprising a metal casing having a recess in one face, a hygrometric body in said recess, primary and secondary oscillatory high frequency circuit devices housed within said
45 casing, said devices including means responsive to the moisture content of said body for varying the current response in said secondary circuit in accordance with variations in the moisture content of said body,
50 and means for indicating such response.

2. The combination in a machine for handling traveling sheet material, of a casing having a face across which said material
55 is passed, said casing having a recess in said face, a hygrometric body in said recess, mechanism including high frequency circuits within and shielded by said casing and responsive to moisture conditions of said
60 hygrometric body, and means for indicating such response.

3. An instrument of the class described comprising a metal casing having a recess in one face, a hygrometric body in said recess, primary and secondary oscillatory high

frequency circuit devices housed within said casing, said devices including a variable element and means for varying said element in response to varying moisture content of said body for varying the current response in
70 said secondary circuit in accordance with variations in the moisture content of said body, said element having a high potential lead in one of said circuits shielded by said casing, and means for indicating such response.
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In testimony whereof I have affixed my signature.

ALBERT ALLEN.

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