

ALIEN PROPERTY CUSTODIAN

WEIGHING APPARATUS

Vladimir Popov, Prague, Bohemia; vested in the
Allen Property Custodian

Application filed April 5, 1941

My invention relates to apparatus for weighing and sorting articles by weight and it is an object of this invention to provide apparatus of the character referred to capable of realizing a weighing process which renders possible to ascertain the weight differences of the articles in comparison with a predetermined correct weight.

It is also an object of this invention to provide improved and more sensitive means for grading or sorting the articles by weight, e. g. into three groups: under the weight limit, within the limits allowed and over the limit.

It is a further object to provide means in the said apparatus which enables to record, in a suitable way, the result of every weighing operation effected on the apparatus.

These objects are effected by my invention, as will be apparent from the following description and claims taken in connection with the accompanying drawing in which:

Fig. 1 is a diagrammatic view of preferred embodiment of the apparatus in arrested position, whereby an electric control is provided,

Fig. 2 shows the mechanical control in connection with the apparatus shown in Fig. 1,

Fig. 3 shows the same apparatus in the released position and after a finished weighing operation,

Fig. 4 illustrates the recording mechanism which is actuated in dependence of the weight of the measured article, and

Fig. 5 shows a detail of the last-named recording mechanism.

To achieve the specified objects of my invention my apparatus comprises a weighbeam which is provided with a scale-pan for the measured articles, on one arm and a counterweight on the other arm, and a dynamometric spring serving to ascertain and measure the value of the weight differences i. e. the differences between the correct and the actual weight of the articles. This spring is not sprung in the rest position and acts on the weighbeam only by its own weight in positive or negative sense with regards to the counterweight in accordance to that, on which arm of the beam it is placed. When this spring is stretched during the weighing operation it acts on the beam dynamically within close limits, which correspond approximately to the allowed weight tolerances of the articles.

The dynamometric spring is thus a very fine organ which is subjected only to slight stresses within predetermined limits, sufficient for ascertaining the weight differences, so that this spring is not exposed to the full load of the ar-

ticle and its function can be composed with that of a rider used in connection with an ordinary analytic balance.

To achieve a sufficient stability and elasticity of these springs, the same can be made of a thin glass fibre for measurements in the limits of 0.01 gramme, of thin bronze wire from 0.01 up to 0.1 gm. and of thin steel piano-wire over 0.1 gm. The springs made of said materials are so sensitive that great amplitudes are obtained by small loads, e. g. a load of 0.01 gm. can produce a compression or elongation of 3-5 mm, so that the scale shown in the drawing can be considered as being in actual size. This sensitivity is sufficient for ascertaining and recording the weight differences with an accuracy equal to that of an ordinary analytic balance.

The invented apparatus comprises furthermore means for loading the spring by a force which is independent of the weighbeam as well as of the weight of the article, this means actuating simultaneously a registration member which, in dependence of the actual weight of article, indicates and respectively also records the value of the weight differences. The said registration member may be used to operate any suitable known device for sorting the articles by weight, this device being not described in detail in my description.

According to its utilization, my apparatus can be adapted either for mechanical or for hand operation. For the sake of simplicity, the described and illustrated embodiment relates to a hand operated apparatus.

Referring now to the drawing, the numeral 1 indicates the articles, the weight of which should be checked and ascertained by the invented apparatus. These articles are transferred one by one to a scale-pan 2 suspended on the right arm of the weighbeam 3. The correct weight of the articles should be e. g. 3 grammes with with maximum allowed tolerances ± 0.02 gram., i. e. the lowest admissible weight is 2.98 gm., the highest 3.02 gm. For this purpose the left arm of the weighbeam 3, which is suspended in the bracket 4, is loaded with a counterweight 5 and with a dynamometric spring 6, which together imposes such a weight that the left arm of the weighbeam is slightly less charged than the right arm, when an article having the minimum admissible weight, i. e. 2.98 gm. is laid on the scale-pan.

A stabile abutment 7 prevents the weighbeam to swing in one direction (to the right according to Fig. 1). The swings of the weighbeam in the other direction can be effected only

after an arrestment member 8 has been released. This member holds the beam in horizontal position during arrestment and releases the same for swings when it is lowered down.

Supposing that the right arm of the weighbeam 3 is loaded by an article having a weight of 2.98 gm. and that the arrestment is released, the weighbeam will remain resting on the abutment 7, as the total of the counterweight 5 and of the weight of the spring 6 is slightly less than 2.98 gm. Thereby it is supposed that the spring 6 is suspended freely and subject to no force in the moment of releasing of the arrestment.

The arresting and releasing movement of said member 8 is realised by a series of organs, which will be described later on.

A gear wheel 11 is connected with a crank handle 8, which, in the arrested position, rests on an abutment 10. After one half of a revolution in the direction *a*, the handle 9 is stopped by the abutment 12 (Fig. 3). During this rotation, the plate 13, which is rigidly connected to a rack 14, engaging constantly the gear wheel 11, effects a movement from its upper position A—B (Fig. 1) into the lowermost position C—D (Fig. 3). In the same time, the arrestment member 8 is lowered down and the weighbeam is released.

As soon as the weighbeam executes a small swing to the left, the contact of the beam with the abutment 7 is interrupted and, on the other hand, the beam touches a contact-closing screw 15, hereby completing an electric circuit comprising a current-generator 16 and a solenoid 17.

The completion of the circuit can naturally be realized also by other means, such as e. g. by means of a photo-cell which is far more sensitive and reacts upon the slightest movement of the weighbeam. Also, in the mechanism described and shown in the drawing, the movement of the rack 14 is obtained by hand, but arrangements for automatic operation of the same can easily be taken by those skilled in the art.

During the positive downwards movement of the plate 13, the dynamometric spring 6 is stretched, automatically and without regard to the weighbeam or to the weight of the measured article, up to a predetermined maximum which is given by the lowest position C—D of the plate 13 (Fig. 3).

In addition to said members 6 and 8, a rod 18 of a registration mechanism cooperates with the plate 13, said rod passing freely through the bushes 18a, 18b and resting by its own weight upon the plate 13.

Supposed that an article having the exact correct weight of 3 gm. is laid on the scale-pan 2 and that the dynamometric spring 6 is dimensioned in such way that a weight of 0.01 gm. produces an elongation corresponding to one point of the scale 19. The registration rod 18 follows the downwards movement of the plate 13, until the electric circuit of the solenoid 17 is completed by the contact-closing screw 15, upon which the lever 20 is shifted by the action of the solenoid 17 into the position according to Fig. 3 and its nose 21 engages a tooth-space of the rod 18, thus hindering its further movement.

If the weight of the article is equal to the correct theoretical weight, the contact of the weighbeam 3 with a screw 15 will be assumed and the movement of the registration rod 18 with the pointer 22 stopped, after this rod has travelled from its upper position, in which the pointer 22 indicates the minus mark against the scale 19, to the position, where the pointer indicates

zero on the scale. This moment corresponds to the mid-way position of the plate 13, as denoted by letters E—F in Fig. 3. The plate continues its movement to its lowest position C—D, but the registration rod 18 is held in the arrested position by the nose 21 of the lever 20. The rod is returned to its original position later on during the backward movement of the plate 13 to the position A—B.

An article having the correct weight can be used for checking the correct adjustment of the apparatus and of the dynamometric spring 6. If this spring is correctly dimensioned, the articles of a weight of 3-0.01 gm. will produce the arrestment of the rod 18 with the pointer 22 standing opposite the 0.01 mark over the zero-line, the articles of 3-0.02 gm. opposite the 0.02 over the zero-line, whilst articles under 3-0.03 gm. will not influence the rod 18 at all, as the arm of the weighbeam loaded by this light article will close the contact with the screw 15 immediately after the releasement of the arrestment and the registration rod 18 will be blocked by the lever 20 even before it could execute any movement.

The swing of the weighbeam 3 from its position of rest on the abutment 7 into the position of contact with the screw 15 should of course be so small as possible.

If the articles possess a weight over 3 grms., e. g. 3.01, 3.02 gm., the rod 18 will be stopped with the pointer 22 standing opposite the corresponding marks 0.01, 0.02 underneath the zero-line of the scale. If the weight of the article exceeds 3.03 gm., the rod will follow the movement of the plate 13 to its lowest position and the contact will indicate the plus mark of the scale 18.

It is clear, from the above said, that for every article having the allowed weight, the registration rod 18 will be stopped with the pointer 22 indicating in the limits of 0.02 over and 0.02 under the zero-line of the scale. For the articles over the limit, the pointer 22 will stand over the 0.02 mark and for the inadmissibly heavy articles underneath the 0.02 mark under the zero-line.

It is also clear that the accuracy of the weighing increases in same measure as the movement of the plate 13 is slower and the gearing of the rod 18 finer.

The electric control of the registration rod 18 can be replaced by mechanical means, as shown in Fig. 2. This figure shows a two-arm lever 23, which cooperates with the weighbeam 3 and blocks the movement of the rod 18 as soon as the weighbeam executes a swing. To this effect, a gear-wheel 24 engages the gearing of the rod 18 and the nose 23b of the lever 23 is adapted to engage this wheel, when the end 3a of the weighbeam 3 presses down the arm 23a of the lever, the movement of the rod 18 being thus prevented.

The registration rod 18 can be provided with a member 25 which serves to record the movements of the rod 18 during every weighing operation e. g. on a paper band 26 wound on the drum 27, as shown in Figs. 4 and 5.

The drum 27 is rotated by means of a clock-work or similar mechanism, preferably with interruptions in the time of arrestment of the weighbeam. The paper band 26 can be ruled and provided with minus and plus marks and numbers similarly as the scale 19 in previous case.

As the recording member 25 effects, during

every weighing operation, a movement downwards and upwards and the drum 27 with the paper band 26 rotates, a curve will be recorded on the band, as shown in Fig. 4. From this curve, the weight of every individual measured article can be ascertained. The point *c* of the curve shows that the measured article was too

heavy, the point *d* corresponds to an article under the weight limit, the point *e* to an article of allowed weight and the point *f* shows that the measured article has the correct theoretical weight.

VLADIMIR POPOV.