Aug. 23, 1960 W. E. RAPP 2,950,100

BALANCE

Filed July 29, 1959 2 Sheets-Sheet 1

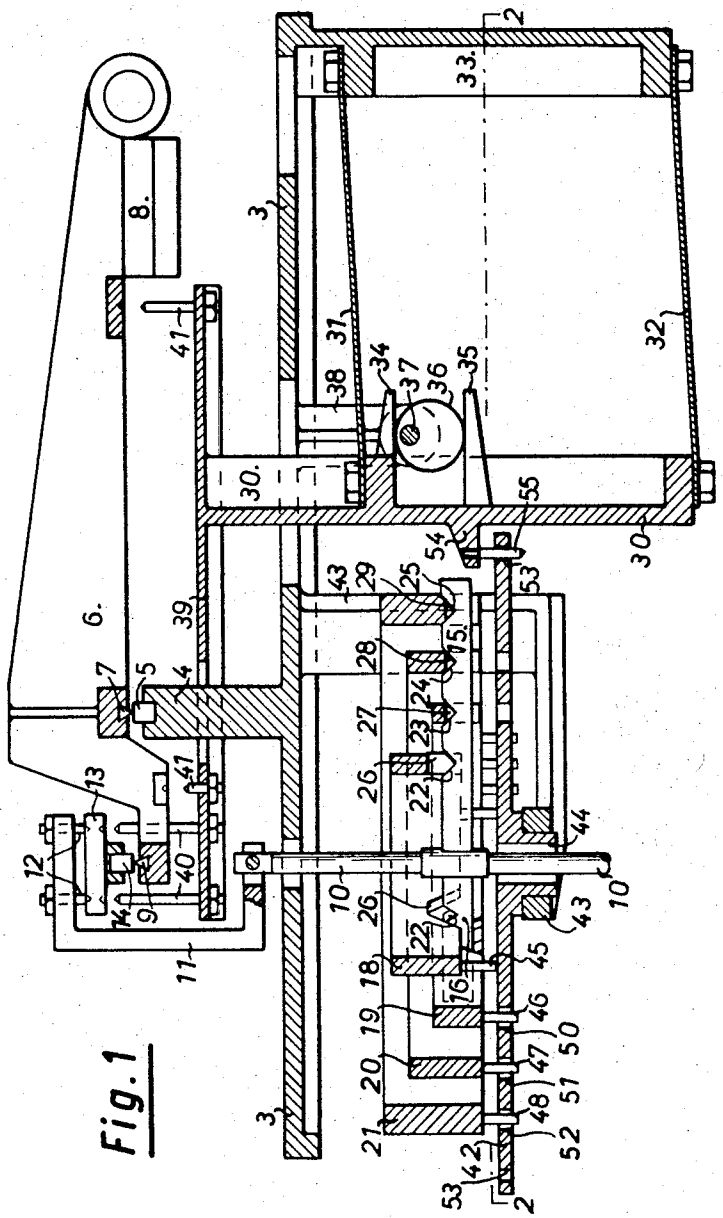


Fig. 1

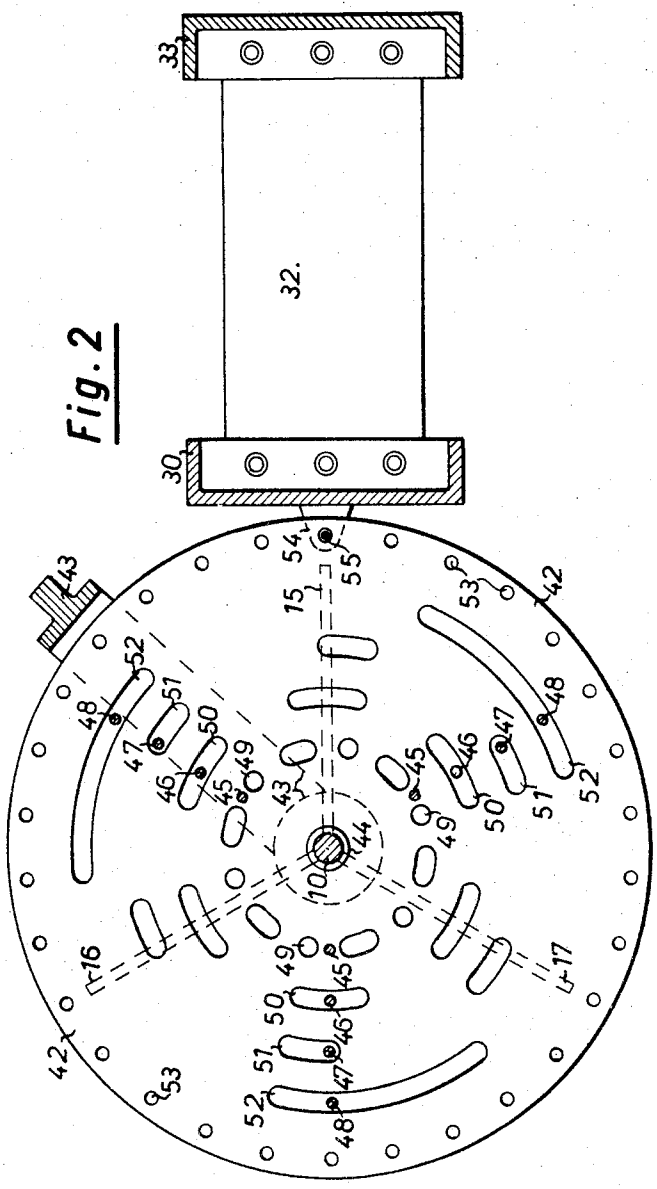
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Fig. 2



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BALANCE

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5 Claims. (Cl. 265—60)

This invention relates to a balance and more particularly to a laboratory or analytical balance having removable weights and manually operable means for arresting the balance.

Objects of the invention are to provide a balance of the type stated having a vertically movable member which in an upper position is adapted to lift a carrier off the outer knife edge of the balance beam and which, in a lower position is adapted to allow said outer knife edge to pivotally support said carrier, a set of ring-shaped weights, supporting means on said carrier for horizontally supporting said ring-shaped weights in a position concentric to one another, a plurality of downwardly-projecting legs on each ring-shaped weight, and a rotatable disc provided with apertures and mounted below said set of ring-shaped weights for angular positioning about its vertical axis so that when said vertically movable member is in said upper position all ring-shaped weights are supported by said carrier with the lower end of said legs positioned above said disc, and when in said lower position the legs of selected weights extend with clearance through apertures in said disc and the legs of the remaining weights of said set are supported by said disc so that each of said remaining weights is lifted off said carrier. A further object is to provide a balance of the kind outlined having locking means acting between said disc and said arresting means so that said disc is free to rotate when said vertically movable member is in said upper position and is locked against rotation when said vertically movable member is in said lower position.

These and other objects and the advantages of the invention will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawing in which:

Figure 1 shows a vertical cross-section through the relevant parts of an analytical balance provided with an arresting device and a set of ring-shaped weights, the arresting device being in the lowered position so that the beam of the balance rests on its centre knife edge, and the weight carrier is suspended from the outer knife edge, and

Figure 2 is a horizontal section along the line 2—2 in Fig. 1 showing a top view of the rotatable disc forming part of the balance, and showing the apertures in the disc.

The balance rack has a plate-shaped intermediate base 3 equipped with a column 4. The top end of this column 4 carries a fitted, plate-shaped bearing 5 which supports a centre knife edge 7 of a beam 6, shown in the lowered position. The beam 6 is asymmetrical, and carries, on its longer, right-hand arm, a firmly attached counterweight 8, while the shorter, left-hand arm is provided with an outer knife edge 9.

A weight carrier 10 is suspended from the outer knife-edge 9 by the usual supporting members. The supporting members include a yoke 11, pivoted to the weight

carrier 10 and supported on an intermediate member 13 by means of a pivot support 12 in such way that the yoke can swivel. A plate-shaped bearing 14, fitted in the intermediate member 13, rests, in the lowered position of the beam 6, on the outer knife edge 9 of the beam 6, as shown in Fig. 1. For the application of a first set of weights, consisting of horizontal ring-shaped weights, the carrier 10 is equipped with three supporting members 15, 16, 17, as shown in Fig. 2, which are rigidly fixed to the carrier 10 and extend radially outwards. In the space under the supporting members 15 to 17 further spoke-shaped supporting members for further sets of weights may be arranged on the carrier 10. Below the lowest set of weights, the carrier 10 has a load hook, on which the weighing pan is suspended. These additional sets of weights and their supporting members, as well as the load hook, are not shown in the drawing for the sake of clarity. Accordingly, only the top part of the weight carrier 10 is reproduced. In Fig. 2, the supporting members 15 to 17 of the top set of weights are shown by dotted lines.

The set of weights shown in Fig. 1 consists of four horizontal ring-shaped weights 18, 19, 20, 21, which are arranged coaxially and have sufficient clearance to enable a smaller weight to be moved in a vertical direction through the ring-aperture of the next larger weight. By way of example, the annular weights 18 and 19 represent each one unit of weight, whilst annular weight 20 represents two, and annular weight 21 five units of the desired decade. The annular weights 18 to 21 surround the carrier 10 concentrically; for this purpose the spoke-shaped support members 15 to 17 are preferably equipped with triangular-shaped notches 22 to 25 in which the annular weights 18 to 21 may be supported in concentric arrangement. Furthermore, the annular weights 18 to 21 are equipped at the bottom edges with recesses 26 to 29, which cooperate with the notches 22 to 25 to prevent the annular weights 18 to 21 from effecting peripheral rotational movements, so long as these annular weights rest on the supporting members 15 to 17. In Fig. 1, only the annular weight 19 to 21 are supported on the members 15 to 17; annular weight 18 is shown lifted from the supporting members 15 to 17.

The arresting device for relieving the beam knife edges 9 and 7 is equipped with a vertically extending member 30 which is guided in parallel to a downward protruding extension 33 of the intermediate base 3 by means of two leaf springs 31 and 32. The member 30 carries two forks 34, 35 with mutually facing sliding surfaces, which are in contact with an eccentric disc 36, fitted to a shaft 37. The shaft 37 is rotatably mounted in a downwardly protruding arm 38 of the intermediate base 3, the shaft 37 carrying on its end protruding the casing of the balance an operating knob or lever, which, for the sake of clarity, is not shown in the drawing. Rotation of the shaft 37 will therefore make it possible to raise or lower the member 30. The top end of the member 30 carries a plate-shaped head 39, which extends above the intermediate base 3, and below the balance beam 6. This head is equipped with three pin-shaped relieving devices 40 which lift the intermediate member 13 and thereby also the carrier 10 and arrest the same, when the member 30 is raised. In Fig. 1, only the two rearward lifting pins 40 can be seen, which project in an upward direction on both sides of the rear face of the bearing plate 14; the third relieving pin, facing towards the front is located in front of the front end of the bearing plate 14 and is not shown. Three further relieving pins 41 serve to raise the balance beam 6 in such a way that one of these relieving pins 41 acts on the centre of the beam arm carrying the outer knife-edge 9, and the two other relieving pins 41 act on the

vicinity of the counterweight 8 on both sides of the vertical centre plane of the beam 6. Of the two last mentioned relieving pins 41 only the rearward one is shown in Fig. 1. The length of these relieving devices fitted to the head 39 is adjusted in such a way that, with the member 30 sufficiently raised, both the centre knife-edge 7 is lifted off the bearing 5 and the bearing 14 of the intermediate member 13 is lifted off the outer knife edge 9 so that both the beam 6 and the intermediate member 13 and its carrier 10, pivoted to the latter, are arrested.

The device for operating the annular weights 18 to 21 is combined with said arresting device, and is equipped with a flat disc 42 located underneath the ring-shaped weights 18 to 21; the diameter of this disc is larger than that of the largest ring-shaped weight 21. This circular disc 42 is located rotatably on an arm 43 extending downwardly from the intermediate base 3. The axis of rotation of the disc 42 is vertical, and the entire arrangement is such that the ring-shaped weights 18 to 21 are arranged concentrically in relation to the axis of rotation of the disc 42. The disc 42 has, in addition, a centre bore 44, which admits the carrier 10 with clearance. Each of the ring-shaped weights 18 to 21 is provided with three legs, extending in a downwards direction, the legs of annular weight 18 being indicated by 25, those of annular weight 19 by 46, those of annular weight 20 by 47, and those of annular weight 21 by 48. In Fig. 2, which shows these pin-shaped legs in cross-section, the legs extend through the centres between the supporting members 15 to 17 in a downward direction so that the angular distance between each leg and the two neighbouring supporting members is 60°. The disc 42 has, under each annular weight 18 to 21 a set of apertures 49 to 52, co-ordinated with the appropriate annular weight so that the apertures 49 are correlated to annular weight 18, the apertures 50 to annular weight 19, the apertures 51 to the annular weight 20, and the apertures 52 to the annular weight 21. These apertures cooperate with the legs of the annular weights in such a way that, with the arresting device lowered to the position shown in Fig. 1, the legs of the annular weights will, according to the setting of the disc 42, either protrude with clearance through the apertures or be supported by the disc 42. As can be seen from Fig. 2, if this requirement is to be fulfilled, the disc 42 must be located in certain angular positions. For this purpose, a locking device is arranged between the member 30 of the arresting device and the rotatable disc 42, whereby the member 30 can be lowered only if the disc 42 is located in one of the permissible positions. Conversely, this locking device can also serve to prevent the disc 42 from rotating as soon as the member 30 assumes the lowered position according to Fig. 1. The locking device illustrated uses a ring of holes 53 in the disc 42, which are arranged on the outer periphery of the disc 42, and surround the apertures 52, corresponding to the largest annular weight. The member 30 is provided with a lug 54, carrying a pin 55, which engages into one of the holes 53, as shown in Fig. 1. The length of the pin 55 is such that, with the member 30 raised, its preferably conically shaped end is located above the level of the disc 42 so that the disc 42 may be rotated. In addition, the disc 42 may also be equipped with a toothed rim along its periphery so that it can be rotated by means of an operating knob and a suitable geared transmission, and that its position can be read off a scale graduated in units of weight. For reasons of clarity, however, these operating and indicating means are not shown in the drawing.

The lift of the eccentric disc 36 is selected so that by a rotation of the same by 180° the carrier 10 is raised sufficiently to support all the annular weights on the supporting members 15 to 17, and so that the legs 45 to 48 of these annular weights terminate above the disc 42. In this raised position, in which also the bearing 14 is disengaged from the outer knife edge 9, and the centre knife edge 7 from the bearing or fulcrum 5, the raised locking pin 55 frees the disc 42 so that the latter may be rotated without thereby removing or applying any ring-shaped weight. The rotation of the disc 42 represents therefore merely a pre-selection. The annular weights 18 to 21 are lifted off the supporting members 15 to 17, only by the downward movement of the member 30 and the consequential lowering of the carrier 10, in accordance with the pre-selected position of the disc 42 so that their legs are supported on the disc 42 whilst those annular weights of which the legs pass with clearance through the apertures in the disc 42 remain lodged on the supporting members 15 to 17. In the drawing, only the annular weight 18 is shown lifted off, whilst the annular weights 19 to 21 remain on the supports 15 to 17.

If the disc 42—after raising the arresting device—is rotated from the position according to Fig. 2 in an anti-clockwise direction by one aperture 53, that is by 12°, the lowering of the arresting device would result in all the annular weights 18 to 21 remaining on the supporting members 15 to 17, since the legs 45 to 48 of all annular weights 18 to 21 engage in the apertures 49 to 52 of the disc 42 and pass through the same with clearance. In a like manner, rotation of the disc 42 from the position shown in Fig. 2 in a clockwise direction through an angle of 12° would result in the annular weight 20 resting with its legs 47 on the disc 42, whilst the annular weights 18, 19 and 21 remain lodged on the supporting members 15 to 17. A study of the arrangements shown in Fig. 2 of the apertures 49 to 52 will reveal that a rotation of the disc 42 in a clockwise direction through 120° will apply the set of weights, consisting of the annular weights 18 to 21, in steps of its weight units, that is in units of the annular weight 18, if, as already mentioned, the annular weight 19 represents one, annular weight 20 two, and annular weight 21 five weight units.

The above described arrangement of a balance makes it therefore possible not only to fulfill its purpose with very few individual components, but also prevents an incorrect or faulty application of the fractional weights which might result in damage to the knife edges of the balance beam. In the case of a balance with several sets of weights, preferably all sets, but at least those comprising the heavier weights, are operated by means of the arresting device in the manner described above.

The invention is not limited to the particular embodiment herein shown and described and modifications which may occur to those familiar with the art fall within the spirit and scope of the invention as set forth in the following claims.

I claim:

1. A balance, comprising a balance beam, a carrier extending in the vertical direction, said balance beam having a centre knife edge for its support and an outer knife edge for suspension of said carrier therefrom, arresting means comprising a vertically movable member which in an upper position is adapted to lift said carrier off said outer knife edge and which, in a lower position is adapted to allow said outer knife edge to support said carrier, a set of ring-shaped weights having dimensions graduated in such manner that any of said weights encloses with clearance the next smaller weight so that the smaller weight may be moved through the ring aperture of the next larger weight, supporting means on said carrier for horizontally supporting said ring-shaped weights in a position concentric to one another, a plurality of downwardly-projecting legs on each ring-shaped weight, and a horizontal disc provided with apertures and mounted below said set of ring-shaped weights for angular positioning about its axis so that when said vertically movable member is in said upper position all of said ring-shaped weights are sup-

ported by said carrier with the lower end of said legs positioned above said disc, and when in said lower position the legs of selected weights extend with clearance through apertures in said disc and the legs of the remaining weights of said set are supported by said disc so that each of said remaining weights is lifted off said carrier.

2. The invention as recited in claim 1, wherein each ring-shaped weight of said set and said supporting means on said carrier are provided with means by which the weights are maintained in their coaxial positions and by which the weights are prevented from rotating in an angular direction.

3. A balance, comprising a balance beam having a centre knife edge and an outer knife edge, a balance rack having a fulcrum for pivotally supporting said centre knife edge of the balance beam, a carrier suspended from said outer knife edge of the balance beam and extending in the vertical direction, means for arresting the balance, said means comprising a vertically movable member which in an upper position is adapted to lift said carrier off said outer knife edge and to lift said balance beam off said fulcrum and which, in a lower position is adapted to allow said outer knife edge to support said carrier and to allow said fulcrum to support said centre knife edge of said balance beam, a set of ring-shaped weights, supporting means on said carrier for horizontally supporting said ring-shaped weights in a position concentric to one another, a disc rotatably mounted on said balance rack about a vertical axis and horizontally extending below said set of ring-shaped weights, locking means acting between said disc and said arresting means so that said disc is free to rotate when said vertically movable member is in said

upper position and is locked against rotation when said vertically movable member is in said lower position, and a plurality of downwardly-projecting legs on each of said ring-shaped weights, said disc having apertures cooperating with said legs of the ring-shaped weights so that when said vertically movable member is in said upper position all ring-shaped weights of said set are supported by said carrier with the lower ends of said legs positioned above said disc, and when in said lower position the legs of selected weights according to the angular position of said disc extend with clearance through apertures in said disc and the legs of the remaining weights of said set are supported by said disc so that each of said remaining weights is lifted off said supporting means on said carrier.

4. The invention as recited in claim 3, wherein the axis of rotation of the horizontal disc is collinear with the axis of the coaxial set of ring-shaped weights, and in which said ring-shaped weights are each provided with three uniformly-spaced legs and in which said apertures in the horizontal disc are such that the disc is to rotate through an angle of 120° in successively applying the complete set of weights to said carrier in steps corresponding to the unit of weight of the set.

5. The invention as recited in claim 3, wherein said supporting means on said carrier extend above said disc and below said set of ring-shaped weights.

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