

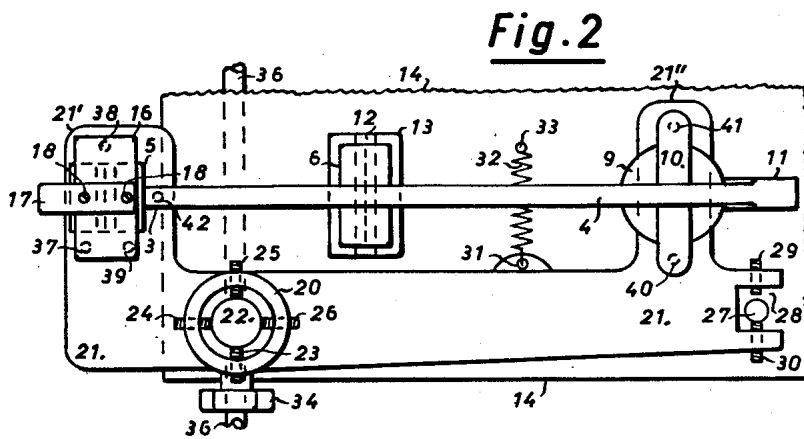
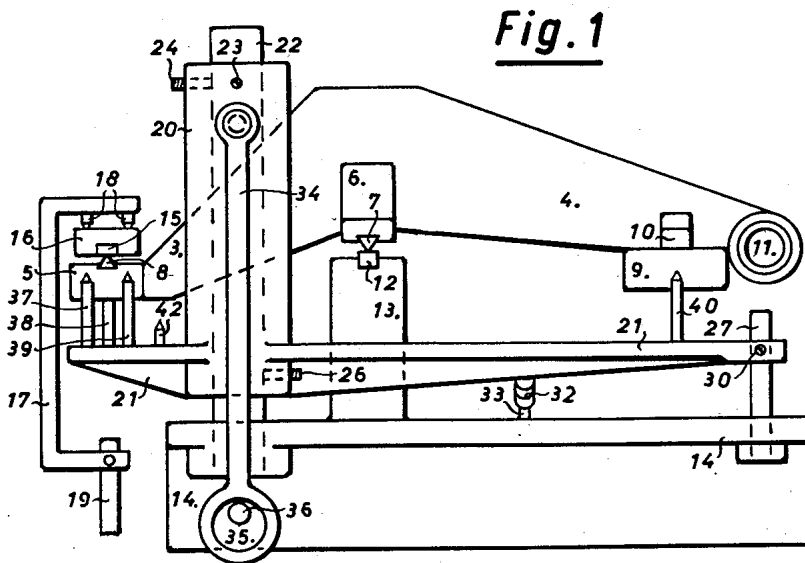
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ANALYTICAL BALANCE

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ANALYTICAL BALANCE

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This invention relates to an analytical balance including an asymmetrical balance beam and means for arresting the balance by lifting the central knife edge of the balance beam off the fulcrum and by lifting the suspension means carrying the scale pan off the outer knife edge of the balance beam.

Objects of the invention are to provide a balance of the type stated having an intermediate support extending below said balance beam, said intermediate support carrying the fulcrum for pivotally supporting said central knife edge of the balance beam, a cylindrical column fastened to said intermediate support and extending in a vertical direction upwardly from said intermediate support adjacent said balance beam, a vertical guide piece provided on said intermediate support at a distance from said cylindrical column, a slide member vertically movable on and mounted for rotation about the axis of said column, a spring by means of which said slide member is made to bear against said guide piece and along which it can slide in a vertical direction, an actuating mechanism mounted on said intermediate support for vertically moving said slide member, and arresting pins on said slide member. A further object is to provide a balance of the kind outlined having arresting means in which said slide member has a sleeve at least partially surrounding said column and carrying at its lower end a plate-shaped transversely extending member, which extends across below the level of said balance beam and which is provided with the arresting pins.

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:

FIG. 1 shows a side view of the relevant parts of an analytical balance provided with an arresting device being in the lowered, non-arresting position of the slide member, and

FIG. 2 shows the same, viewed from above.

The asymmetrical balance beam consists essentially of an edge arranged plate to form the two balance arms 3 and 4. This beam also has two rigid, laterally projecting knife-edge supports 5 and 6, the central knife-edge 7 being attached to the bottom of the support 6 and the end knife-edge 8 to the top of the support 5. The longer balance arm 4 is provided with a counterweight 9, a further laterally projecting support 10 and a graduated dial 11, the last serving to give readings of the inclinations of the balance beam.

When the balance is in use, the support knife-edge 7 rests on a fulcrum 12, which is set in a post 13 upstanding from the intermediate carrier 14. This intermediate carrier 14 forms part of the balance rack, the rest of which is not illustrated; it extends in an essentially horizontal direction below the balance beam 3, 4, and is supported on the base-plate of the balance rack by means of a plurality of supporting columns. The scale-pan and the housing surrounding it, with doors through which is inserted the object to be weighed, is in the space between the base-plate and the intermediate carrier 14. For the sake of clarity these parts of the balance are not reproduced in the drawing.

The suspension means which can be placed on the end knife-edge 8 of the shorter beam arm 3 have a plate-shaped thrust block 15 let into the bottom of an inter-

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mediate member 16. On the top of the intermediate member 16, in known manner, a connecting yoke 17 is pivotable, by means of conical bearings 18, about a horizontal axis extending transversely to the edge of the end knife 8. To the lower end of the yoke 17 is connected the conventional carrying rod 19, from which hang both the scale-pan and the control weights. The scale-pan, the control weights, and the related suspension parts on the carrying rod 19 are not illustrated, and only part of the carrying rod 19 is shown.

The arresting mechanism has a slide member, consisting substantially of a tubular sleeve 20 and a plate-shaped part 21 extending transversely from the lower end thereof. The sleeve extends erect beside the shorter balance arm 3, whereas the plate-shaped part 21 has two tongues 21' and 21'' extending below the balance beam 3, 4. Passing through the sleeve 20 with radial play is a cylindrical column 22 which is attached to the intermediate support 14 and which also extends vertically adjacent the balance beam 3, 4. At the upper end of the sleeve 20 two set-screws 23, 24 are screwed in, projecting radially inwards, the inner end faces of which can abut the column 22. The lower end of the sleeve 20 is correspondingly provided with two further set-screws 25, 26 so that, when the sleeve is viewed from above (FIG. 2), the set-screws 25, 26 are seen diametrically opposed to the set-screws 23, 24. In relation to the centre of gravity of the plate-shaped part 21, the screws 23 to 26 are arranged in the sleeve 20 in such a way that their inner faces press lightly against the column 22. By means of the screws 23 to 26 the slide member 20, 21 is thus both movable in a vertical direction along the column 22 and rotatable about the vertical axis of the column 22. A guide piece in the form of a pin 27 is attached to the intermediate carrier 13, 14 in order to give a parallel guidance of the slide member 20, 21. The pin 27 extends vertically upwards from the horizontal member 14 of the intermediate carrier, parallel to the column 22 and, relatively to the balance beam 3, 4 is arranged on the intermediate carrier 13, 14 on the side of the longer balance arm 4. The transversely extending plate-shaped part of the sliding member 20, 21 has, in the place where the pin 27 is situated, a recess 28 (FIG. 2) accommodating the pin 27. Set-screws 29 and 30 extend into this recess 28 and by means of these screws the range of angular movement of the entire slide member 20, 21 about the axis of the column 22 is limited. A helical tension spring 32 is hung in an eyelet 31 of the slide member, the other end of the spring being held in a hook 33 attached to the intermediate carrier 14. The spring 32 tends to pivot the slide member 20, 21 anti-clockwise (FIG. 2) about the axis of the column 21 until the end face of set-screw 30 abuts against the pin 27. The slide member 20, 21 is thus guided for parallel movement in a vertical direction, such vertical movement of the slide member causing its set-screws 23 to 26 to travel along the column 22 and its set-screw 30 to travel along the pin 27.

The slide member 20, 21 is moved by means of a transmission rod 34 which is hinged to the outside of the sleeve 20 and the lower end of which freely encircles an eccentric disc 35. The latter is attached to a shaft 36 which for its part is rotatably mounted on the intermediate carrier 13, 14. A control knob may be provided at one end (not shown) of the shaft 36 to actuate the entire arresting device. In FIG. 1 the lowered, non-arresting position is shown. In order to raise the slide member 20, 21 the shaft 36 is turned through 180°.

On the arm 21' of the slide member the three upwardly pointing arresting pins 37 to 39 are attached, by means of which, in the raised position of the slide member 20, 21 the suspension means 15 to 19 are lifted off the end knife edge 8. At the same time the tips of these arresting pins

37 to 39 extend into guideways (not shown) which are provided on the lower surface of the intermediate member 16. In the lowered position of the slide member 20, 21, the tips of the arresting pins 37 to 39 are downwardly withdrawn, as shown in FIG. 1. On the other arm or tongue 21 of the slide member two upwardly extending pins 40 and 41 are provided, one on either side of the counterweight 9. By means of the pins 40 and 41 the support 10 of the longer balance beam arm 4 is raised. The shorter balance beam arm 3 is raised by means of the other arresting pin 42 which can engage the shorter arm 3 from below. Thus, the balance beam 3, 4, in its entirety may be arrested so that in the raised position of the slide 20, 21 the centre knife edge 7 is also lifted off the fulcrum 12. Both the support part 10 and the shorter balance arm 3 have on their lower surfaces appropriate guideways (not shown), in which the tips of the pins 40 to 42 can engage. In the lowered position of the slide member shown in FIG. 1 the arresting pins 40 to 42 are downwardly withdrawn, so that the balance beam rests on the fulcrum 12 and is freely pivotable about its centre knife edge 7. As a result of this construction, a very exact and playless parallel guiding of the slide member is achieved and the centre knife edge 7 is set on the fulcrum 12 always in exactly the same manner and on the same place, so that a highly constant sensitivity of the balance is possible.

In the arresting device described, all the essential parts, and particularly the means for guiding the slide members, are situated above the horizontal part 14 of the intermediate carrier and thus within the same space as contains the balance beam 3 and 4. Temperature fluctuations within this space act on the balance beam and on the arresting device in the same manner and cannot upset the desired accuracy. Further, a construction of the whole balance is possible, in which the space below the intermediate carrier part 14 holds only the housing surrounding the scale-pan, while the intermediate carrier itself can be supported, by means of a plurality of free-standing columns, on the base plate of the balance rack. The space above the intermediate carrier 13, 14 can be limited by a housing supported on the intermediate carrier, and in order to adjust the arresting device it is necessary only to lift off said housing. The use of the arresting device described accordingly permits a very simple construction of the whole balance, which in itself brings considerable advantages. Apart from this, the entire arresting device can be simply and accurately adjusted by means of the set-screws 23 to 26 and 29 and 30.

In the embodiment shown in FIGS. 1 and 2 the arresting device has only one slide member 20 and 21, carrying all the arresting pins 37 to 42. It is also possible, however, to use two slide members, in which case one of the slide members will have, for instance, only the arresting pins 37 to 39 to arrest the suspension means 15 to 19, while the second slide member will have the arresting pins 40 to 42 to arrest the balance beam 3 and 4. By means of transmission rods and associated cam discs both slide members can be moved in the same direction but with differentiated timing of their movements. A further variant with two slide members would consist in having the arresting pins 37 to 39 and the arresting pins 40 and 41 mounted on one slide member, in which case the arresting members 40 and 41 would have to engage the knife-edge support 6 from below, not on both sides of the counterweight 9, but on both sides of the centre knife edge 7. On the second slide member there would have to be mounted not an upwardly but downwardly directed retaining member, pressing from above onto a part of the knife edge support 5 of the shorter balance arm, so that the arresting pin 42 is superfluous. The latter, second slide member would have to be moved in the direction opposed to that of the first slide member; in order to release the balance from the arresting position, the first slide member provided with the arresting pins 37 to 41

would accordingly have to be moved downwardly and the second slide member, provided with the retaining member, upwardly.

In these and similar variants with several slide members each slide member can be assigned a particular column 22, on which it is mounted as described. This applies equally to the guide pin 27 and the spring 32, and when several slide members are used a corresponding number of these parts can also be used. When two slide members are used, the tubular sleeves 20 of the two slide members can, finally, be dimensioned so that they can be inserted one in the other with radial clearance and mounted on the same column 22. For this purpose the inner sleeve of the slide member concerned need have recesses only in those places where the set-screws 23 to 26 of the slide member provided with the outer sleeve have to project inwardly to the column 22. When two slide members are used, only one slide member can be guided parallel by means of a pin 27 attached to the intermediate carrier, the second slide member being guided parallel by means of a pin attached to the first slide member. The same applies to the springs which press the appropriate slide members onto the guide pins. These and similar adaptations of the arresting device 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. An analytical balance comprising an asymmetrical balance beam having a counterweight, a centre knife edge and an outer knife edge; an intermediate carrier extending below said balance beam and having a fulcrum for pivotally supporting said centre knife edge of the balance beam, suspension means hung from said outer knife edge of the balance beam, a cylindrical column fastened to said intermediate carrier and extending upwardly from said intermediate support adjacent said balance beam, a vertically extending guide piece provided on said intermediate carrier at a distance from said column, a slide member vertically movable on and mounted for rotation about the axis of said column, a spring by means of which said slide member is made to bear against said guide piece and along which it can slide in a vertical direction, arresting pins provided on said slide member for arresting the balance, and an actuating mechanism mounted on said intermediate carrier for vertically moving said slide member.

2. The invention as recited in claim 1, wherein on said slide member there are attached both the arresting pins serving to raise the centre knife edge of the balance beam off said fulcrum and the arresting pins serving to raise said suspension means off the outer knife edge of said balance beam.

3. The invention as recited in claim 1, wherein said actuating mechanism comprises a shaft rotatably mounted on said intermediate carrier, an eccentric on said shaft, and a transmission rod hinged to said slide member and encircling said eccentric disc.

4. An analytical balance comprising an asymmetrical balance beam, said balance beam having a counterweight, a centre knife edge and an outer knife edge; an intermediate carrier having a fulcrum for pivotally supporting said centre knife edge of the balance beam, said balance beam extending above said intermediate carrier, suspension means hung from said outer knife edge of the balance beam for supporting a scale pan and removable weights, a cylindrical column fastened to and extending upwardly from said intermediate carrier, a vertically movable slide member consisting of a sleeve at least partially surrounding said column and having at its lower end a plate-shaped transversely extending member which extends below the level of said balance beam and above said intermediate carrier, upwardly directed arresting pins mounted on said plate-shaped member of the movable slide member, means for slidably guiding said sleeve on said column, means provided at a distance from said column for preventing

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a rotation of said slide member about the axis of said column, and an actuating mechanism mounted on said intermediate carrier for vertically moving said slide member.

5. The invention as recited in claim 4, wherein said sleeve surrounds said column with radial clearance and has both at its upper end and its lower end a plurality of radially directed set-screws screwed in, the end faces of which abut said column, so that said slide member is movably guided on said column by means of said set-screws.

6. The invention as recited in claim 4, wherein said means preventing a rotation of said slide member about said column comprise a vertically extending pin, a recess in said slide member to accommodate said pin with clearance in order to limit the angular movement of said slide member, a set-screw screwed in said slide member and extending into said recess for abutting said pin, and resilient means which tend to rotate said slide member so that the face of said set-screw comes in sliding engagement with said pin.

7. The invention as recited in claim 6, wherein said pin is fastened on said intermediate carrier and wherein said resilient means consists essentially of a tension spring which acts between said plate-shaped member of the slide member and said intermediate carrier.

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8. An analytical balance comprising an asymmetrical balance beam having a counterweight on its longer arm, a centre knife edge, and an outer knife edge on its shorter arm; an intermediate carrier having a fulcrum for pivotally supporting said centre knife edge of the balance beam, suspension means hung from said outer knife edge of the balance beam, a cylindrical column fastened to said intermediate carrier and extending upwardly from said intermediate carrier adjacent the shorter arm of said balance beam, an upwardly extending guide piece fastened to said intermediate carrier at a distance from said column and adjacent said longer arm of the balance beam, a slide member having upwardly directed arresting pins for arresting the balance in the raised position of said slide member, said slide member having means for slidably guiding it along said column, a spring by means of which said slide member is made to bear against said guide piece in a vertically movable manner, and an actuating mechanism mounted on said intermediate carrier for vertically moving said slide member.

9. The invention as recited in claim 8, wherein said slide member has tongues extending below said balance beam, said arresting pins being fastened on said tongues.

No references cited.