

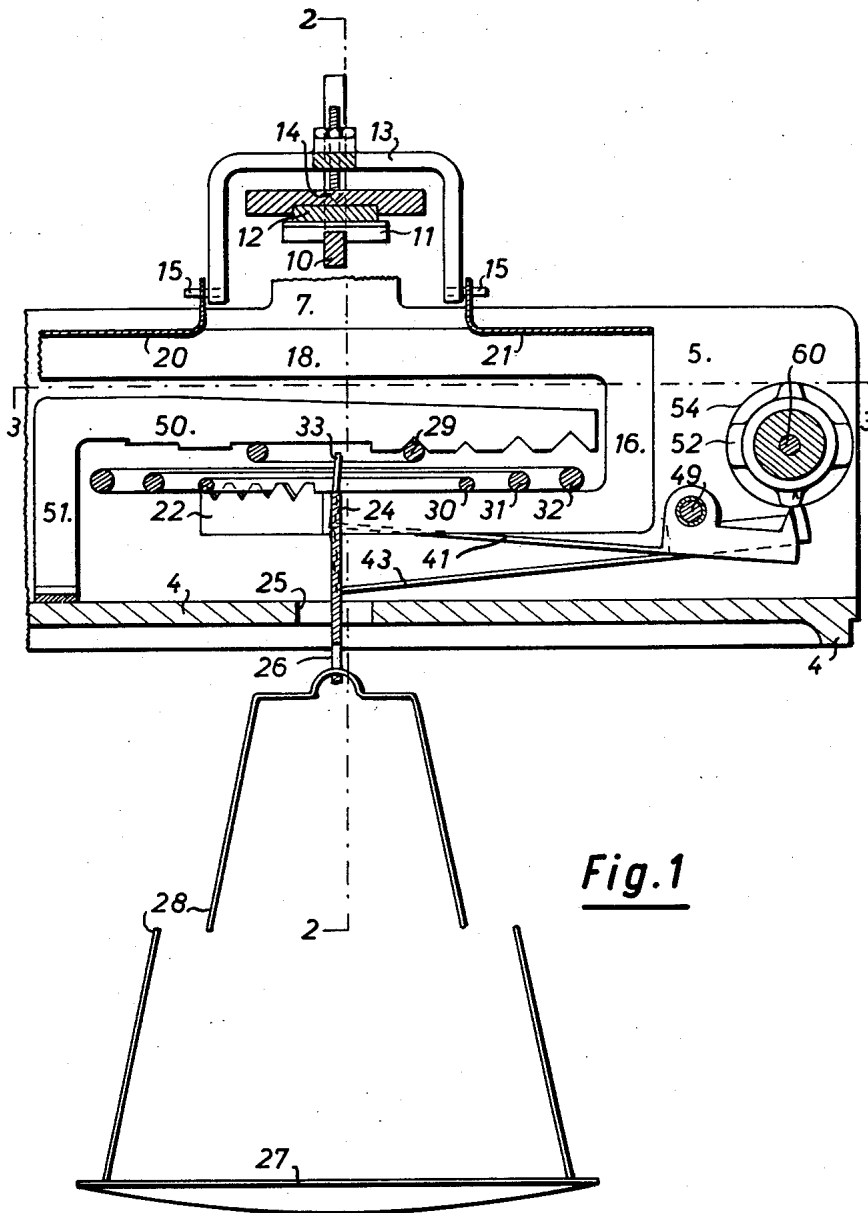
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J. MEIER  
BALANCE

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3 Sheets-Sheet 1



**Fig. 1**

INVENTOR

Johann Meier

By  
Pierce, Scheffler & Parker  
Attorneys

Oct. 17, 1961

J. MEIER  
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3 Sheets-Sheet 2

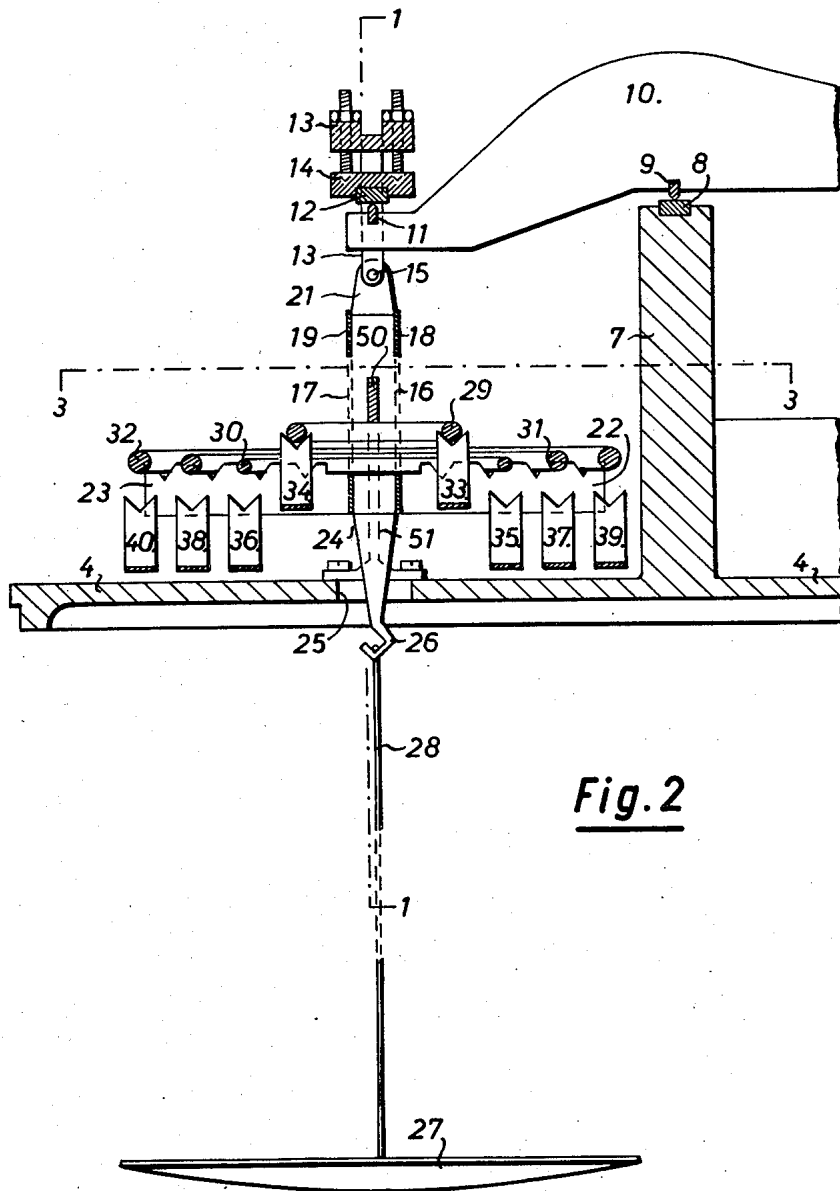


Fig. 2

INVENTOR

Johann Meier

By  
Pierre, Scheffler & Parker  
Attorneys

Oct. 17, 1961

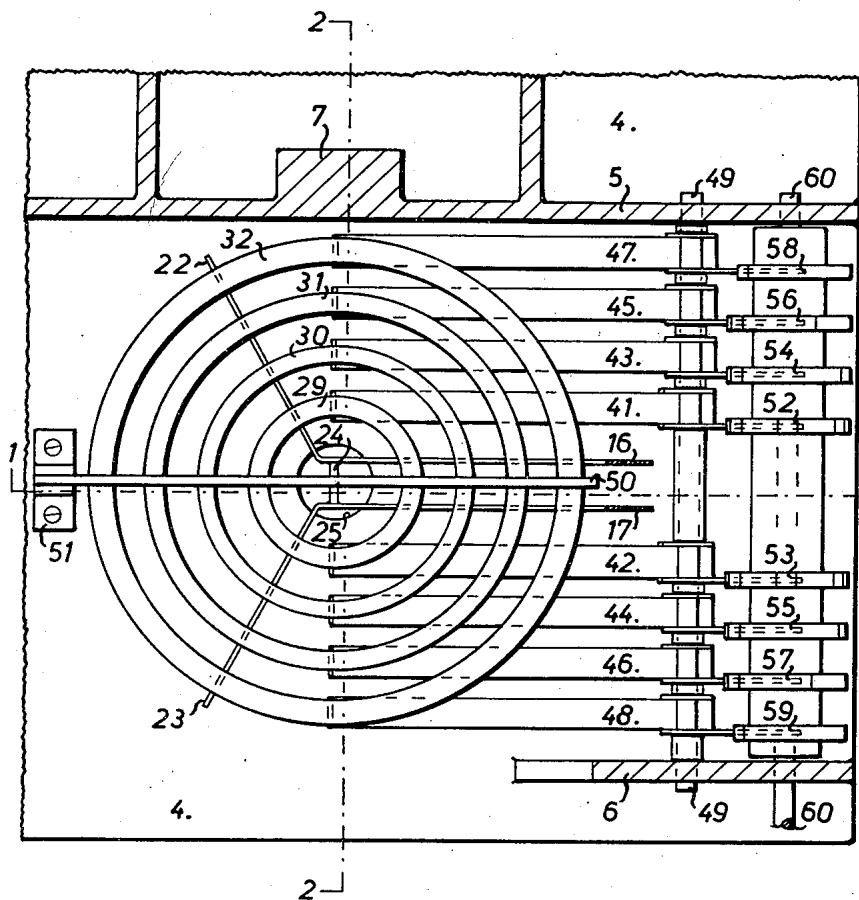
J. MEIER  
BALANCE

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3 Sheets-Sheet 3

Fig. 3



INVENTOR

Johann Meier

By  
Pierce, Sheffler & Parker  
Attorneys

1

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BALANCE

Johann Meier, Stafa, Switzerland, assignor to

Erhard Mettler, Zollikon, Zurich, Switzerland

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7 Claims. (Cl. 177—248)

This invention relates to a balance and more particularly to a laboratory or analytical balance having one or more removable ring-shaped weights and an operating device for mechanically placing these weights in position and for lifting-off the same.

Objects of the invention are to provide a balance of the type stated having a balance beam, a carrier, said balance beam having a center knife edge for its support and an outer knife edge for suspension of said carrier therefrom, a ring-shaped weight, supporting means on said carrier for horizontally supporting said ring-shaped weight, a pair of lifting-off members which are adapted to make contact with said ring-shaped weight from below at points on opposite sides of its centre of gravity for lifting-off said ring-shaped weight from said supporting means, an operating device for simultaneously actuating said two lifting-off members, and a stop member disposed above said ring-shaped weight in such manner that said ring-shaped weight in its raised position is held between said two lifting-off members and said stop member. A further object is to provide a balance of the kind outlined having a carrier suspended from the outer knife edge of the balance beam, a set of ring-shaped weights graduated in such manner that any of said weights enclose with clearance the next smaller weight so that a 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 pair of lifting-off members for each of said ring-shaped weights which are adapted to make contact with the respective ring-shaped weight from below at points on opposite sides of its centre of gravity for lifting-off said ring-shaped weight from said suspension means, a stop member common for all of said ring-shaped weights and disposed above them in such manner that each of said ring-shaped weights in its raised position is held between its two lifting-off members and said common stop member, a plurality of levers movable about horizontally disposed axes and extending below said set of ring-shaped weights for supporting said lifting-off members, and an operating device for actuating said levers in order to lift-off or to place on said ring-shaped weights in a predetermined sequence.

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, wherein like reference characters indicate like parts throughout the figures and in which:

FIGURE 1 is a vertical cross-section of a balance according to the invention taken on the line 1—1 in FIGS. 2 and 3,

FIGURE 2 is a longitudinal section of the balance, taken on the line 2—2 in FIGS. 1 and 3, and

FIGURE 3 is a horizontal section of the balance, taken on the line 3—3 in FIGS. 1 and 2.

The casing of the balance, not shown in the drawing, encloses within its upper portion a cast intermediate base plate 4 with upwardly extending stiffening ribs 5 and 6 and a column 7 which carries a bearing plate 8 for the main knife edge 9 of a preferably asymmetrical beam 10. The arm of the beam on the right, which is only partly

2

shown, carries a counterpoise which is not illustrated. The left hand shorter arm has a knife edge 11 at its end from which is suspended a carrier consisting of two arching stirrup members 16, 17 supported by a bearing plate 12 by means of two compensating links 14 and 15, attached to an intermediate member 13. Members 16, 17 are arranged side by side and their upper ends 18, 19 are connected by cross members 20, 21 whereas their lower ends are rigidly connected together by another cross member 24. Attached to the lower cross member 24 is the load carrying hook 26 which projects through an opening 25 in the intermediate base plate 4 and from which the pan 27 is suspended on rods 28.

The free ends of the lower portions 22, 23 of the carrier 16 to 24 are bent outwards beyond the lower cross member 24 in the manner illustrated in FIG. 3 so that they form supports shaped somewhat like the spokes of a wheel and adapted to carry concentric ring-shaped weights 29, 30, 31, 32. As will be seen by reference to FIG. 2, the lower portions 22, 23 are provided with V-shaped notches in which the ring-shaped weights 29 to 32 rest horizontally in a predetermined position, so that they cannot be laterally displaced. In the illustration according to FIGS. 1 and 2 only the ring-shaped weights 30 to 32 are shown resting on the supports 16 to 24, whereas the ring-shaped weight 29 has been raised from the supports. For the purpose of thus raising the weights 29 to 32 there are provided, in respect of each ring-shaped weight, two lifting fingers. In the drawing the lifting fingers 33, 34 are associated with the ring-shaped weight 29, the lifting fingers 35, 36 with the ring-shaped weight 30, the lifting fingers 37, 38 with the ring-shaped weight 31, and the lifting fingers 39, 40 with the ring-shaped weight 32. The lifting fingers 33 to 40 are the upwardly bent ends of levers 41 to 48 (FIG. 3) which as such are of equal length, and all of which extend below the ring-shaped weights 29 to 32, and are individually pivotable about a common shaft 49. As shown in FIG. 2 all the lifting fingers 33 to 40 have V-shaped notches which face upwardly and which are adapted to support the respective ring-shaped weight in the raised position, as exemplified in the case of weight 29. In its raised position the ring-shaped weight 29 is pressed by the two lifting fingers 33, 34 from below against a stop member 50 located above all the ring-shaped weights 29 to 32 and having the shape of a narrow stirrup, bolted by means of an upright shank 51 which rises beyond the periphery of the largest ring-shaped weight 32, to the intermediate base plate 4, as shown in FIGS. 1 and 3. FIG. 1 shows that in respect of each ring-shaped weight 29 to 32 the stirrup-shaped stop member 50 has a V-shaped notch which opens downward so that any one of the ring-shaped weights that is lifted will be held between the upward V-shaped notches in the lifting fingers and the downward V-shaped notch in the stop member 50, as shown in the case of the ring-shaped weight 29. Since the points of contact of the ring-shaped weight 29 with the underside of the stop member 50 are in cross-wise arrangement in relation to the points of contact with the upper edges of the lifting fingers 33, 34 the ring-shaped weight 29 will be secured against lateral displacement also when it is raised.

If the two levers 41, 42 with their lifting fingers 33, 34 are tilted down, then the ring-shaped weight 29 will be deposited on the lower portions 22, 23 of the carrier 16 to 24, the lifting fingers 33, 34 continuing the downward movement until they reach the same end position as that occupied by the other lifting fingers 35 to 40 (FIG. 2) in the drawing. The satisfactory operation of the arrangement that has been described when a ring-shaped weight is being lifted or lowered presupposes that the

two lifting fingers which lift or lower the ring-shaped weight apply themselves to points on the periphery of the ring-shaped weight that are as accurately as possible at opposite ends of the same diameter of the ring-shaped weight. During the actual lifting and lowering movement the ring-shaped weight will then temporarily be in a state of unstable equilibrium. On the other hand, it is an advantage if the raised ring-shaped weight can bear against the stop member 50 at points on a diameter which is preferably at right angles to the first mentioned diameter, as shown in FIG. 3. If this is the case the ring-shaped weight—although it may temporarily assume an inclined position on the lifting fingers—will be prevented from slipping out of the notches provided in the stop member and in the lifting fingers.

To permit the levers 41 to 43 and the associated lifting fingers 33 to 40 to be rapidly raised and lowered, the lever arms remote from the lifting fingers are acted upon by cam discs 52 to 59 (FIGS. 1 and 3) which are secured to a shaft 60 rotatably mounted in the rib members 5 and 6. To ensure that the lifting fingers associated with the same ring-shaped weight are actuated in synchronism the cam discs 52 and 53, 54 and 55, 56 and 57, and 58 and 59 are pairs of equal shape and secured on the shaft 60 in the same angular positions. Shaft 60 is parallel to shaft 49 and, in the same way as the latter, extends horizontally on one side of the periphery of the widest ring-shaped weight 32, so that each set of weights will require an arrangement of very low overall height. The end of shaft 60 which projects from the case of the balance, and which is not shown in the drawing, may carry a knob by means of which the weights can be deposited, in the sequence determined by the positions of the cam discs 52 to 59, on the supporting members 22, 23 of the carrier, or conversely raised from the same.

To make the illustration clear the upper portion 18 to 21 of the carrier is shown in FIGS. 1 and 2 as being entirely above the stop member 50. However, in order to keep the structural height as low as possible the described balance will in practice be so designed that the stirrup-shaped stop member 50 will project between the upper portions 18 and 19 and leave sufficient clearance so that the vertical distance between the upper portions 18, 19 on the one hand, and the lower portions 22, 23 on the other hand will be accordingly reduced.

While in accordance with the provision of the patent statutes I have illustrated and described the best forms and embodiments of the present invention as now known to me, it will be apparent to those skilled in the art that other changes and modifications may be made in the apparatus described without deviating from the invention as set forth in the following claims.

I claim:

1. In a balance apparatus having a base, a balance beam pivotally connected to said base by main knife edge means, a carrier suspended from one arm of said balance beam by knife edge suspension means and including horizontal supporting means, and a plurality of concentrically-arranged spaced annular weight members removably supported on said horizontal supporting means; the improvement which comprises a horizontal stop member secured to said base and extending horizontally above and spaced from said supporting means and said

weight members thereon, said stop member extending diametrically across said annular weight members and having longitudinally-spaced deformations in the lower surface thereof above diametrically opposed portions of each of said weight members, and means sequentially lifting said weight members upwardly from said supporting means into engagement respectively with the deformations in the lower surface of said stop member comprising a plurality of pairs of lifting members each arranged respectively below one of said annular weights, each pair of said lifting members being arranged to contact the associated weight member at diametrically opposed portions thereof, said stop member cooperating with said lifting members to hold secure against lateral displacement each of said ring-shaped weights, when in its raised position, in a crosswise arrangement between said lifting members and said stop member, and operating means sequentially raising said pairs of lifting members comprising a plurality of levers pivotally connected to said base and connected at their ends, respectively, to said lifting members, and means pivoting said levers in a predetermined order to sequentially move said annular weights vertically.

2. Apparatus as defined in claim 1 wherein each of said lifting members has an upwardly directed V-shaped notch therein and further wherein the deformations in said stop member comprise downwardly extending V-shaped notches, said notches cooperating upon upward movement of said lifting members to secure the annular weight member clamped therebetween against lateral displacement.

3. Apparatus as defined in claim 1 wherein each pair of said lifting members contacts the associated weight member at diametrically opposed portions lying in a vertical plane normal to said horizontal stop member, and further wherein said levers are all pivotally movable about a common horizontal axis which is parallel to said vertical plane and laterally spaced from said weight members.

4. Apparatus as defined in claim 3 wherein the horizontal supporting means of said carrier is connected to the upper portion of said carrier by a vertical portion extending between said common horizontal axis and said weight members.

5. The invention as recited in claim 1, wherein said levers can be tilted by means of cam discs secured to a common actuating shaft extending horizontally outside the periphery of the widest ring-shaped weight of said set.

6. The invention as recited in claim 1, wherein said lifting members are the upwardly bent ends of said levers.

7. The invention as recited in claim 1, wherein said levers are individually tiltable about a common shaft extending horizontally outside the periphery of the widest ring-shaped weight of said set.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

60	2,368,655	Fraps	Feb. 6, 1945
	2,764,400	Mettler	Sept. 25, 1956

##### FOREIGN PATENTS

	523,483	Great Britain	July 16, 1940
65	719,985	Great Britain	Dec. 8, 1954