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Stelwagen et al.

[11] **3,800,622**

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[54] **BALANCING DEVICE**

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[30] **Foreign Application Priority Data**

Sept. 11, 1971 Netherlands 7112526

[52] **U.S. Cl.** ..... **74/573 F,** 210/363, 233/1 C, 233/23 A

[51] **Int. Cl.** **F16f 15/16**

[58] **Field of Search** ..... 74/573 F, 573 R; 210/144, 210/363; 233/1 C, 23 A

[56] **References Cited**

UNITED STATES PATENTS

3,135,688	6/1964	Compans et al.	210/144
3,262,569	7/1966	Wade et al.	74/573 X
3,307,424	3/1967	Mandarino et al.	74/573

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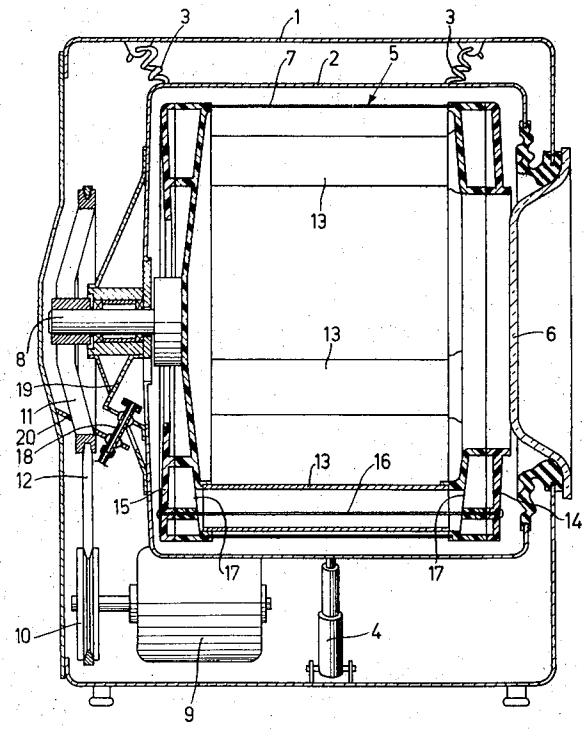
[57] **ABSTRACT**

Balancing device for a rotatable drum, which is resiliently mounted and may be eccentrically loaded, provided with receptacles for a balancing material. A nozzle of a conduit portion intended to convey this material to the receptacles is mounted for movement about two axes at right angles to one another by relative movement of two component parts of the device to which it is attached. The conduit is supported by ball joints to two separate support brackets, one of which is movable with respect to the other.

6 Claims, 5 Drawing Figures



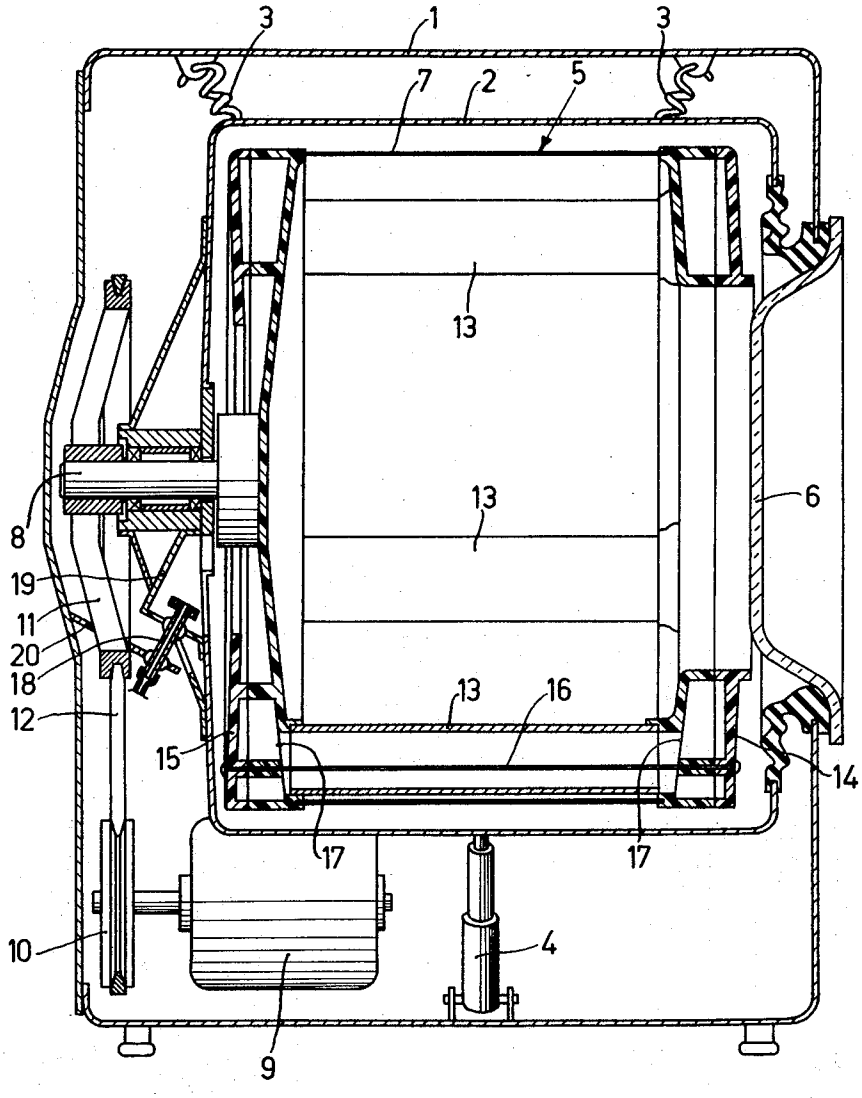


Fig.1

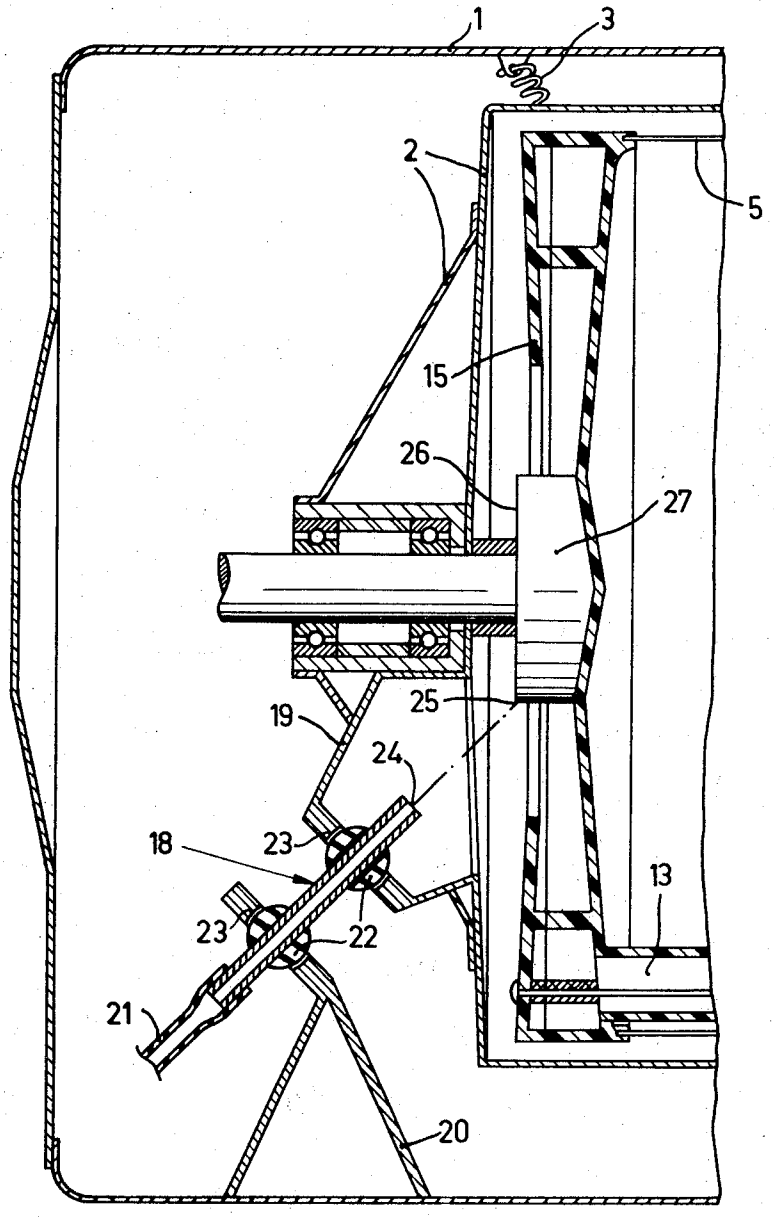


Fig.2

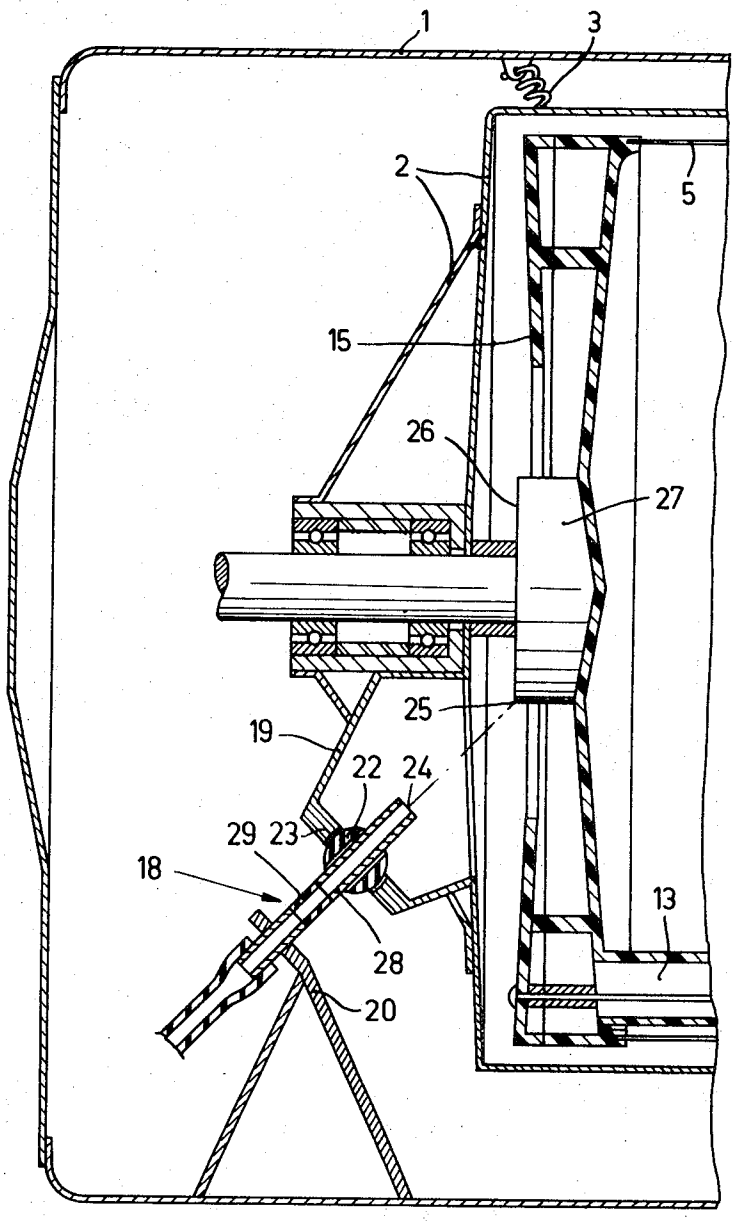


Fig.3

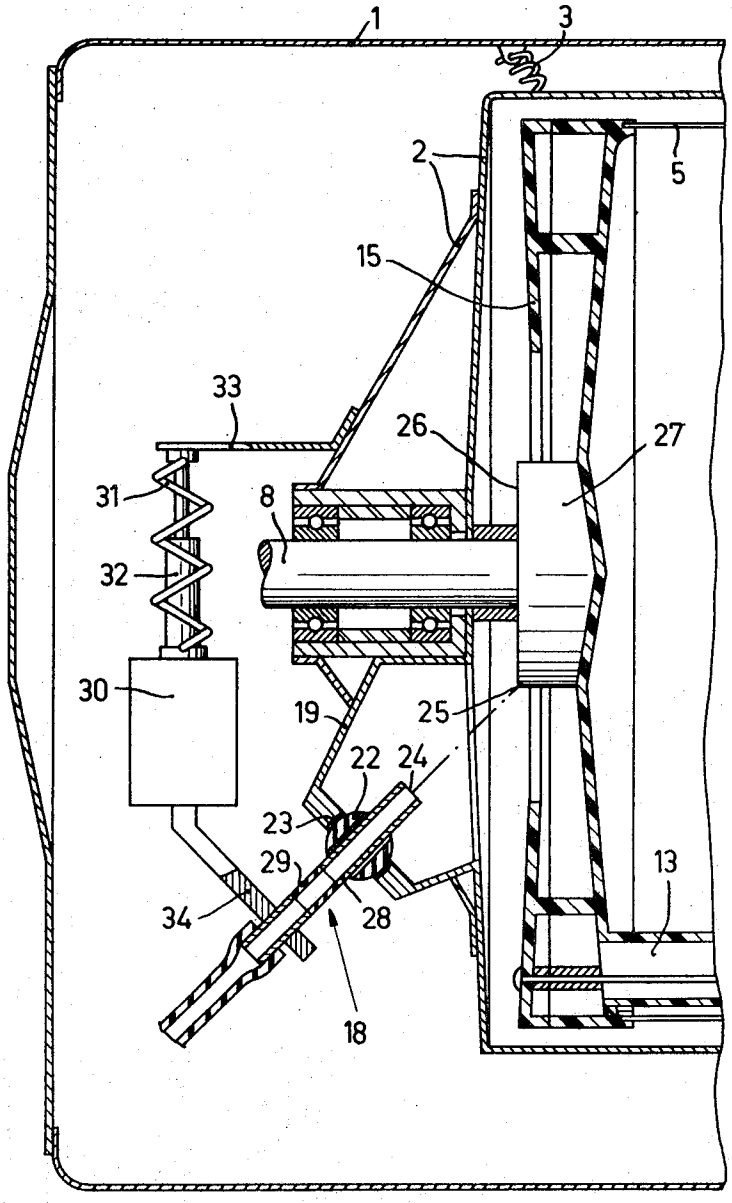


Fig.4

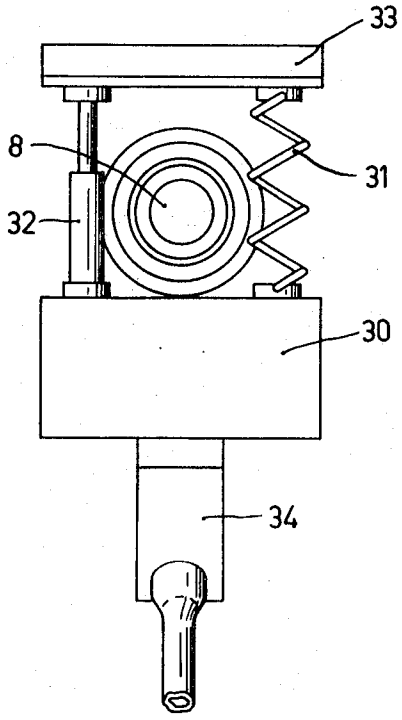


Fig.4a

BALANCING DEVICE

The invention relates to a balancing device for a rotatable drum which is mounted in a resiliently arranged frame and may be eccentrically loaded by uneven distribution of its contents and is provided with receptacles for balancing material. The device includes a conduit portion having a nozzle for supplying this material to at least one of the receptacles, which nozzle is adapted to be directed by the relative movement of two component parts of the device to which the conduit portion is connected.

Devices of this type are preferably used in domestic washing machines which are provided with a drum which is mounted for rotation about a horizontal axis and into which the articles to be washed are introduced and which during the wash cycle is driven at a speed of, say, 50 r.p.m., whilst to achieve a certain drying effect by spinning the speed is increased to, say, 1,000 r.p.m..

A problem in accelerating the drum from the washing speed to the spin-drying speed is that the drum contents never distribute evenly along the circumference of the drum, so that a certain degree of unbalance is produced which may give rise to undesirable oscillations unless compensating steps are taken.

A device of the type mentioned at the beginning of this specification is described in U.S. Pat. No. 3,135,688. In this device the conduit portion carrying the nozzle is connected pivotably about an axis to a component part, in this case the cabinet, of a washing machine, the nozzle being periodically brought within the range of the receptacles, which are secured to a washing machine drum, by rotation about the said axis due to the horizontal movements of a machine part which supports the bearings for the washing machine drum.

Another solution of the problem stated at the beginning of this specification is described in Netherlands Patent application No. 265,297.

In this application it is proposed to provide a member which is mechanically coupled to the frame and is capable of moving in phase with the rotation of the body and of interrupting a flow of liquid which is discharged from the conduit and is directed to the receptacles of the drum. In this device the conduit itself is fixed.

The devices described have the disadvantage that only part of the continuously discharging flow of liquid is used for the balancing effect proper, a large part of the liquid being lost. Furthermore, the supply of the balancing liquid to the receptacles is intermittent, thereby prolonging the period in which complete balancing has not yet been reached. Thus, these devices operate inefficiently, and in addition the use of a large number of component parts renders them expensive both to manufacture and to maintain.

The invention is characterized in that the nozzle is mounted so as to be movable about two axes which extend at right angles to one another. This provides a very simple construction which enables the nozzle to be continuously directed to the appropriate receptacle of the drum during the entire balancing period.

Advantageous embodiments are characterized in that the connection of the conduit portion of one of the component parts comprises a hinge which permits movement about two axes at right angles to one another and in that the connection of the conduit portion to the other component part also comprises a hinge which permits movement about two axes at right angles to one another.

Furthermore in another advantageous embodiment a flexible part of the conduit portion may extend between the two component parts.

An advantageous embodiment of the invention is characterized in that one of the said component parts forms part of a system comprising a mass, a spring and a damper. This enables a securing point of the conduit portion to be rendered accurately motionless, which condition sometimes is referred to as "seismically fixed." An advantage of this construction is that in assembling the appliance the part which comprises the rotatable body, the shaft on which it rotates, the bearings and the frame may entirely be prepared for building in, with the inclusion of the complete balancing device. In addition this construction provides a fixed rest position of the nozzle which is independent of the loading of tub and drum.

Finally an embodiment of the invention is characterized in that the orifice of the nozzle in the rest position of the device is directed to an edge of an outer boundary surface of the rotatable drum, which surface, viewed in the axial direction, lies before the front boundary surface of the receptacles for the balancing material. As will be set out more fully hereinafter, this arrangement increases the sensitivity of the device.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying diagrammatic drawings, in which:

FIG. 1 is a sectional view of a domestic washing machine provided with a device according to the invention,

FIG. 2 is a sectional view of a detail of an embodiment of the invention.

FIG. 3 is a sectional view of a corresponding detail of another embodiment,

FIG. 4 is a schematic sectional view of a detail of a washing machine in which a point of attachment has been made "seismically fixed," and

FIG. 4*a* is a rear view of this detail.

The domestic washing machine shown in FIG. 1 is of a known type and comprises a cabinet **1** in which a tub **2** is resiliently suspended from four springs **3**, at least one shock absorber **4** being provided at the bottom. A wash drum **5**, which is open at the front for the introduction and removal of the washing load, is mounted for rotation in the tub. The front walls of the tub **2** and of the cabinet **1** are formed with corresponding openings which may be closed by a door **6** which is hinged to the front wall of the cabinet **1**. The drum **5** has a cylindrical wall **7** made of perforated stainless steel sheet. To the rear wall of the drum **5** is secured a shaft **8** supported in a bearing in the rear wall of the tub **2**. The drum **5** is driven by an electric motor **9** secured to the tub wall. The drum is driven via pulleys **10** and **11** which are mounted on the motor shaft and the drum shaft **8** respectively and over which a belt **12** runs.

The motor **9** has two speeds, enabling the drum **5** to be rotated at a speed of about 50 r.p.m. for washing and at a speed of about 1,000 r.p.m. for spin-drying the washing load. The drum is internally provided with a plurality of ribs **13** which maintain the load in motion during washing.

The drum **5** has a front wall **14** and a rear wall **15** which are made of a synthetic material by injection moulding and are connected to one another by the

aforementioned cylindrical wall **7** made of perforated sheet material and by the ribs **13.** The assembly is held together by means of bolts **16** which pass through the ribs **13.**

The front wall **14** and the rear wall **15** are partly doubled, the front wall being double from the loading opening to its outer circumference and the rear wall being double from the area at which the shaft **8** is mounted to its outer circumference. The spaces between the double walls are interconnected via the ribs **13,** for which purpose the inner walls of the front and rear walls **14** and **15** are formed with suitable openings. The double-walled spaces are each divided into five receptacles by five radially extending partitions **17.** In the balancing process the balancing fluid is supplied to these receptacles and hence they form part of the balancing device. This device further comprises a conduit portion **18** through which the balancing fluid passes and which at one end is connected to a bracket **19** secured to the tub and at the other end to a support **20** secured to the cabinet **1.**

Two embodiments of these component parts are shown on an enlarged scale in FIGS. **2** and **3.**

It should be noted that the balancing fluid will in general be water, but that alternatively other liquids, such as oil, or powdered or granulated solids, such as sand, may be used. In the embodiment described the fluid is assumed to be water.

The conduit portion **18** shown in FIG. **2** is made of a metal, a hard synthetic material or a similar rigid material, and it is connected to a water pipe or hose through which during the period in which balancing is to be effected a flow of water is conveyed.

The pipe **18** is mounted in the bracket **19** and the support **20** by means of ball joints which comprise rings **22** which surround the pipe and are externally spherical and rings **23** which are internally spherical and are mounted in openings in the parts **19** and **20.** One of the rings **22** is rigidly secured to the pipe, but the other can freely slide over the pipe. It will be appreciated that this arrangement enables the orifice **24** of the pipe **18** to be directed in any direction, but that its position is determined by the position of the tub **2** relative to the cabinet **1.** The rest position, that is to say the position in which the tub **2** and the drum **5** are empty and the drum **5** is stationary, is selected so that the orifice of the pipe **18** points at an edge **25** of a front surface **26** of a hub **27.** In this position the sensitivity of the balancing device is a maximum, because even a small deflection of the tub **2** causes the orifice **24** to be directed to one of the compartments, whereas in the rest position reached after balancing any water which may still be discharged strikes the edge **25** and is not supplied to a given receptacle.

In FIG. **3** the conduit portion **18** comprises a rigid, for example metal, portion **28** and a flexible, for example rubber, portion **29.** The connection to the bracket **19** may again be a ball joint as described hereinbefore, however, the connection to the support **20** may be a fixed junction.

FIGS. **4** and **4***a* diagrammatically show an embodiment in which a securing point of the conduit portion **18** is secured to a seismic mass **30** which forms part of a system which comprises this mass **30,** a spring **31** and a damper **32,** is connected to the tub **2** of the machine by a bracket **33** and is proportioned so that at the critical frequency of the spring-suspended tub **2** and the drum **5** accommodated in it the mass **30** does not perform a movement relative to the cabinet **1,** so that the point **34** at which the conduit **18** is secured to this mass **30** may be regarded as a fixed point. In this embodiment the unit which comprises the tub and the drum and the components directly associated with them, such as the motor and the balancing device, may be entirely completed before being mounted in the cabinet **1,** permitting a considerable saving in cost of assembly.

What is claimed is:

1. A balancing device for balancing an eccentrically loaded drum resiliently mounted in a frame for rotational movement comprising a plurality of receptacles carried by said drum for receiving balancing material so as to balance said load, a conduit for supplying said balancing material to at least one of said receptacles connected at two points to separate component parts of said device, a nozzle at one end of said conduit for directing flow of said balancing material, said nozzle arranged for movement about two axes extending at right angles to each other by relative movement of said separate component parts.

2. The balancing device according to claim **1** wherein the connection of said conduit to one of said component parts comprises a joint permitting motion about two axes at right angles to each other.

3. The balancing device according to claim **2** wherein the connection of said conduit to the other of said component parts of said device comprises an additional joint permitting motion about two axes at right angles to each other.

4. The balancing device according to claim **1** wherein a portion of said conduit extending between said connections to said component parts is flexible.

5. The balancing device according to claim **1** further comprising a mass, a spring and a damper connected by one of said component parts to said conduit.

6. The balancing device according to claim **1** wherein said drum has an edge of an outer boundary surface which when viewed in the axial direction is located in front of the front boundary surface of said receptacles for reception of the balancing material, and wherein said nozzle is directed to said edge when the device is in a rest position.

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