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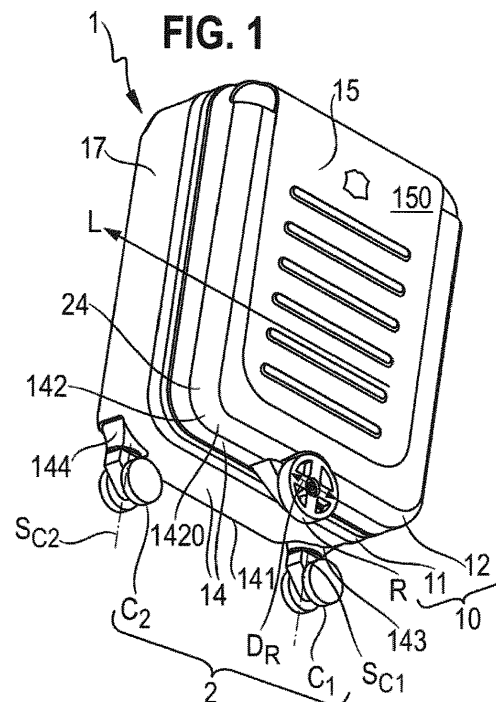
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(54) **PIECE OF LUGGAGE WITH WHEEL ARRANGEMENT**

(57) Piece of luggage (1) with a luggage body (10), the latter delimits an interior packing space (13) and comprising a bottom wall (14). The bottom wall (14) has a rear longitudinal edge (141) and a front longitudinal edge (142). The piece of luggage (1) comprises a wheel arrangement (2) that is arranged at said bottom wall (14) and comprises at least two swivel casters (C_1, C_2), each having a swivel axis (S_{C1}, S_{C2}) and a caster wheel rotation axis (R_{C1}, R_{C2}). Said wheel arrangement (2) further comprises at least one rigid wheel (R) with a rigid wheel rotation axis (R_R), the rigid wheel (R) being arranged between the two swivel casters (C_1, C_2) and in a region (1420) of said front longitudinal edge (142) of the bottom wall (14).



Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to a piece of luggage, in particular a suitcase, with a wheel arrangement for enhancing a mobility of said piece of luggage.

PRIOR ART

10 **[0002]** Luggage manufacturer strive toward providing items of luggage that offer, on the one hand, reliability, duration, and sufficient packing space, whilst being, on the other hand, light and mobile alike. It is well known in the art to fit suitcases with wheel arrangements such that they may be rolled instead of carried over smooth terrain.

[0003] Such suitcases are described, for example, in US 6,148,971 disclosing suitcases fitted with a caster wheel set. EP 0 874 564 shows further examples of suitcases with wheel arrangement enhanced mobility.

SUMMARY OF THE INVENTION

[0004] It is an object of the present invention to provide a piece of luggage, in particular a suitcase, with improved wheel arrangement enhanced mobility.

20 **[0005]** This object is achieved by a piece of luggage with the features of claim 1. Accordingly, a piece of luggage is suggested that comprises a luggage body, the luggage body delimiting an interior packing space and comprising a bottom wall, the bottom wall having a rear longitudinal edge and a front longitudinal edge opposite said rear longitudinal edge. Furthermore, the piece of luggage comprises a wheel arrangement, said wheel arrangement being arranged at, preferably attached to, said bottom wall. The wheel arrangement comprises at least two swivel casters, preferably exactly

25 two swivel casters, wherein each swivel caster has a swivel axis and a caster wheel rotation axis. The two swivel axes are preferably arranged in opposing first and second corner regions of said rear longitudinal edge of the bottom wall. **[0006]** The object is now achieved in that said wheel arrangement further comprises at least rigid wheel, preferably exactly one rigid wheel, the rigid wheel having a rigid wheel rotation axis and the rigid wheel being arranged between the two swivel casters and in a region of said front longitudinal edge of the bottom wall.

30 **[0007]** The present invention is based on the insight that a luggage wheel arrangement for mobilizing a piece of luggage with a rigid bottom wall provides improved mobility and an optimized empty-weight to packing-volume ratio while offering sufficient stability if the wheel arrangement has two swivel casters arranged on the bottom rear longitudinal edge side and one opposing rigid wheel on the bottom front longitudinal edge side between the two swivel casters. Thereby, the rigid wheel is arranged spaced from the swivel casters over a depth of the piece of luggage and, at the same time, space

35 from the swivel casters in lengthwise direction (*i.e.* in the direction of a straight connecting line between the swivel casters) in-between the two swivel casters. The two swivel casters and the rigid wheel are thus provided in a triangular arrangement with the swivel casters defining the hypotenuse of the triangle. The triangular arrangement offers stability and a minimal turning circle of the piece of luggage, the depth being the height of the triangle. In effect, the rigid wheel is already properly oriented for movement along the turning cycle while, in prior art, the swivel casters have to be first properly oriented, which requires space and force and is therefore disadvantageous to the mobility. Moreover, the two

40 swivel casters aligned along or close to a floor facing edge of the piece of luggage allow for tilting the piece of luggage and pulling or pushing it suspended on the two swivel casters in an inclined position, preferably via an extendable handle located at the other end of the piece of luggage. Furthermore, upon putting the piece of luggage to rest on all its wheels, the entire weight of the piece of luggage is carried by the piece of luggage in the upright position (spinner function) while

45 the piece of luggage may be pushed or pulled.

[0008] Preferably, said triangle is an equilateral triangle. Also, the preferred minimum wheel arrangement requires only three items (two swivel casters and one rigid wheel) which reduces the weight of the piece of luggage whilst allowing for increasing the interior packing space as there is one wheel case less that protrudes into the interior packing space. Accordingly, there is no need for wheel cases in the front corners or along the bottom front longitudinal edge of the piece

50 of luggage, accordingly, in some embodiments. Having no wheel cases in at the bottom front longitudinal edge also allows for fitting a maximized access opening in the front main face. Moreover, the front face may also be a soft wall with an integrated mounting plate while the rigid wheel is attached to the mounting plate (*cf.* below).

[0009] In the context of the present invention, the expression "*the rigid wheel being arranged [...] in a region of said front longitudinal edge of the bottom wall*" means that the rigid wheel is arranged close to the front longitudinal edge, *i.e.* with a distance of less than half, preferably of less than a third or a fourth or a fifth, of the depth of the piece of luggage at the position of the rigid wheel. It is to be understood that the rear and/or the front edge of the bottom wall may be rounded (*i.e.* curved), wherein the edge region includes or is defined by the rounded portion at the respective edge. A no-rounded sharp edge would, however, also work in the context of the present invention.

[0010] It is to be understood that a wheel arrangement consisting of three wheel groups, *i.e.* the two swivel casters and the single rigid wheel, is preferred. It is, however, also conceivable to have more casters and/or rigid wheels in the wheel arrangement.

[0011] In the context of the present invention, the term "*interior packing space*" refers to compartment provided by the luggage body for receiving items such as clothes or the like.

[0012] In some embodiments, said luggage body comprises a first body portion and a second body portion, said first and second body portions being configured such as to form said bottom wall and to form, therebetween, the interior packing space, wherein said two swivel casters are arranged on said first body portion and said rigid wheel is arranged on said second body portion. Accordingly, the first body portion is the rear body portion and the second body portion is the front body portion. The two preferably rigid body portions may be attached to one another by pivot joints, while a zipper connection provided along the gap between the first and the second body portion may be used to close the interior packing space.

[0013] It is, however, also conceivable that the luggage body is a single-piece rigid luggage body, or a luggage body with a soft front wall, or a soft shell luggage body with a rigid bottom wall.

[0014] In some embodiments the rigid wheel may not necessarily be attached to the bottom wall. It may be attached to a rigid mounting wall that is attached to the front face of the piece of luggage. Here, the front face may be a rigid or a soft wall structure. Accordingly, the present invention provides wheel arrangements for at least partially soft pieces of luggage.

[0015] In some embodiments, said two swivel axes of the swivel casters are arranged spaced to one another along a connecting line, wherein said rigid wheel rotation axis extends parallel to and at a distance of less than 150 millimeters to a perpendicular bisector plane of said connecting line. The perpendicular bisector plane extends perpendicular to the connecting line and through a middle point of said connecting line. Accordingly, the rigid wheel is arranged in a middle region of the front longitudinal edge region of the bottom wall. This is particularly advantageous as the piece of luggage is then optimally balanced, which further improves mobility of the device. Preferably, said rigid wheel axis extends in said perpendicular bisector plane, *i.e.* it is arranged through the midpoint between the two swivel casters and perpendicular to said connecting line.

[0016] In some preferred embodiments, the piece of luggage includes a handle, said handle preferably being extendable substantially perpendicularly to the bottom wall.

[0017] In particular, if the embodiments comprise the two body portions, it is preferred to have the handle attached to the first body portion, *i.e.* to the rear side of the piece of luggage. Then, the piece of luggage may simply be pivoted to the rear direction about the two swivel casters, which raises the rigid wheel from the ground, whereby the swivel casters automatically align themselves in traveling direction and the piece of luggage may simply be dragged behind oneself.

[0018] In some embodiments, a rigid wheel diameter is larger than 40 millimeters, preferably larger than 50 millimeters or larger than 75 millimeters. A large rigid wheel, which may be a single wheel and which may be skeletonized, improves the rolling stability of the piece of luggage. Preferably, the rigid wheel diameter is larger than a swivel caster wheel diameter. Accordingly, the rigid wheel rotation axis is arranged above (*i.e.* closer to the top wall than) the swivel caster rotation axes, while the latter are preferably arranged on the same height and perpendicular to the swivel axes. The rigid wheel rotation axis may, for example, be arranged above the swivel caster rotation axes by a distance that is equal to a difference between the rigid wheel diameter and the swivel caster wheel diameter.

[0019] In some embodiments, the rigid wheel is arranged and designed such as to extend from below the bottom wall to above the bottom wall. This allows having a large rigid wheel. Preferably, the rigid wheel is recessed into the major front face of the piece of luggage. This may decrease the interior packing space a little bit, but far less than a wheel case for a swivel caster does. Accordingly, it is preferred that the luggage body defines a major front face, wherein said rigid wheel is arranged such that an front facing surface of the rigid wheel is flush and parallel with said front major face.

[0020] In some embodiments, said preferably rigid bottom wall is substantially rectangular.

[0021] In some embodiments, said two swivel casters are arranged in a recessed manner. This allows maximizing the interior packing space if the outer dimensions of the piece of luggage are subject to regulations such as currently provided by airline companies. The maximizing effect is due to the use of the space between the different wheel groups of the wheel arrangement.

[0022] Preferably, said two swivel casters are of double- or compound-wheel type and are preferably of automatic-aligning type and/or wherein said rigid wheel is of single-wheel type.

[0023] As outlined above, said rigid wheel may, in some embodiments, be attached to a rigid mounting plate, the latter being attached to the luggage body, preferably to the front face (internally or externally). For that purpose, the rigid wheel rotation axis may be attached to the mounting plate instead of being attached to the bottom wall. Thereby, also soft shell luggage such as soft side luggage, rolling duffle bags, and rolling backpacks may be fitted with the wheel arrangement according to the present invention.

[0024] Preferably, the piece of luggage is a suitcase with a front wall, an opposing rear wall, rear and front walls connecting side walls, and a top wall, the top wall being arranged opposite of the bottom wall, wherein said walls delimit

the interior packing space. Preferably, the piece of luggage is a hard side luggage, in particular a hard side suitcase.

[0025] It is to be understood that the herein-described embodiments may be combined with one another to form a further embodiment with parts or all the features of the combined embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] Preferred embodiments of the invention are described in the following with reference to the drawings, which are for the purpose of illustrating the present preferred embodiments of the invention and not for the purpose of limiting the same. In the drawings,

Fig. 1 shows in a front perspective view from below, an embodiment of the piece of luggage according to invention;
 Fig. 2 shows a bottom rear perspective view of the suitcase according to Fig. 1;
 Fig. 3 shows a bottom view of the suitcase according to Figs. 1 & 2; and
 Fig. 4 shows a side view of the suitcase according to Figs. 1-3.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0027] Figures 1 to 4 show an isometric view of a preferred embodiment in a true to scale manner therefore showing true angles and aspect ratios of said embodiment.

[0028] Figure 1 shows said embodiment of the piece of luggage as a cuboidal suitcase 1.

[0029] The term "*bottom*" part is to be understood as the lower part of the suitcase 1, *i.e.* where the wheel arrangement 2 is arranged. The "*top*" part is opposite the bottom part. The "*rear*" part is to the left in Figs. 3 and 4. The "*front*" part is opposite the rear part.

[0030] According to Fig. 1, the suitcase 1 comprises a luggage body 10 with a first body portion 11 and a second body portion 12. The body portions 11, 12 are hard-top half shells that are hinged to one another. They may be produced by deep-drawing techniques. The both body portions 11, 12 are hinged to one another such as to be pivotable relative to one another.

[0031] The body portions 11, 12 of suitcase 1 may be moved between a closed and an opened position, while the suitcase 1 may be secured in closed position by means of a zipper running between the two rigid body portions 11, 12. The zipper may extend circumferentially in the gap between the first and second body portions 11, 12 around the suitcase 1, from first to second ends of a hinge portion. The zipper is configured to attach the two body portions 11, 12 to one another. The first body portion 11 is the rear body portion; the second body portion 12 is the front body portion.

[0032] The suitcase 1 has a front wall 15 that is part of the second body portion 12, an opposing rear wall 16 (*cf.* Fig. 2) that is part of the first body portion 11. Moreover, the suitcase 1 comprises rear and front walls 15, 16 connecting side walls 17 and a top wall 18 (*cf.* Fig. 4). The top wall 18 is arranged opposite of the bottom wall 14. The bottom wall 14, the side walls 17, and top wall 18 are formed by corresponding sections of the first and second body portions 11, 12; accordingly, these walls 14, 17, 18 are each divided into two parts. Said six walls 14-18 delimit the interior packing space 13 (*cf.* Figs. 3, 4).

[0033] The bottom sections of the body portions 11, 12 form the bottom wall 14, which is divided into two parts by the gap running between the two body portions 11, 12, the zipper being arranged in said gap.

[0034] The rear body portion 11 has at the bottom side a lengthwise extending rear longitudinal edge 141 with rounded region 1410 (*cf.* Fig. 2) and rounded first and second corner regions 143 and 144, respectively. The longitudinal direction L is depicted in Fig. 1. The front body portion 12 has at the bottom side a lengthwise extending front longitudinal edge 142 with a rounded region 1420. The rounded regions 1410, 1420 may have radii in the range of 20 millimeter to 40 millimeter. The rounded regions 1410, 1420 are preferably shaped as circular cylinder sections.

[0035] In the first and second corner regions 143, 144 of the rear longitudinal edge 141 are arranged in wheel cases first and second swivel casters C_1 and C_2 , respectively. The swivel casters C_1 , C_2 are suspended in vertically extending swivel joints with first and second swivel axes S_{C1} and S_{C2} , respectively. The vertical direction extends between the top and the bottom of the suitcase 1. The swivel axes S_{C1} and S_{C2} are arranged to have an offset distance to a center axis of the wheels such as to allow automatic alignment of the swivel wheels into traveling direction. The double-wheels of the swivel casters C_1 , C_2 are rotatable about horizontal rotation axes R_{C1} , R_{C2} , respectively. The rotation axes R_{C1} , R_{C2} are the center axis of the wheels. Each double-wheel has a diameter D_S of about 50 millimeters (*cf.* Fig. 4). In some embodiments, D_S may be up to 120 millimeters or more.

[0036] The swivel casters C_1 and C_2 are arranged recessed in said wheel cases such that an interior package space 13 is maximized. Moreover, the first and second swivel axes S_{C1} and S_{C2} may be connected by a straight connecting line 1 (*cf.* Figs. 2, 3). The connecting line 1 runs parallel to the rear and front edges 141, 142, respectively, and perpendicular to the swivel axes S_{C1} and S_{C2} .

[0037] Figure 2 shows the suitcase 1 in a bottom rear view. An extendable handle 3 with a telescopic grip 32 is

attached at the suitcase 1's rear body portion 11.

[0038] Moreover, at the front edge 142 is arranged in a middle region a rigid wheel R. The rigid wheel R has a rigid wheel diameter D_R of about 80 millimeters and a front surface 21 (cf. Fig. 3).

[0039] In some embodiments, D_R may be up to 150 millimeters or more. A thickness of the rigid wheel R may range from 15 millimeters to 30 millimeters. The rigid wheel R may be a single piece wheel, preferably with an elastic damping material on its bearing surface.

[0040] In order to further reduce weight and improve appearance, the rigid wheel R is skeletonized. Preferably the wheel R is skeletonized such as to form a structure with four webs that are oriented perpendicular to one another to form a cross (cf. Fig. 1).

[0041] The rigid wheel R is rotatable about its horizontal rotation axis R_R . The rotation axis R_R is arranged to extend in a perpendicular bisector plane M that runs through the connecting line 1 middle point between the swivel casters C_1 , C_2 (cf. Figs. 2 & 3).

[0042] The rigid wheel rotation axis R_R is suspended in a substantially triangular mounting structure 22 which has a skeletonized front face 23 with a bearing point to receive the axis R_R . The mounting structure 22 has a base with a length that is larger than the diameter D_R of the rigid wheel R. In the embodiment according to Figs. 1 to 4, the mounting structure 22 is arranged in the middle between the casters C_1 , C_2 .

[0043] A height of the mounting structure 22 protrudes over the bottom wall 14 and extends vertically beyond the rotation axes R_{C1} , R_{C2} . The mounting structure 22 tapers in the direction parallel to the height (cf. Figs. 3 & 4). This tapering reduces the width of the mounting structure to 50% of the width at the base and helps to minimize the weight while the dimensions are chosen such that any stability requirements are met.

[0044] In other embodiments, the mounting structure 22 (and therefore the rigid wheel R) may be shifted away from the middle position, e.g. by 10% to 30% of a length of the suitcase 1 in the L direction.

[0045] Figure 3 shows suitcase 1 in a bottom view. From Fig. 3 is apparent that the wheel arrangement 2 is an equilateral triangular arrangement of swivel caster C_1 , C_2 and rigid wheel R with the connecting line 1 as the hypotenuse.

Also, it is apparent that the front surface 21 of the rigid wheel R is flush with a front major face 150 of the front wall 15.

[0046] Figure 4 shows the suitcase one from a side view. From Fig. 4 it becomes clear that the rigid wheel rotation axis R_R is arranged above the swivel caster rotation axes R_{C1} , R_{C2} . This is a result from the fact that the double-wheel diameter D_S is smaller than the rigid wheel diameter D_R , while the bottom end of the wheels may be arranged to contact horizontal ground such that the suitcase 1 stands vertically on the wheel arrangement 2. This further enhances stability.

From Fig. 4 it is also apparent that the outward facing surface 21 of the rigid wheel R is flush with the major front face 150.

[0047] The present invention is not limited to the above-described embodiments, it is to be understood that the invention may also be differently embodied within the scope of the following claims.

LIST OF REFERENCE SIGNS

1	piece of luggage	23	mounting plate for R_R
10	luggage body of 1	24	rigid rounded mounting plate for R
11	first body portion of 10	R	rigid wheel of 2
12	second body portion of 10	R_R	rotation axis of R
13	interior space of 10	D_R	diameter of R
14	bottom wall of 10		
141	rear longitudinal edge	C_1	first swivel caster of 2
1410	rounded edge region of 141	C_2	second swivel caster of 2
142	front longitudinal edge	R_{C1}	rotation axis of C_1
1420	rounded edge region of 142	R_{C2}	rotation axis of C_2
143	first corner region of 141	S_{C1}	swivel axis of C_1
144	second corner region of 141	S_{C2}	swivel axis of C_2
15	front wall of 10	D_S	diameter of swivel caster wheel
150	major front face of 15		
16	rear wall of 10	I	connecting line of S_{C1} and S_{C2}
17	side wall of 10	L	longitudinal direction
18	top wall of 10	M	perpendicular bisector plane of 1
2	wheel arrangement	3	handle
21	outer facing surface of R	32	grip

(continued)

22 mounting structure for R

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Claims**1.** Piece of luggage (1) comprising:

10 a luggage body (10), the luggage body (10) delimiting an interior packing space (13) and comprising a bottom wall (14), the bottom wall (14) having a rear longitudinal edge (141) and a front longitudinal edge (142) opposite the rear longitudinal edge (141); and
 a wheel arrangement (2), said wheel arrangement (2) being arranged at said bottom wall (14) and comprising at least two swivel casters (C_1, C_2) each having a swivel axis (S_{C1}, S_{C2}) and a caster wheel rotation axis (R_{C1}, R_{C2});
 15 **characterized in that**
 said wheel arrangement (2) further comprises at least one rigid wheel (R) with a rigid wheel rotation axis (R_R), the rigid wheel (R) being arranged between the two swivel casters (C_1, C_2) and in a region (1420) of said front longitudinal edge (142) of the bottom wall (14).

20 **2.** Piece of luggage (1) according to claim 1, wherein the two swivel axes (S_{C1}, S_{C2}) are arranged at said rear longitudinal edge (141), preferably in opposing first and second corner regions (143, 144) of said rear longitudinal edge (141) of the bottom wall (14).

25 **3.** Piece of luggage (1) according to claim 1 or 2, wherein said luggage body (10) comprises a first body portion (11) and a second body portion (12), said first and second body portions (11, 12) being configured such as to form said bottom wall (14) and to form, therebetween, the interior packing space (13), wherein said two swivel casters (C_1, C_2) are arranged on said first body portion (11) and said rigid wheel (R) is arranged on said second body portion (12).

30 **4.** Piece of luggage (1) according to any one of the preceding claims, wherein said two swivel axes (S_{C1}, S_{C2}) are arranged spaced to one another along a connecting line (1), and wherein said rigid wheel rotation axis (R_R) extends parallel to and at a distance of less than 150 millimeters to a perpendicular bisector plane (M) of said connecting line (1).

35 **5.** Piece of luggage (1) according to claim 4, wherein said rigid wheel axis (R_R) extends in said perpendicular bisector plane (M).

6. Piece of luggage (1) according to any one of the preceding claims, including a handle (3), said handle (3) preferably being extendable substantially perpendicularly to said bottom wall (14);
 40 wherein said piece of luggage (1) being preferably according to any one of claims 3 to 5 and said handle (3) being preferably arranged on the first body portion (11).

7. Piece of luggage (1) according to any one of the preceding claims, wherein a rigid wheel diameter (D_R) is larger than 40 millimeters, preferably larger than 50 millimeters or larger than 75 millimeters, and wherein, preferably, the rigid wheel diameter (D_R) is larger than a swivel caster wheel diameter (D_S).

45 **8.** Piece of luggage (1) according to any one of the preceding claims, wherein the rigid wheel rotation axis (R_R) is arranged above the swivel caster rotation axes (R_{C1}, R_{C2}).

9. Piece of luggage (1) according to any one of the preceding claims, wherein the rigid wheel (R) is arranged and designed such as to extend from below the bottom wall (14) to above the bottom wall (14).
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10. Piece of luggage (1) according to any one of the preceding claims, wherein the luggage body (10) defines a major front face (150) and wherein said rigid wheel (R) is arranged such that a front facing surface (21) of the rigid wheel (R) is flush with said front major face (150).
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11. Piece of luggage (1) according to any one of the preceding claims, wherein said bottom wall (14) is substantially rectangular.

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12. Piece of luggage (1) according to any one of the preceding claims, wherein said two swivel casters (C_1, C_2), and preferably also the rigid wheel (R), are arranged in a recessed manner.
- 5 13. Piece of luggage (1) according to any one of the preceding claims, wherein said two swivel casters (C_1, C_2) are of double- or compound-wheel type and are preferably of automatic-aligning type and/or wherein said rigid wheel (R) is of single-wheel type.
- 10 14. Piece of luggage (1) according to any one of the preceding claims, wherein said rigid wheel (R) is attached to a rigid mounting plate (24), the latter being attached to the luggage body (10).
- 15 15. Piece of luggage (1) according to any one of the preceding claims, wherein the wheel arrangement (2) is attached to the bottom wall (14).

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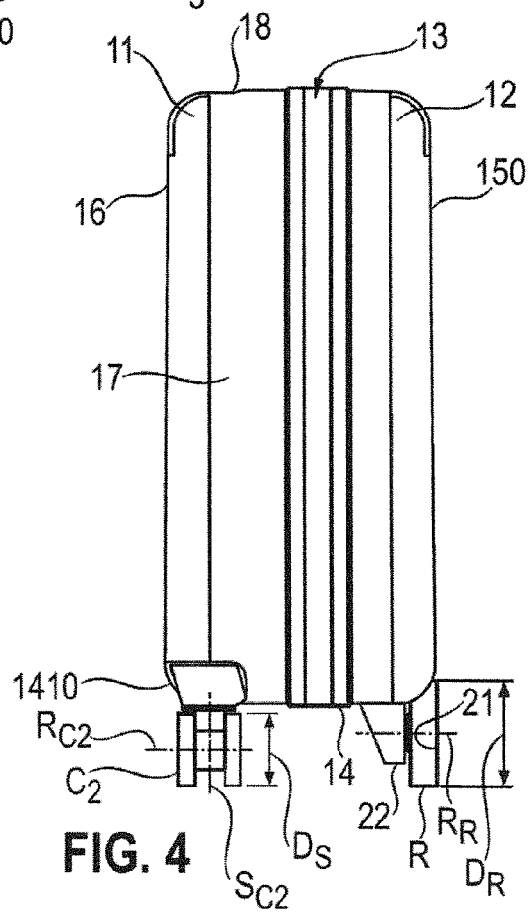
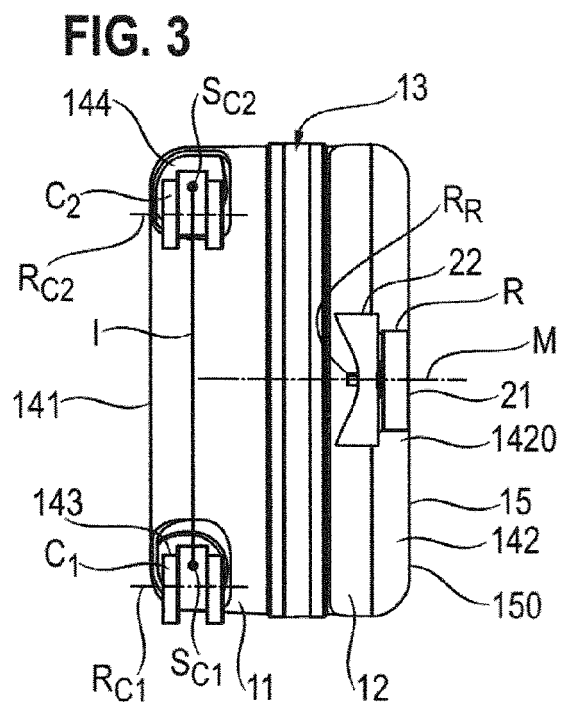
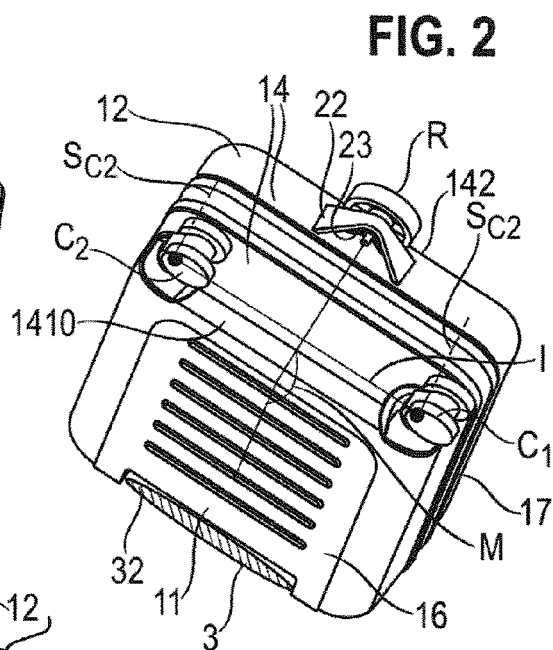
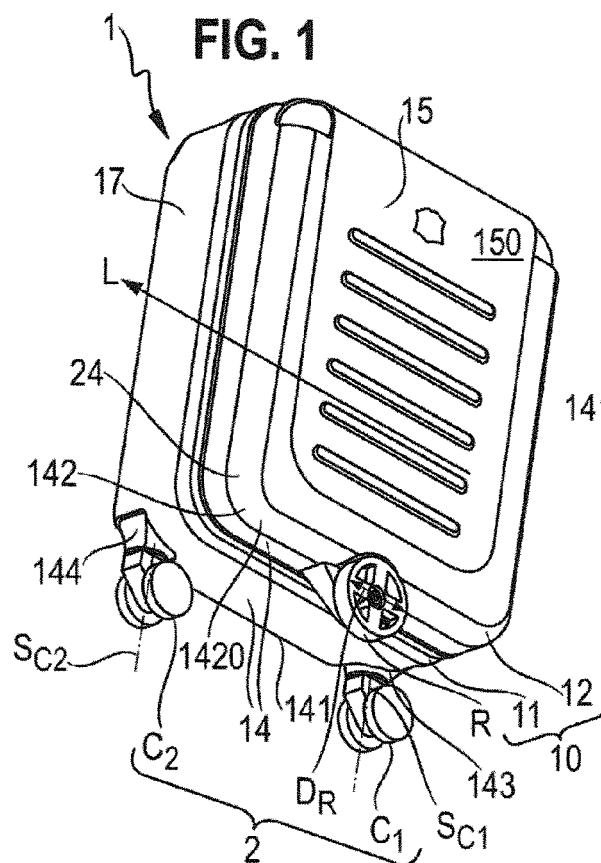
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EUROPEAN SEARCH REPORT

Application Number
EP 15 17 8624

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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