

TROLLEY, IN PARTICULAR FOR AIRLINE APPLICATIONS**Scope of the invention**

The present invention regards a trolley, in particular for use for airline applications, more particularly of the food-and-drink trolley type.

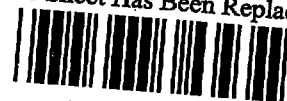
5 Prior art

Today, for use in the field of air transport, there exist trolleys, in particular trolleys on board aeroplanes, such as food-and-drink trolleys and duty-free goods trolleys, the design of which is obsolete and altogether inadequate for present needs as regards reduced weight and improved functionality. Consequently, airline
10 companies have expressed the strong need for innovative trolleys characterized in particular by reduced weight, reduced maintenance, and better safety characteristics. Another negative feature of known trolleys is that they are not very easy to handle and manoeuvre, owing to the inadequacy of the wheels. For example, food trolleys are subjected to stresses when they are pushed backwards
15 and forwards along the aisles of aeroplanes for transporting drinks and food for the passengers. Another negative aspect regards the debris and dirt that gathers in the trolleys, for example in the recesses of the wheels, as a result of friction with the floor, which is frequently carpeted, and as a result of the necessary use of lubricants.

20 Consequently, the need exists of having durable trolleys which are easy to manoeuvre and to brake, require very little and easy maintenance, are resistant to impact and, above all, are light. It has been estimated that a reduction in weight of 1 kilogram on board an aeroplane can lead, in the course of a year, to a saving for the airline company of approximately 300,000 Italian lira per Kg.

25 Existing trolleys, in particular the trolleys used on aeroplanes, are built according to technical concepts that are outdated, and one of the materials used is steel, which can easily rust. The various parts that make up trolleys are moreover assembled by riveting and bonding, and hence trolleys cannot be dismantled easily for carrying out maintenance operations (cleaning and replacement of
30 parts). In addition, as regards in particular the wheels or casters, if it is necessary to change them when they are worn out, they cannot be replaced easily, as may

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be seen from an example illustrated in Figures 6A and 6B, in that it is necessary to replace the entire wheel or caster assembly, where by the term "caster assembly" is meant the assembly that comprises not only the wheel or wheels, but also the swivel plate on which the wheel is mounted by means of a fork.

5 Figures 6A and 6B show, respectively, a front view and a cross section of a caster assembly 10 used for existing food-and-drink trolleys. With reference to Figure 6A, the caster assembly 10 comprises the wheels 12 and a swivel plate 14. The wheels are fastened on by means of a nut 16 and a bolt 18 to the swivel plate 14. The said swivel plate comprises a certain number of parts, shown in Figure 6B,
10 assembled together to form a single unit 14; consequently, the user cannot dismantle the swivel plate into its individual parts without damaging it irreparably. Figure 6B is a cross-sectional view along B-B of Figure 6A. As may be seen, the swivel plate 14 consists of approximately seven interconnected parts, not including the wheels 12 and the nut 16 and bolt 18, which together with the swivel
15 plate 14 make up the wheel assembly 10. The swivel plate 14 comprises a brake with a pin 20, a disk 22 and a nut 24. A spring 26 surrounds the pin 20 adjacent to the top of the swivel plate 14 for lowering the brake disk 22 to bring it up against the wheel 12 when the top of the pin 20 is pressed. So that the pin can move within the plate, to be pressed against the wheel 12, a central rivet 28 is used to
20 secure the parts of the swivel plate permanently together. The parts fastened together by the rivet 28 comprise a fork 30 to connect the wheel 12 to the swivel plate (shown more clearly in Figure 6A), a plurality of balls 32a, 32b (only two of which are shown) of a ball bearing, a seat 34 for the balls of the ball bearing, one or more flanges or collars 35, 36 which, together with the seat 34, define a ball
25 race of the ball bearing, and a top plate 38. The seat 34 of the bearing and the flanges 35, 36 may be made of one piece with, or firmly fixed to, the fork or the plate 38. In any case, the balls are traditionally arranged within a circular ball race and are typically made of steel, as are the remaining parts of the caster assembly. The housings must be lubricated to reduce friction and to enable easy rotation of
30 the fork 30 and of the wheel 12 with respect to the top plate 38.

The swivel plates currently used for casters and described above are traditionally

made of galvanized steel and may weigh approximately 750 g, as against approximately 500 g of those of the present invention.

It has now been found that an adequate choice of materials and shapes may bestow on trolleys the advantages required by users, who are dissatisfied with existing trolleys. The configuration and conformation described in the following create a more durable device, one which is easier to use, lighter, and which is rust-proof. Further advantages of the invention will be evident by the following description.

Summary of the invention

10 It is an object of the present invention a food-and drink trolley having a substantially parallelepipedal structure built of suitable materials selected among aluminium, Kevlar®, carbon fibre, or materials with similar performance features, the parts of the said trolley being assembled with screws. In particular, the trolley comprises a load-bearing structure moved by a caster assembly, which is
15 basically made of aluminium, side panels, base and top panel, made basically of aluminium, Kevlar®, carbon fibre or a material presenting similar features, appropriately combined together as described hereinafter.

Another object of the invention is a caster assembly basically made of aluminium and basically comprising an insert, a base and a fork. The fork is mounted on one
20 or more of the wheels and is connected to the bottom part of the base, which, at the top houses the insert. In a cavity made between the insert and the base, balls of the ball bearing are housed, so that the insert and the fork, which are held together by screws, can rotate with respect to the base, which is fastened to the bottom of the trolley.

25 A further object of the invention is the use of aluminium, which is extruded and subsequently machined using numeric-control machines, Kevlar®, carbon fibre or a material presenting similar features, the said materials being suitably combined together to form a food-and-drink trolley, in particular for use on aeroplanes.

Further objects of the invention will be evident from the following description of the
30 invention.

Brief description of figures

For a better understanding, a non-limiting example of the invention is shown in the attached figures.

Fig. 1 is a schematic front view of the trolley according to the invention, with a first door embodiment, the door in this case being plane.

5 Fig. 2 presents the same view as Fig. 1, with the door completely open and turned back against the side wall of the trolley.

Fig. 3 is a schematic front view of a second door embodiment, the door in this case being crowned.

Fig. 4 is a schematic top view of the trolley.

10 Fig. 5 is a schematic side view of the trolley.

Fig. 6A is a schematic front view of a known caster assembly mounted on trolleys used for serving meals and drinks on aeroplanes.

Fig. 6B is a side sectional view along the line B-B of Fig. 1A.

15 Fig. 7 is a schematic perspective view of a caster assembly that is to be mounted on the trolley of the invention.

Fig. 8 is a schematic sectional view in an assembled configuration of the swivel plate and of the wheel.

Fig. 9 is a schematic side sectional view of the fork, base and insert (separated) which make up the swivel plate of Fig. 8.

20 Fig. 9A is a schematic view of a first embodiment of the swivel plate 56 of small size.

Fig. 9B is a schematic view of a second embodiment of the swivel plate 56 of medium size.

25 Fig. 9C is a schematic view of a third embodiment of the swivel plate 56 of large size.

Fig. 10 is a schematic perspective view of the separate elements that make up the wheel assembly of Fig. 7.

Fig. 11 is a schematic perspective view of the entire trolley.

Detailed description of the invention

30 The trolley according to the invention is a food-and-drink trolley having a basically parallelepipedal structure having, at the vertices, three-way joints made of

aluminium, connected together by means of aluminium strips set on the edges of said parallelepipedal structure. The said strips are connected to shaped surfaces made of a material selected among aluminium, Kevlar®, carbon fibre, or of a material presenting similar features, or of combinations of the above materials. In addition, the said joints, strips and surfaces are fixedly connected together with screws. The trolley further carries, on at least one side surface, a door, which can be hinged to the load-bearing structure of the trolley, or else may be connected to it in a sliding way. The said trolley is likewise equipped with a caster assembly for moving it, the said caster assembly being basically made of aluminium, and with at least one braking device.

The invention will now be described with reference to the attached figures, which simply provide a non-limiting illustration thereof.

With particular reference to Figures 1-5 and 11, the trolley according to the invention has a basically parallelepipedal shape and is mounted on casters. The caster assembly 50 will be described in detail in what follows.

The basically parallelepipedal structure of the trolley carries at its vertices joints 1 of the three-way type, connected together by means of strips 1' set on the edges of the said parallelepipedal structure. These joints 1 and strips 1' are made of extruded aluminium, preferably the alloy 6082T6 produced by the firm Alcoa or Metra, or another product having similar features in terms of lightness and resistance. The above joints and strips are obtained by extrusion and are machined with numeric-control machines, i.e., using machining processes which are well known to the experts of the art. This type of process guarantees precision-machined pieces without tolerances. By comparison, the joints of known trolleys are made of die-cast steel and, on account of the stresses which they undergo, are very subject to failure.

The side panels 2 and the rear panel (not shown) are panels of the sandwich type with a honeycomb internal structure, manufactured by the firm Seal-Milano, or panels presenting similar features in terms of lightness, resistance, impact strength, breaking strength, etc. The aforesaid panels have an internal layer made up of an epoxy-resin or glass-fibre lamina, preferably having a thickness of

approximately 0.2 mm, and of an external layer consisting of an epoxy-resin or Kevlar® lamina, preferably having a thickness of approximately 0.3 mm. Between the internal layer and the external layer, an aluminium mesh or a vegetal-fibre honeycomb structure may be present. The panels are characterized by an impact strength determined by an impact test with a 5-kg steel ball dropped from a height of 1.50 m.

The internal panels 3, provided with projecting ridges 3' to provide support for possible trays, are made of aluminium and are obtained by drawing.

The handle 4 is of the ergonomic type, coated with non-slip plastic material.

10 The door, in its first embodiment 5 and in its second embodiment 6, may be made with sandwich panels of the type described previously, or may be made of milled aluminium, according to the individual requirements of the various airline companies. On the external surface of the door, there may be applied drawings and decorations made using known techniques, such as sublimation or application of pre-decorated paper. The doors may also carry handles 5', 6' and friezes 5'', 6''.
15 The doors may be hinged to the trolley with hinges 5a of a conventional shape, these also being made of aluminium having the same characteristics as those mentioned previously. Alternatively, according to one embodiment which is not shown, the doors may slide with guides on bearings and be positioned parallel to
20 the side panels 2. The doors may be made with flat or crowned panels (maximum thickness 6-24 mm) or radiused with a radius of curvature of 20° so as to keep the temperature inside the trolley as far as possible at a given value.

The top panel 7 can be made in a similar way to the side panel 2 or to the base 8. The latter is obtained by co-extrusion of aluminium and of a fibre material, such as
25 Kevlar® or carbon fibre, or other material presenting similar features.

A separator element 9 may be present, which has the purpose, for example, of strengthening the structure of the trolley, or has other purposes.

The assembly may be completed by a drawer made of aluminium and a working surface, also made of aluminium (neither of which shown), for containing dry ice in
30 order to keep the temperature low. In addition, on the top part of the trolley tanks or cavities may be present, or else projecting ridges and/or railings (also these are

not shown), etc., for housing bottles.

All the elements making up the trolley are shaped so that they fit together in order to be joined with screws 11, some of which are shown in the figures. All the parts are thus easy to dismantle.

5 The trolley illustrated in Figures 1-5 and 11 is a food-and-drink trolley. Other types of trolleys may be built using the techniques and materials described above and simply modifying the top part according to the specific requirements of the airline company that orders the trolley, all these modifications being intended to be within the scope of the present invention.

10 The trolley according to the invention is equipped with a brake 100. The brake is provided with two pedals 101 and 102, one for braking and the other for releasing the wheels. In an alternative embodiment (not shown), the brake 100 may be made with a single pedal for braking, whilst release of the wheels may be effected by a control or release mechanism located near the handle 4 or in another
15 ergonomic position.

The materials selected above must likewise meet the requirements in compliance with the standards of registration of the airline companies; they must therefore also be self-extinguishing, scratch-proof, fire-retardant and non-toxic materials, and ones that, in the event of fire, produce a low density of fumes, according to
20 FFA (Federal American Aviation) Boeing Air-bus regulations.

The final dimensions of the trolley are preferably as follows: length, approximately 800-820 mm; width, approximately 290-315 mm; height, approximately 980-1050 mm. The trolley must have these dimensions so that it can be advantageously housed in the compartments provided inside the aircraft of each airline company.

25 All the parts of the trolley may be easily removed using simple tools, such as a screw-driver, to carry out cleaning, repairs and replacement of parts.

As regards the caster assembly designed for moving the trolley, it has been found that the difficulties associated to current caster assemblies may be solved by using a swivel plate basically made up of just three detachable parts (as
30 compared to approximately seven in the known art): a fork, a base, and an insert; these parts are made starting from blocks of extruded and machine aluminium,

and are used in combination with plastic, in particular Torlon®, ball-bearing balls. The ball bearings used have balls made of a suitable plastic material having adequate resistance and being self-lubricating (e.g., Torlon®). Conventional ball bearings with balls made of steel are to be avoided in that they scratch the aluminium and require lubrication.

The wheels are coated with rubber, either natural or synthetic; in the latter case, in particular polyurethane rubbers may be used. The advantage of natural rubber is that the wheels roll more smoothly on the floor, and the disadvantage is the high cost. On the other hand, polyurethane (or other types of synthetic rubber) is cheaper but the wheels do not roll so smoothly.

With reference to Figures 7-10, Figure 7 shows a perspective view of the caster assembly 50 comprising the swivel plate 52 and, attached thereto, the wheels 54a, 54b. The wheels 54a, 54b are attached to the swivel plate by means of a nut (not shown) and bolt 53. The swivel plate 52 comprises a base 56, a fork 57, and an insert 58 (substantially hidden from view by the fork 57; in this figure, only the underside of the insert 58 is visible). The base 56, the fork 57, and the insert 58 are made of extruded and machined aluminium, preferably the alloy 6082T6 referred to above. The aforesaid parts are connected together by means of securing screws (in this case, four) 59a, 59b, 59c, 59d which traverse the base 56, the fork 57, and the insert 58, in such a way that the assembly can be dismantled. Instead of four screws, it is possible to use a different number of screws.

Figure 8 is a cross-sectional view of the internal alignment of the base 56, the fork 57, and the insert 58 (in the drawing various types of hatching are used to distinguish the various parts). The extension downwards of the fork 57, which is attached to the wheel (see Figure 7), is here substantially hidden by the wheel 54. However, as may be seen from Figure 8, the fork has a raised part 63 which extends upwards with a part of its angled surface 64. The angled surface 64, together with the base 56 and the insert 58, defines a ball race for the balls of a ball bearing; i.e., the insert 58 has a raised part 66, and at least one part of the surface of this raised part 66 is inclined to define an inclined surface 67. The base 56 has an internal cavity with a groove 68, so that, when the base 56, fork 57, and

insert 58 are assembled together, a seat or ball race 65 is obtained defined by the angled surface 64 of the fork, the angled surface 67 of the insert, and the groove 68 of the base. Preferably, the angled surfaces 64, 67 and the surfaces of the groove 68 are plane surfaces set at roughly 45° with respect to the horizontal plane of the swivel plate. However, other forms may be used, provided that they do not present any hindrance to rolling. Arranged inside the ball race 65 of the ball bearing is a set of balls 70, preferably between approximately 15 and 25. Advantageously, the ball race has a rhombus-shaped profile. The use of profiles that do not conform to the shape of the balls is an aid to their rolling in that it decreases the number of points of friction and provides recesses in which debris can accumulate without interfering with the rolling of the balls. In the seat 65 the debris can accumulate in the four corners. The balls may be advantageously made of a plastic material, more preferably of an acetal-type material like Deldrin® and, more preferably, a polyamide-imide material commonly known as Torlon®. Nylon is the least preferred because it is readily subject to thermal expansion; since during use of the trolley the temperature of the surrounding environment may vary greatly, any thermal expansion of the nylon parts would hinder rolling. Figure 9 presents a side view of the base 56, of the fork 57, and of the insert 58, separated from one another. In the drawing these parts are hatched in order to highlight their dimensions in greater detail. The insert 58 bears the raised part 66 with the angled surface 67 and a projection 76 with holes 79a, 79b for the screws which extend through the raised part 66. The insert 58 also has a through hole 80 for insertion of the pin 81 of the brake, as shown in Figure 10. The fork 57 has a raised part 63 and an angled surface 64. A plurality of holes 74a, 74b are also arranged in the fork and extend through the raised part 63 to connect, in a way so that they can be dismantled, the insert to the fork by means of the screws 59a, 59b, which thread into the holes 79a, 79b and 74a, 74b. The fork 57 has an internal hole 75 for inserting the projection 76 of the insert 58. Consequently, the internal dimensions of the hole 75 will be slightly greater than the external dimensions of the projection 76, whilst the raised part 66 will be positioned on the raised part 63. The base 56 has an internal hole 77 which accepts the raised part

63 of the fork 57 and moreover receives both the projection 76 and the raised part 66 of the insert.

With reference to Figures 8 and 9, the base 56 is set on the raised part 63 of the fork 57. A number of balls 70 is set within the channel defined by the groove 68 and by the inclined surface 64 of the raised part. The projection 76 of the insert 58 is inserted in the hole 75, so that the balls are withheld in the seat 65 defined by the groove 68, by the inclined surface 64, and by the inclined surface 67. The fork 57 and the insert 58 are held together by the screws 59a, 59b inserted in the holes 74a, 79a and 74b, 79b. The balls 70 enable the base 56 to rotate with respect to the fork 57 and the insert 58, in that the base 56 is configured so that there is a small space 82 between the base 56 and the fork and the insert. The base may be fixed on the bottom of the trolley of the present invention with screws inserted in the holes 72a, 72b and on the base of the trolley. Figures 9A, 9B and 9C present a top plan view of the different embodiments of the base 56, i.e., small, medium and large, respectively, with reference to their dimensions referred to the on-centres between the holes 56', which may be respectively for each base approximately 41.2 mm and 54.0 mm; approximately 32.5 and 79.4 mm; and approximately 62.0 mm and 62.0 mm. The version described made of aluminium with plastic balls does not require lubrication.

Figure 10 presents a perspective view of the components of the swivel plate 52 together with the wheels and the brake, which make up the caster assembly 50 of the invention, here shown detached from one another. As may be seen, all the parts may be easily disassembled with the use of simple tools, such as a screw-driver, to enable repairs and replacement of parts.

Figure 10 also shows the brake, which comprises a pin 81, a spring 84 and a nut 88. As may be seen from the figure, the pin is inserted in the hole 80 which passes through the insert. When the projection 78 of the insert 58 is inserted in the hole 75 of the fork 57, the pin 81 extends below the fork 57. A spring 84 surrounds the pin 81 at the top of the entire assembly so as to press the disk 86 of the brake against the wheels 54a, 54b when the top of the pin 81 is pressed. The wheels 54a, 54b are connected to the fork 57 with a nut 53 and a bolt 53a.

A caster assembly configured and built according to the invention made for trolleys for use on aeroplanes may weigh approximately 450 g as against the 750 g of current caster assemblies, with a consequent substantial reduction in weight (approximately 1200 g per trolley for the wheels alone).

- 5 It had previously been considered desirable to use stamped, galvanized steel for the components of the swivel plate, with steel ball-bearings for the required durability. However, it has been discovered that these caster assemblies presented a fatigue point in which fractures developed. Instead, the caster assembly according to the present invention, which uses machined aluminium,
- 10 and the remainder of the trolley, where also plastic material is used as described above, is lighter, simpler, easier to assemble, stronger, more resistant, and corrosion-proof. In addition, it entails the use of a smaller number of parts, which are assembled using only screws, and hence are easy and fast to assemble and disassemble. All the parts, in fact, may be disassembled without any particular
- 15 equipment. Furthermore, the service life of the trolley and of the casters is decidedly increased by the use of the materials selected. The fact that the parts can be readily dismantled makes the trolley easy to maintain and, if necessary, to repair, because the user does not need to replace entire components of which only one part is damaged. For example, in the caster assembly described above it
- 20 is possible to replace the wheels, the fork, the insert, and the ball bearings individually. The fact that the various parts can be dismantled also makes the construction and assembly of the trolley easier. In addition, parts made of machined aluminium are more durable; in the first place, there is no danger of rusting, and lubricants are not required. Furthermore, the caster assembly of the
- 25 present invention does not involve the use of particular techniques for assembling the parts. Moreover, it is not necessary to lubricate the balls of the ball bearings, in that they are made of plastic and are made to turn in a ball race made of extruded and machined aluminium and defined by the fork, the insert and the base of the swivel plate. In the swivel plate of the invention, the profile of the ball race enables
- 30 an easier and continuous pivoting of the fork with respect to the base even when lubricant is not used. The fact of eliminating the use of lubricants enables a higher

degree of cleanness of the device, which is less likely to collect dirt and debris, so maintaining a greater freedom of rotation and preventing lubricant from dirtying the surfaces.

Other advantages of the invention are the following:

- 5 Reduction of approximately 30% or more in the weight of the trolley, with almost zero maintenance costs.

Thanks to the type of machining of the parts made of aluminium (machining with numeric-control machines), tolerances are avoided, and precise pieces are obtained. Consequently, their assembly using screws (there are no bonded parts)
10 enables easy mounting and dismantling of the individual parts, and hence fast cleaning and fast maintenance and replacement of just the parts worn out or damaged; this can be carried out, where required, via immediate on-the-spot intervention. Likewise, maintenance times are reduced, and there is also a reduction in the number of pieces to be replaced.

- 15 There is nothing to prevent the trolley according to the present invention from being used on other means of transport, such as trains, in particular high-speed trains, ships, etc.

What is illustrated in the figures is merely for providing examples, and a person skilled in the branch may make variations or modifications that do not depart from
20 the spirit and sphere of the invention. It is understood that such variations and modifications are included in the scope of the description and claims.

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**CLAIMS**

- 1 1. Trolley of the food-and-drink transporting type having a basically
2 parallelepipedal structure with, at the vertices, three-way joints (1) made of
3 aluminium, connected together by means of strips (1') of aluminium set on the
4 edges of said parallelepipedal structure, the said strips being connected to shaped
5 surfaces (2, 3, 5, 6, 7, 8) made of a material selected among aluminium, Kevlar®,
6 carbon fibre, or of a material presenting similar features, or of combinations of the
7 above materials, the said joints, strips and surfaces being moreover fixedly
8 connected together with screws (11).
- 1 2. Trolley according to Claim 1, further having, on at least one side surface, a door
2 (5), (6), which may be hinged with a hinge (5a) to the structure of the trolley, or
3 else may be connected to the trolley so that it can slide on ball bearings.
- 1 3. Trolley according to Claims 1 and 2, comprising, for its movement, a wheel
2 assembly (50), substantially made of aluminium, and at least one braking device
3 (100).
- 1 4. Trolley according to Claim 3, in which the caster assembly (50) basically
2 comprises an insert (58), a base (56), and a fork (57), the fork being mounted on
3 one or more wheels (54a, 54b) and being connected to the underside of the base
4 (56), which, on top, houses the insert (58); balls (70) of a ball bearing being
5 housed in a seat (65) made between the insert and the base, so that the insert
6 (58) and the fork (57), which are held together by screws (59a, 59b), may be free
7 to turn with respect to the base (56), which is fixed to the bottom of the trolley.
- 1 5. Trolley according to the previous claims, in which the parts made of aluminium
2 are obtained from elements made of aluminium extruded and machined using
3 numeric-control machines.
- 1 6. Trolley according to Claim 5, in which the aluminium is an alloy identified as
2 6082T6 or a material presenting similar features.
- 1 7. Trolley according to Claims 1-5, in which the shaped surfaces made up of the
2 side panels (2), one rear panel, the top panel (7), the doors (5), (6) are made of
3 panels of the sandwich type with a honeycomb internal structure, or panels
4 presenting similar features in terms of lightness, resistance, impact strength,



- 5 breaking strength, etc., the said panels having an internal layer made up of an
6 epoxy-resin or glass-fibre lamina, and an external layer consisting of an epoxy-
7 resin or Kevlar® lamina, between the internal layer and the external layer, an
8 aluminium mesh or a vegetal-fibre honeycomb structure possibly being present.
- 1 8. Trolley according to Claim 7, in which the panels are characterized by an
2 impact strength determined with an impact test by dropping a 5-kg steel ball from
3 a height of 1.50 m.
- 1 9. Trolley according to Claims 1-5, in which the shaped surfaces (3) consist of
2 internal panels provided with projecting ridges (3') for supporting possible trays
3 and are made of aluminium and obtained by drawing.
- 1 10. Trolley according to any one of the previous claims, in which the handle (4) is
2 of the ergonomic type, coated with non-slip plastic material.
- 1 11. Trolley according to Claims 1-5, in which the shaped surface that constitutes
2 the door (5), (6) is made of milled aluminium.
- 1 12. Trolley according to Claim 7 or Claim 11, in which the door (5), (6) bears, on
2 its outer surface, patterns, decorations, handles (5'), (6') and friezes (5''), (6'').
- 1 13. Trolley according to Claim 7 or Claims 11 and 12, in which the door (5), (6) is
2 made with plane or crowned panels having a maximum thickness of 6-24 mm or
3 radiused with a radius of curvature of 20°.
- 1 14. Trolley according to Claims 1-5, in which the shaped surfaces represented by
2 the top panel (7) and the base (8) are made by co-extrusion of aluminium and a
3 fibre material, such as Kevlar® or carbon fibre, or other material presenting similar
4 features.
- 1 15. Trolley according to any one of the previous claims, having moreover one or
2 more of the following elements: aluminium drawer, aluminium working surface,
3 tanks or cavities or projecting ridges, and/or railings.
- 1 16. Caster assembly (50) for trolleys, as claimed in the foregoing claims,
2 comprising a swivel plate (52) connected to a fork (57), which is in turn connected
3 to at least one wheel (54a, 54b), and containing a plurality of balls (70) of a ball
4 bearing, such as to enable the fork (57) and the wheels (54a, 54b) connected
5 thereto to swivel with respect to the structure, the said assembly comprising:

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6 an insert (58) provided with a raised part (66) and a projection (76), in which at
7 least one part of the surface of the raised part (66) defines an angled surface (67);
8 the fork (57) having a raised part (63) and a hole (75) located within said raised
9 part, said hole (75) being sized so as to receive the projecting part (76) of the
10 insert (58), and the raised part (63) being shaped so as to have an angled surface
11 (64), so that, when the insert (58) is inserted in the hole (75), the raised part (66)
12 is positioned on the top surface of the raised part (63) and the angled surface (67)
13 of the insert (58) is axially aligned with the angled surface (64) of the raised part
14 (63); and

15 a base (56) having an internal hole (77) with a groove (68), the said hole (77)
16 being sized so as to receive the insert (58) and the raised part (63) of the fork
17 (57), and the groove (68) being configured so that, when the insert (58) is set
18 above the raised part (63) of the fork (57), the said groove (68) forms, with the
19 angled surfaces (67, 64), a race (65) for the balls (70) of the ball bearing;
20 said insert (58) being firmly fixed to the fork (57), and the plurality of balls (70)
21 enabling the base (56) to turn with respect to the insert (58) and fork (57), or vice
22 versa.

1 17. Caster assembly according to Claim 16, in which the surfaces (64, 67) and the
2 groove (68) are shaped so as to make a seat or ball race (65) having a section
3 such as not to hinder free rotation of the balls (70).

1 18. Caster assembly according to Claims 16 and 17, in which the balls (70) are
2 made of plastic material chosen from between Delrin® and Torlon®, or a
3 material presenting similar features.

1 19. Use of elements made of extruded and machined aluminium and elements
2 made of plastic, such as Kevlar® or carbon fibre, to make the trolley according to
3 any one of the previous claims.