the owning airline at least some of the empty containers that would otherwise be flying around the world.

In the loading method according to the invention, the principle of the average degree of filling is used and the air-transport units are loaded using devices with economical manufacturing and installation costs, smart sensors and computation algorithms supporting and controlling their operation, as well as efficient packing methods, in such a way that the air-transport units are loaded computationally sufficiently full. This is because, in the method, the filling of the transport units is facilitated by tilting them relative to the necessary degrees of freedom that are useful in terms of increasing the efficiency of the packing event, in such a way that the baggage is packed clearly faster, more directly, and to a higher degree of filling than if the transport unit is stationary and in a vertical position during the packing event, as in the known solutions.

In particular, in the method according to the invention, piece-goods and an air-transport unit, on at least one side of which is an openable loading opening, are transported to the loading location, when the piece goods are packed automatically through the loading openings into the air-transport unit. The air-transport unit is tilted in connection with packing, in such a way that the side with the loading opening is raised relative to the opposite side, so that the air-transport unit is loaded in at least two different positions.

According to one embodiment, the air-transport unit is manipulated in several degrees of freedom and backwards and forwards relative to at least one degree of freedom, in order to compact the pieces inside the air-transport unit and to increase the stability of the totality (stack) they form.

More specifically, ~~the loading method according to the invention is characterized by what is stated in the characterizing portion of Claim 1~~the present invention provides a method for loading piece goods automatically into an air-transport unit, in which method:

- transporting the piece goods and the air-transport unit, on at least one side of which there is an openable loading opening, to the packing location, and
- packing the piece goods automatically through the loading opening into the air-transport unit,

**characterized** in tilting the air-transport unit in connection with packing, in such a way that the side with the loading opening is raised relative to the side opposite to the

loading opening, wherein the air-transport unit is loaded in at least two different attitudes.

A corresponding result can also be achieved using the loading system according to the invention, which comprises means for bringing piece goods to the loading location, means for bringing an air-transport unit to the loading location, and means for packing the piece goods into the air-transport unit through its loading opening. In addition, the system comprises means for manipulating the air-transport unit, in such a way that the air-transport unit can be manipulated to be loaded in at least two different attitudes.

More specifically, ~~the loading system according to the invention is characterized by what is stated in the characterizing portion of Claim 10~~the present invention provides a system for automatically loading air-transport units with piece goods, which system comprises:

- means for bringing the piece goods to the loading location,
- means for bringing an air-transport unit to the loading location, and
- means for packing the piece goods into the air-transport unit through its loading opening,

**characterized** in that the system comprises means for manipulating the air-transport unit, wherein said means is configured to manipulate the air-transport unit by tilting the air-transport unit in such a way that the side with the loading opening is raised relative to the side opposite to the loading opening, wherein the air-transport unit is to be loaded in at least two different attitudes.

~~*Advantages of the invention*~~

Significant advantages ~~are~~ may be achieved with the aid of the invention. By automating the loading stage, in a manner that is advantageous in terms of packing and the packing result, but economical in terms of the manufacturing, installation, and operating costs for the solution used for this, it will be possible to replace manual handling of baggage, which is slow and expensive and endangers work safety and work health. This will reduce airport personnel costs significantly. In fact, the use of one of the possible automation solutions according to the invention can replace the work input of five people, signifying a direct improvement in profitability. On the other hand, automation reduces the possibility of work-related injuries and improves airport reliability. Above all, automation increases capacity and accelerates the loading process, to the benefit of both customers and airlines.

Due to the cost-effective manufacturing and installation method of the system, the loading method according to the invention can be applied to both new and old airports, as only minor alterations are required to the existing infrastructure. One of the greatest challenges of the baggage-packing automation solutions presented in the literature and implemented in practice is that their introduction requires significance alterations to airport infrastructure – often even building baggage transport and sorting equipment from the very start around the packing-robot cell. In addition, if the invention is taken into account already in the design stage of the construction of new baggage-handling

accommodation, it will be possible to operate with considerably smaller baggage-handling accommodation that at present, because an automatic packing system implemented in the manner disclosed by the invention will need significantly less space or floor area, even as little as less than 50 %, in order to achieve a packing capacity corresponding to that of existing solutions. Depending on the case, the savings arising from building costs alone can be greater than the costs arising from the introduction of automatic packing.

Because, with the aid of the method, the air-transport units can be loaded to an even degree of filling, the aircraft will also be loaded evenly, in which case the even weight

CLAIMS

1. Method for loading piece goods ~~(30)~~ automatically into an air-transport unit, in which method:
   - transporting the piece goods ~~(30)~~ and the air-transport unit ~~(10)~~, on at least one side of which there is an openable loading opening ~~(11)~~, to the packing location, and
   - packing the piece goods ~~(30)~~ automatically through the loading opening ~~(11)~~ into the air-transport unit ~~(10)~~,

   **characterized** in tilting the air-transport unit ~~(10)~~ in connection with packing, in such a way that the side with the loading opening ~~(11)~~ is raised relative to the side opposite to the loading opening ~~(11)~~, wherein the air-transport unit ~~(10)~~ is loaded in at least two different attitudes.

2. Method according to Claim 1, in which the loading opening ~~(11)~~ of the air-transport unit ~~(10)~~ is closed once loading has ended.

3. Method according to Claim 1 or 2, in which the air-transport unit ~~(10)~~ is an air container or a baggage cart.

4. Method according to any one of Claims 1 to 3~~Claim 1, 2, or 3~~, in which the air-transport unit ~~(10)~~ is tilted around its horizontal axis.

5. Method according to any one of Claims 1 to 4~~of the above Claims~~, in which the air-transport unit ~~(10)~~ is manipulated in several degrees of freedom.

6. Method according to any one of ~~the above Claims~~Claims 1 to 5, in which the air-transport unit ~~(10)~~ is tilted, in such a way that the loading opening ~~(11)~~ rotates relative to the tilting axis or tilting axes.

7. Method according to any one of Claims 1 to 6~~of the above Claims~~, in which the air-transport unit is tilted around its horizontal axis, in such a way that the essentially vertical loading opening is tilted towards a horizontal position.

8. Method according to any one of Claims 1 to 7~~of the above Claims~~, in which the air-transport unit ~~(10)~~ is tilted through 90 degrees around its horizontal axis, in such a way that the vertical loading opening is tilted towards a horizontal position, wherein the

transport unit is first of all loaded from the side and then, after tilting, from above.

9. Method according to any one of Claims 1 to 8~~of the above Claims~~, in which the air-transport unit ~~(10)~~ is manipulated backwards and forwards relative to at least one degree of freedom, in order to compact the pieces ~~(30)~~ inside the air-transport unit ~~(10)~~.

10. System for automatically loading air-transport units ~~(10)~~ with piece goods ~~(30)~~, which system comprises:
- means for bringing the piece goods ~~(30)~~ to the loading location,
- means for bringing an air-transport unit ~~(10)~~ to the loading location, and
- means for packing ~~(20)~~ the piece goods into the air-transport unit ~~(10)~~ through its loading opening ~~(11)~~,

**characterized** in that the system comprises means for manipulating ~~(40)~~ the air-transport unit, wherein said means is configured to manipulate the air-transport unit ~~(10)~~ by tilting the air-transport unit ~~(10)~~ in such a way that the side with the loading opening ~~(11)~~ is raised relative to the side opposite to the loading opening ~~(11)~~, wherein the air-transport unit ~~(10)~~ is to be loaded in at least two different attitudes.

11. System according to Claims 10, wherein the means for manipulating ~~(40)~~ the air-transport unit is arranged to tilt the air-transport unit ~~(10)~~ relative to at least one axis, in such a way that the side with the loading opening ~~(11)~~ can be raised relative to the side opposite to the loading opening ~~(11)~~.

12. System according to Claim 10 or 11, wherein the means for manipulating ~~(40)~~ the air-transport unit is arranged to manipulate the air-transport unit ~~(10)~~ backwards and forwards relative to at least one degree of freedom, in order to compact the pieces ~~(30)~~ inside the air-transport unit ~~(10)~~.

13. System according to any one of Claims 10~~, 11, or~~ to 12, wherein the means for manipulating ~~(40)~~ the air-transport unit is arranged to manipulate the air-transport unit ~~(10)~~ in several degrees of freedom, in order to position the air-transport unit ~~(10)~~ relative to the means for packing ~~(20)~~ piece goods.

14. System according to Claim 13, wherein the means for manipulating ~~(40)~~ the air-transport unit is an industrial robot, which is equipped with a grab suitable for gripping the air-transport unit ~~(10)~~.

15. System according to any one of Claims 10 – 14, which comprises a buffer store ~~(83)~~ inside the packing cell, for evening variations in the flow of piece goods arriving at the packing location.

16. System according to any one of Claims 10 – 15, which, in addition, comprises a separate buffer store ~~(80)~~, for evening variations in the flow of piece goods arriving at the packing location.