

5 **PERSONAL EMERGENCY DEVICE FOR LOWERING PEOPLE FROM
HIGH RISE OBJECTS (embodiments)**

Field of the invention

10 The invention is related to people rescue facilities and comprises a device designed to rescue people in emergency, mainly for lowering of people from top floors of high raised buildings in case of fire and other emergency.

15 **Prior art**

 The prior art describes a lifesaving device designed for the emergency lowering of people jumping or falling from loftiness, comprising a pneumatic chamber that includes tubing forming lines of the top and bottom bases
20 joined with uprights of frame covered with a flexible shell, including horizontal absorbing membrane (RU No. 2150980, A62B1/22, published in 1999).

 The disadvantage of this device is that the volume of the said frame is a considerable part of the total capacity size of the said chamber.

25 The prior art describes a personal emergency device for lowering of people from high-rise objects, comprising a knapsack fastened on the back of an escaping person, connected through an intermediate membrane with a folded parachute having inflatable chambers intended for formation of the bases of a pneumatic frame joined with each other to form an elastic skirt,
30 yielding a conic deceleration shield and a landing basket formed with the said inflatable chambers (RU published application No.2003124165/12, 8/5/2003).

 The disadvantage of this device is that it has a large size, heavy weight and low efficiency.

35 The prior art describes a personal emergency device for lowering of people from high-rise objects, comprising a bearing element in the form of a knapsack which is equipped by a fastener for fixing it to the back of a

5 rescued person, connected with an intermediate membrane to a folded parachute comprising inflatable chambers, intended for formation in the process of filling them with air of the top and bottom bases of a pneumatic frame with formation of an elastic skirt, yielding a conic deceleration shield in joint with the said inflatable chambers, parachute opening assembly,
10 including a gas generator fixed to the knapsack and interconnected with the said inflatable chambers via flexible elastic gaspipe tubing, and inflatable chambers for formation of a landing basket, and the inflatable chambers of the said landing basket are designed in the form of a bottom basis and uprights forming a frame, and interconnected with the said bottom basis of
15 the said pneumatic frame, thus the landing basket has several vertical and horizontal and one top and bottom separating walls forming cavities, the lower separating walls has holes, and the top separating walls is fastened to the said bottom basis of the said pneumatic frame and with the said knapsack (RU No. 2288758, A62B1/00, B64D 25/14 published in
20 2006.12.10).

Disadvantage of this device is that it has large size, big weight and low efficiency.

The prior art describes a personal emergency device for lowering of people from high-rise objects, comprising a knapsack which is provided with
25 a fastener for fixing it to the back of a rescued person and adjoined to the back of this person part of which is designed in the form of a supporting element and which contains an inflatable frame arranged therein and consisting of an inflatable by a gas generator toroidal chamber connected to inflatable spokes which are connected to the top toroidal chamber of a
30 cylindrical inflatable structure, which is formed by placed one above the other toroidal inflatable chambers, the diameter of which is less than the diameter of the first above-mentioned inflatable chamber, for forming a conical deceleration shield; meanwhile the top inflatable toroidal chamber of a smaller diameter is fixed to the said supporting element of the said
35 knapsack, inflatable to the atmospheric pressure cylindrical chamber with the calibrated holes for releasing an excessive pressure from an external force stress at the moment of hitting the ground, placed under the supporting

5 element to which the rescued person is fastened, in the cavity formed by the
cylindric arrangement of inflatable toroidal chambers of the smaller diameter
and pressurized from the side which is reverse to the place of location of the
toroidal chambers of the bigger diameter, the supporting element of the
knapsack is designed in the form of an anatomic cradle conformed to the
10 form of the back of the person fixed to the top inflatable toroidal chamber of
a smaller diameter by means of strips accomplished with possibility of
separation or division lengthwise to equal in strength parts in case of a load,
and the gas generator for inflatable toroidal chamber is designed in the form
of a generators of cold gas placed in the corresponding cavity of the
15 inflatable toroidal chamber, at least in one of the spokes the gas generator,
connecting two chamber insulated from volumes of the other inflatable
chamber and spokes, is placed (RU No. **66206, A62B1/00, B64D 25/14,**
published in 2007.09.10).

Disadvantage of this device is that it has large size, big weight and low
20 efficiency in the part of energy dissipation at landing of the system with the
person.

The given solution is taken as a prototype for claimed objects.

Disclosure of invention

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Technical purpose achieved by the present invention lies in the fact that
the weight of the device decreases, demand for gas for inflation of the said
device reduces efficiency of the invention due to simplification of
construction increases, and safety due to exclusion of cases of overturning
30 of the device at the moment of landing increases.

The specified art for the first variant of embodiment of the invention is
achieved by the fact that in a personal emergency device for lowering of
people from high-rise objects, fixed to the back of a person and comprising
an inflatable by an independent gas-filling source central toroidal chamber
35 having a membrane in which to arrange the rescued person the chamber
being connected on one side to inflatable spokes which, upon inflation, are
arrangeable in a cone and which are interconnected by inflatable

5 connectors, and being connected on the other side to an inflatable damping
structure which has a toroidal inflatable chamber which is likewise connected
by inflatable spokes to the central toroidal chamber, the toroidal inflatable
chamber of the damping structure has a diameter which is greater than the
10 base of the cone which is formed by spokes which are straightened out upon
inflation and are interconnected by connectors, an air-impermeable
perforated fabric is stretched between the spokes and toroidal chambers, or
the spokes together with the toroidal chambers are covered by air-
impermeable perforated protective coverings in order to form a conical
15 deceleration shield in the form of two truncated conical pyramids with a
common base in the central toroidal chamber zone and with big bases of
different diameter directed likewise, the membrane is stretched in the
toroidal chamber of a damping structure, an independent gas-filling source
communicates with one of the toroidal inflatable chambers or with one of the
20 inflatable spokes, and the internal volumes of all the toroidal chambers and
spokes communicate with one another and form a single closed volume.

The specified art for the second variant of embodiment of the invention
is achieved by the fact that in a personal emergency device for lowering of
people from high-rise objects, fixed to the back of a person and comprising
25 an inflatable by an independent gas-filling source central toroidal chamber,
connected on the one side to the inflatable spokes, which are connected to
the top toroidal chamber, with diameter bigger than diameter of central
toroidal chamber, and to inflatable damping construction composed of the
bottom toroidal inflatable chamber on the other side, the membrane in which
30 to arrange the rescued person is attached to the central toroidal chamber,
the bottom toroidal inflatable chamber has a diameter which is greater than
the diameter of the central toroidal chamber and is less than the diameter of
the top toroidal chamber and connected to the central toroidal chamber by
the inflatable spokes, and the membrane is attached to the bottom toroidal
35 chamber in its central cavity, an air-impermeable perforated fabric is
stretched between the spokes of each bottom and top toroidal chambers or
spokes of each toroidal chamber are covered outside by air-impermeable

5 perforated protective coverings for formation of two truncated conical
pyramids with a common base and with big bases of different diameter
directed likewise, and an independent gas-filling source communicates with
one of the toroidal inflatable chambers or with one of the inflatable spokes,
and the internal volumes of all the toroidal chambers and spokes
10 communicate with one another and form a single closed volume.

The specified features are essential, interdependent and form a stable combination
of essential features sufficient to achieve the specified art.

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Brief description of drawings

The present invention is explained by particular variants which,
however, aren't unique, but clearly demonstrate possibility of achievement
20 by the summarized cumulative features of required technical purpose.

In fig.1 – side-view of the personal emergency device for lowering of
people from high-rise objects, first variant of embodiment;

fig. 2 – upper view of the personal emergency device for lowering of
people from high-rise objects in fig. 1;

25 fig.3 – side-view of the personal emergency device for lowering of
people from high-rise objects, the second embodiment;

fig. 4 – upper view of the personal emergency device for lowering of
people from high-rise objects in fig. 3.

According to the present invention the personal emergency device for
30 lowering of people from high-rise objects, which is represented by an
inflatable deceleration unit, is considered. This device is intended for
personal rescue of people and valuable cargoes located on any floor of
high-rise buildings in case of a fire or other emergency cases demanding
emergency evacuation. It is possible to create such a device due to the fact
35 that it combines both an effective deceleration device for reentry and a
damping device. Special control skills are not required to use the device, it
is possible to use it almost instantly, it protects during descending from hits

5 against walls and influence of high temperature and open flame, the damping system (damping construction) provides safe landing.

The device is the basic component of rescue system and is intended for shaping of the device and providing of estimated descent and landing speed. The device comprises two cascades: main cascade having a form of
 10 "inverted or inverse truncated cone", and additional cascade also having a form of truncated cone, but with greater diameter (is represented by damping construction). In the inflated, unfolded (operating) state the device has the form of two truncated cones connected "towards each other", having different diameters of the big bases, and having a central toroidal chamber
 15 as the small bases of both cones. In such an embodiment the device is a body which is aerodynamically steady and self-oriented in flight, so that at descent it will constantly tend to turn in such a manner that the big cone will be above and a small cone below.

The personal emergency device for lowering of people from high-rise
 20 objects according to the first variant of embodiment (fig. 1, 2) comprises means for fixing it to the back of a rescued person including an inflatable by a gas generator central toroidal chamber 1, connected on the one side to the inflatable spokes 2, which, upon inflation, are arrangeable in a cone and which are interconnected by inflatable connectors 3, and on the other side to
 25 an inflatable damping structure, composed of the spokes 4 of the bottom toroidal inflatable chamber 5, the membrane 6 for arranging of a rescued person is attached to the central toroidal chamber 1. The bottom toroidal inflatable chamber 5 has the diameter bigger which is greater than the diameter of the central toroidal chamber 1 and less than the diameter of the
 30 cone basis formed by spokes 2 straightened out along the cone and connected to the central toroidal chamber 1 by the inflatable spokes 4.

An air-impermeable fabric 7 is stretched between the spokes of toroidal chambers, or the spokes together with the toroidal chambers are covered by air-impermeable coverings. An air-impermeable fabric or air-impermeable
 35 coverings are perforated.

In the bottom toroidal chamber the membrane is stretched (not shown) for formation of two truncated conical pyramids with a common base in the

5 central toroidal chamber zone and with big bases of different diameter directed likewise, for formation of a conic deceleration shield.

An independent gas-filling source communicates with one of the toroidal inflatable chambers or with one of the inflatable spokes, and the internal volumes of all the toroidal chambers and spokes in their turn
10 communicate with one another and form a single closed volume.

Definite embodiment of the first variant is considered thereafter.

Under the first variant of the embodiment the device (fig. 1, 2) comprises a fastener for fixing it to the back of a rescued person (is designed in the form of a knapsack, not shown) which includes an inflatable
15 by a gas generator central toroidal chamber 1, connected on the one side to the inflatable spokes 2, which are connected to each other by inflatable connectors 3 with the top toroidal inflatable chamber with diameter greater than diameter of the central toroidal chamber 1 and on the other side to an inflatable damping construction, composed of the bottom toroidal inflatable
20 chamber 5. The membrane 6 for arranging of a rescued person is attached to the central toroidal chamber 1. The bottom toroidal inflatable chamber 5 has the diameter greater than the diameter of the central toroidal chamber 1 and lesser than the diameter of the top toroidal chamber and connected with the central toroidal chamber by the inflatable spokes 4. An air-impermeable
25 fabric 7 is stretched between the spokes 2 and spokes 4 of the toroidal chambers for formation of two truncated conic pyramids with a common base and with big bases of different diameter directed likewise for formation of a conic deceleration shield. Cavities of the spokes connected with each other by crossflows and connected with an independent gas generator.

30 The top cone is intended for effective aerodynamic braking and stabilization of the device position in flight and has the form of the "inverted truncated cone", formed by the central toroidal chamber 1, and spokes 2 with the connectors 3.

35 The top and bottom cones are in the form of inflatable leak-tight spokes which are placed along generators of cones and covered by a conic air-impermeable covering, in the strict sense cones degenerate into pyramids

5 having in their bases polygons with number of angles equal to number of spokes, i.e. from 6 to 16, and in our situation equal to 8.

The spokes of the top and bottom cones and central chamber are interconnected by gas crossflows and are a uniform, isolated and leak-tight volume. The device is filled with gas under excess pressure hereupon it
10 doesn't change its form during descent. The outer side of the device can be supplied with the thermal coating providing safety when passing through the centers of open flame.

The bottom cone is intended for effective aerodynamic deceleration and stabilization of the device position during flight and comprises of cylindrical
15 spokes 4 placed downwards which are a generator of a cone and are interconnected by the bottom inflatable chamber 5. The top cone has the form of the "cone", formed by the central toroidal chamber 1, and spokes 2 with the connectors 3.

An air-impermeable fabric (material) covers the bottom and central
20 tores along the bottom edges of the tores. Air-impermeable fabric (material), having some calibrated holes for intercommunication of the internal volume of "pneumobag" with atmosphere, is also attached to the spokes of the top cone on the inner side (from the side of symmetry axis of the device). When filling a pneumoframe of the device (tore, spokes, bridges) to excessive
25 pressure with gas by means of independent filling system, in the process of unfolding of the device from the folded state outboard (from atmosphere) air ingoes into damping "pneumobag" and the top cone takes the necessary working shape.

The person is arranged in the lodgement on the device's membrane. By
30 means of the restrained system a person is fixed to the lodgement by their back. The lodgement is a part of a knapsack in which the device with all its systems is packed. The lodgement is designed in the form that anatomically conforms to the form of the person's back to provide even pressure upon the person at the moment of landing and is strongly attached to the power
35 tore.

The amortization system (damping system of the device) is intended to decrease the shock load at the moment of landing to the safe level, and

5 works as follows:

At the moment the bottom chamber contacts the landing surface due to elasticity of spokes the bottom tore, having small mass, loses its speed in the system of coordinates connected with the landing surface practically to zero, the person in the lodgement, the central chamber, and the top cone, 10 having lager mass, continue to move towards landing surface. As elasticity of the bottom spokes in compression resistance is limited, "destruction" of spokes or elastic deformation of spokes of the bottom cone take place. By the time of "destruction" of spokes of the bottom cone the speed of a person with the lodgement essentially decreases due to the power tore, but 15 movement to the landing surface continues. Then, in case of considerable moving the damping "pneumobag" is deformed and as a consequence the inside pressure raises. The higher the speed of moving a person with the lodgement and the power tore accordingly, the more intensive the excessive pressure in the damping "pneumobag". The excessive pressure in the bag 20 influences the power tore with the gas-barrier material attached to it and creates an additional effort, apart from elasticity of spokes which finally extinguishes kinetic energy of a person with the lodgement that leads to the full stop of the latter. It should be noted that as excessive pressure rises in the damping "pneumobag", the air from the pneumobag goes into 25 atmosphere through the calibrated holes. The more intensive excessive pressure in the bag, the higher the speed of outcoming air that leads to stabilization or decrease of the excessive pressure in the bag. When the quantity, diameters and arrangement of the given holes is correct, it is possible to provide overloads by a person at landing within reasonable 30 values experienced. The organized damping system is universal and helps to guarantee landing of a person with any weight within the prescribed limits.

The lodgement is designed for placing a person during flight into horizontal position and fixing a person. By means of the restrained system a 35 person is fixed to the lodgement by their back. The lodgement is a part of a knapsack in which the device with all its systems is packed. The lodgement is designed in the form that anatomically conforms to the form of the

5 person's back to provide even pressure at the moment of landing. The lodgement is a load-bearing element. It is fastened to the power tore ONTU by means of breaking flanges. A person arranged in the lodgement is fixed with the help of the restrained system. The knapsack is fixed to the back.

10 During flight of the device effective aerodynamic braking to the speed less than 11 m/s is provided. Landing load at a touchdown are extinguished by the damping system. Load factor at the moment of landing doesn't exceed 16 *g* and time of its effect is less than 0, 5 s.

15 According to the second variant of embodiment the central toroidal chamber is connected on the one side to the inflated spokes which, upon inflation, are arrangeable in a cone and which are interconnected by inflatable connectors without formation of the top toroidal chamber.

20 The personal emergency device for lowering of people from high-rise objects according to the second variant of embodiment (fig. 3, 4) also comprises means for fixing it to the back of a rescued person (is designed in the form of a knapsack, not shown) which includes an inflatable by a gas generator central toroidal chamber 1, connected on the one side to the inflatable spokes 2, which are connected to the top toroidal inflatable chamber 8 with diameter greater than diameter of the central toroidal chamber 1 and on the other side to an inflatable construction, composed of
25 the bottom toroidal inflatable chamber 5. The membrane 6 for arranging of a rescued person is attached to the central toroidal chamber 1 with an independent gas-filling source (not shown). The bottom toroidal inflatable chamber 5 has a diameter which is greater than the diameter of the central toroidal chamber 1 and is less than the diameter of the top toroidal chamber
30 8 and connected to the central toroidal chamber 1 by the inflatable spokes 4. An air-impermeable fabric 7 is stretched between the spokes of every top and bottom toroidal chamber, or the spokes of every toroidal chamber are covered by air-impermeable coverings. An air-impermeable fabric 7 or air-impermeable coverings are perforated.

35 To downside of the bottom toroidal chamber 5 the membrane 9 is attached for formation of two truncated conical pyramids with a common base and with big bases of different diameter directed likewise, for formation

5 of a conic deceleration shield.

An independent gas-filling source communicates with one of the toroidal inflatable chambers or with one of the inflatable spokes, and the internal volumes of all the toroidal chambers and spokes in their turn communicate with one another and form a single closed volume.

10 The construction under the second variant functions similar to the previously described construction under the first variant.

The present invention is exploitable, can be manufactured with the use of materials and technologies applied at production of automobile safety systems such as bags inflatable from a gas generator.

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5 **Claims**

1. The device for the emergency lowering of a person from a high-rise object is fastened on the person's back. The said device comprises an inflatable central toroidal chamber having a membrane in which to arrange
10 the person, the chamber being connected on one side to inflatable spokes which, upon inflation, are arrangeable in a cone and which are interconnected by inflatable connectors, and being connected on the other side to an inflatable damping structure which has a toroidal inflatable chamber which is likewise connected by inflatable spokes to the central
15 toroidal chamber. The toroidal inflatable chamber of the damping structure has a diameter which is greater than the diameter of the central toroidal chamber and is less than the diameter of the base of the cone which is formed by spokes which are straightened out upon inflation and are interconnected by connectors. An air-impermeable fabric is stretched
20 between the spokes of each toroidal chamber, or the spokes together with the toroidal chambers are covered by air-impermeable protective coverings in order to form a conical deceleration shield in the form of two truncated conical pyramids with a common base in the central toroidal chamber zone with big bases of different diameter directed likewise, the membrane is
25 stretched in the toroidal chamber of a damping structure, air-impermeable fabric of the inflatable damping structure is designed perforated. An independent gas-filling source communicates with one of the toroidal inflatable chambers or with one of the inflatable spokes, and the internal volumes of all the toroidal chambers and spokes communicate with one
30 another and form a single closed volume.

2. The personal emergency device for lowering of people from high-rise objects, fixed to the back of a person and comprising an inflatable by an independent gas-filling source central toroidal chamber, connected on the
35 one side to the inflatable spokes, which are connected to the top toroidal chamber, with diameter bigger than diameter of central toroidal chamber, and to inflatable damping construction composed of the bottom toroidal

5 inflatable chamber on the other side, the membrane in which to arrange the
rescued person is attached to the central toroidal chamber, the bottom
toroidal inflatable chamber has a diameter which is greater than the diameter
of the central toroidal chamber and is less than the diameter than the top
toroidal chamber and connected to the central toroidal chamber by the
10 inflatable spokes, and the membrane is attached to the bottom toroidal
chamber in its central cavity, an air-impermeable fabric is stretched between
the spokes of each bottom and top toroidal chambers or spokes of each
toroidal chamber are covered outside by air-impermeable protective
coverings for formation of two truncated conical pyramids with a common
15 base and with big bases of different diameter directed likewise, and an
independent gas-filling source communicates with one of the toroidal
inflatable chambers or with one of the inflatable spokes, and the internal
volumes of all the toroidal chambers and spokes communicate with one
another and form a single closed volume, air-impermeable fabric of the
20 inflatable damping structure is designed perforated.

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