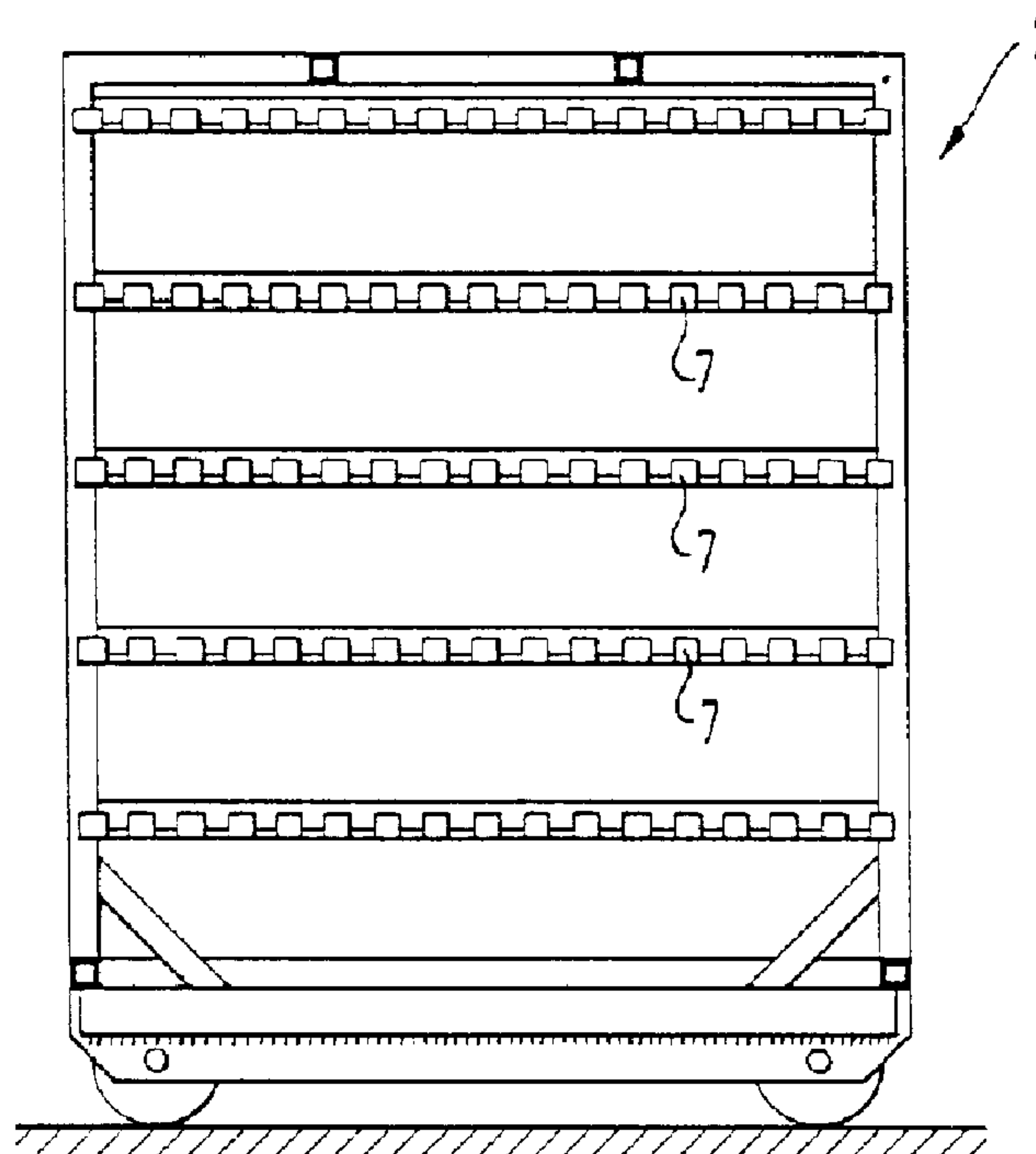




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(54) Titre : PROCEDE DE TRAITEMENT DE VIANDES FRAICHES
(54) Title: METHOD OF PROCESSING FRESH MEAT



(57) Abrégé/Abstract:

Described is a method for the processing of fresh meat, in particular the curing and preservation of fresh beef, pork, veal, lamb, game, poultry, fish, sausage and ham. The method calls for the meat to be stored for a pre-determined length of time in a hermetically sealable space (1) in an atmosphere which is different from the ambient atmosphere. This atmosphere is established by first extracting from the hermetically sealable space the gases corresponding to the ambient atmosphere through an extraction port (13) and then introducing oxygen through an inlet port (4) to give an oxygen atmosphere at a pressure above atmospheric pressure. Throughout the whole of the remaining storage time, the pressure in the hermetically sealable space is kept above atmospheric pressure. This improves the tenderness of the meat, as well as its keeping qualities, and ensures long-lasting freshness. Also described is a device for carrying out the method.



A b s t r a c t o f D i s c l o s u r e

Described is a method for the treatment of fresh meat, in particular the curing and preservation of fresh beef, pork, veal, lamb, game, poultry, fish, sausage and ham. The method calls for the meat to be stored for a predetermined length of time in a hermetically sealable space (1) in an atmosphere which is different from the ambient atmosphere. This atmosphere is established by first extracting from the hermetically sealable space the gases corresponding to the ambient atmosphere through an extraction port (13) and then introducing oxygen through an inlet port (4) to give an oxygen atmosphere at a pressure above atmospheric pressure. Throughout the whole of the remaining storage time, the pressure in the hermetically sealable space is kept above atmospheric pressure. This improves the tenderness of the meat, as well as its keeping qualities, and ensures long-lasting freshness. Also described is a device for carrying out the method.

Method of Processing Fresh Meat

Description:

The invention relates to a method for the processing of fresh meat, in particular for the maturation and conservation of fresh beef, pork, veal, lamb, game, poultry, fish, raw sausage and ham, wherein the fresh meat is subjected to intermediate storage for a predeterminable time in a chamber closable in an air-tight manner in a gas atmosphere different from the external atmosphere. Furthermore the invention is directed to an apparatus for carrying this method.

A method for the treatment of meat is known from DE/EP 0 274 334 T1 which serves to make the meat tender and/or to improve its shelf life and its appearance when conserved. For this purpose the meat is placed into a closed container in which a vacuum is generated. Thereafter a compressed preferably sterile gas is introduced into this container in order to generate a pressure in the container which is higher than the atmospheric pressure. The container is intended to rotate about itself during the low pressure / high pressure cycles, preferably in the manner of a butter barrel. This method of treatment is intended to be used during the thawing phase of frozen meat but also prior to the freezing of the meat and also after the freezing of the meat.

The object of the present invention is to develop the initially named method in such a way that the tenderness of the fresh meat is substantially increased in the course of

the maturation process, that the flavour is improved, that the total number of germs is decisively reduced and thus the shelf life considerably increased and that a durable fresh state is achieved which manifests itself in an intensive red colour of the meat which in the free state of the meat is retained for several days and under vacuum for several weeks.

This object is satisfied in accordance with the invention essentially in that after extracting the gases corresponding to the environmental atmosphere an oxygen atmosphere with a pressure above the atmospheric pressure is built up in the chamber which can be closed off in air-tight manner; and in that the pressure in the closed off chamber is maintained at a pressure above atmospheric pressure for the full further time of intermediate storage.

During this the oxygen atmosphere provided in the chamber should advantageously have a degree of purity of at least 50%, in particular more than 80% and preferably of at least 93%.

Through the high oxygen concentration provided in accordance with the invention an extremely pronounced maturation and conservation effect is achieved. This stands in association with a binding and extraction of carbon dioxide and nitrogen and with a significant increase of the oxygen concentration in the meat brought about by diffusion from the pure oxygen atmosphere into the fresh meat.

It has turned out to be of advantage to retain the pressure which has once been built up in the closed off chamber during the entire further intermediate storage period. The permanent high pressure thereby clearly has the consequence that the clenching of the fibers present in the meat is

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released, the fibers become more mobile relative to one another and thus the meat becomes more accessible for the entry of oxygen which is aimed at.

5 After the period of intermediate storage in the specially
provided oxygen atmosphere which can last for typically
about 3 days for pork and about one week for beef, the fresh
meat attains a pH value which is frequently somewhat higher
10 than in the received state. Since the pH value is a
criterion for the state of quality of the meat it is clear,
as a result of this characteristic value, that unexpected
freshness values can be achieved with the method of the
invention. For meat these freshness values manifest
themselves in a pronounced intensive red colour which is in
15 turn retained for a long time in a manner typical for the
invention.

A further substantial advantage of the method of the
invention is that the loss of juice which occurs during
20 maturation is very low and for example only amounts to about
1% for beef and only approximately 2% for pork. These
quoted values naturally only represent examples and are in
no way to be understood restrictively.

25 The surprising maturation result also permits the transport
of larger pieces of meat without the use of vacuum sleeves
without the dark colouring of the fresh meat arising which
is otherwise usual. A shelf-life of the meat of one week
after the period of intermediate storage is
30 straightforwardly possible without additional measures.

This behaviour of the fresh meat matured in accordance with
the method of the invention makes it possible to enclose
fresh meat in reusable containers, in particular in glass

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containers and in this manner to avoid the plastic foil packages which are customary nowadays and thus to contribute to a reduction of the environmental burden. An oxygen atmosphere can be provided in the closable container, if
5 required with a low overpressure.

It is also advantageous that as a result of the high oxygen concentration in the meat present after the oxygen treatment no oxygen from the environmental atmosphere, or only an
10 unimportant portion of oxygen from the environmental atmosphere needs to act on the meat in order to long maintain the fresh state. Large containers which hold a corresponding quantity of oxygen are thus not necessary for the storage and transport of the meat.

15 The method of the invention can also be particularly advantageously carried out with the build up of the oxygen atmosphere within the closed chamber taking place up to a pressure of 6 to 11 bars.

20 The oxygen may be generated and stored in an oxygen tank outside of the closed space at an overpressure, preferably with 6 bars of overpressure relative to the atmosphere; and that at least the initial build up of the oxygen atmosphere
25 in the closed chamber is carried in accelerated manner by means of the stored oxygen until a pressure equalization between 0 to 0.6 bars takes place between the closed off chamber and the oxygen tank, whereupon the connection between the oxygen tank and the closed off chamber is
30 interrupted and oxygen is directly supplied from an oxygen source to the closed off chamber for the further build up of the overpressure.

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A further embodiment of the method of the invention is characterized in that during the period of intermediate storage a continuous or discontinuous supplementation of the oxygen atmosphere in the closed off chamber is effected, with oxygen being preferably continuously introduced into the closed off chamber at a pressure which is higher than a presetable discharge-pressure, so that a continuous through flow sets in as a result of the pressure difference.

Through this preferably continuous supplementation of the oxygen in the closed off chamber the original oxygen-content in the chamber can be maintained during the entire period of intermediate storage so that a particularly good maturation and conservation effect sets in.

Depending on the nature of the fresh meat different embodiments of the invention are particularly advantageous. Thus particularly good results are achieved with beef, veal, lamb, game, poultry meat and fish when the closed chamber is kept at a cold room temperature during the period of intermediate storage and the oxygen is supplied to the closed chamber at a temperature of -3°C to $+3^{\circ}\text{C}$. With raw sausage and ham which are also intended to fall under the

collective term "fresh meat" it can however be advantageous to keep the temperature within the closed space at a higher temperature, for example + 20°C during the period of intermediate storage.

For the carrying out of the method of the invention an apparatus is preferably used which has a housing with a housing body in which there are provided an opening which can be closed in air-tight manner for the introduction / removal of the fresh meat, an inlet opening which can be connected to at least one oxygen source and which opens in particular at least at the ceiling side and at least one discharge opening which ensures a defined flow out of the inner chamber of the housing, with the discharge opening preferably being arranged beneath the inlet opening, in particular at the floor or in the vicinity of the floor of the housing, wherein a housing enlargement element belongs to the housing which can be connected to a side wall of the housing and preferably to the side wall opposite to the opening for the introduction / removal of the fresh meat, wherein, in the connected state, a connection opening of the side wall of the housing body and a connection opening provided in a side wall of the housing enlargement element associated with the connection opening of the housing body lie opposite to one another, and wherein the connection opening in the side wall of the housing body can be closed by a cover when no housing enlargement element is attached to the housing body.

Through the arrangement of the inlet and extraction openings at opposite points of the housing it is ensured that the entire inner chamber is substantially uniformly filled with oxygen. The capacity of the apparatus can be enlarged in advantageous manner if a housing enlargement element is attached to the housing body. In this arrangement the

housing enlargement element is advantageously attached to the side wall of the housing body which lies opposite to the opening for the introduction / removal of the fresh meat, so that the inner chamber of the apparatus extends in a straight line in elongate manner.

By providing a connection opening corresponding to the connection opening at the side of the housing enlargement element opposite to the connection opening the plant can be enlarged as desired by housing enlargement elements. The further connection opening in the last housing enlargement element is then closed by a cover.

Since, in accordance with the present invention, very high pressures are generated in the closed off chamber formed by the housing, the connections between the housing body and the housing enlargement elements and also the cover must be correspondingly designed. This takes place in advantageous manner by connection flanges which are appropriately provided around the connection openings and/or at the cover. Such flange connections are known from high pressure technology and do not therefore require any further explanation here.

In accordance with a further embodiment the same inlet and outlet openings are respectively provided in the housing enlargements as in the housing body in order to ensure, with a relatively large apparatus, an adequately rapid suction process and an adequately rapid pressure build up and also a good circulation of the flowing oxygen during the period of intermediate storage.

In order to be able to close the housing door in air- and pressure-tight manner a pneumatic seal is provided in accordance with an advantageous embodiment of the invention

in the form of a hose which is guided in a closed circuit around the opening, with the diameter of the hose being resiliently enlargeable by the supply of a fluid. The air- and pressure-tight closing can also take place by a bayonet connection.

In accordance with an advantageous embodiment of the invention an oxygen tank for the storage of oxygen is arranged outside of the housing and is connected via a branch-line closable by a solenoid valve with both the oxygen generator and also with the inlet opening. With the aid of this oxygen tank it is possible to store with elevated pressure oxygen supplied during the suction phase from an oxygen source, so that after termination of the suction phase the oxygen stored in the oxygen tank can be very rapidly introduced into the closed space.

During this the oxygen source can be an oxygen generator or an oxygen store, and in particular for smaller plants the use of an oxygen bottle is advantageous.

In other respects the oxygen can be supplied in liquid or gaseous form.

An excess pressure valve is advantageously associated with the extraction opening which responds at a predeterminable pressure in the closed off chamber of the housing. It is hereby possible to build up the oxygen atmosphere in the closed chamber up to the opening pressure of the excess pressure valve and to subsequently maintain a continuous oxygen flow while retaining this pressure.

Further advantageous developments of the invention are evident from the subordinate claims.

The invention will now be explained in more detail in the following with reference to the drawing by way of example in which are shown:

- Fig. 1 a schematic sideview of an apparatus for carrying out the method of the invention,
- Fig. 2 a schematic view of a carrier frame which can be introduced into the apparatus of Fig. 1,
- Fig. 3 a schematic illustration to make clear the manner of operation of the apparatus for carrying out the method of the invention, and
- Fig. 4 a schematic side view of an apparatus enlarged by a housing enlargement element.

Fig. 1 shows an apparatus in accordance with the invention with a housing 1 of closed shape consisting of a welded construction with a loading side opening 3 which can be sealingly closed by means of a housing door 8.

A run up ramp 6 which is preferably suspendably designed is hingedly connected to the housing 1 in the door region. This run up ramp 6 can be so designed that it can be pivoted into the interior chamber of the housing 1 and stored there, so that it is available at any time when required but does not enter disturbingly into appearance when the housing is closed. An oxygen generator 9, evacuation pump 10 and also an oxygen tank 11 and an electronic control unit 12 are attached to the housing 1 at the outside. Fig. 2 shows a carrier frame 1 consisting of a welded construction with a plurality of hanging devices 7 for the fresh meat.

By the suspension or small area support of the fresh meat it

is ensured that the fresh meat is accessible from all sides to the purest oxygen present in the interior space of the housing 1 and accordingly the oxygen can diffuse into the entire volume of meat unhindered.

The carrier frame 2 is of mobile design and is moved in the loaded state via the run up ramp 6 into the interior space of the housing 1. After the run up ramp 6 has been swung upwardly the door 8 of the housing 1 can be closed and the oxygen treatment process can be commenced.

The housing 1 has further, as schematically shown in Fig. 3, an evacuation opening 13 and an oxygen inlet opening 4 at the ceiling side and also an oxygen discharge opening 5 at the floor side.

The evacuation pump 10 is connected via a tubular duct closable by means of a solenoid valve 14 or via a hose 15 to the evacuation opening 13. From the tubular duct 15 a tubular duct or a hose 16 branches off between the solenoid valve 14 and the evacuation opening 13, opens into the environmental atmosphere and is likewise closable by means of a solenoid valve 17.

At the end of the tubular duct 15 lying inside the housing 1 there are provided two horizontal, parallel, plate-like elements 18 with the lower plate-like element covering over the open end of the tubular duct 15. In this manner a ring-like gap arises between the two plate-like elements 18 which promotes a large area sucking in of the air or of the oxygen from the housing and a uniform evacuation effect.

The oxygen generator 9 is connected via a tube duct or a hose 19 to the inlet opening 4 and the sucking in end of the tubular duct 15 is closable by means of a solenoid valve 20.

Between the oxygen generator 9 and the inlet opening 4 there is furthermore provided a heat exchanger 27 in the form of a Peltier element. Here the temperature of the oxygen is measured and the oxygen cooled down to ca. 0°C. The cooling of the oxygen contributes significantly to the freshness of the meat.

Between the oxygen generator 9 or the heat exchanger 27 and the inlet opening 4 there is furthermore provided a solenoid valve 21.

A further tubular duct or a hose 22 branches off from the tubular duct 19 between the solenoid valve 21 and the heat exchanger 27, is closable by a solenoid valve 23 and leads to the oxygen tank 11.

The tubular duct 19 ends within the housing 1 in an oxygen distribution device which consists of tube elements 24 arranged in star-like manner, i.e. of tube elements 24 which are directed outwardly in star-like manner from the end of the tubular duct 19. These tube elements 24 serve for the uniform distribution of the oxygen supplied over the entire inner space of the housing 1.

The discharge of the oxygen from the inner chamber of the housing 1 takes place from a specific predeterminable pressure onwards via a tubular duct or a hose 25 which is closed by an excess pressure valve 26 below this predeterminable pressure. The end of the tubular duct 25 arranged within the housing 1 is led back in arcuate manner to the floor of the housing 1 in order to prevent the entry of water or contamination.

In Fig. 4 the housing 1 is formed in section-like manner and

consists of a housing body 28 and also a housing enlargement element 29. The housing enlargement element 29 is arranged at the side wall 30 of the housing body 28 which lies opposite to the loading opening 3 of the housing body 28. In this arrangement connection openings 31, 32 of the housing body 28 and of the enlargement element 29 which fill the larger part of the surfaces of the corresponding side walls lie in alignment against one another.

The enlargement element 29 has at its side wall opposite to the connection 32 a further connection opening 35 in order to be able to connect on a further housing enlargement element. This connection opening 35 is in the present case closed off in air-tight manner by a cover 36.

In the illustrated embodiment connection flanges 37, 38, 39, 40 are provided around the connection openings 31, 32, 35 of the housing body 28 and of the housing enlargement element 29 and also at the cover 36. In Fig. 4 it is indicated that the connection flanges 37, 38, 39, 40 have openings 41 uniformly distributed around their circumference through which clamping screws can be inserted to connect the connection flanges 37, 38, 39, 40. A sealing means is in each case provided between the connection flanges 37, 38, 39, 40 in order to avoid the penetration of air in the evacuation phase and the emergence of oxygen in the pressure phase.

This apparatus operates in the following way when carrying out the method of the invention:

After the loading of the housing 1 with fresh meat, which for example takes place with the carrier frame 2 illustrated in Fig. 2 the housing door 8 is closed and locked. The control unit now causes the filling of a non-illustrated

pneumatic seal in the form of a hose which is guided in a closed circuit around the opening 3 with air at high pressure, whereby the diameter of the hose is increased in order to seal off the door 8 relative to the housing body 28 in gas- and pressure-tight manner.

In this initial state the solenoid valves 14, 17, 20, 21 and 23 are closed.

Subsequently the inner space of the housing is evacuated approximately one hour long, with the solenoid valve 14 being opened via the control unit 12. At the end of the one hour evacuation period a vacuum has almost been achieved within the housing 1, i.e. a depression of 50 to 100 mbars prevails.

Approximately two hours before the start of the evacuation of the housing the oxygen generation has already started via the oxygen generator 9, with the solenoid valves 20 and 23 being opened, but with the solenoid valve 21 still remaining closed.

The oxygen thus flows after corresponding cleaning via the heat exchanger 20 and the tubular duct 22 into the oxygen tank 11 in which an excess pressure of approximately 6 bars prevails at the end of the one hour evacuation period.

After approximately one hour the evacuation of the internal space of the housing is terminated and the solenoid valve 14 is closed. The solenoid valve 21 is now opened so that the oxygen which stands under excess pressure can now flow out of the oxygen tank 11 into the interior space of the housing 1. After approximately five minutes a pressure equalisation takes place between the oxygen tank 11 and the internal space of the housing 1 and lie at about 0 to 0.6 bars

overpressure.

After the oxygen atmosphere within the housing 1 has been relatively rapidly built up via the storage tank 11 the solenoid valve 23 closes with pressure equilibrium so that the oxygen from the oxygen generator 9 is now led by the direct path into the interior space of the housing.

After a several hour build up phase an oxygen pressure of approximately 10 to 11 bars has been achieved in the interior space of the housing at which the overpressure valve 26 opens. From this timepoint on the oxygen continuously flows from the region of the inlet opening 4 to the discharge opening 5 so that the interior space of the housing is continuously flooded with fresh oxygen. This state is retained until the end of the intermediate storage period which can last for two to five days for pork and five to nine days for beef.

After termination of the desired period of intermediate storage the oxygen generator 9 is switched off and the two solenoid valves 20 and 21 are closed. The solenoid valve 17 is opened for a few minutes in order to obtain a pressure balance between the internal chamber of the housing and the environmental atmosphere.

Prior to the opening of the housing door 8 the air is necessarily let out of the pneumatic door seal via a correspondingly controlled solenoid valve in order to avoid the door seal being damaged by the lack of counter-pressure on opening of the door.

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. Method for the processing of fresh meat, wherein the fresh meat is subjected to intermediate storage for a predeterminable time in a container containing a chamber closable in an air-tight manner in a gas atmosphere different from the external atmosphere, and wherein an oxygen atmosphere with a pressure above the atmospheric pressure is built up in the chamber which can be closed off in an air-tight manner, and characterised in that the oxygen atmosphere in the closed off chamber is brought to an overpressure with respect to the atmospheric pressure of more than 6 bars, and this overpressure is maintained for the full further time of intermediate storage.

2. Method for the processing of fresh meat according to claim 1, wherein said processing of fresh meat is the maturation and conservation of fresh beef, pork, veal, lamb, game, poultry, fish, raw sausage and ham.

3. Method for the processing of fresh meat according to claim 1 or 2, wherein said overpressure with respect to atmospheric pressure is more than 11 bars.

4. Method in accordance with claim 1, wherein the oxygen atmosphere has a degree of purity of at least 50%.

5. Method in accordance with claim 1, wherein the oxygen atmosphere has a degree of purity of at least 80%.

6. Method in accordance with claim 1, wherein the oxygen atmosphere has a degree of purity of at least 93%.

7. Method in accordance with claim 1, wherein oxygen is produced at an oxygen source outside the closed chamber and is

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stored in an oxygen tank at an overpressure; and wherein at least the initial build up of the oxygen atmosphere in the closed off chamber is carried out in an accelerated manner by means of the stored oxygen.

8. Method in accordance with claim 7, wherein said overpressure is 6 bars relative to the atmospheric pressure.

9. Method in accordance with claim 7 or 8, wherein after pressure equalization between the oxygen tank and the closed off chamber the connection between the oxygen tank and the closed off chamber is interrupted and the oxygen required to further build up the overpressure is supplied to the closed off chamber directly from the oxygen source.

10. Method in accordance with claim 9, wherein the pressure equalisation takes place at approximately 0 to 0.6 bars.

11. Method in accordance with claim 9, wherein the oxygen is supplied to the closed off chamber from the oxygen source at a pressure which is somewhat higher than the pressure to be achieved in the closed off chamber.

12. Method in accordance with any of one of claims 1 to 9, wherein during the period of intermediate storage a continuous or discontinuous supplementation of the oxygen atmosphere in the closed off chamber is effected, with oxygen being continuously introduced into the closed off chamber at a pressure which is higher than a presettable discharge pressure, so that as a result of the pressure difference a continuous throughflow sets in.

13. Method in accordance with any one of claims 1 to 12, wherein for pork 2 to 5 days and for beef 5 to 9 days is selected as the period of intermediate storage.

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14. Method in accordance with any one of claims 1 to 13, wherein the fresh meat is introduced in a well-cooled state, into the closed or sealable chamber, with the container containing the closed chamber being arranged during the period of intermediate storage in a cool-room at a temperature in the range from -3°C to $+3^{\circ}\text{C}$.

15. Method in accordance with claim 14, wherein said well-cooled state is at a temperature in the range from 1°C to 3°C .

16. Apparatus for carrying out the method in accordance with any one of claims 1 to 15, comprising a housing having a housing body in which there are provided an opening which can be closed in air-tight manner for the introduction/removal of the fresh meat, an inlet opening which can be connected to at least one oxygen generator and which opens at the ceiling side and at least one discharge opening which ensures a defined flow out of the inner chamber of the housing, with the discharge opening being arranged beneath the inlet opening, or at the floor or in the vicinity of the floor of the housing, and with a housing enlargement element which can be connected to a side wall of the housing for the introduction/removal of the fresh meat, wherein, in a connected state, a connection opening of the side wall of the housing body and a connection opening provided in a side wall of the housing enlargement element associated with the connection opening of the housing body lie opposite to one another, and wherein the connection opening in the side wall of the housing body can be closed by a cover when no housing enlargement element is attached to the housing body.

17. Apparatus in accordance with claim 16, wherein said side wall of the housing is the side wall opposite to the opening.

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18. Apparatus in accordance with claim 16 or 17, wherein a connection opening corresponding to the connection opening is provided in the side wall of the housing enlargement element opposite to the connection opening for the connection with a further housing enlargement element which can be closed by the cover.

19. Apparatus in accordance with any one of claims 16 to 18, wherein mutually associated connecting elements are formed on the housing body and on the housing enlargement element around the connection openings and also at the cover by means of which the components can be connected to one another.

20. Apparatus in accordance with claim 21, wherein a sealing element is inserted between said connecting elements.

21. Apparatus in accordance with claim 19 or 20, wherein the connection elements are connection flanges.

22. Apparatus in accordance with any one of claims 16 to 21, wherein the connections between the housing body and the cover or the housing enlargement and also between the housing enlargement and the cover are designed as high pressure connections.

23. Apparatus in accordance with any one of claims 16 to 22, wherein there are provided, in the housing enlargement, an inlet opening which can be connected to at least one oxygen generator, and which opens at the ceiling side, and at least one discharge opening which ensures a defined outflow from the inner chamber of the housing and is arranged beneath the inlet opening or at the floor or in the vicinity of the floor of the housing.

24. Apparatus in accordance with any one of claims 16 to 23, wherein the housing is of rectangular shape.

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25. Apparatus in accordance with any one of claims 16 to 23, wherein the housing is of cylindrical shape, with the opening for the introduction/removal of the fresh meat and the connection openings being respectively provided in end faces of the housing body and of the housing enlargements.

26. Apparatus in accordance with any one of claims 16 to 25, wherein a pneumatic seal is provided for air- and pressure-tight sealing of the housing body and is provided in the form of a hose which is guided in a closed circuit around the opening of the housing body, with the diameter of the hose being resiliently enlargeable by the supply of a fluid with an overpressure greater than 1 bar.

27. Apparatus in accordance with claim 26, wherein said overpressure is 6 to 11 bars.

28. Apparatus in accordance with any one of claims 16 to 25, wherein a bayonet closure is provided for air- and pressure-tight closure of the opening of the housing body.

29. Apparatus in accordance with any one of claims 16 to 28, wherein the supply of the oxygen takes place via an oxygen distribution device arranged inside the housing which consists of tube elements arranged in a radially projecting, star-like manner.

30. Apparatus in accordance with any one of claims 16 to 29, wherein the housing has an evacuation opening which is arranged at the ceiling for the extraction of the gas mixture corresponding to the environmental atmosphere, with the evacuation opening being covered over at the inner side of the housing by a plate-like element spaced from it.

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31. Apparatus in accordance with any one of claims 16 to 30, wherein an oxygen tank arranged outside of the housing is provided for the storage of oxygen and is connected via a branch line closable by means of a solenoid valve both with the oxygen generator and also with the inlet opening.

32. Apparatus in accordance with any one of claims 16 to 31, wherein in each case an overpressure valve is associated with an extraction opening or extraction openings and responds at a predeterminable pressure in the closed off inner chamber of the housing.

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Fig. 1

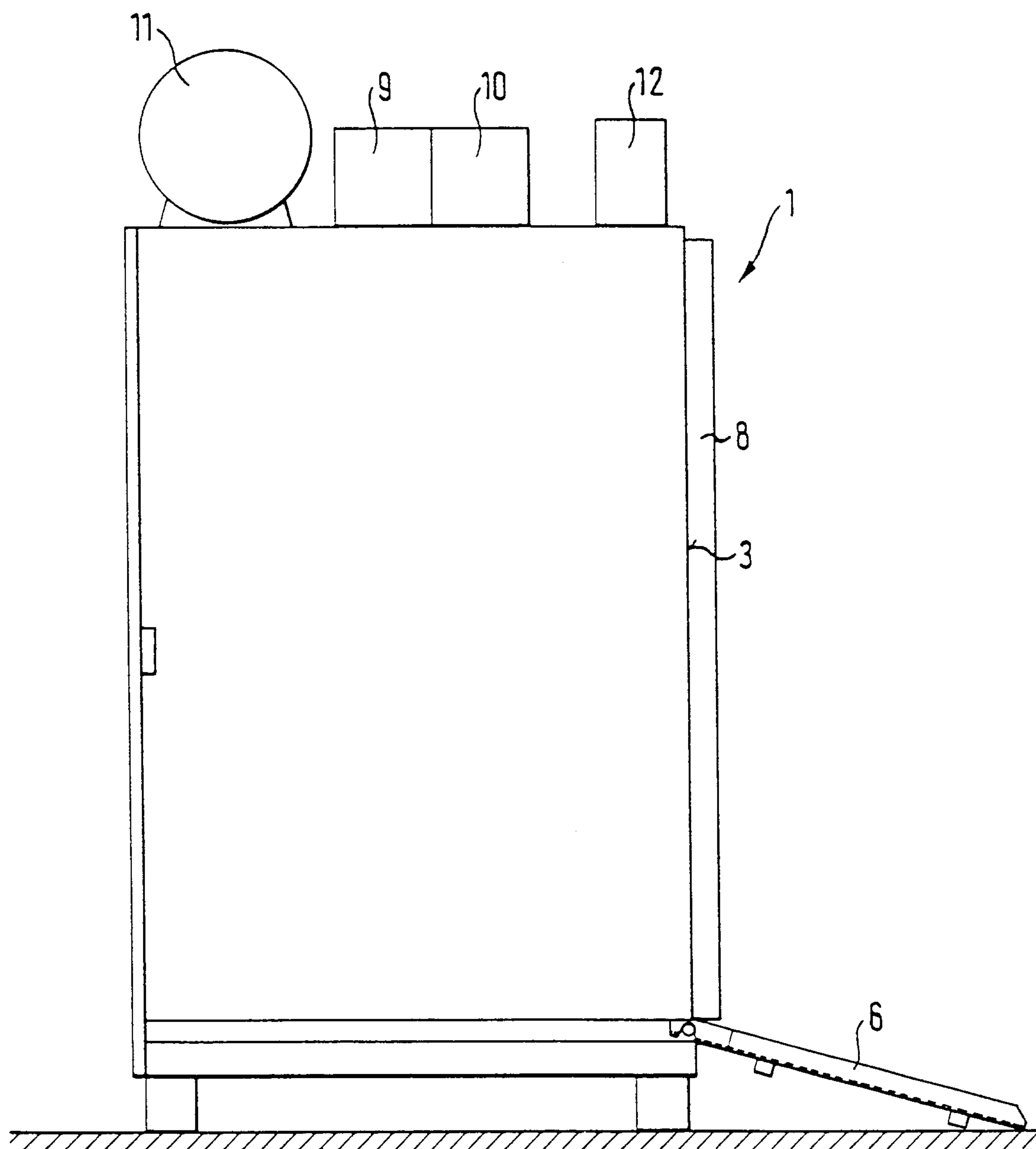
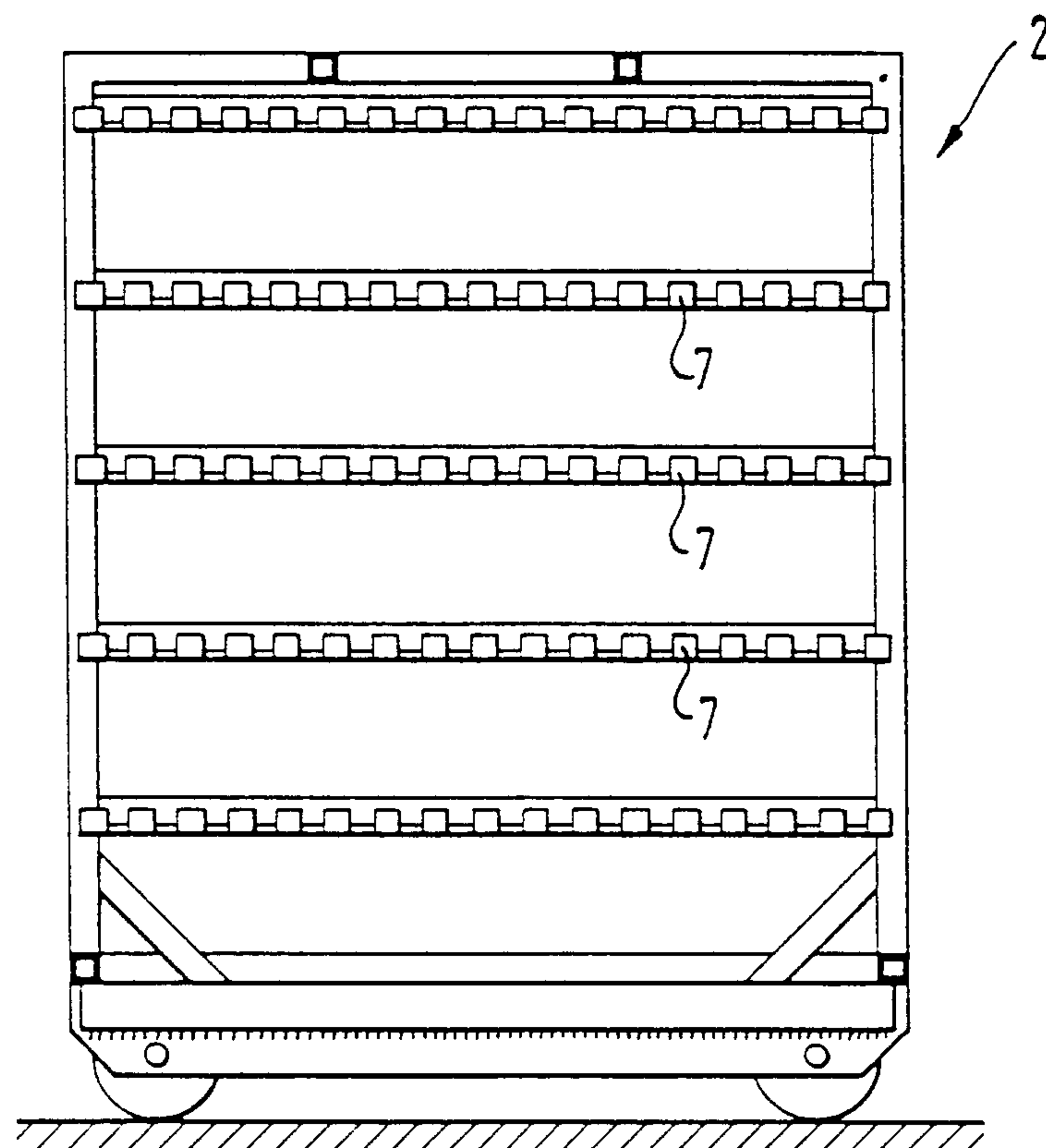
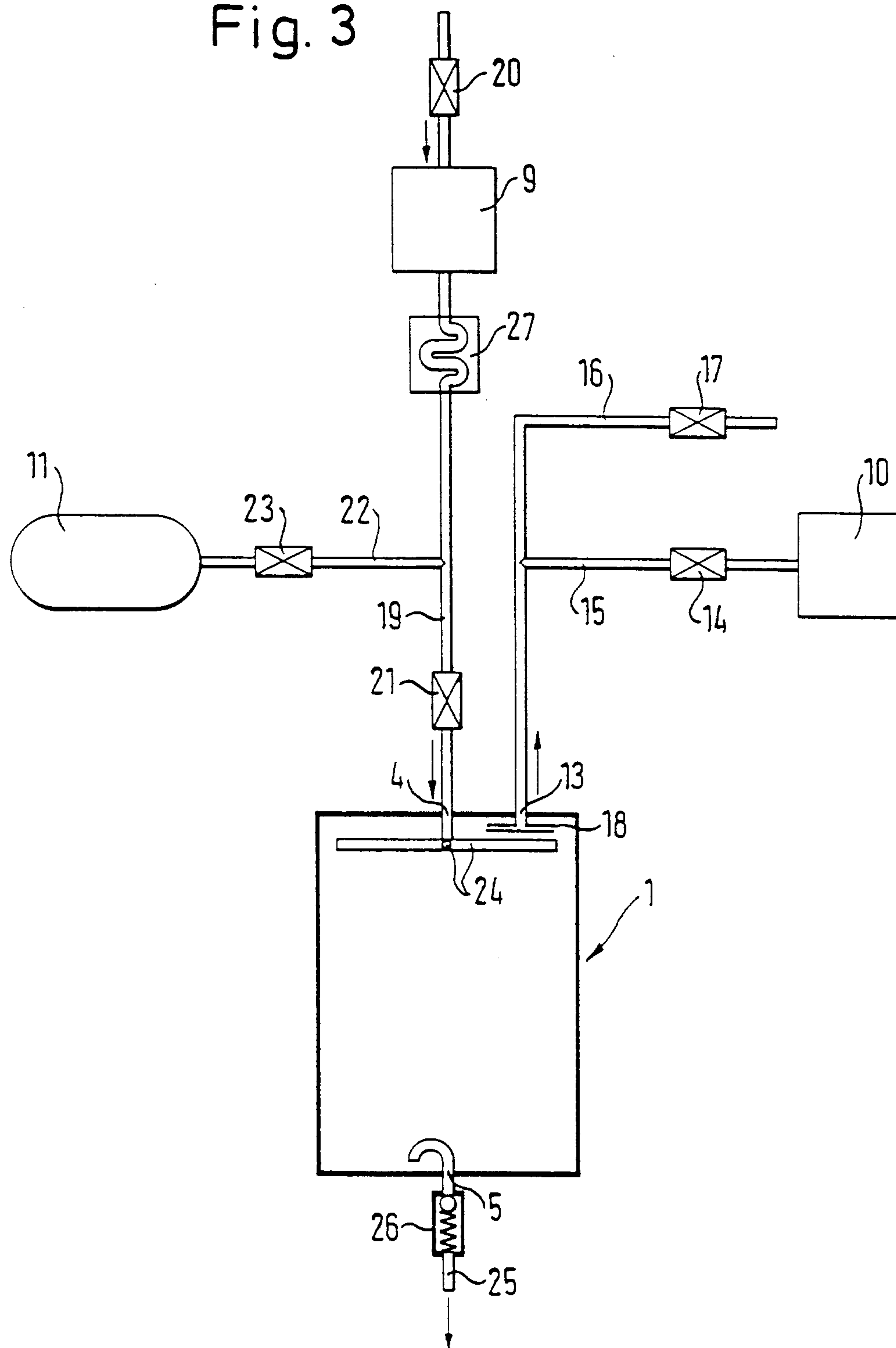


Fig. 2



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Fig. 3



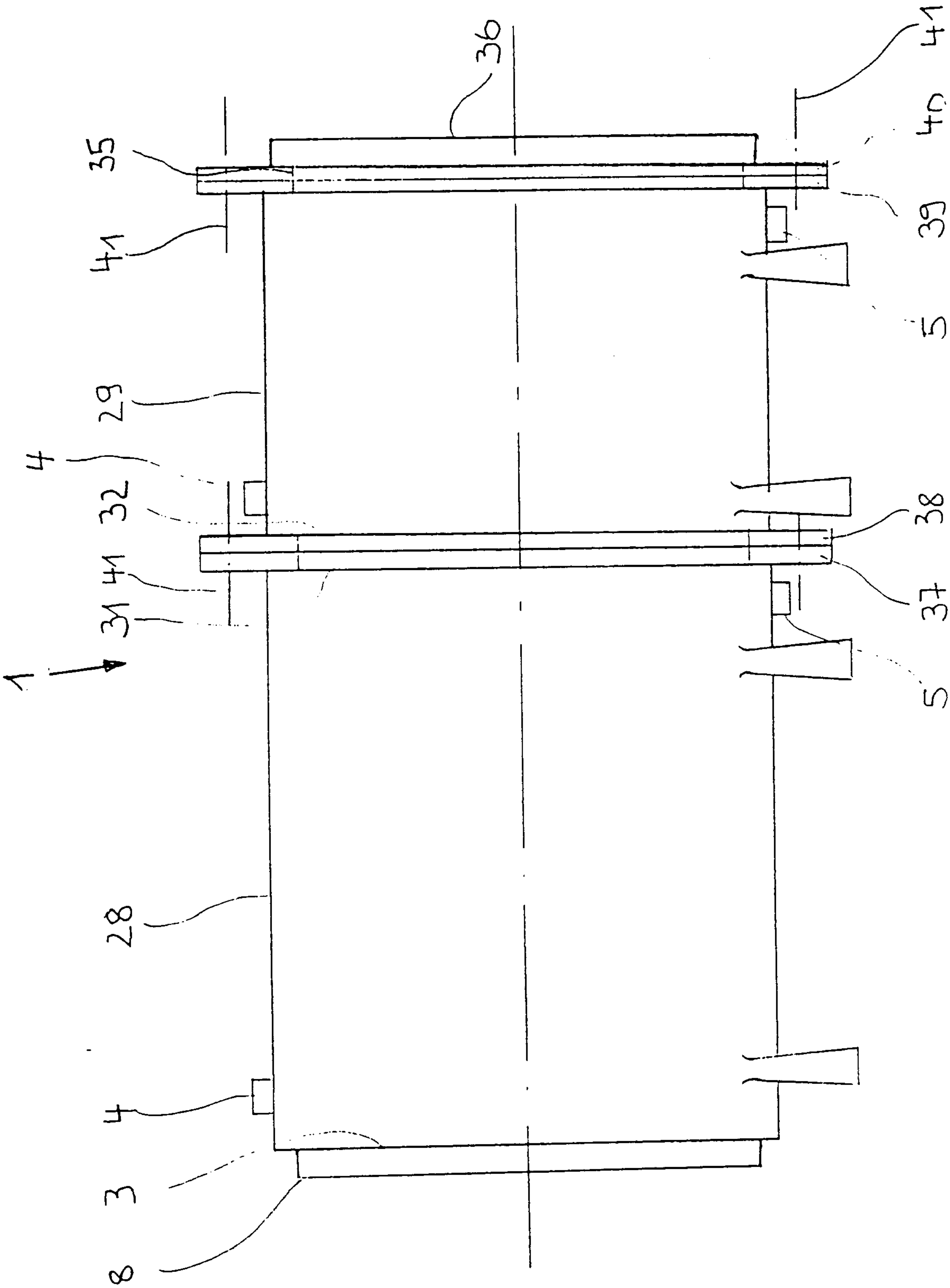


Fig. 4

