Inside a chamber (1) is/are treated and/or manufactured one or more objects at a pressure below the pressure surrounding the chamber. Amongst the type of treatment intended is that in which a material is sprayed onto a mould or a semi-finished article. An apparatus intended for the creation of a pressure difference (17) which belongs to or is included in the chamber is so arranged as to evacuate the air from the chamber once the latter is closed. Inside the chamber is arranged treatment or manufacturing apparatus, and the chamber is executed with at least one door (8) capable of being opened and closed. The chamber is constructed from a number of self-supporting elements (2) bearing against each other and exhibiting low weight. The respective elements have a length (1) which represents only a limited part of the corresponding extent (L) of the chamber. The chamber also comprises gable components or end components arranged or capable of being arranged in conjunction with the two outermost self-supporting elements (2', 2''). Pressure sealing organs are arranged against said elements and gable components or end components (8, 9). The elements, the components and the pressure sealing organs are so arranged that, in spite of the light structure of the elements, they are capable of withstanding a differential pressure between the inside and the outside of the chamber and generated by means of the pressure difference creating apparatus (17).
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TITLE OF THE INVENTION

Arrangement enabling the treatment and/or manufacture of objects to take place inside a chamber.

TECHNICAL FIELD

The present invention relates to an arrangement enabling inside a chamber the treatment and/or the manufacture of one or more objects, at a pressure below the pressure surrounding the chamber, preferably being treatment and/or manufacture such as consists of or involves the application, in the first instance by spraying, of a material onto a mould or an unfinished article, referred to hereinafter as a semi-finished article or a blank. The arrangement includes a pressure difference creating apparatus belonging to or capable of being connected to the chamber, and treatment apparatus or manufacturing apparatus capable of being arranged or present inside the chamber. The chamber is also equipped with at least one unit (door) capable of being opened and closed for the purpose of introducing and removing the objects.
DESCRIPTION OF THE PRIOR ART

Previously disclosed is the arrangement of a chamber of this kind in the form of a unit capable of being connected in a hermetically sealed manner which is equipped with entry and exit doors, air evacuation equipment, inspection devices, an arrangement for the introduction and removal of objects which are to be treated or processed, and material application equipment in the form of industrial robot and spray devices, etc. The previously disclosed type is used in the first instance for the application of material to open moulds for boat hulls which are intended to be produced from, amongst other things, plastics material or equivalent material. The application of the material can thus take place by spraying onto the mould under a vacuum, for instance at a value of about 300 millibar and below as far as to the values which are practical in this context. The expression vacuum in this context denotes a partial vacuum or a so-called rough or low vacuum. Amongst the advantages of this operating procedure are better and more uniform products which are capable of being manufactured at lower costs and in better working conditions on comparison with conventional methods.

DESCRIPTION OF THE PRESENT INVENTION

TECHNICAL PROBLEM

A permanent installation of the previously disclosed kind presents a variety of problems. It must be dimensioned to suit those objects, for instance boat hulls, which are intended from the outset to be treated or processed in the installation, and is accordingly difficult to be used and adapted for other types and sizes of manufacturing or treatment processes or objects, which, in view of the high levels of cost associated with the previously disclosed type of plant, is perceived as a major disadvantage.

The floor or the base must, in accordance with the previously disclosed construction, be used as an underlying load-bearing element and must accordingly be dimensioned for that purpose, which imposes special requirements in the case of a large chamber. It should be pointed out in this connection that chambers of the previously disclosed type may be up to 20 metres in length, and that cross-sectional areas of, for instance, 10 x 10 metres may exist at least at certain points along the length of the chamber.
The previously disclosed principle also means that much of the installation must be produced at a place where the necessary technical expertise, for instance skilled welders, is readily available.

SOLUTION

5 The object of the present invention is to propose an arrangement which will solve, amongst other things, the problem outlined in the above, and what may essentially be regarded as being characteristic of the novel arrangement is that amongst other things, the chamber is constructed from a number of elements preferably bearing against each other, each of which is arranged at least essentially in a self-supporting fashion, that each element has a length (in the case of upright elements) or a height (in the case of horizontal elements) which represents a part of the corresponding extent of the chamber, that one or more pressure sealing organs is/are fitted to said elements, and that the elements and said pressure sealing organs are so arranged as to withstand a differential pressure between the inside and outside of the chamber and generated by means of the pressure difference creating apparatus.

Further developments of the idea of invention are concerned in greater detail with a number of alternative embodiments of the construction of the chamber. The self-supporting elements are executed so as to exhibit a closed cross-section or light-admitting openings and may be built up with the help of one or more clear span elements (structures). The chamber should preferably include gable components or end components arranged or capable of being arranged in conjunction with the two outermost self-supporting elements. The internal surfaces of the self-supporting elements and the gable components or the end components support first and second internal surfaces inside the chamber. In one case open (e.g. semi-circular) clear span elements may be arranged in conjunction with a common floor, ceiling or wall component which may thus be considered as a constituent part of the self-supporting elements. Said component will then exhibit a third internal surface.
It is also proposed via the aforementioned further developments that the self-supporting elements shall be executed in the form of extruded profiles, preferably in aluminium or an equivalent material with equivalent or essentially equivalent properties with regard to, amongst other things, its extrudability, its specific gravity, its strength, its fatigue strength, its buckling (Euler critical tension) and its lateral bending, etc. The profile in this case should preferably be executed in either a fully closed or an essentially closed form. Alternatively, said profile may be executed from steel or an equivalent material.

In a first embodiment of the self-supporting element, the element is given a four-cornered cross-section, preferably a rectangular or square cross-section, and is composed of four parts forming a frame in which the parts of the frame are cut away obliquely, preferably at an angle of 45°, in the corners. In the aforementioned frame the component parts are connected together in each of the corners with the help of one or more clamping organs, for example in the form of metal angles. At the corners of the thus executed frames, which are arranged one after the other or are stacked one on top of the other, are arranged long angular components which extend along the entire longitudinal direction of the chamber and are attached to at least the two outermost frames. The gaps between the frames are sealed by means of long first rubber strips which extend in the transverse direction of the chamber and by means of long second rubber strips which are arranged below the long angled components and provide seals at the aforementioned corners of the frame. Alternatively, the sealing of the corners may be achieved by providing a tight fit, for instance by the use of flat rolled steel or similar.

In a second embodiment the self-supporting elements may be of essentially circular or semi-circular cross-section, in addition to which each self-supporting element may be composed of two or more element components which are displaced at an angle in relation to the element components on an adjacent self-supporting element. Each element component is executed as a section extruded or rolled from aluminium or an equivalent (see above)
material. The section will preferably have been bent on rollers in order to produce the circular or semi-circular form of the respective elements. The element components may be executed with guide organs to provide mutual locations or self-locking of the various element components and elements. In this case the pressure sealing organs consist of or incorporate a sealing cloth or sealing mat arranged over the external surfaces of the elements.

Each door may be constructed from or may incorporate a number of parallel element components arranged in the section referred to above, in addition to which sealing organs, for instance in the form of sealing strips, are arranged between the element components. The chamber is provided with at least one door, and the door in question may be situated on the gable component, the floor component, the roof component or the wall component of the chamber. The chamber may alternatively or additionally be provided with an inlet and/or outlet for instance for the continuous input and/or output of material and/or objects.

In a preferred embodiment the chamber functions as a vacuum chamber (a low vacuum chamber) for the application of a material, preferably by spraying, a mould or a semi-finished item. The chamber shall in this case operate at an internal pressure of not more than 300 millibar, preferably 50-150 millibar or about 100 millibar.

ADVANTAGES

By the use of light self-supporting elements of the aforementioned kind, the vacuum chamber (low vacuum chamber) can be dimensioned in accordance with the rigidity of each element. The pressure sealing organs may be executed in a comparatively simple fashion, as may the entire chamber structure. The proposed procedure will facilitate the pre-fabrication of the constituent parts and their transport to the construction site, where they can be erected simply by workers without the special expertise required for the erection of permanent installations in accordance with previously disclosed types.
The elements are arranged in a self-supporting fashion so as to withstand external pressure. The elements may possibly be executed with mutual guide components. The chamber intended here will preferably have a capacity of 0.25 m³ or greater. The pressure differential is of a magnitude such as to create a pressure of about 10 tonnes/m².

Each chamber may be constructed at comparatively low cost, and the construction principle will also permit the chamber to be adapted to suit and be integrated into a manufacturing or treatment process in a more flexible fashion than previously. Thanks to these advantages it is no longer necessary to dimension the chamber so as to accommodate the largest conceivable objects, but each time it is erected the chamber may be given the optimum dimensions with regard to the product or process concerned. It is also easy to increase or reduce the dimensions of a finished chamber.

A further advantage is that the chamber is capable of being built around an existing treatment or manufacturing plant, which can be planned in advance before the chamber is erected around the equipment.

The design and the type approval of the new chamber to a certain maximum size will also be facilitated which means that the design calculations and type approval will be valid for all sizes below the aforementioned maximum size. The design and calculation data may be in tabular form, thereby facilitating the preparation and supplying of the production data. The sections or strips which form the elements are easy to cut and are available in any desired length.

In the embodiment with four-cornered closed self-supporting elements, a conventionally executed internal space is provided inside the chamber. The element frames can be produced easily in different sizes by cutting the respective side of the frame from a length of section made available in maximum lengths. The frame is easily endowed with torsional stiffness by the use of angles or equivalent organs in the corners. The axial forces imposed by the doors are easily absorbed by the use of the aforementioned long angular components which, furthermore, are best arranged in conjunction with pressure sealing organs or seals for the sealing of the corners of the frame.
In the case of the embodiments in which the overhung elements are constructed from closed sections, advantageous absorption of the forces in achieved even of those axial forces which are imposed by the respective doors, with the result that, amongst other things, no special devices are required for the purpose of absorbing the axial forces.

The clear span elements (structures) of semi-circular form should preferably include a base on which the elements making up the structure of the chamber are arranged. This type of chamber is easy to construct, and its delivery and erection are particularly advantageous in the case where this involves the use of semi-circular elements.

DESCRIPTION OF THE DRAWINGS

A preferred embodiment of an arrangement which exhibits the significant characteristic features of the present invention is described below with reference to the accompanying drawings, in which:

Figure 1 is a perspective view from the right and from the topfront showing first embodiment of a chamber structure with self-supporting elements in the form of upright four-cornered frames;

Figure 2 is a horizontal view somewhat reduced in scale to that shown in Figure 1 of the chamber in accordance with said Figure together with the equipment contained in the chamber and an object introduced into the chamber;

Figure 3 is a section through the points III-III illustrating a profile of a first embodiment in which the self-supporting elements in accordance with Figure 1 are represented;

Figure 4 is a section through the points IV-IV illustrating the juxtaposition of two element components forming part of one and the same self-supporting element;
Figure 5 is a perspective view from the right looking from the top front of a second embodiment of a chamber with circular, upright self-supporting elements;

Figure 6 is a perspective view from the right looking from the top front of a third embodiment of a chamber with semi-circular, upright clear span elements which, together with a common base, from the self-supporting elements;

Figure 7 is a side view of a fourth embodiment of a chamber with self-supporting elements in the form of horizontal, four-cornered frames and a door capable of being opened and closed which, in its closed position, forms the floor of the chamber;

Figure 8 is a horizontal view of a section by means of which a self-supporting element in the chamber in accordance with the Figures 5 and 6 is executed, and

Figure 9 illustrates in cross-section a further embodiment of a section capable of being used in the self-supporting elements, said section being closed, and

Figure 10 illustrates in cross-section an alternative embodiment of long angular organs in a chamber of four-cornered section.

FUNCTIONAL EMBODIMENT

Figure 1 shows examples of a chamber 1 in accordance with the invention. The chamber is constructed from a number of self-supporting elements 2 which are arranged standing vertically one after the other in the longitudinal direction 3 of the chamber. The elements are then in close contact with each other and each element has a length l which represents only a limited part of the length L of the chamber. Use is made in this case of fifteen self-supporting elements, for which reason the length l is 1/15 of the length L. The chamber may, of course, vary with regard to its length. Similarly, the length l of the respective self-supporting elements may vary, although in accordance with the idea of invention the value of the correlation between l and L should not exceed 1/3 for instance.
In the case in accordance with Figure 1, the self-supporting elements are arranged one after the other, although the invention also covers the case in which the elements are stacked one on top of the other so that the aforementioned longitudinal dimension 3 will instead represent the height of the chamber. An equivalent correlation will then apply between 1 and said height of the chamber.

In accordance with what follows, each of the self-supporting elements in accordance with Figure 1 has the form of a four-cornered or four-edged (multi-cornered) cross-section, preferably being rectangular or square. Across the corners of the self-supporting elements 2 executed as frames are applied long angled components 4, 5 and 6. The corners of the frames 2 not shown here are provided with a corresponding angled component. In the case illustrated, the legs of the respective angled components should preferably be of identical length.

The internal space inside the chamber is indicated by the reference designation 7 in Figure 1. At the gables or ends 1a and 1b of the chamber are arranged openable and closable doors 8 and 9, whereby the opening and closing function is shown only in respect of the door 8. The corresponding function for the door 9 may be executed in a corresponding way. In the case illustrated, the door 8 is capable of being laterally displaced so as to expose and to close the rectangular or square opening of the chamber. A partly open position is indicated by the use of solid lines, whilst a closed position for the door is indicated by the use of broken lines 8a. Each door in the case illustrated has a cross-section corresponding to that of the rest of the chamber. Each frame is constructed from sections described in greater detail below. The door may be constructed from a number of straight element components 8' arranged parallel to each other and containing identical sections, of which the upper and lower ends are held together by means of securing organs 8'' and 8''' which are held to the element components by means of rivets, screws and/or welding. In accordance with what follows, the element components are sealed one against the other by the use
of sealing organs which extend in the longitudinal direction (height direction) of the element components. On its top edge the door is fitted with guide organs 8b and 8c which control the movement of a guide 10a in a track 10. The track extends with its first parts running parallel with the opening, and is then angled so that it extends with its second parts running parallel with the longitudinal direction 3 of the chamber. The track in said first part is executed so as to exhibit two components 10b and 10c so arranged that, for the purpose of opening it, the door must first have applied to it a movement in the longitudinal direction of the chamber and must then be displaced laterally to a position which is parallel with the longitudinal direction of the chamber. The closing sequence is the reverse of the above. The organs permitting lateral displacement of the door to take place are not shown, but are assumed to be capable of being executed in a previously disclosed fashion, for instance by the use of organs 8''' operating in conjunction with air cushions which support the weight of the door.

Each of the outermost self-supporting elements 2', 2'' is fitted with an end seal 11 for the door preferably securely glued to each element. In certain cases the self-supporting elements are not intended to absorb any axial forces, i.e. forces which coincide with the longitudinal direction 3 of the chamber. Forces of this kind, which may occur as a result of differential pressure between the outside and the inside of the chamber exerted on the door, must instead be absorbed by the angled components 4, 5 and 6. For this purpose two pairs of transverse beams 12a, 12b and 13a, 13b, preferably executed in steel, are arranged at the respective ends of the chamber. The beams in the aforementioned pairs are connected by means of the stays 14a and 14b and appropriate bolts, whereby the stays extend in the direction of the height of the chamber and the respective pairs of beams are held together by two stays, one at each end of the respective beam. The beams 12a, 12b and 13a, 13b are connected, for instance by welding, to the angled components 4, 5 and 6. The ends of the door sections are in contact with said beams.

The chamber is equipped with or is capable of being connected to air evacuation equipment 17. Said equipment 17 may be executed in a previously disclosed way. The chamber 7 is connected to the equipment 17 via a hose 18.
via an opening 18a. The chamber is also connected to monitoring and power supplying equipment 19 which is connected to the chamber via said hose 18 and an opening 18b. The monitoring equipment used may be of the kind which incorporates a television camera for the remote monitoring of a treatment or process which is to be performed inside the chamber. The openings are arranged in the form of transcurrent pipes arranged at the point of minimum torque of the beam concerned. The pipes are provided with flanges and the flanges are fastened to the elements on their insides by means of bolts, welding or similar. These connecting passages may be standardized, and certain section components are supplied as standard with connecting passages which are capable of being sealed in a previously disclosed fashion.

The chamber may assume different dimensions. The cross-section of the elements or the transcurrent openings shall be specified, for instance, with minimum dimensions of 0.5 x 0.5 m or with an opening of equivalent area. The dimensions of the openings, however should preferably be 1 x 1 m. The chamber in accordance with Figure 1 is assumed to exhibit a height of about 2 m, a width of about 3 m and length of about 3 m. The chamber may be arranged indoors, for instance inside a large room, or may, for instance, consist of an extension to existing buildings.

In accordance with Figure 2, an object or a semi-finished item shall be capable of being introduced into the chamber for the purpose of subjecting it to processing or treatment inside the chamber. The expression object shall in this sense be understood in its widest meaning and may, for instance, include various products, moulds, material conveyors and frames, etc. The objects may be manufactured, treated or processed either in full or in part inside the chamber. Partial treatment presupposes a subsequent process performed outside the chamber. In this case an object in the form of a parabolic aerial 20 or the blank for a parabolic aerial was introduced into the chamber. The aforementioned parabolic aerial is to be coated inside the chamber with a material sprayed onto the parabolic aerial in a previously disclosed fashion. Spraying takes place by use of a previously disclosed robot 21, of which the arm is indicated by the reference designation 2. The spray equipment has been given the reference designation 23 and may, for example, be moved along a straight or curved or in some other way varied track 24. Alternatively, application may take place by blowing or blasting, etc.
Each of the self-supporting elements in accordance with Figure 1 is composed of four section components cut obliquely at the corners of the fame in accordance with Figure 4 which illustrates the manner in which the corner made up of the element components 2a and 2b is joined together. Each element component is cut obliquely, preferably at an angle of 45°, along the line 25. Each corner is held together with the help of one or more angles preferably made of steel or an equivalent material. The angle components used in a corner have been given the reference designations 26 and 27 in Figure 4. A component 28 extends at an oblique angle in relation to the components 2a and 2b. The component 28 is attached at its ends 28a and 28b to the insides of said element components 2a and 2b. The component 28 extends preferably along the entire chamber, in its longitudinal direction, and a similar component is provided at each corner of the chamber. The components 28 provide a certain staying function together with channels through which electric wiring, etc., may be routed. Said components 28 may be omitted from one or more corners.

Figure 3 illustrates the manner in which three self-supporting elements 21, 22 and 23 form a tight fit one against the other and are arranged in the longitudinal direction 3 of the chamber. Each of the self-supporting elements is, in accordance with the above, composed of four element components together forming a frame, whereby only a part of each of the self-supporting elements or frame components 21, 22 and 23 is shown in Figure 3. The design and the manner of connection to other self-supporting elements is executed in a similar fashion for the remaining frame components. Each frame component is in the form of an essentially closed section which, in the present case, is essentially in the form of an E. The back part of said section bears the reference designation 2c, whilst the components extending from the ends of the back part bear the reference designations 2d and 2e. The middle leg of the aforementioned E is indicated by the reference designation 2f. Said section may also be essentially in the form of a U. In principle, the middle leg 2f will not be present in this case. In a case such as this, the end components 2g and 2h which are connected to the free ends of the outer legs 2d and 2e and which are essentially parallel with the back component 2c may be extended by a certain amount in relation to the case illustrated in Figure 3.
Said back component 2c and said components 2g and 2h are, in the case in accordance with Figure 3, executed with opposing recesses which form opposing pairs of recesses, whereby one of the legs 26 or 27 of the angle in accordance with Figure 4 is capable of being introduced into a similar pair of recesses. The second angle component of the angle 26, 27 fits into a corresponding pair of recesses in the frame component which is set at an angle in relation to that illustrated in Figure 3. Opposing recesses are then also present on the middle leg 2f. In this way four angle components can be arranged in connection with the section illustrated, said four angle components having been given the section illustrated, said four angle components having been given the reference designations 26, 26', 26'' and 26''' . The corresponding opposing pairs of recesses are indicated by the reference designations 29, 30; 31, 32; 33, 34; and 35, 36. In the case of the U-shaped section, two of said angles, 26' and 26'', and their corresponding recesses 31, 32 and 33, 34 will not be present. Said sections exhibit two openings 36 and 37 (a single opening in the case of the U-section). These openings face inwards towards the inside of the chamber, whilst the back components 2c on the beams in the form of frames form the outside of the chamber. In order to prevent material and impurities, amongst other things during processing/treatment, from finding their way into the sections from the inside of the chamber, said openings 36, 37 are covered by means of an internal plate 38 which thus extends over the entire internal surface of the chamber.

In the case illustrated in accordance with Figure 3, the frame components are also provided with first and second guide organs 21 and 2k by means of which mutual guidance is provided for adjacent frames or self-supporting elements. Into the first guide organ 21 on the element 21 is introduced a second guide organ 2k' on the adjacent self-supporting element 23. The second guide organ 2k on the element 21 is in turn introduced into a second guide organ 21' on the following element 22, etc. The gaps 39, 40 between the elements in contact with each other are sealed with the help of pressure sealing rubber strips 41 and 42 which thus extend in the transverse direction of the chamber (cf. 15 in Figure 1). Said rubber strips 41 and 42 are arranged in corresponding depressions 2c' and 2c'' in the back component.
2c in such a way that the outsides of the rubber strips are on a level with the outside of the back component 2c in such a way that the outsides of the rubber strips are on a level with the outside of the back component 2c. As an alternative to or in addition to said rubber strips 41 and 42, use may be made of similar strips 43, 44 each of which is arranged in an individual recess at a distance from said back component 2c. Said recess is made by curved components 21, 2m on the outer legs 2d and 2a, said components 21 and 2m being arranged opposite to corresponding components on adjacent elements. The curved components 21 and 2m are executed in such a way that they exhibit on their outsides said recesses for the rubber strips 43 and 44. The curved component 2m' on each of the outermost self-supporting elements in the chambers is thus so arranged as also to be capable of accommodating a specific end-sealing element 45 providing a seal for any end wall or door present in the chamber.

Figure 4 also shows examples of a pressure sealing organ for sealing the corners of each of the self-supporting elements executed as a frame. The long angle 5 with its legs 5a and 5b is in this case supplemented by two similar long components 5c and 5d, which are joined together by the legs 5a and 5b respectively. The back components 2c'' and 2c''' are thus sealed between the outer surfaces of said back components and the under surfaces of the components 5c and 5d by means of long rubber insert strips 46 and 47 whih extend in the longitudinal direction of the angle 5. Sealing is provided in this way at the corners 25 of the frame components 2a and 2b. The components 5c and 5d can also be replaced by strips corresponding to the strips 46 and 47, thereby achieving a labyrinth sealing.

The length l of each of the self-supporting elements is in the case illustrated about 200 mm. The sectional width b is rather less than said length l and is about 175 mm in the typical embodiment shown. The thickness of the material at the various parts of the section varies somewhat and is between 4 and 8 mm. The section is extruded preferably in aluminium or some material or alloy with equivalent properties with regard to its strength, its low specific weight and its extrudability.
Figure 5 shows a second embodiment of a chamber 46 which in this case is constructed from self-supporting elements 47 exhibiting a circular light-admitting opening or of a circular cross-section. Each of the self-supporting elements may in turn be composed of a number of element components, and the element components in a random self-supporting element will thus be displaced at an angle in relation to the element components of adjacent self-supporting elements. The chamber is mounted on a base 48 to prevent the rolling of a chamber of outwardly cylindrical shape. The end elements are also able to interact with gable components or end components 49, 50 of which one or both may serve as openable and closable doors. The end component 49 constitutes a door which is capable of being displaced laterally so as to adopt the opened position illustrated in Figure 5. The end component 50 may be considered as representing a door in its closed position. In this case, too, the doors or the end components are executed with rectangular or square cross-section, which should represent a more practical embodiment compared with end components or doors of circular or other cross-section. Each door may be arranged and may be capable of being displaced in accordance with the above. The pressure sealing organs consist in this case of a rubber sheet 51 or a rubber mat so arranged as to provide reliable sealing between the inside and the outside of the chamber. The end components 49 and 50 are assumed to be sealed in a similar fashion to the embodiment in accordance with the above. Each door can be constructed in a similar fashion to the door 8 shown in Figure 1.

Figure 6 shows a third embodiment of a chamber 52. In this case the self-supporting elements are formed not only with semi-circular arches 53 acting as clear span elements (structures) anchored by their ends 53a and 53b to a base, preferably a floor 54 so executed as to exhibit a smooth internal surface, but also with said base being common to all the semi-circular arches. The chamber may also be so arranged that the component 54 forms the roof or the floor. Each of the self-supporting elements in this case too consist of or include two or more element components 53c and 53d, whereby the element components in any element taken at random are displaced at an angle in relation to the element components of adjacent self-supporting elements in such a way as to provide self-locking of all the element components in
a similar fashion to the embodiment shown in Figure 5. In this case, too, a rubber sheet or a rubber mat 55 is used as the pressure sealing organ, and the chamber 52, as in the case of the embodiment shown in Figure 5, exhibits end components or doors 56 and 57 of similar structure and arranged in contact with the two outermost self-supporting elements as in the case of the chamber embodiments specified above. The anchorages for the ends 53a and 53b of the elements may be executed in a mounting component 54a and 54b which are then also sealed by the sheet or the mat 55. All the sealing organs specified above can be executed preferably in the form of rubber seals having a Shore number of 90A or softer. Use may thus be made of foam rubber seals of natural grade or Neoprene grade rubber.

Figure 7 illustrates the manner in which a chamber of square or rectangular frames in accordance with Figure 1, but in this case stacked one on top of the other 58, can be arranged within a production line for, for example, parabolic aerials 20' or blanks for parabolic aerials. The chamber 60 arranged on the base 59 has a door or a end component 61 which forms the floor inside the chamber when the door assumes the closed position shown in the Figure. The door is capable of being opened by a vertical movement in the direction of the arrow 62. The door 61 which on its internal surface 61a supports the parabolic aerial or the corresponding object is capable of being lowered to a position 61' indicated by broken lines. In this lowered position an object or a semi-finished item (blank) which has been treated inside the chamber is fed out in the direction of the arrow 62 on the base 59'. An object or a semi-finished item which has not been treated, that is to say the frame for a parabolic aerial, is fed onto the upper surface 61a in the direction of the arrow 64. Since the new semi-finished item or object which is advanced onto the surface 61a will adopt its final position upon said surface, the door or the floor component 61 may be caused to move to the position indicated by means of solid lines, in conjunction with which the chamber is closed at the same time. The air evacuation equipment is then caused to operate in a previously disclosed fashion until the desired vacuum has been created inside the chamber, whereupon the treatment or processing of the object or the semi-finished item, etc., in this case by spraying, takes place. In Figure 7 a self-supporting element has been given the reference designation 65. The organs 66 for guiding the floor or the door 61 may be executed from previously disclosed organs and may, for example, be in the form of hydraulic cylinders, hoist organs or equivalent organs.
Figure 8 shows a typical closed section 67, from which the mainly circular and semi-circular self-supporting elements 47 and 53 can be executed. The section 67 which extends at right-angles to the plane of the paper must accordingly be bent around the centre axis of the chamber, which in Figure 8 is assumed to extend in parallel to one of the long sides of the section and at a distance from it which largely corresponds to the radius of the chamber space. The section in question is completely closed and exhibits a width of about 50 mm. The length l' of the section is also about 200 mm in this case. The section must be bent on rollers around said axis of the chamber in a previously disclosed fashion. Two self-supporting elements being locked together by means of third and fourth guide organs 68 and 69. The third guide organ 68' on the self-supporting element 67' is introduced into the fourth guide organ 69 on the element 67. The third guide organ of the latter element can in turn be introduced into the fourth guide organ on a further self-supporting element, and so on.

Figure 9 shows a closed section extruded from aluminium which can with advantage be used for frame configurations in accordance with Figures 1 and 4. Mutual guides between adjacent elements 70 and 70' have been omitted in this case. The length l'' is about 200 mm, and the distance a in about 180 mm.

The wall components 70a and 70b are provided with external depressions 70a' and 70b' which, when the elements are assembled, will form closed common recesses extending at right-angles to the plane of the Figure along the length of the section, said recesses being able to accommodate one or more sealing organs 71' for example when the section is used as part of a door or gable.

The wall components 70c and 70d are provided with internal ridges 70c' and 70d' so arranged as to prevent, amongst other things, any propensity to buckling and elongation in the sections when these are exposed to load forces due to the aforementioned differential pressure. The number of ridges on each wall component is comparatively high, for instance three.
The corners 70e, 70f, 70g and 70h of the sections are executed from thicker material than the other parts of the wall components. Each of the corners thus includes two mutually angled first parts 72 and 73 of a first thickness, for example about 10 mm. The part 72 changes via a ridge 74 into the wall component 70c which is about 6 mm thick and the part 73 in the wall component 70b which is about 8 mm thick with the exception of the component with the depression 70b', where the wall thickness is about 5 mm. An external groove 75 is formed by means of the heel 74. Corresponding grooves 75', 75'' and 75''' are formed by means of the heels 74', 74'' and 74'''.

The grooves 75, 75' and 75'', and 75''' are arranged towards each other in pairs and are intended to be capable of accommodating one of the legs of the angle-shaped clamping organ (26, 27 in Fig. 4) referred to above. Said clamping organs may also be arranged on the outsides of the section in recesses between the sections, whereby the clamping organs are secured to their appropriate section components, for example by the use of welding or screws, etc. Each of the corners is also provided with a recess 76 which coincides with a corresponding recess on the adjacent self-supporting element section. Into the thus constituted recesses on the outside of the chamber are introduced pressure sealing organs 71 which in the case of the multi-cornered chamber extend all the way round each of the pairs of frames. In the case of a door, the organ 71' is angled at the ends of the sections beneath the organ 8'', 8''' (see Figure 1) in such a way that the sealing of the gap between the recess 70b' and the internal wall of the chamber occurs at said section ends.

The section in accordance with Figure 9 produces optimum self-supporting elements with regard to the material characteristics indicated in the introduction. The weight of the section per metre is about 14 kg, which in the typical embodiment results in a frame weight of about 170 kg. The chamber is thus able to withstand stresses of about 10 tonnes/m².

It is also possible to execute the section shown in the Figure in rolled steel or an equivalent material, although with the material thicknesses reduced so as to provide total or partial compensation for the high specific weight of the steel. In the case of a closed section it is conceivable to cause the self-supporting elements to absorb the forces from the doors, that is to say the angle-shaped organs may be omitted if required.
The chamber may also be provided with a not specifically illustrated inlet and/or outlet for the occasional and/or continuous input and output of material at the present differential pressure between the inside and the outside of the chamber, for example the continuous input of glass fibre material in the form of strands.

In accordance with the above, each chamber will be constructed with the help of a number of self-supporting elements in contact with each other and executed with comparatively large openings (preferably at least 1 m x 1 m). The internal surfaces of said self-supporting elements, for example the elements 47 in Figure 5 form a first limit or an essentially composite first surface 47c inside the chamber. In the embodiment in accordance with Figures 1-4 the internal surfaces 20 of the E-shaped beams constitute the first limit or the first surface together with the covering component or the covering plate 38. Said gable components or end components constitute together with their internal surfaces, for example the internal surfaces 8b and 9a in Figure 2, second limits or second surfaces which are preferably connected to or are capable of being connected to said first limit or surface. In the cases in accordance with Figures 6 and 7, the floor components 54 and 61 together with their surfaces 54c and 61a constitute a third limit or surface which is preferably connected to or is capable of being connected to said first and second limits or surfaces.

In the event of the chamber in accordance with Figure 6 being arranged on edge or upside down, the floor component 54 will constitute a wall component or a roof component, for which reason in such a case a wall component or a roof component with its internal surfaces will form said third limit or surface which is preferably connected or is capable of being connected to said first and second limits.

Said pressure sealing organs, self-supporting elements and gable components or end components are so arranged as to withstand a pressure difference slightly less than atmospheric pressure. The present chamber must accordingly be capable of operating as a vacuum chamber in which the internal pressure used in conjunction with the process and/or the treatment shall assume a maximum pressure of not more than 300 millibar, preferably
25-150 millibar or about 100 millibar. Amongst other things rotationally symmetrical objects or bodies shall be capable of being manufactured, processed and/or treated, for example bodies in the form of unsprayed moulds for parabolic aerials and similar objects. In a preferred embodiment a surface coating in the form of cement is applied to the untreated parabolic aerial in question, said coating being reinforced with steel fibres. In a second preferred embodiment a first colour coat of plastic-based paint, for example polyester with an admixture of colour pigments, is applied to an object. To this first coat is applied a reflective layer of, for example, flame-sprayed aluminium. A layer of glass fibre-reinforced plastic is next applied, followed by a further coat of plastic-based paint, for example in the form of polyester with colour pigments.

Figure 10 shows an example of a modified embodiment of the long angle-shaped organ 77 which extends in the longitudinal direction of the chamber. The four angle-shaped organs of the chamber are in this case held together partly by means of first stay-bolts, of which the stay-bolt 78 is one which extends in the transverse direction of the chamber parallel with the steel beams 12a, 12b and 13a, 13b (Figure 1) on the roof and floor of the chamber, and partly by means of second stay-bolts (not shown) which extend in the direction of the height of the chamber on the outsides of the elements. The second stay-bolts are attached to the angle-shaped organs in a similar fashion to that shown for the stay-bolt 78. Each of the organs 77 bears against the outsides of the elements via lengths of flat steel 79 and 80. In the spaces along the outer edges of said lengths of flat steel are arranged long sealing organs 81 and 82 in accordance with the above. The angle-shaped organs and the bolts are executed in steel.

The present invention is not restricted to the typical embodiment specified above, but may undergo modifications within the context of the following Patent Claims and within the context of the idea of invention. It is thus possible to execute the chamber so as to exhibit only a single gable component or end component or none at all. The chamber in this case is given a cone-shaped closure at each of the ends in question. Said cone shape is produced by selecting the self-supporting elements so as to exhibit a light-admitting or cross-sectional opening which decreases towards each of the ends concerned, which means that the sections used in the adjacent elements must
be displaced laterally and/or in respect of their height in relation to each other. Various combinations of the chamber embodiments specified are also conceivable. Similarly, the closed sections may, for example, exhibit a rounded shape, most appropriately in those parts of the cross-section which are not in contact with each other. The organs which hold each of the groups of elements in position or the clamping organs, i.e. in the case in accordance with Figure 1 said angle components 4, 5 and 6 and their clamping organs 12a, 12b, 14a, 14b and 78 etc., and in the cases in accordance with Figures 5 and 6, the sheet 51 or the sheet 55, and the component 54 may be of different configurations, each of which is dependent on the cross-sectional or light-admitting openings of the elements.
PATENT CLAIMS

1. Arrangement enabling inside a chamber (1, 46, 52, 60) the treatment and/or manufacture at a pressure below the pressure surrounding the chamber of one or more objects (20), preferably being treatment and/or manufacture such as consists of or involves the application, in the first instance by spraying, of a material to a mould or an unfinished article, referred to hereinafter as a semi-finished article, and incorporating a pressure difference creating apparatus (17) belonging to or capable of being connected to the chamber, and treatment apparatus or manufacturing apparatus capable of being arranged inside the chamber, in addition to which the chamber is executed with at least one unit (8, 49, 61) enabling the introduction and removal of said objects (20), characterized in that the chamber is constructed from a number of preferably against each other bearing elements arranged at least for the most part in a self-supporting fashion, in that said elements have a length (1) in the case of upright self-supporting elements or a height in the case of horizontal self-supporting elements representing a part of the corresponding length (L) or height of the chamber, in that one or more pressure sealing organs are arranged against said elements, and in that the elements and the pressure sealing organs are so arranged as to withstand, by means of the pressure creating difference apparatus (17), a generated differential pressure between the inside and the outside of the chamber.

2. Arrangement in accordance with Patent Claim 1, characterized in that the self-supporting elements are executed with closed light-admitting or transverse openings and consist of one or more self-supporting elements, and in that the respective self-supporting elements or clear span elements consist of a closed or essentially closed section extruded preferably from aluminium of an equivalent material or rolled from steel or an equivalent material.

3. Arrangement in accordance with Patent Claims 1 or 2, characterized in that the internal surfaces of the self-supporting elements form one or more at least essentially composite first internal surfaces (47c) inside the chamber, in that the chamber comprises gable components or end components arranged or capable of being arranged against the two outermost self-supporting elements (2', 2''), in that said
gable components or end components either form by means of their insides or determine second internal surfaces (8b, 9a) inside the chamber, and in that in the case of open clear span elements (53) the chamber comprises a wall component (54) connected or capable or being connected to the free ends (53a, 53b) of the clear span elements, said wall component together with said clear span elements forming the self-supporting elements and with its internal surface forming or determining a third internal surface inside the chamber.

4. Arrangement in accordance with Patent Claims 1, 2 or 3, characterized in that each self-supporting element (2) is of rectangular cross-section and is composed of four parts which are cut away obliquely at their corners and are joined together in each corner with one or more angular clamping devices (26, 27).

5. Arrangement in accordance with Patent Claim 4, characterized in that each self-supporting element is executed in the form of a rectangular frame as composite sections of closed or essentially U-shaped or E-shaped cross-section, in that at least one of the gable components or end components (8, 9) is arranged as a door, in that angled components (4, 5, 6) extending over the various corners of the frames are arranged along the actual length (3) of the chamber, said angled components each being attached to at least the two outermost elements (2', 2''), and in that aforementioned pressure sealing organs comprise long first seals (41, 42) arranged in the gaps between the frames, sealing organs (11) arranged in the two outermost elements (2', 2'') for the purpose of sealing said gable components and end components, and long second seals (46, 47) extending against said angled components in the longitudinal sense of the latter.

6. Arrangement in accordance with Patent Claims 1, 2 or 3, characterized in that the self-supporting elements (47, 45) are of essentially circular or semi-circular shape, in that the respective elements are composed of two or more element components (47a, 47b or 53c, 53d) displaced at an angle in relation to the element components on an adjacent self-supporting element in order to achieve self-locking between the element components, in that the respective element components are
executed as a closed section preferably extruded from aluminium or an equivalent material or rolled from steel which has preferably been bent on rollers in order to produce the circular or semi-circular from of the element, and in that said pressure sealing organs incorporate or consist of a sealing cloth (51 or 55) or sealing mat arranged over the elements, preferably on their external surfaces.

7. Arrangement in accordance with any of the preceding Patent Claims, characterized in that each unit in the form of an openable and closable door is constructed from or incorporates one or more self-supporting elements.

8. Arrangement in accordance with any of the preceding Patent Claims, characterized in that the chamber is executed with at least one door which is situated on or forms one or the aforementioned gable components or end components and a floor component, a roof component or a wall component.

9. Arrangement in accordance with any of the preceding Patent Claims, characterized in that chamber is so arranged as to function as a vacuum chamber for the application of a material, preferably by spraying, to a mould or a semi-finished article, and in that the chamber is so arranged as to be capable of working at an internal pressure of not more than 300 millibar, preferably 25-150 millibar or about 100 millibar.

10. Arrangement in accordance with any of the preceding Patent Claims, characterized in that the chamber includes an inlet and/or outlet for the continuous input and/or output of material and/or objects at the pressure existing between the inside and the outside of the chamber.
# INTERNATIONAL SEARCH REPORT

**International Application No.** PCT/SE83/00412

## I. CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) or to both National Classification and IPC:

B 05 C 15/00

## II. FIELDS SEARCHED

**Classification System** | **Classification Symbols**
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IPC 3 | B 05 C 15/00, 11/16, B 65 D 9/00-66, 87/00, 34,36 88/00-88/78, B 65 J 1/00-1/06
US Cl | 220: 1, 5; 118: 326

Documentation Search other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched:

SE, NO, DK, FI classes as above

## III. DOCUMENTS CONSIDERED TO BE RELEVANT

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<tr>
<th>Category</th>
<th>Citation of Document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to Claim No.</th>
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<tbody>
<tr>
<td>A</td>
<td>SE, A, 8003531-4 (BJÖRN HEED) 12 November 1981</td>
<td>1-10</td>
</tr>
<tr>
<td>A</td>
<td>DE, C, 2 624 098 (BRIDGEME TIRE CO LTD) 23 November 1982</td>
<td>1-10</td>
</tr>
<tr>
<td>A</td>
<td>DE, A, 2 330 570 (NAGEL GEB PUNG IRMGARD) 20 February 1975</td>
<td>1-10</td>
</tr>
<tr>
<td>A</td>
<td>DE, B, 2 016 305 (RANSBURG ELECTRO-COATING CORP) 15 October 1970</td>
<td>1-10</td>
</tr>
<tr>
<td>A</td>
<td>AT, B, 368 037 (UNITHERM ÖSTERREICHE GESELLSCHAFT FÜR UNIVERSELLE WÄRME-TECHNIK M B H) 23 August 1982</td>
<td>1-10</td>
</tr>
<tr>
<td>A</td>
<td>EP, A, 0 023 176 (SOCIETE D’ETUDES TECHNIQUES AGUITAINELANGUEDOC) 28 January 1981</td>
<td>1-10</td>
</tr>
<tr>
<td>A</td>
<td>US, A, 3 561 633 (ROBERT S MORRISON) 9 February 1971</td>
<td>1-10</td>
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## IV. CERTIFICATION

Date of the Actual Completion of the International Search: 1984-02-20

Date of Mailing of this International Search Report: 1984-02-23

International Searching Authority: Swedish Patent Office

Signature of Authorized Officer: [Signature]

Form PCT/ISA/210 (second sheet) (October 1981)
### III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

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<tbody>
<tr>
<td>A</td>
<td>US, A, 3 306 487 (R S GREGOIRE) 28 February 1967</td>
<td>1-10</td>
</tr>
<tr>
<td>A</td>
<td>US, A, 3 044 656 (T C COMBS ET AL) 17 Juli 1962</td>
<td>1-10</td>
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</tbody>
</table>