(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 904 823 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
03.11.2021 Bulletin 2021/44

(51) Int Cl.:
F42D 5/04 *(2006.01)*

(21) Application number: **20171580.2**

(22) Date of filing: **27.04.2020**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Olcon Engineering AB**
653 43 Karlstad (SE)

(72) Inventor: **Olsson, Jonny**
665 92 KIL (SE)

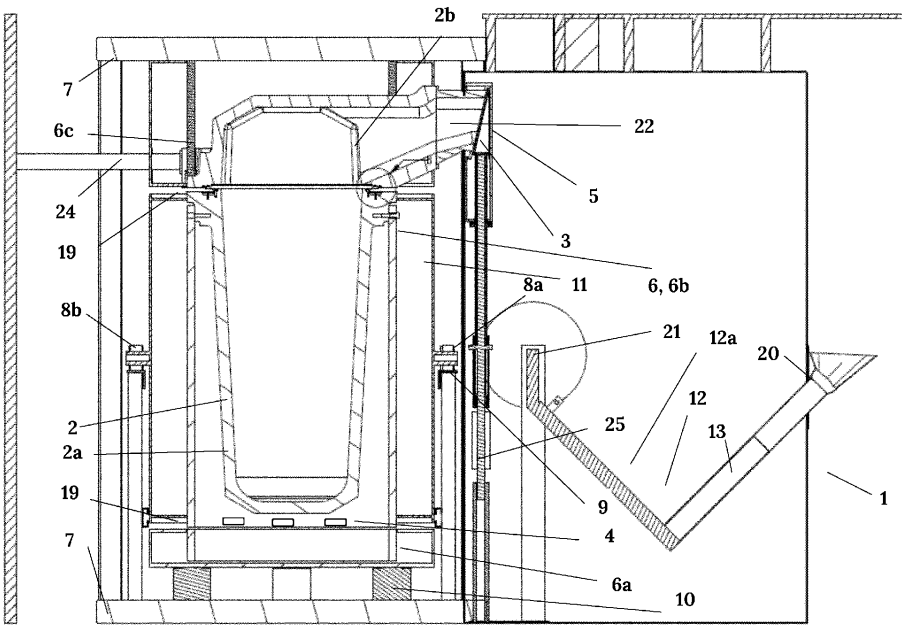
(74) Representative: **Groth & Co. KB**
P.O. Box 6107
102 32 Stockholm (SE)

(54) DESTRUCTION ARRANGEMENT AND SYSTEM THEREFOR

(57) The invention relates to an arrangement (1) for destructing explosive-containing objects comprising
i) an inner chamber (2) extending in a vertical direction, said inner chamber (2) comprising a lower portion (2a); and an upper portion (2b)
ii) an outer chamber (6) extending in a vertical direction comprising a lower section (6a), an intermediate section (6b), and an upper section (6c), wherein the portions of the inner chamber (2) and the sections of the outer chamber (6) are configured to be arranged in either of the following modes:
a) the portions (2a, 2b) are sealed to one another and the sections (6a, 6b, 6c) are sealed to one another
b) the portions (2a, 2b) are separated from one another and the sections (6a, 6b, 6c) are separated from one another

iii) lifting and lowering means (10) arranged below the lower section (6a), wherein said lower portion (2a) of the inner chamber (2) is attached to said intermediate section (6b) and wherein said arrangement (1) can be switched between said modes a) and b) by said lifting and lowering means (10). The invention also relates to a system comprising the arrangement, and the use thereof, and a method for destructing explosive-containing objects.

FIG.1



EP 3 904 823 A1

Description

[0001] The present invention relates to an arrangement and a method of destructing explosive-containing objects. The invention also relates to a system comprising the arrangement, means for supplying explosive-containing objects to the arrangement and removal of residues of explosive-containing objects therefrom. The invention also relates to the use of the arrangement and system for deflagration, detonation and/or burning of explosive-containing objects.

Background of the invention

[0002] Chambers for destruction of ammunition such as artillery shells, landmines and other explosives are well-known in the art.

[0003] However, such chambers are not always easily transportable to storage sites of ammunition. Destruction systems often also confer other inconveniences in the handling of explosives, for example during charging and discharging of the chambers and even during the destruction operation. Known solutions have for example involved complicated methods to safeguard gas-tight sealing of the destruction chamber during the destruction operation.

[0004] One objective of the present invention is to provide a destruction arrangement which can be effectively charged and discharged. A further objective of the invention is to provide a destruction chamber which operates in a safe manner safeguarding gas-tight and explosive-proof handling of the objects to be destructed.

[0005] A further object of the invention is to provide a mobile system which can easily be moved to storage sites of explosives.

The invention

[0006] The present invention relates to an arrangement for destructing explosive-containing objects comprising

(i) an inner chamber extending in a vertical direction, said inner chamber comprising a lower portion; and an upper portion

(ii) an outer chamber extending in a vertical direction comprising a lower section, an intermediate section, and an upper section,

wherein the portions of the inner chamber and the sections of the outer chamber are configured to be arranged in either of the following modes:

a. the portions are sealed to one another and the sections are sealed to one another;

b. the portions are separated from one another and the sections are separated from one another;

(iii) lifting and lowering means arranged below the lower section, wherein said lower portion of the inner chamber is attached to said intermediate section and wherein said arrangement can be switched between said modes a) and b) by said lifting and lowering means. According to one embodiment, the lower and upper portions of the inner chamber comprise substantially cylindrical, rounded and/or truncated cone-shaped sections. According to one embodiment, said lower portion constitutes at least half of the volume of the inner chamber. Preferably, the thickness of the inner chamber is in the range from 50 to 150 mm. Preferably, the thickness of the outer chamber is in the range from 20 to 40 mm. Preferably, the inner and outer chambers are made of steel or other material resistant to the process conditions.

[0007] According to one embodiment, the side walls of the inner chamber are divided into a wall structure comprising individual segments combined with one another to form a shock wave-absorbing and fragmentation-absorbing unit. The inner chamber preferably comprises segments which are replaceable.

[0008] According to one embodiment, the outer chamber is configured to be pressure-absorbing and gas-tight.

[0009] According to one embodiment, the system may comprise spaces for arranging the explosive-containing objects intended for destruction prior to feeding the objects to the charging device for supply to the inner chamber, means for taking care of residues of the explosive-containing objects, i.e. the scrap, which is discharged from the inner chamber, means for managing and purifying the gases formed on detonation, deflagration or burning.

[0010] According to one embodiment, a charging aperture for supply of explosive-containing objects is provided in the upper portion of the inner chamber. In this way, supply of explosive-containing objects is facilitated since already supplied objects does not interfere or block further supply of new objects.

[0011] According to one embodiment, the inner chamber and the outer chamber are substantially coaxially arranged. The inner and outer chambers need, however, not have symmetrical shapes. The inner and outer chamber may for example be provided with various outlets, channels, attachment means facilitating the use thereof.

[0012] According to one embodiment, the outer chamber is axially spaced apart from the inner chamber, preferably at a radial distance from 40 to 150 mm. Such distance may be safeguarded by appropriate attachment means between the inner and outer chamber and/or by means of spacers.

[0013] According to one embodiment, the arrangement is arranged in mode a) during loading and destruction of explosive-containing objects; and in mode b) after completed destruction and during an emptying procedure of the residues of the explosive-containing objects.

[0014] According to one embodiment, at least one electric heating means is configured to heat the interior

of the inner chamber arranged at the bottom of the outer chamber. However, also other locations of the electric heating means in the vicinity of the bottom of the outer chamber may be applicable.

[0015] According to one embodiment, said lifting and lowering means is configured to lift the lower and intermediate sections, said intermediate section being attached to said lower portion.

[0016] The intermediate and the upper sections will also be in contact with each other during lifting.

[0017] According to one embodiment, the contact surfaces between the sections are substantially horizontal. As the sections of the outer chamber are in contact, the horizontal contact surfaces will provide for smooth sealing between the sections. Preferably, a frame surrounding the outer chamber safeguards the sections of the outer chamber can be pressed together. The frame is preferably arranged below the lifting and lowering means which thus is preferably placed on the inner side of the bottom portion of the frame. Preferably, in mode b) as explained above, the lifting and lowering means is not in contact with the lower section. The intermediate section which preferably rests on supporting rails is not in contact with the lower section and the upper section which is attached to the frame. Preferably, the frame comprises a bottom portion on which the lifting and lowering means is arranged, vertical walls attached to the bottom portion and a top portion attached to the vertical walls of the frame. As the lifting and lowering means is actuated to lift the lower section, the lower section will be pressed against the intermediate section which likewise will be lifted and eventually the intermediate section will be pressed against the upper section attached to the frame. Preferably, the lifting and lowering means is fixedly attached to the bottom portion of the frame to safeguard secure lifting and lowering of the sections.

[0018] According to one embodiment, a frame surrounds the outer chamber, wherein the upper section of the outer chamber is attached to said frame, preferably the top portion of the frame.

[0019] According to one embodiment, the intermediate section of the outer chamber is provided with rolling means allowing the intermediate section of the outer chamber to rest and move along supporting rails when said arrangement is arranged in mode b).

[0020] According to one embodiment, said rolling means comprise rolls or wheels allowing the intermediate section to be displaced along said rails between a first position reached after having lowered the intermediate section from mode a) as described above such that it rests on supporting rails and a position for discharging of the residues of the explosive-containing objects.

[0021] According to one embodiment, the lifting and lowering means is arranged on the frame below the lower section of the outer chamber.

[0022] According to one embodiment, said lifting and lowering means comprises at least one jack, preferably three or four jacks. By the term "jack" is meant to include any device for lifting heavy objects off the ground including objects having a weight ranging from 3000 to 15000 kg. Preferably, the term "jack" includes any such device for lifting heavy objects having a capacity to compress the sections of the outer chamber by a force in the range from 1000 to 8000 kN.

[0023] According to one embodiment, a thermo-isolating layer is arranged to the outer chamber. By means of such thermo-isolating layer, heat losses from the arrangement can be considerably reduced which of course saves energy.

[0024] The invention also relates to a system for destruction of explosive-containing objects comprising the arrangement as described herein, wherein a charging device is arranged to charge explosive-containing objects to the inner chamber. According to one embodiment, the charging device comprises a pipe configured to be axially loaded with explosive-containing objects in a charging mode prior to displacing said pipe to a discharging mode at a position for transferring said objects via a charging aperture to the inner chamber. Preferably, a dampening rubber element is arranged to damp the movement of the charging device as it reaches its end position for charging the inner chamber.

[0025] According to one embodiment, said pipe is connected to a rotatable shaft configured to move the end of the pipe to said charging aperture for charging the inner chamber.

[0026] According to one embodiment, the rotatable shaft is attached to an axle of a reel, said reel suspending a releasable weight which, when released, displaces the pipe loaded with explosive-containing objects from a charging mode to a discharging mode. According to one embodiment, the pipe is directly or indirectly connected to the axle, e.g. via said rotatable shaft.

[0027] According to one embodiment, means for locking and releasing the weight are provided.

[0028] According to one embodiment, when the charging device is in a discharging mode, an engine via a pressure cylinder pneumatically or hydraulically may after discharge return the charging device from its discharging mode to its charging mode. A valve housing is preferably arranged next to the pressure cylinder. According to one embodiment, the intermediate section of the outer chamber attached to the lower portion of the inner chamber is configured to be displaceable along the rails.

[0029] According to one embodiment, a turning device is configured to rotate the intermediate section of the outer chamber subsequent to displacement of the intermediate section along the rails from an initial position to an emptying position allowing emptying of the lower portion of the inner chamber.

[0030] According to one embodiment, the turning device is driven by an engine.

[0031] The invention also relates to a method for destructing explosive-containing objects in a system as described herein, comprising

i) charging explosive-containing objects to a charging device in a charging mode
ii) bringing said charging device to a discharging mode at a charging aperture of the arrangement in mode a) as described herein to charge the inner chamber with said objects
iii) heating the inner chamber to a temperature allowing for burning, deflagration and/or detonation of said objects
iv) separating the upper portion and the lower portion of the inner chamber by lowering the lower and intermediate sections by means of the lifting and lowering means, said intermediate section being attached to the lower portion, to arrange said arrangement in mode b) as described herein
v) displacing the intermediate section from a first position to a position for emptying the inner chamber by a turning device configured to empty the lower portion of the inner chamber
vi) rotating the intermediate section attached to the lower portion by means of said turning device to remove residues of explosive-containing objects.

[0032] According to one embodiment, the charging of the inner chamber is performed batchwise during destruction of the explosive-containing objects by means of the charging device.

[0033] Preferably, the charging aperture is provided with at least one panel safeguarding the charging aperture can be in an open or closed mode.

[0034] According to one embodiment, at least one panel such as a board is brought from a closing position to an opening position when the charging device is moved from a charging mode to a discharging mode. By the term panel is also included a hatch or other slidable door, preferably a planar hatch.

[0035] Preferably, at least two panels are used which are openable and closable, preferably one at a time during charging of the inner chamber. Preferably, when the charging is completed, said at least two panels are closed.

[0036] According to one embodiment, said at least two panels are never opened at the same time.

[0037] According to one embodiment, the sections and portions are returned to mode a) after emptying of the residues of the explosive-containing objects as described herein to allow for further destruction of explosive-containing objects.

[0038] The invention also relates to the use of the arrangement as described herein and a system as described herein for burning, deflagrating and/or detonating explosive-containing objects.

[0039] The present invention provides an improved arrangement and system for destruction of explosive-containing objects such as ammunition, e.g. small and medium sized ammunitions, grenades, shells and other types of warheads, propellant charges such as fuel, gasoline, oxidizer, rocket fuel, jet fuel etc., mines etc.

[0040] By provision of the arrangement and system, the environment may be retained free from explosion gases formed during burning, deflagration and/or detonation of explosive substances.

[0041] Preferably, the destruction process itself is substantially based on indirect heating whereby the explosive-containing objects are provided with a sufficiently high temperature in order to be burnt, detonated or deflagrated.

[0042] According to one embodiment, the system is arranged on a trailer or other platform allowing mobility of the system. This way, fast and simple relocation of the destruction system is enabled. It is further advantageous because a trailer may be towed by a standard vehicle, such as e.g. a truck. The destruction system may also be arranged inside of a standard sized container. Accordingly, the destruction system is preferably dimensioned for allowing mobility (e.g. trailer) or fitting within a standard sized container.

[0043] According to one embodiment, the explosive-containing objects are electrically heated, for example by means of heating elements and heating systems from Kanthal®. However, as an alternative or complement, even though not preferred, at least one burner can be arranged outside the inner chamber to provide for heating.

[0044] According to a further embodiment, heating is partially carried out by means of residues of explosive-containing objects, i.e. formed scrap, inside the inner chamber which thus serves as a heat accumulator for retaining heat liberated during the destruction.

[0045] According to one embodiment, to empty the inner chamber, the inner chamber is rotated to allow residues of the explosive-containing objects to fall out from the chamber via the open top of the lower portion of the inner chamber. Preferably, the residues of the explosive-containing objects are collected in a carriage or scrap box arranged below the chamber. Preferably, the inner chamber is turned about 180° but other turning angles allowing for emptying the inner chamber are likewise possible.

[0046] According to one embodiment, explosive-containing objects are successively batchwise charged to the inner chamber during the destruction operation. According to one embodiment, a venting outlet is provided to vent out formed gases inside the inner chamber in order to control the overpressure within predetermined ranges.

[0047] According to one embodiment, in the vicinity of the wall of the outer chamber, there is provided at least one gas outlet for the combustion gases generated by the heating means.

[0048] According to one embodiment, there is provided a gas outlet for gases formed inside the inner chamber during the destruction process. Preferably, the gases withdrawn from the inner chamber are subsequently subjected to cleaning. According to one embodiment, an average temperature in the chamber during operation rang-

es from 300 to 600, preferably from 450 to 550 °C.

[0049] According to one embodiment, a fan is arranged outside the outer chamber to further convey combustion gases for treatment thereof.

[0050] According to one embodiment, the volume of the inner chamber ranges from 100 to 2000, preferably from 300 to 1500 liters. This determines the capacity thereof, i.e. how much explosive-containing objects may be charged before the objects eventually must be discharged after the destruction process has been completed. This, of course, determines also whether the arrangement is suitable as a mobile or permanent arrangement.

[0051] According to one embodiment, the inner chamber is provided with at least one charging aperture for explosive-containing objects which preferably is arranged in the upper portion thereof.

[0052] According to one embodiment, at least one charging aperture designed as a tunnel of a predetermined length is provided.

[0053] According to one embodiment, in order to prevent the outflow of disturbing quantities of explosive gases through the charging aperture through which the explosive-containing objects are fed into the inner chamber, the inner chamber may, in addition to closing means such as a panel, also be provided with a number of nozzles disposed around the charging aperture for the supply of compressed air providing for a counterpressure.

[0054] According to one embodiment, with respect to the charging device, a first shaft is arranged radially to the axle of the reel. Preferably, a co-planar second shaft is arranged substantially perpendicularly to the end of the first shaft. Preferably, said second shaft comprises a pipe which may be charged with explosive-containing objects, preferably via the end thereof opposite to the end arranged to the first shaft. Preferably, in a first charging position, the pipe is arranged such that its open end portion is angled upwards so as to allow the pipe to be filled with explosive-containing objects.

[0055] Preferably, the charging device comprises locking means which can be released whereby the attached weight is allowed to fall downwards while forcing the first shaft of the charging device to rotate around the reel whereby the open end of the pipe is swung to the charging aperture of the inner chamber allowing for transfer of explosive-containing objects to the inner chamber.

[0056] By means of this swinging motion, the explosive-containing objects obtaining a certain tangential velocity will readily be transferred to the inner chamber and thus prevent remainders in the pipe.

[0057] By means of the present invention with respect to the inner and outer chamber parts being pressed together, extension of the materials of the chambers is allowed radially and axially.

[0058] Thus, in the first mode a) as described above, both the inner chamber portions and the outer chamber sections are sealed such that charging of explosive-containing objects and the destruction process can take place.

[0059] Preferably, subsequently to the completed destruction process, the lower portion of the inner chamber and the intermediate and lower sections of the outer chamber are lowered to the second mode ii) thereby separating the lower and upper portions of the inner chamber. The lower portion containing the formed residues of explosive-containing objects has thus an open top.

[0060] Preferably, in mode b), rolling means arranged on the outside of the intermediate section of the outer chamber are provided and utilized to let the intermediate section of the outer chamber and the lower portion of the inner chamber attached to the intermediate section rest on rails.

[0061] According to one embodiment, the inner walls of the inner chamber are lined with temperature-proof material and resist preferably temperatures up to about 3000 °C.

[0062] According to one embodiment, the lower portion and/or the upper portion of the inner chamber are provided with sealings at the contact surfaces of the two portions. Such sealings may be e.g. pre-stressed sealings which safeguard tightening between the lower and upper portions as the lower portion is lifted to seal against the upper portion.

[0063] According to one embodiment, the lower portion of the inner chamber comprises a bottom plate and a substantially cylindrical portion making up the side walls thereof. The upper portion of the inner chamber comprises substantially cylindrical and/or rounded portions.

[0064] The inner chamber may have any suitable shape such as a substantially cylindrical portion and rounded or truncated cone-shaped bottom and upper portion or have other details as set out in e.g. EP0898693B1.

[0065] According to one embodiment, the portions of the inner chamber are attached to the sections of the outer chamber, for example with fixing means such as screws, bolts etc. For example, the parts of the chambers may be affixed to one another via flanges or other elements.

[0066] Preferably, the outer chamber is welded to the inner chamber via affixing means or other elements such that the inner and outer chambers are substantially spaced apart from each other. Distal elements or spacers may also be arranged to safeguard the attached inner chamber is spaced apart from the outer chamber at a distance in the range from 40 to 150 mm.

[0067] According to one embodiment, the upper section of the outer chamber is attached to the top portion of the frame surrounding the outer chamber.

[0068] Preferably, when the quantity of explosive-containing objects and residues thereof in the inner chamber has become so great that emptying is necessary, the introduction of new explosive-containing objects is interrupted. Emptying of the inner chamber is initiated by lowering the lower portion of the inner chamber from the upper portion by the lifting and lowering means by lowering the lower and the intermediate sections of the outer

chamber.

[0069] According to one embodiment, the charging device may be provided with a spring suspension for allowing the charging device to switch between a charging mode and a discharging mode. The spring suspension mechanism may additionally allow for coping with a temperature expansion of the chamber taking place during the destruction process.

[0070] According to one embodiment, the system is arranged in a container which protects the surrounding during operation burning and/or detonation in the combustion chamber in case of any unintended occurrences. Such a container thus comprises the complete system including the arrangement, charging device, emptying device, frame surrounding the outer chamber etc.

Brief description of the drawings

[0071]

Figure 1 shows an arrangement for destructing explosive-containing objects and a charging device for supplying such objects.

Figure 2 shows means for removal of residues of the explosive-containing objects.

Figure 3 likewise shows removal of residues after having rotated the inner chamber.

Detailed description of the invention

[0072] Figure 1 shows an arrangement 1 for destructing explosive-containing objects comprising an inner chamber 2 having a lower portion 2a and an upper portion 2b, and an outer chamber 6 comprising a lower section 6a, an intermediate section 6b and an upper section 6c spaced apart from the inner chamber 2.

[0073] The arrangement 1 in figure 1 is in a non-operating mode, i.e. no destruction is currently taking place. Spaces 19 are provided between the upper section 6c, the intermediate section 6b and the lower section 6a. As the inner chamber 2 also is in an open non-sealed mode, space is available also between the lower and upper portions thereof. The intermediate section 6b provided with rolling means 8a, 8b on the outside thereof and the lower portion 2a, being attached to the intermediate section 6b by for example screws or bolts, rest on rails 9 via rolling means 8a, 8b in contact with the rails on which they may be displaced as further described herein. The outer chamber 6 is provided with a thermo-isolating layer 11 retaining heat formed inside the chamber.

[0074] Typically, as can be seen from figure 1, the lower and upper portions 2a, 2b are attached to the outer chamber 6 at or close to the contact surfaces between the respective portions 2a, 2b which are sealed to one another when in an operation mode. The portions 2a, 2b are suitably attached to the sections of the outer chamber 6 by fixing means, for example at protruding flanges or spacers between the inner and outer chambers. The upper portion of the inner chamber 2b is attached to the upper section 6c of the outer chamber 6. The upper portion 6c of the outer chamber is in turn attached to the frame 7. A charging aperture 22 which is closable/openable by inner and outer panels 3 and 5 is provided to which a charging device 12 supplies explosive-containing objects. The explosive-containing objects are transferred to the inner chamber 2 via a space or tunnel 22 of the aperture extending from panels 3 and 5 to the upper portion of the chamber 2b. Any further inner aperture which is openable/closable may be provided.

[0075] The charging aperture 22 may be controlled to be in a charging mode by means of inner and outer panels 3 and 5, such as boards. The inner and outer panels preferably function as a sluice or lock system during charging, wherein one of the panels is open and the other panel is closed. Preferably, inner and outer panels, such as inner or outer boards 3 and 5 are arranged as an integral part such as a panel structure comprising the inner and outer panels which are thus connected directly to each other or via any interposed element. The inner and outer panels 3 and 5 may be arranged to one another or in the vicinity of one another directly or indirectly, for example at their respective ends. Preferably, the position of the lower portion of the inner and outer panels 3 and 5 respectively, is controlled by a pressure cylinder, such as a hydraulic or pneumatic pressure cylinder, mounted e.g. right under the lower end of the inner and outer panels or panel structure. The pressure cylinder retains, when the panels close the charging aperture 22, the panels to seal the charging aperture 22. Preferably, to further improve the sealing of the charging aperture 22, additional seals can be actuated such that they press the backside of the panels, i.e. the side facing away from the chamber, preferably at the ends of the panels just below and above the charging aperture 22 when the charging aperture 22 is closed by the inner and outer panels. Such additional seals then further contribute to the tightening of the charging aperture 22 to render it gas-tight. The seals may be actuated by means of hydraulic or pneumatic pressure and may be controlled by the same or different pressure cylinder. The seals may be controlled by valves arranged in the valve housing which may be automatically controlled. When further explosive-containing objects are to be supplied to the inner chamber 2, a weight 25 acting as a counterweight forces the pressure cylinder downwards whereby the inner and outer panels 3 and 5 are displaced one at a time downwards from the charging aperture 22 thereby opening it and rendering it ready for supply of explosive-containing objects. As the inner and outer panels 3 and 5 are displaced, preferably one at a time, they slide downwards along e.g. a vertical groove by their respective gravity. The weight 25 is preferably manually released and configured to enable the pressure cylinder to be pressed downwards allowing the panels to fall downwards one at a time. As the pressure cylinder is pressed downwards, the seals pressed substantially horizontally on the panels are si-

multaneously released to allow for the panels to fall downwards one at a time. When the charging aperture 22 again is to be closed, the pressure cylinder presses the panels or panel structure upwards to seal the charging aperture 22 again.

[0076] In particular the inner panel, when in closed position, preferably safeguards leakage of fragments formed from the explosive-containing objects and heat evolved in the inner chamber does not leak.

[0077] According to one embodiment, the zone between panels 3 and 5 is provided with heat-insulating material. Valves arranged in valve housings may be fixedly arranged to the inner chamber, for example by means of screws, in order to actuate the seals to further seal the panels 3 and 5 at the charging aperture 22. Outflow of gases via the charging aperture 22 from the inner chamber 2 may thus be reduced or omitted totally as batchwise supply of explosive-containing objects continue over time as the destruction of explosive-containing objects proceeds inside the chamber.

[0078] Electrical heating means are preferably arranged to heat the inner chamber 2. However, heating means, such as burners, 4 may also be provided beneath the bottom part of the lower portion of the inner chamber 2 to provide for destruction. Jacks 10, for example 3 or 4 jacks, are provided beneath the bottom of the outer chamber 6 which may lift the lower and intermediate sections 6a, 6b and the inner chamber 2 to a closed position whereby the sections 6a, 6b, and 6c of the outer chamber and the upper and lower portions of the inner chamber become sealed. As the upper section of the outer chamber 6 is arranged to the frame 7, the sections 6a, 6b, and 6c having substantially horizontal contact surfaces will be pressed against each other and towards the frame to provide a gas-tight seal against the external environment. A venting channel 24 is provided to vent out gases formed in the inner chamber.

[0079] Figure 1 further shows a charging device 12 for charging the inner chamber 2. The charging device 12 may comprise a reel on which a cable or the like is wound up at the end of which the cable suspends a weight 25. A first shaft 12a is arranged radially to the axle 21 of the reel. A second shaft 13 is arranged in the same plane and substantially perpendicularly to the end of the first shaft 12a. The second shaft 13 constitutes a pipe which may be axially charged with explosive-containing objects. A releasable funnel-shaped element 20 may be connected to the shaft 13 to facilitate supply of explosive-containing objects which suitably is withdrawn prior to discharge of the objects.

[0080] The charging device 12 comprises locking means which can be manually or automatically released whereby the attached weight 25 is allowed to fall downwards thereby forcing shaft 13 to rotate around the axle 21 whereby the open end of the pipe of the charging device 12 is swung to the charging aperture 22 of the inner chamber 2 thus allowing for transfer of explosive-containing objects to the inner chamber 2. Weight 25 is further connected to press a pressure cylinder downwards whereby inner and outer panels 3 and 5 will slide downwards one at a time, one at a time so as to open the charging aperture 22. The charging device 12 thus provides an automatic charging system in which the charging aperture 22 is opened when supply of explosive-containing objects occurs. An engine may be provided to allow the charging device 12 return to its mode at which the charging device 12 can be recharged after completed discharge to the chamber.

[0081] Figure 2 shows a side view of the arrangement in which the intermediate section 6b of the outer chamber 6 and lower portion 2a of the inner chamber 2 have been transferred from its position in figure 1 along rails 9 to a device 14 for emptying the lower portion of the inner chamber 2 by turning it around a horizontal axis of device 14 as best seen in figure 3. The device 14 comprises a turning mechanism 16, preferably driven by an engine 17, whereby the residues of the explosive-containing objects can be removed from the chamber and collected in a container 26 which may be arranged to a carriage. The container 26 is movable below the chamber portion 2b to transport the residues for further treatment thereof.

[0082] The chamber 2a is then transferred back to its position right below the upper portion 2b of the chamber and then lifted to seal to the upper portion 2b for continued destruction of explosive-containing objects. A fan 18 may be provided to ventilate gases originating from the chamber 2.

[0083] The present invention should not be considered as restricted to that described above and shown on the drawings as many modifications are conceivable without departing from the spirit and scope of the appended claims.

Claims

1. Arrangement (1) for destructing explosive-containing objects comprising

   i) an inner chamber (2) extending in a vertical direction, said inner chamber (2) comprising a lower portion (2a); and an upper portion (2b)
   ii) an outer chamber (6) extending in a vertical direction comprising a lower section (6a), an intermediate section (6b), and an upper section (6c),
   wherein the portions of the inner chamber (2) and the sections of the outer chamber (6) are configured to be arranged in either of the following modes:

   a) the portions (2a, 2b) are sealed to one another and the sections (6a, 6b, 6c) are sealed to one another
   b) the portions (2a, 2b) are separated from one another and the sections (6a, 6b, 6c)

are separated from one another

iii) lifting and lowering means (10) arranged below the lower section (6a),

wherein said lower portion (2a) of the inner chamber (2) is attached to said intermediate section (6b) and wherein said arrangement (1) can be switched between said modes a) and b) by said lifting and lowering means (10).

2. Arrangement according to claim 1, wherein a charging aperture (22) for supply of explosive-containing objects is provided in the upper portion (2b) of the inner chamber (2).

3. Arrangement according to claim 1 or 2, wherein the arrangement (1) is arranged in mode a) during loading and destruction of explosive-containing objects; and in mode b) after completed destruction and during an emptying procedure of the residues of the explosive-containing objects.

4. Arrangement according to any one of claims 1 to 3, wherein said lifting and lowering means (10) is configured to lift and lower the lower and intermediate sections (6a, 6b), said intermediate section (6b) being attached to said lower portion (2a).

5. Arrangement according to any one of claims 1 to 4, wherein a frame (7) surrounds the outer chamber (6), wherein the upper section (6c) of the outer chamber (6) is attached to said frame (7).

6. Arrangement according to any one of claims 1 to 5, wherein the intermediate section (6b) of the outer chamber (6) is provided with rolling means (8a, 8b) allowing the intermediate section (6b) of the outer chamber (6) to rest and move along supporting rails (9) when said arrangement is arranged in mode b).

7. Arrangement according to claim 6, wherein said rolling means (8a, 8b) comprise rolls or wheels allowing the intermediate section (6b) to be displaced along said rails (9) between a first position reached after having lowered the intermediate section (6b) such that it rests on supporting rails (9) to a position for discharging of the residues of the explosive-containing objects.

8. Arrangement according to any one of claims 1 to 7, wherein the lifting and lowering means (10) is arranged on the frame (7) below the lower section (6a) of the outer chamber (6).

9. System for destruction of explosive-containing objects comprising the arrangement according to any one of claims 1 to 8, wherein a charging device (12) is arranged to charge explosive-containing objects to the inner chamber (2).

10. System according to claim 9, wherein the charging device (12) comprises a pipe (13) configured to be axially loaded with explosive-containing objects in a charging mode prior to displacing said pipe (13) to a discharging mode at a position for transferring said objects via a charging aperture (22) to the inner chamber (2b).

11. System according to claim 9 or 10, wherein the pipe (13) is directly or indirectly connected to an axle (21) of a reel, said reel suspending a releasable weight (25), wherein the system is configured to allow the charging device (12) to be displaced from a charging mode to a discharging mode by releasing said weight (25) triggering the displacement of the charging device (12) from said charging mode to said discharging mode.

12. System according to any one of claims 9 to 11, wherein the intermediate section (6b) of the outer chamber (6) attached to the lower portion (2a) of the inner chamber (2) is configured to be displaceable along the rails (9).

13. System according to any one of claims 9 to 12, wherein a turning device (14) is configured to rotate the intermediate section (6b) of the outer chamber (6) subsequent to displacement of the intermediate section (6b) along the rails (9) from an initial upright position to an emptying position allowing emptying of the lower portion (2a) of the inner chamber (2).

14. Method for destructing explosive-containing objects in a system according to any one of claims 9 to 13, comprising

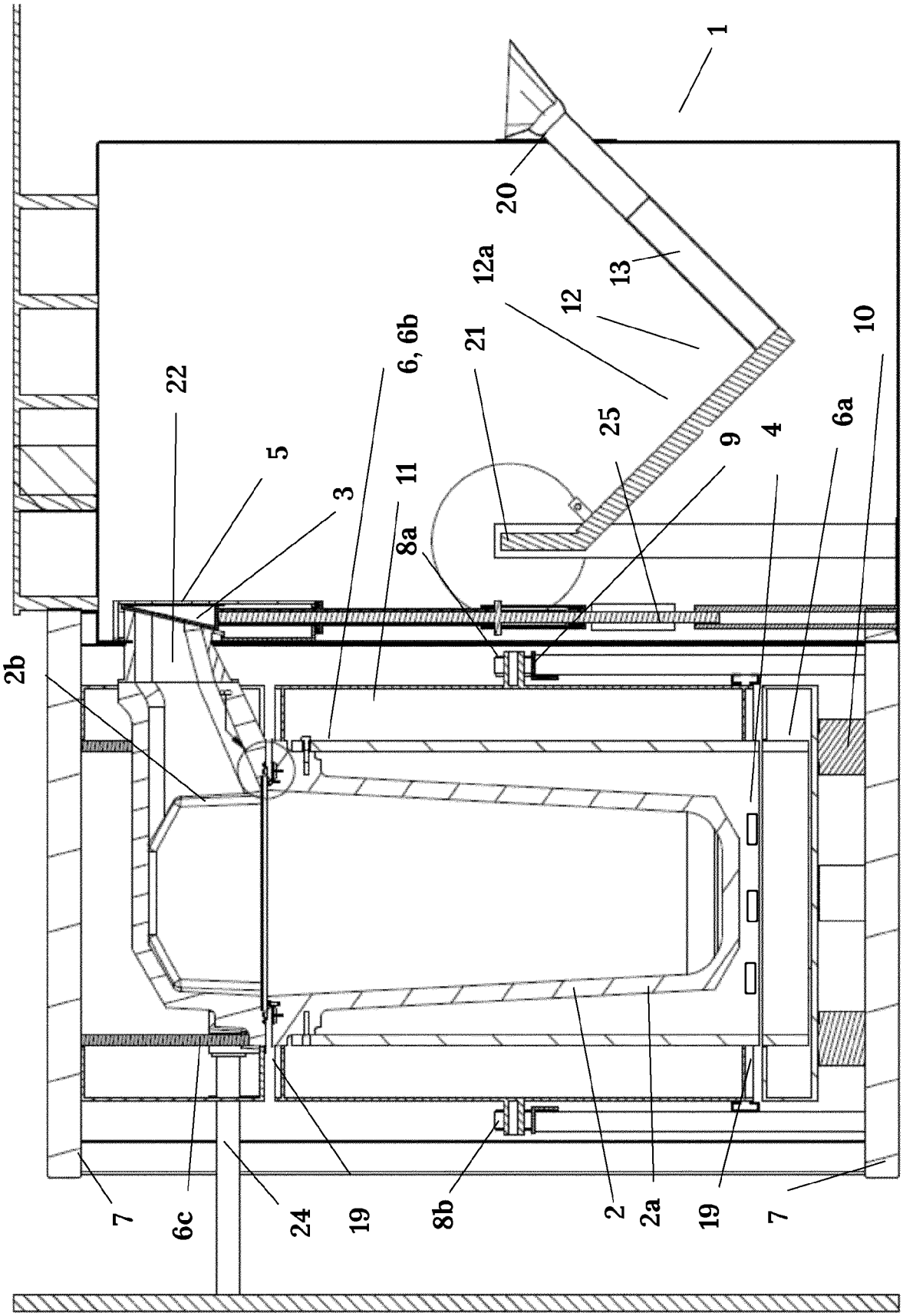
i) charging explosive-containing objects to a charging device (12) in a charging mode
ii) bringing said charging device (12) to a discharging mode at a charging aperture (22) of the arrangement in mode a) according to claim 1 to charge the inner chamber (2) with said objects
iii) heating the inner chamber (2) to a temperature allowing for burning, deflagration and/or detonation of said objects
iv) separating the upper portion (2b) and the lower portion (2a) of the inner chamber (2) by lowering the lower and intermediate sections (6a, 6b) by means of the lifting and lowering means (10), said intermediate section (6b) being attached to the lower portion (2a), to arrange said arrangement in mode b) according to claim 1
v) displacing the intermediate section (6b) from a first position to a position for emptying the inner

chamber (2a) by a turning device (14) configured to empty the lower portion of the inner chamber (2a)

vi) rotating the intermediate section (6b) attached to the lower portion (2a) by means of said turning device (14) to remove residues of explosive-containing objects.

15. Use of the arrangement according to claims 1 to 8 and a system according to claims 9 to 14 for burning, deflagrating and/or detonating explosive-containing objects.

FIG.1



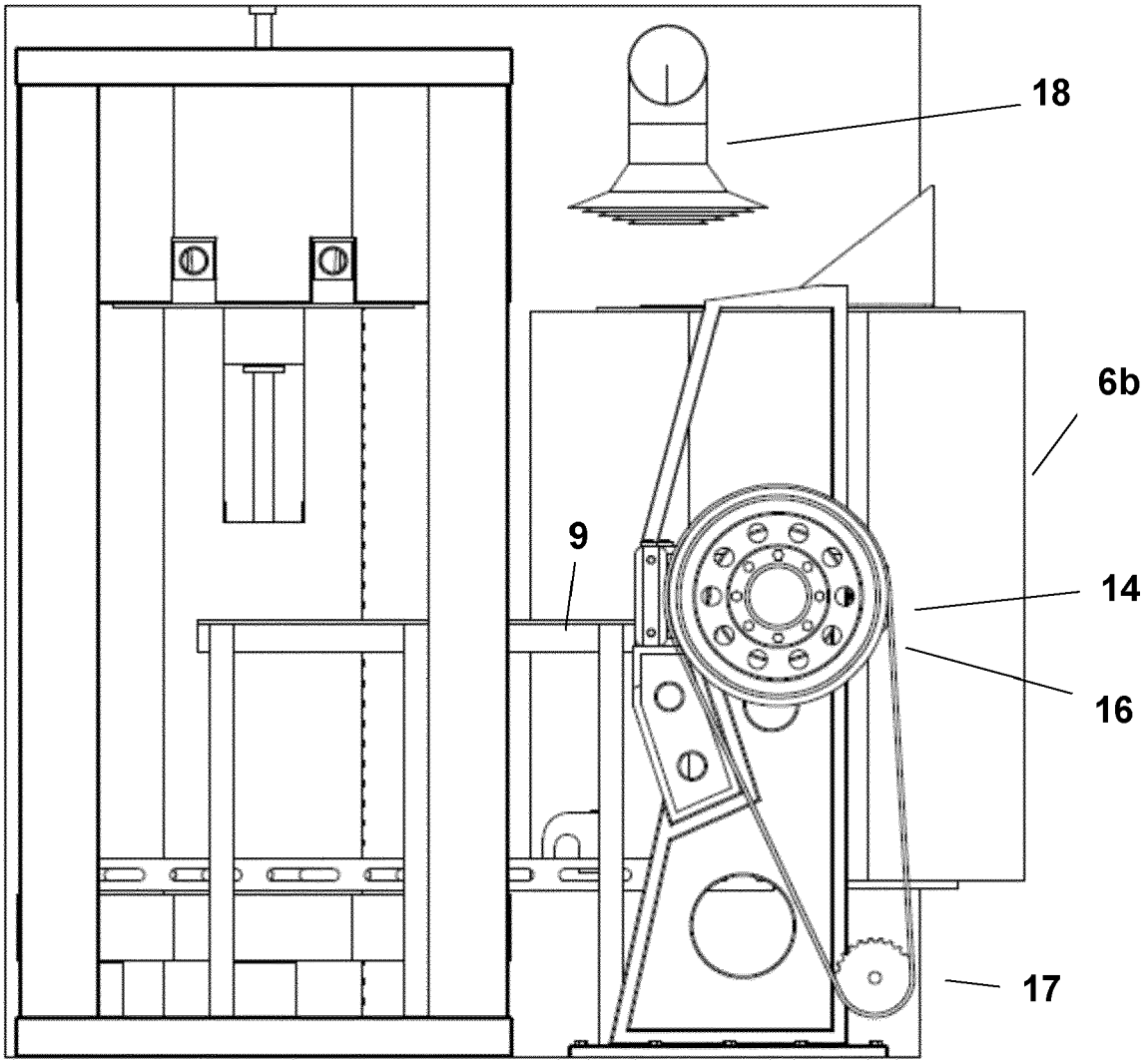


FIG.2

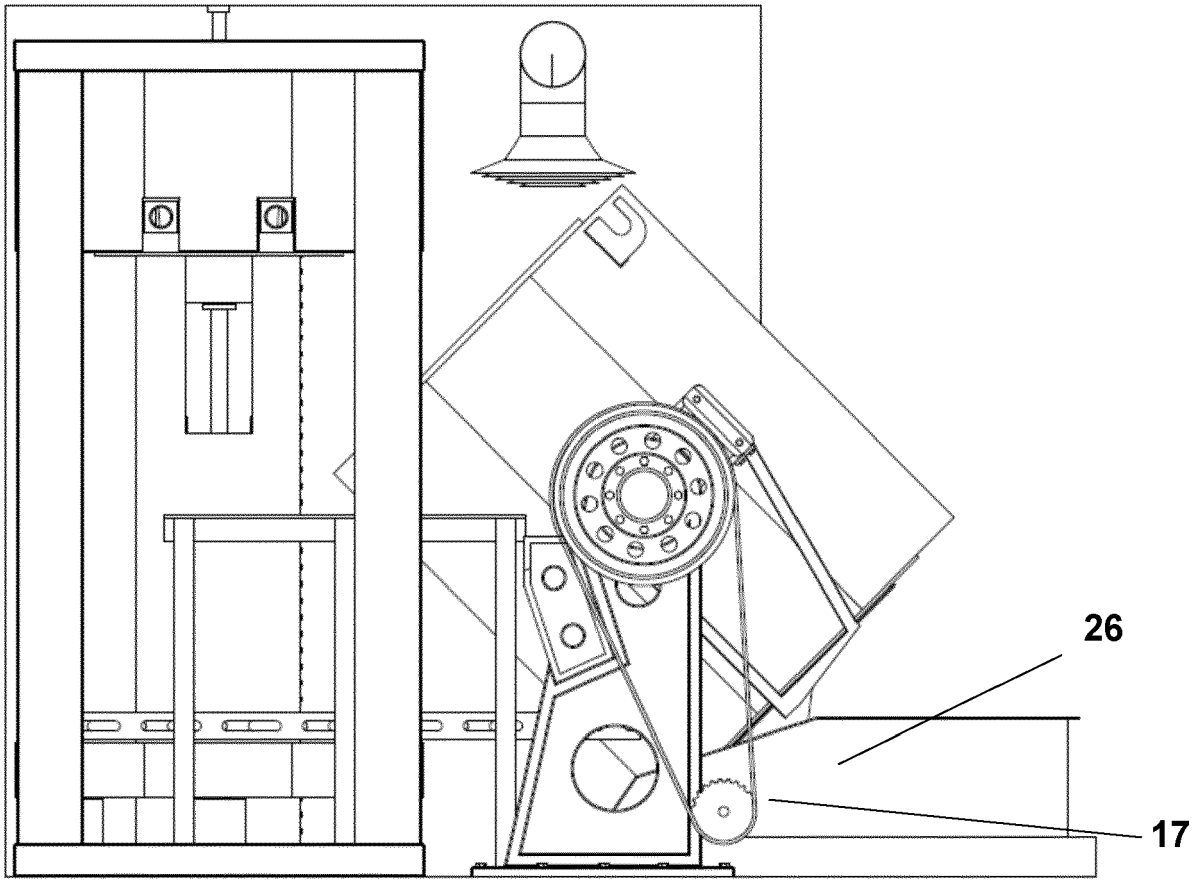


FIG.3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 20 17 1580

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y A	CN 109 470 103 A (ZHEJIANG LUJIESHUN AUTOMOBILE MFG CO LTD) 15 March 2019 (2019-03-15) * claim 1; figures 1-7 *	1-5,8,9, 14,15 6,10	INV. F42D5/04
Y	US 4 085 883 A (DERIBAS ANDREI ANDREEVICH ET AL) 25 April 1978 (1978-04-25) * claim 1; figures 1-6 *	1-5,8,9, 14,15	
Y	CN 107 883 823 B (XIAN MODERN CHEMISTRY RES INST) 27 September 2019 (2019-09-27) * claim 1; figures 1-3 *	2,9,14	
			TECHNICAL FIELDS SEARCHED (IPC) F42D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	16 September 2020	Beaufumé, Cédric

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 17 1580

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-09-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 109470103 A	15-03-2019	NONE	
US 4085883 A	25-04-1978	NONE	
CN 107883823 B	27-09-2019	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 0898693 B1 **[0064]**