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(54) **Penetration device for use in fire-fighting operations, in particular in the context of airport rescue**

Penetrationsvorrichtung zur Verwendung bei Brandlöscharbeiten, insbesondere im Kontext einer
Flughafenrettung

Dispositif de pénétration pour utilisation dans la lutte contre les incendies, en particulier dans le contexte
de sauvetage d'aéroport

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(73) Proprietor: **IVECO MAGIRUS AG**
89079 Ulm (DE)

(72) Inventor: **Semmler, Oliver**
88416 Ochsenhausen (DE)

(74) Representative: **Franzolin, Luigi et al**
Studio Torta S.p.A.
Via Viotti, 9
10121 Torino (IT)

(56) References cited:
EP-A1- 1 369 145 EP-A2- 1 980 294
US-A- 4 625 808 US-B1- 7 055 613

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Description

Field of the invention

[0001] The present invention relates to a penetration device for use in fire-fighting operations, in particular in the context of airport rescue.

Description of the prior art

[0002] Penetration devices associated with the tip portion of a telescopic cantilever arm or with the tip portion of a boom of an emergency vehicle are known.

[0003] An example of penetration tool is given in US7055613.

[0004] The penetration device comprises a movable punch having a tapered shape for piercing through a body wall and a nozzle for introducing a fire-retardant or fire-extinguishing medium into an interior space of the body through the penetration tool.

[0005] Thus the movable punch is substantially tubular shaped, with its interior portion connected in line to a fire-retardant/extinguishing medium tank.

[0006] Several drives or hydraulic actuators can be used in order to adjust the orientation of the penetration tool.

[0007] Another example of penetration device is given in EP1980294. Such penetration device has an inner tubular element associated with an outer tubular element. The latter being fixed with the tip of a boom.

[0008] The inner element, as usual, has a tapered end and is sliding associated to the outer element.

[0009] In order to achieve the required stability of the inner element with respect to the outer element, the inner element has a relevant development length, that is substantially double with respect to the outer element.

[0010] Figure 1 of the prior art shows a sketch of the known solution from EP1980294.

[0011] This implies a relevant size of the overall penetration device and a relevant weight.

Summary of the invention

[0012] Therefore it is the main object of the present invention to provide a very compact but effective penetration device which overcomes the above problems/drawbacks, with a relevant reduction of space and weight.

[0013] The main principle of the invention is the arrangement of three tubular, reciprocally coaxial, elongated members: inner, middle, outer element, with the inner member and the outer member being fixed between each other; the middle member has a first tapered end and a second opposite end, the first end defining a punch; the middle member being coaxially movable between a retracted and an elongated condition with respect to both the inner and outer elements, wherein the inner and the middle members define a pipe for the retarder/extinguish-

ing medium, and wherein the outer member cooperates with said second end of the middle member to define a double-acting pressure cylinder for the middle member.

[0014] Both the inner and outer members define a sliding guide for the middle member, by assuring a high stability for the middle member, that, thus, can have a development length similar with respect to the development length of the inner and outer members.

[0015] A first object of the present invention is a penetration device according to claim 1.

[0016] Another object of the present invention is a fire-fighting vehicle provided with said penetration device.

[0017] These and further objects are achieved by means of the attached claims, which describe preferred embodiments of the invention, forming an integral part of the present description.

Brief description of the drawings

[0018] The invention will become fully clear from the following detailed description, given by way of a mere exemplifying and non limiting example, to be read with reference to the attached drawing figures, wherein:

- Fig. 1 shows a longitudinal section view of an example of penetration device according to the present invention;
- Fig.2 shows an example of control circuit for controlling the penetration device in different operation stages;

[0019] The same reference numerals and letters in the figures designate the same or functionally equivalent parts.

[0020] According to the present invention, the term "second element" does not implies the presence of a "first element", first, second, etc.. are used only for improving the clarity of the description and should not be interpreted in a limiting way.

Detailed description of the preferred embodiments

[0021] According to figure 1 an example of penetration device according to the present invention is shown.

[0022] It comprises, substantially, three hollow tubular members OC, MC, IC, coaxially between each other and defining a development axis X.

[0023] With the exception of the presence of openings C1C and C2C, it is preferable that the penetration device P is axially symmetric along the X-axis.

[0024] The inner IC and outer OC tubular members are fixed between each other through a first end FE of the device, the right side of figure 1. The coupling of the inner member and outer member define a fixed member FP of the device P, suitable to be associated with tip of an arm of a boom of a rescue vehicle.

[0025] The middle member MC defines the movable member of the device P.

[0026] An annular wall W1 connecting the inner and outer members at the first end FE of the device can be integral with one or both of the same members IC, OC, in order to define an annular chamber.

[0027] The middle tubular member MC is interposed between the inner and outer members, being suitable to slide coaxially through the second end SE of the device.

[0028] Also the middle member comprises two opposite ends, one of those being tapered to define a punch MCT, the opposite end MCO being hollow tubular shaped.

[0029] The tapered portion of the middle member MC protrudes outwards through the second end SE of the device P. One or more nozzles MCN are realized at the tapered portion of the middle member, communicating the internal volume bounded by the middle member itself with the outside.

[0030] The inner and outer members define two guides for the middle element in connection with its sliding capability.

[0031] Said middle member MC is suitable to define two extreme conditions: a first retracted condition and a second elongated condition: figure 1 shows an intermediate condition.

[0032] Said opposite end MCO of the middle member MC comprises at least one seal, in order to define a seal assembly, both with the outer member and with the inner member.

[0033] The seal assembly between the inner member and the middle member defines a pipe for injecting extinguishing or retarding fluid through the nozzles MCN.

[0034] The seal assembly between the middle member and the outer member divide the annular chamber into two portions C1 and C2. C1, adjacent with respect to the first end FE of the device, acts on the hollow tubular end MCO of the middle element by pushing it outwards with respect to the device to assume said elongated condition when pressurized by means of a hydraulic fluid introduced in C1 through the opening C1C. C2, adjacent with respect to the second end SE of the device, acts on the end MCO of the middle element by pushing the middle member MC inwards with respect to the fixed portion FP of the device, to assume said retracted condition when pressurized by means of a hydraulic fluid introduced in C2 through the opening C2C.

The whole volume of C1 is bigger than the one of C2 due to a different inner diameter of the chambers.

This implies that the cross section area of C1 is wider than the cross section area of C2.

[0035] Thanks to the presence of both the inner and outer member to define a sliding guide for the middle member, the axial length LM of the latter is similar/comparable with the axial lengths LI and LO of the inner and outer members respectively, by assuring the same stability and the same elongation of the device shown in EP1980294. However, the movable member shown in EP1980294 has a double length with respect to the length of the movable member according to the present inven-

tion, by considering the same elongation in the elongated condition.

[0036] The outer member, at the second end SE of the device, comprises a second annular wall W2 provided with a seal S in order cooperate with the inner member in defining said second chamber C2.

[0037] It should be noted that, even if the hydraulic chamber C2 is defined between the middle member MC and the outer member OC, it could be defined between the inner member IC and the middle member MC. In such a case, the second annular wall W2 would be fixed with the inner member IC and the second opening C2C should be realized through the inner member.

[0038] According to a preferred embodiment of the invention, the inner end MCO of the middle member MC has an enlarged section ES operatively associated with the inner annular seal S2 arranged in close position with respect to the second annular wall W2, within the chamber C2.

[0039] Between the outer member OC and the annular seal S2 is defined a narrow passage for the hydraulic medium. In addition, the opening C2C is arranged between the second annular wall W2 and the annular seal S2.

[0040] The enlarged section ES at the inner end MCO of the middle member MC is realized in order to cooperate with the annular seal S2. In particular, when the enlarged section ES of the middle member MC contacts annularly the annular seal S2 during a penetration operation, the hydraulic medium is forced to pass through the narrow passage PSS in order to leave the chamber C2 through the opening C2C. In this way, a cushioning effect is obtained in order to reduce the speed of the middle member MC when it is going to reach the maximum elongated condition, by avoiding any mechanical damage.

[0041] The first end FE of the device P defines, with the hollow portion of the inner member, a coaxial opening CO suitable to be connected to a source of fire-retardant and/or fire-extinguishing medium.

[0042] Figure 2 shows a preferred embodiment of an implementation of the device P of the present invention.

[0043] The penetration device is mounted on the tip of a telescopic boom 15, adjustable around a horizontal axis 14 by a hydraulic pivot drive 12.

[0044] The pivot drive 12 is controlled by a proportional directional valve 13, preferably integrated into the main hydraulic bench of the boom and mounted at the base of the basic boom.

[0045] A switch valve 11, instead, is mounted at the tip of the telescopic boom 15.

[0046] The switch valve 11 is suitable to commutate the connection between the hydraulic source S and the discharge tank T (not shown) with the hydraulic pivot drive 12 (first operator 11.1) or with the hydraulic chambers C1, C2 of the penetration device (second operator 11.2).

[0047] The proportional directional valve 13, instead, is suitable to

- interrupt the connection between the hydraulic actuators P, 14 and the source S/tank T - second operator 13.2
- connect the hydraulic actuators P, 14 and the source S/tank T - third operator 13.3 - or to revert such connection - operator 13.1-

[0048] A switch valve 16, instead, is mounted at the tip of the telescopic boom 15, and has

- a first port 1p connected with the line L1,
- a second port 2p connected with the line L2,
- a third port 3p connected with the opening C2C and
- a fourth port 4p connected with the opening C1C.

[0049] In particular, while the first operator 16.1 connects the port 1p with the port 4p and the port 2p with the port 3p, the second operator 16.2 connects the ports 1p, 4, and 3p together, by closing the port 2p.

[0050] When, the third operator 13.3 of the valve 13, the second operator 11.2 of the valve 11 and the second operator 16.2 of the valve 16 are simultaneously activated, the hydraulic medium flows from the source S towards the chamber C1, that expands compressing the chamber C2, whose hydraulic medium herewith stored flows towards the third port of the second operator 16.2 to recirculate towards the first chamber C1. Thus the line L2 connected with the second port is bypassed, hence no hydraulic medium reaches the tank T.

This recirculation of the hydraulic medium is obtained also in view of the wider size of the chamber C1 in comparison with C2.

In these conditions the hydraulic medium pressure is identical between the two chambers, but the force for elongating the middle member is bigger than the force for retracting. Thus, the oil expelled out from C2 is automatically recirculated in C1.

Even if the mass flow of hydraulic medium from the hydraulic source S is constant, this arrangement permits to increase the elongation speed of the device P.

[0051] When the operators 16.2, 11.2 and 13.1 are activated, the line L2, and thus the chamber C2 of the device P is pressurized, while the chamber C1 is connected with the discharging tank T, thus the middle member is retracted.

[0052] When, the first operator 11.1 of the switch valve is activated, the third and fourth ports of the same operator 11.1 connect the opposite chambers (not shown) of the actuator 12 for pivoting the penetration device P around the pivoting axis 14, while the line connections L1 and L2 towards the chambers C1 and C2 are interrupted for locking the middle member MC.

[0053] In this case, one of the chambers of the hydraulic actuator 12 is connected with the source S when the operator 13.3 is activated and the other one is connected with the discharging tank T and vice versa when the first operator 13.1 is activated.

[0054] When the piercing cylinder, namely the middle

member MC, is orientated correctly onto the fuselage of the airplane to be succored, the second operator 11.2 of the switch valve 11 is enabled to supply the piercing cylinder.

[0055] The stroke of the piercing cylinder is realized hydraulically through only one hydraulic source, i.e. a pump, without saving any hydraulic energy in any kind of pressure reservoir.

[0056] The device P could also be provided with a further hydraulic drive to enabling its rotation around a vertical axis, so that it can be easily positioned orthogonally onto the wall to be penetrated.

[0057] In this case, the switch valve 11 can be provided with a further operator similar with the first operator 11.1.

[0058] Many changes, modifications, variations and other uses and applications of the subject invention will become apparent to those skilled in the art after considering the specification and the accompanying drawings which disclose preferred embodiments thereof. All such changes, modifications, variations and other uses and applications which do not depart from the scope of the appended claims are deemed to be covered by this invention.

[0059] Further implementation details will not be described, as the man skilled in the art is able to carry out the invention starting from the teaching of the above description.

30 Claims

1. Penetration device (P) for use in fire-fighting operations, in particular in the context of airport rescue, comprising a fixed member (FP) suitable to be associated with a tip of an arm or of a boom (15), and a member partially tapered and slidably movable (MC) with respect to said fixed member in order to penetrate a wall of a body, for injecting a fire-retardant and/or fire-extinguishing medium within said body, wherein said fixed member (FP) comprises a hollow tubular outer member (OC) and said movable member (MC) comprises also a hollow tubular portion, coaxially arranged within said outer member, **characterized by** said fixed member (FP) comprising an inner hollow tubular member (IC) fixed with said outer hollow tubular member (OC) and arranged so as said movable member is interposed between said inner and outer members (IC, OC), the inner and outer members (IC, OC) both defining a sliding guide for the movable portion (MC).
2. The device according to claim 1, wherein said movable member (MC) defines a double action piston suitably to assume a retracted condition, within the fixed portion of the device, and an elongated condition, outside the fixed portion (FP).
3. The device according to any of previous claims 1 or

- 2, wherein said movable member (MC) has a first tapered end (MCT) provided with at least a nozzle (MCN) in order to realize said injection of said fire-retardant and/or fire-extinguishing medium, and a second opposite end (MCO) in seal assembly with both said inner member (IC) and said outer member (OC) in order to define respectively a pipe for realize said injection and a first hydraulic chamber (C1) for pushing said movable member (MC) outwards with respect to said fixed member (FP).
4. The device according to claim 3, wherein said first hydraulic chamber (C1) is also defined by a first annular wall (W1) connecting for sealing, between each other, said inner member and said outer member at a first end (FE) opposite with respect to a second end (SE) through which protrudes said tapered portion of the movable member (MC).
5. The device according to any of previous claims, wherein a second hydraulic chamber (C2) is defined between said movable member and said outer member by means of second annular wall (W2) integral with said outer member, at a second end (SE) through which protrudes said tapered portion of the movable element (MC), and provided with a respective seal (S).
6. The device according to any of previous claims, wherein said first hydraulic chamber (C1) is wider than said second hydraulic chamber (C2) and wherein the device further comprises recirculating means (16.2) for recirculating a hydraulic medium expelled out from the second chamber (C2) to be introduced within the first chamber (C1), while the latter is connected to a hydraulic source (S) pumping further hydraulic medium.
7. Firefighting vehicle for use in fire-fighting operations, in particular in the context of airport rescue comprising an arm or a boom (15) comprising a penetration tool (P) associated with a tip of said arm or of said boom, wherein said penetration tool (P) is according of any of previous claims from 1 to 5.
8. Firefighting vehicle according to claim 7, further comprising only one hydraulic source (S) of hydraulic medium and a discharging tank (T) of the hydraulic medium for pressurizing said first and second chambers (C1, C2) in order to move said movable member (MC), without saving any hydraulic energy in any kind of pressure reservoir.
9. Firefighting vehicle according to claim 7 or 8, wherein said penetration device (P) is associated to said tip through a hydraulic drive suitable to adjust the penetration tool over a horizontal axis (14).

10. Firefighting vehicle according to claims 8 and 9, further comprising a proportional directional valve (13) suitable to lock or reverting the flowing of the hydraulic medium from to the hydraulic source and discharging tank and a switch valve (11) suitable to commutate the connection between the hydraulic source (S) and the discharge tank (T) with hydraulic chambers of said hydraulic drive (12) or with said hydraulic chambers (C1, C2) of the penetration device (P).

Patentansprüche

1. Penetrationsvorrichtung (P) zur Anwendung in Feuerlöschsätzen, insbesondere für den Einsatz in der Flughafenrettung, wobei die Vorrichtung ein feststehendes Teil (FP) umfasst, dazu geeignet, an der Spitze eines Arms oder eines Auslegers (15) angebracht zu werden, und ein Teil (MC), welches teilweise spitz zuläuft und gleitend gegen das feststehende Teil (FP) beweglich ist, um die Wand eines Körpers zu durchdringen, um ein feuerhemmendes und/oder feuerlöschendes Mittel in das Innere des Körpers einzubringen, wobei das feststehende Teil (FP) ein hohles rohrförmiges äußeres Teil (OC) umfasst und das bewegliche Teil (MC) ebenfalls einen hohlen rohrförmigen Teilbereich umfasst, der innerhalb des äußeren Teils (OC) koaxial angeordnet ist, **dadurch gekennzeichnet, dass** das feststehende Teil (FP) ein inneres hohles rohrförmiges Teil (IC) umfasst, welches an dem äußeren hohlen rohrförmigen Teil (OC) befestigt ist und so angeordnet ist, dass das bewegliche Teil zwischen dem inneren Teil (IC) und dem äußeren Teil (OC) einliegt, welche zusammen eine Gleitführung für das bewegliche Teil (MC) bilden.
2. Vorrichtung gemäß Anspruch 1, bei welcher das bewegliche Teil (MC) einen Differenzialkolben definiert, dazu geeignet, einen eingezogenen Zustand innerhalb des feststehenden Teilbereichs (FP) der Vorrichtung und einen ausgefahrenen Zustand außerhalb des feststehenden Teilbereichs (FP) anzunehmen.
3. Vorrichtung gemäß Anspruch 1 oder 2, bei welcher das bewegliche Teil (MC) ein erstes, spitz zulaufendes Ende (MCT) hat, welches mit mindestens einer Düse (MCN) ausgestattet ist, um das Einbringen der feuerhemmenden und/oder feuerlöschenden Mitteln zu ermöglichen, und ein zweites, gegenüberliegendes Ende (MCO), welches in einer versiegelten Anordnung mit dem inneren Teil (IC) und dem äußeren Teil (OC) steht, um jeweils eine Leitung zum Einbringen des Mittels und eine erste Hydraulikkammer (C1) zum Drücken des beweglichen Teils (MC) gegenüber dem feststehenden Teil (FP) nach außen

zu begrenzen.

4. Vorrichtung gemäß Anspruch 3, wobei die erste Hydraulikkammer (C1) ferner durch eine erste ringförmige Wand (W1) begrenzt ist, welche das innere Teil (IC) und das äußere Teil (OC) an einem ersten Ende (FE), gegenüberliegend einem zweiten Ende (SE), an dem das spitz zulaufende Teilstück des beweglichen Teils (MC) hervorsteht, miteinander versiegelt. 5
5. Vorrichtung gemäß einem der vorhergehenden Ansprüche, bei welcher eine zweite Hydraulikkammer (C2) zwischen dem beweglichen Teil (MC) und dem äußeren Teil (OC) durch eine zweite ringförmige Wand (W2) begrenzt ist, welche einstückig mit dem äußeren Teil (OC) ausgebildet ist, an einem zweiten Ende (SE), an welchem das spitz zulaufende Teilstück des beweglichen Teils (MC) hervorsteht, und mit einer entsprechenden Dichtung (S) versehen ist. 10
6. Vorrichtung gemäß einem der vorhergehenden Ansprüche, bei welcher die erste Hydraulikkammer (C1) breiter als die zweite Hydraulikkammer (C2) ist, und wobei die Vorrichtung ferner Rückführungsmittel (16.2) zur Rückführung von ausgestoßenem Hydraulikmedium aus der zweiten Hydraulikkammer (C2) zur Einleitung in die erste Hydraulikkammer (C1) umfasst, während letztere mit einer Hydraulikquelle (S) verbunden ist, die weiteres Hydraulikmedium pumpt. 15
7. Feuerlöschfahrzeug zum Einsatz in Feuerlöschein-sätzen, insbesondere im Zusammenhang mit der Flughafenrettung, wobei das Fahrzeug einen Arm oder Ausleger (15), welcher eine Penetrationsvorrichtung (P) gemäß einem der Ansprüche 1 bis 5, an der Spitze des Arms oder des Auslegers umfasst. 20
8. Feuerlöschfahrzeug gemäß Anspruch 7, welches nur eine Hydraulikquelle (S) für Hydraulikmedium und einen Rücklauftank (T) für das Hydraulikmedium umfasst, um die erste und zweite Hydraulikkammer (C1, C2) unter Druck zu setzen, um das bewegliche Teil (MC) zu bewegen, ohne dabei hydraulische Energie in irgendeinem Druckreservoir zu speichern. 25
9. Feuerlöschfahrzeug gemäß Anspruch 7 oder 8, wobei die Penetrationsvorrichtung (P) mit der Spitze durch einen Hydraulikantrieb verbunden ist, dazu geeignet, die Penetrationsvorrichtung (P) über eine horizontale Achse zu verstellen (14). 30
10. Feuerlöschfahrzeug gemäß Anspruch 8 und 9, welches ein proportionales Wegeventil (13) umfasst, dazu geeignet, den Fluss des Hydraulikmediums von der bzw. zur Hydraulikquelle und dem Rücklauftank (T) zu blockieren oder zurückzuleiten, und ein 35

Umschaltventil (11) umfasst, dazu geeignet, die Verbindung zwischen der Hydraulikquelle (S) und dem Rücklauftank (T) mit den Hydraulikkammern des hydraulischen Antriebs (12) oder den Hydraulikkammern (C1, C2) der Penetrationsvorrichtung (P) herzustellen. 40

Revendications

1. Dispositif de pénétration (P) pour une utilisation dans des opérations de lutte contre les incendies, en particulier dans le contexte de secours d'aéroport, comprenant un élément fixé (FP) adapté pour être associé avec un bout d'un bras ou d'une flèche (15), et un élément partiellement effilé et mobile de manière coulissante (MC) par rapport audit élément fixé afin de pénétrer dans une paroi d'un corps, pour injecter un agent retardateur de flamme et/ou extincteur dans ledit corps, dans lequel ledit élément fixé (FP) comprend un élément extérieur tubulaire creux (OC) et ledit élément mobile (MC) comprend aussi une partie tubulaire creuse, agencée coaxialement dans ledit élément extérieur, **caractérisé par** ledit élément fixé (FP) comprenant un élément tubulaire creux intérieur (IC) fixé avec ledit élément tubulaire creux extérieur (OC) et agencé de sorte que ledit élément mobile soit interposé entre lesdits éléments intérieur et extérieur (IC, OC), les éléments intérieur et extérieur (IC, OC) définissant à la fois un guide coulissant pour la partie mobile (MC). 45
2. Dispositif selon la revendication 1, dans lequel ledit élément mobile (MC) définit un piston à double action adapté pour adopter une condition rétractée, dans la partie fixée du dispositif, et une condition allongée en dehors de la partie fixée (FP). 50
3. Dispositif selon l'une quelconque des revendications précédentes 1 ou 2, dans lequel ledit élément mobile (MC) a une première extrémité effilée (MCT) dotée d'au moins une buse (MCN) afin de réaliser ladite injection dudit agent retardateur de flamme et/ou extincteur, et une seconde extrémité en regard (MCO) en assemblage étanche à la fois avec ledit élément intérieur (IC) et ledit élément extérieur (OC) afin de définir respectivement un tuyau pour réaliser ladite injection et une première chambre hydraulique (C1) pour pousser ledit élément mobile (MC) vers l'extérieur par rapport audit élément fixé (FP). 55
4. Dispositif selon la revendication 3, dans lequel ladite première chambre hydraulique (C1) est aussi définie par une première paroi annulaire (W1) reliant pour rendre étanche, l'un entre l'autre, ledit élément intérieur et ledit élément extérieur sur une première extrémité (FE) en regard par rapport à une seconde extrémité (SE), par laquelle fait saillie ladite partie 60

effilée de l'élément mobile (MC).

5. Dispositif selon l'une quelconque des revendications précédentes, dans lequel une seconde chambre hydraulique (C2) est définie entre ledit élément mobile et ledit élément extérieur à l'aide d'une seconde paroi annulaire (W2) formée intégralement avec ledit élément extérieur sur une seconde extrémité (SE), par laquelle fait saillie ladite partie effilée de l'élément mobile (MC), et dotée d'un joint respectif (S). 5
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6. Dispositif selon l'une quelconque des revendications précédentes, dans lequel ladite première chambre hydraulique (C1) est plus large que ladite seconde chambre hydraulique (C2) et dans lequel le dispositif comprend en outre des moyens de recirculation (16.2) pour faire recirculer un agent hydraulique expulsé hors de la seconde chambre (C2) à introduire dans la première chambre (C1) alors que cette dernière est reliée à une source hydraulique (S) pompant davantage l'agent hydraulique. 15
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7. Véhicule de lutte contre les incendies pour une utilisation dans des opérations de lutte contre les incendies, en particulier dans le contexte de secours d'aéroport comprenant un bras ou une flèche (15) comprenant un outil de pénétration (P) associé à un bout dudit bras ou de ladite flèche, dans lequel ledit outil de pénétration (P) est réalisé selon l'une quelconque des revendications précédentes 1 à 5. 25
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8. Véhicule de lutte contre les incendies selon la revendication 7, comprenant en outre une seule source hydraulique (S) d'agent hydraulique et un réservoir d'évacuation (T) de l'agent hydraulique pour pressuriser lesdites première et seconde chambres (C1, C2) afin de déplacer ledit élément mobile (MC) sans économiser de l'énergie hydraulique dans aucune sorte de réservoir de pression. 35
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9. Véhicule de lutte contre les incendies selon la revendication 7 ou 8, dans lequel ledit dispositif de pénétration (P) est associé audit bout par un entraînement hydraulique adapté pour ajuster l'outil de pénétration sur un axe horizontal (14). 45
10. Véhicule de lutte contre les incendies selon les revendications 8 et 9, comprenant en outre une valve directionnelle proportionnelle (13) adaptée pour verrouiller ou rétablir l'écoulement de l'agent hydraulique depuis et vers la source hydraulique et évacuer le réservoir et une valve de commutation (11) adaptée pour commuter la connexion entre la source hydraulique (S) et le réservoir d'évacuation (T) avec des chambres hydrauliques dudit entraînement hydraulique (12) ou avec lesdites chambres hydrauliques (C1, C2) du dispositif de pénétration (P). 50
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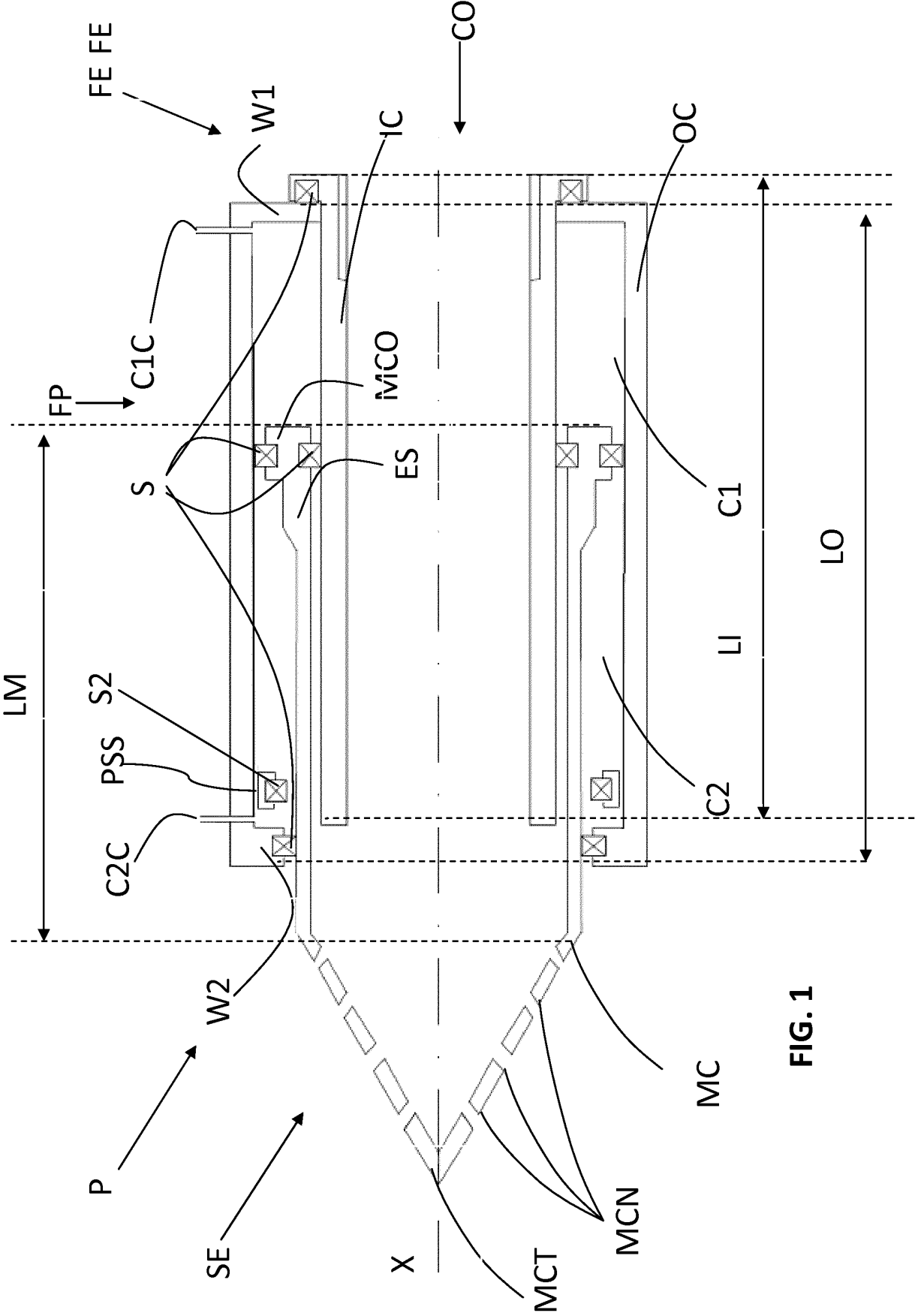


FIG. 1

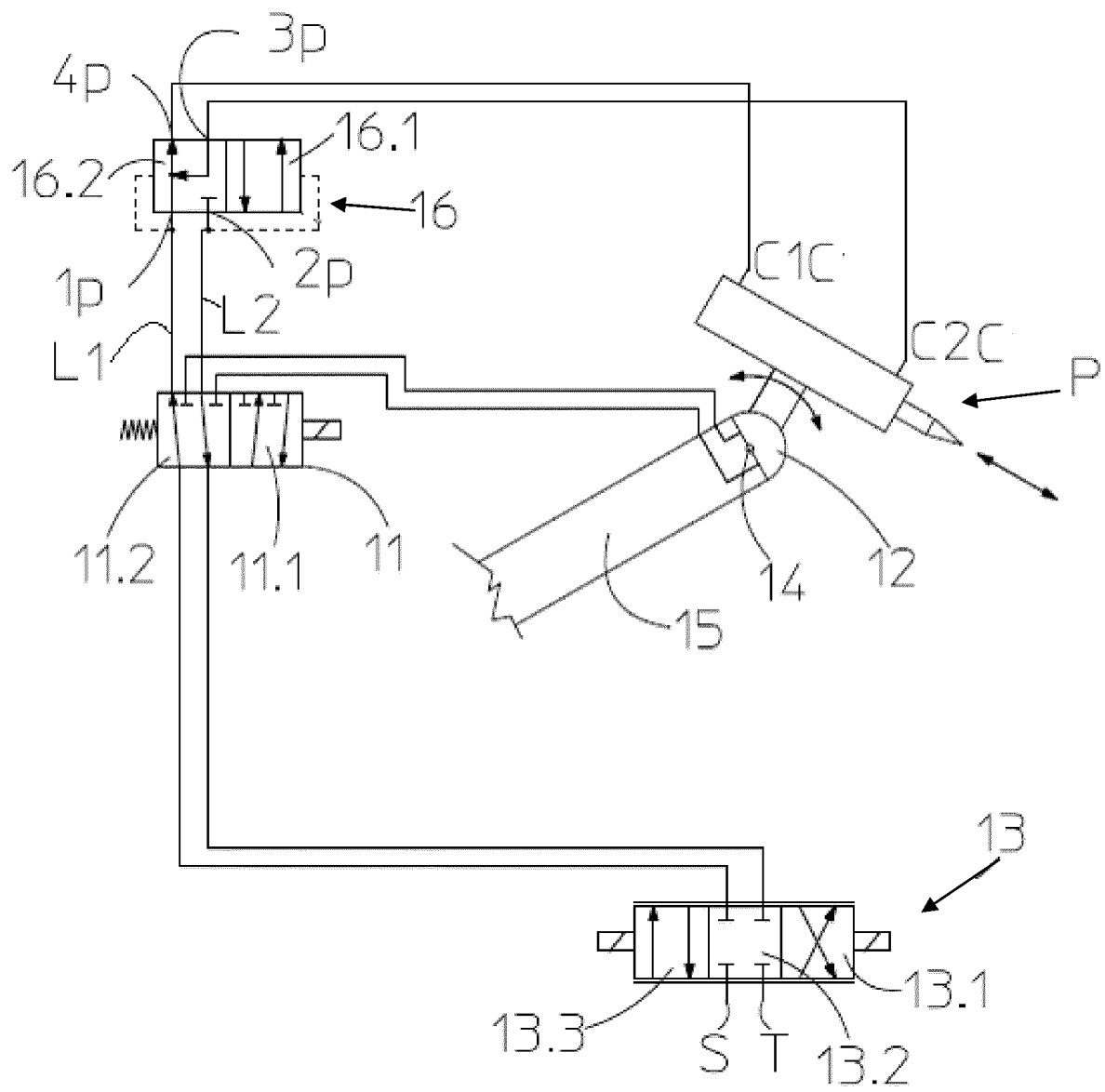


FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 7055613 B [0003]
- EP 1980294 A [0007] [0010] [0035]