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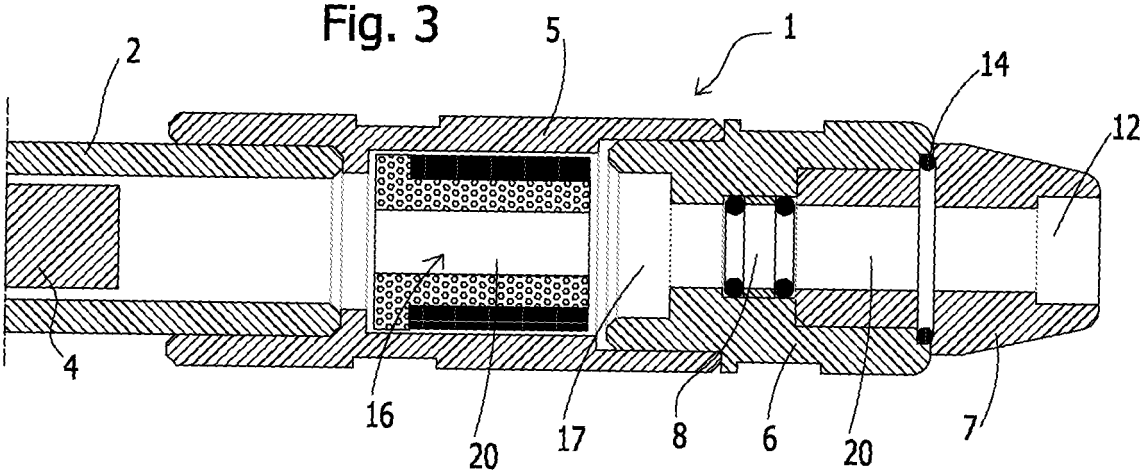
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(54) **Watertight loading device for spearguns**

(57) Watertight loading device for spearguns with a piston (4) comprising a tip (1) arranged for being mounted on a barrel (2) of a speargun and suitable for a spear (3) to pass through, wherein elastic sealing means (8), arranged for cooperating by friction with said spear (3) to obtain a watertight seal, are associated with said tip (1).

Fig. 3



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Description

[0001] The present invention relates to a watertight loading device for spearguns, particularly of an oleo-pneumatic type.

[0002] Traditional oleo-pneumatic spearguns substantially consist of three parts: a tank containing compressed air; a barrel with a muzzle, containing a piston arranged for firing a spear on a rectilinear trajectory, and a grip incorporating the firing mechanism, controlled by a trigger and a compressed air charge/discharge valve. In particular, the mechanisms in this class of spearguns work in an oil bath.

[0003] Operation usually involves the following steps: the tank is precharged with a quantity of air (pre-charge) which is furtherly compressed when the speargun is loaded, while the oil acts as a lubricant for the piston and the various internal levers. When the trigger is pulled, the piston is released and pushes forward the spear, which comes out the barrel at high speed, depending on the pressure with which the speargun is charged. The piston is stopped by the muzzle of the barrel, while the spear, attached to a thin line, comes out the muzzle and strikes the prey.

[0004] These oleo-pneumatic spearguns have certain disadvantages caused by manufacturing characteristics that limit or compromise their functioning.

[0005] One of the main defects is that during manual loading, these spearguns introduce a large quantity of water into the barrel along with the spear: this means that, to expel the spear and the water, the spear-gun requires the piston, which receives the expulsion command from the trigger, to overcome high pressures, requiring considerable effort and waste of energy.

[0006] In addition, when in use, the spear-gun is made heavier by the water present in the barrel and, with the difficult expulsion of the spear, is disadvantageously noisier, much slower and less accurate when it comes to striking the prey.

[0007] Furthermore, with this type of spearguns, it is not possible to load smaller or very light spears, since they would not be able to withstand the high pre-charge pressures necessary for expulsion.

[0008] These defects are partly resolved by the technical solution described in Italian Patent No. 0001331990 and illustrated in Figure 1 (Prior art), which proposes a particular element for coupling the spear to the muzzle of watertight oleo-pneumatic spearguns.

[0009] Said element comprises watertight spear coupling means arranged, when the spear is inserted, for isolating the inside of the speargun barrel from the external environment, thereby constituting a barrier against water flowing into the barrel, both during loading and when the speargun is loaded.

[0010] Said coupling means consist of a special tip, to be positioned on the muzzle, at the end of the spear-gun barrel, and arranged for forming a watertight coupling with a first cylinder, or shutter, sliding on the spear and made of metallic or plastic material.

[0011] This particular watertight coupling between the tip and the metallic shutter can be achieved by shape coupling, for example by means of a conical portion, or by the interposition of a seal of known type.

[0012] Furthermore, the watertight shutter is coupled with a second watertight means constituted of a toroidal seal sliding on the spear and arranged for being forced into a recess in the mouth of said watertight cylinder.

[0013] This technical solution, although having the main advantage of keeping the gun barrel isolated from the water, nevertheless has certain disadvantages that can create difficulties both when loading the speargun and when actually fishing.

[0014] When the speargun is fired, the watertight cylinder and the toroidal seal that make up the coupling element arranged for isolating the barrel from the external environment remain on the spear and travel with it, thereby disadvantageously conditioning its hydrodynamicity: the spear is subject to slowing due to friction, with a consequent reduction in its expulsion velocity and less firing accuracy.

[0015] Said coupling means, since they slide along the spear, when the spear is expelled, impact violently against the retaining end and can generate noise that can disturb and interrupt the silence and state of calm that are essential for the success of a fishing expedition.

[0016] Also disadvantageously, said coupling means, by remaining on the spear, are subject to various types of impacts with preys, or with rocks, and so can be easily damaged and can wear quickly.

[0017] In addition, for the technical solution described in Italian Patent No. 0001331990 to be effective, the procedure for loading the spear into the barrel must be done in a single manoeuvre, by consecutive steps, without pauses or interruptions that could lead to the spear being released outwards. Otherwise, for example, with the risk of the toroidal seal being moved, the watertight system is compromised and a certain amount of water will inevitably be introduced into the barrel, preventing the achievement of the preset aim.

[0018] A further disadvantage consists in the need to use special, longer spears with this type of spearguns, to be able to hold the extra components. Longer spears require greater loading pressures to overcome the additional weight: consequently, the whole speargun becomes more difficult to load, heavier and more difficult to handle, with complications for fishing.

[0019] Lastly, during a fishing expedition, in case of damage or breakage to any of the elements on the spear, given the special method of assembly and coupling between the parts, the disassembly or replacement of this element is impossible or particularly difficult and inconvenient.

[0020] The aim of this invention, in addition to completely eliminating the possible formation of a column of water inside the barrel when loading and fishing, regardless the methods of loading, is also to overcome the limits

and disadvantages of Italian Patent No. 0001331990.

[0021] In particular, the aims of the invention are substantially the following:

- to eliminate the friction and the hydrodynamicity problems the spear is often subject to, thereby to give it an accurate and fast trajectory without generating noise;
- to make the entire speargun more solid, ensuring good durability for its components, and at the same time simplifying the assembly and disassembly systems so that, if necessary, the replacement of certain parts is quick and simple;
- to use spears of a standard size, thereby keeping the speargun light and easy to handle, and not obliging users to purchase special, longer spears to accommodate extra, heavier and more costly components;
- to facilitate loading of the speargun itself, by allowing users to divide and leave an interval between the various steps, resulting in a lighter workload and greater safety, without nullifying the creation of the vacuum inside the barrel in total absence of water;
- to reduce the intensity of the noise generated by the piston striking against the barrel muzzle.

[0022] These aims are achieved with a watertight loading device for spearguns with a piston, comprising a tip arranged for being mounted on a barrel of a speargun and suitable for a spear to pass through, **characterized in that** elastic sealing means, arranged for cooperating by friction with said spear to obtain a watertight seal, are associated with said tip.

[0023] According to one aspect of the invention, the tip comprises a head and a terminal element arranged for being coupled by means of the interposition of said elastic means. Advantageously, said elastic means comprise at least one seal.

[0024] According to a further aspect of the invention, the coupling between the head and the terminal element is achieved preferably by means of reciprocal rotation, causing the compression of the elastic means between said surfaces.

[0025] Preferably, the tip also comprises a muzzle arranged for being interposed between the head and the speargun barrel. Said muzzle features a housing suitable to contain damping means used to muffle the impact of the piston against the head.

[0026] In particular, said damping means comprise a cylindrical bushing, made of elastic yielding material, coaxial to a plunger with a T-section, axially perforated and suitable for the spear to pass through. Compared to the surrounding cylinder, the plunger is preferably made of a more rigid material to withstand the impact of the piston.

[0027] Lastly, according to another preferred aspect of the invention, a bottom element shaped without corners is associated with the spear.

[0028] The device in question totally eliminates the column of water inside the barrel of oleo-pneumatic spearguns, by using furtherly advantageous construction techniques and assembly methods.

[0029] The device, as described above, does not require the use of special elements on the spear and does not exceed the dimensions of a traditional muzzle: this does not force the user to use spears of a length longer than that normally used, thereby guaranteeing a higher expulsion speed and a greater effect on the target.

[0030] The device therefore guarantees excellent firing precision, as it does not make use of additional elements that can often have poor hydrodynamics.

[0031] Advantageously, the speargun is lighter, easier to handle, and therefore also suitable for fishing by women, protects the joints of the arm and wrist, and reduces the need for a particular physical strength in order to use it.

[0032] Advantageously, the invention requires low precharge pressures, thereby considerably reducing the amount of wear on rubber parts and sealing means, and ensuring a longer life for the entire system.

[0033] However, should it be necessary to replace certain parts, the device guarantees that this can be done extremely simply: for example, the sealing means can be quickly replaced by the user by simply unscrewing the terminal element from the muzzle to reach the recess where the seals are positioned.

[0034] The device also comprises damping means, specifically a damping bushing with the specific task of absorbing the energy produced by the piston during expulsion. Advantageously, said damping bushing is made of a sound-absorbent material, resistant to impact and wear, especially by external agents, such as water and hydrocarbons, with which it may come into contact.

[0035] The sealing means are also safeguarded by the presence on the end of the spear of a special bottom element, specially shaped to exploit the elasticity of the seals and prevent them from tearing or breaking.

[0036] Also advantageously, thanks to the sealing means described and positioned according to the invention, and to the presence of a power regulator on the weapon, loading can be split into several intervals, with pauses in between, resulting in less fatigue for the user, but still preventing water from entering the barrel of the gun.

[0037] These and other advantages will become more apparent hereafter, by a description of a preferred embodiment of the invention, which is illustrated by way of non-limitative example, with the help of drawings, in which:

Figure 1 shows an oleo-pneumatic speargun with a piston, with the spear restrained by a line, according to the most relevant known art;

Figure 2 shows a longitudinal section of a loading device according to the invention, whose parts are partially exploded;

Figure 3 shows an assembled longitudinal section

of the components illustrated in Figure 2;
Figure 4 shows a spear that can be used with the speargun provided with said device.

[0038] Figure 1 indicates an oleo-pneumatic speargun, according to known art, consisting of a grip, a tank and a barrel 200 with which a tip 100 is associated. The barrel 200 and the tip 100 can both be passed through by a spear 300, tied to the speargun by means of a line.

[0039] Figures 2 and 3 illustrate the composition of the tip 1, constituting the loading device object of the invention, and the methods for assembling its parts.

[0040] The tip 1, which can be associated with the barrel 2 of the gun, has a hole 20 through which a spear 3 can pass, and comprises three main elements: a muzzle 5, a head 6 and a terminal element 7.

[0041] The muzzle 5 is substantially cylindrical in shape, the internal diameter of its axial cavity is almost constant and it has two internally threaded ends, one of which is arranged for being associated with a gun barrel 2, and the other to the head 6 of the tip 1.

[0042] The head 6, which is also substantially cylindrical in shape, has portions with different internal diameters: the two ends threaded respectively internally and externally have a larger diameter and form an intermediate seat 9, with a smaller diameter, into which it is possible to insert elastic sealing means 8 arranged for cooperating by friction with the spear 3 to guarantee the watertightness of the gun barrel 2.

[0043] Said elastic sealing means 8 may comprise toroidal seals, or scrapers or lip seals, based on specific needs. The figure, for example, shows two O-Ring type seals 8' and 8" with a rigid spacer element 8"' placed between them.

[0044] The terminal element 7 has a cylindrical portion threaded externally, one base of which constitutes a thrust surface 11, and a tapered end portion fitted with a seat 12 for housing a centring ring 13 slidingly associated with the spear 3; the internal cavity of the terminal element 7 has a constant diameter, needed for the passage of the spear 3.

[0045] When screwing the terminal element 7 onto the head 6, the thrust surface 11 compresses the watertight elastic sealing means 8 against a stop surface 10 on the head 6, until they are squeezed into a special seat 9, thereby guaranteeing the maximum impermeability against the surrounding water, in conjunction with the spear 3. To furtherly guarantee watertightness, the terminal element 7, between the cylindrical part and the tapered portion, is provided with a further seal 14 arranged for being forced into a special recess15 around the head 6.

[0046] The muzzle 5 is also fitted on the inside with damping means 16, suitable to absorb the energy generated by the impact of the piston 4 when the spear 3 is expelled, thereby reducing and damping the noise due to the impact between the two bodies 4 and 6. The damping means 16 comprise two coaxial elements with different stiffness: a more rigid plunger 16' made of sound-absorbent material, against which the piston 4 impacts, and an elastically yielding cylindrical bushing 16", coaxial with said plunger.

[0047] With the tip 1 assembled, the rigid plunger 16' under the thrust of the piston 4 engages the cavity 17 at the end next to the head 6; the T-section of said plunger 16' enables it to withstand the blow of the piston 4 and at the same time to reduce the impact thanks to the compression on the elastically yielding coaxial cylinder 16".

[0048] Figure 4 shows a spear 3 that can be used with an oleo-pneumatic speargun fitted with the device object of the invention. This spear 3, of traditional length, has a special bottom element 18 on the bottom end, specially shaped without corners, with a substantially ogival shape, arranged for protecting the elastic sealing means 8 against tears.

[0049] The spear is also provided with a retainer ring 19 whose movement, when the spear is expelled, is limited by the bottom element 18, which also constitutes a stop element for the centring ring 13 according to the known art.

[0050] The speargun can be armed by following a series of simple steps: once the tip 1 is mounted on the barrel 2 as described above, the gun is loaded by inserting the bottom end 18 of the spear 3 into the hole 12 on the terminal element 7 and sliding it into the barrel 2 until the bottom element 18 rests on the piston 4. Furthermore, the piston 4 is pushed towards the grip of the speargun, completely compressing the air in the tank, thereby creating the pressure that the spear 3 will be subjected to when it is expelled.

[0051] Said procedure is therefore similar to that used for traditional underwater weapons, except for the possibility of splitting the force needed by having intervals between the spear loading steps, by means of a power regulator of a known type positioned on the grip.

[0052] The conformation of the device in object and the means of assembly described above achieve the preset aims of the invention, guaranteeing excellent watertightness and good performance of the weapon.

[0053] The only water present in the barrel at the moment of expulsion is the column of water under the piston before insertion of the bottom element of the spear into the hole on the terminal element. The quantity of water is minimal and has no impact on the performance or advantages described above.

[0054] It will be apparent to the expert that the invention has been described making reference, by way of example, to a watertight loading device for oleo-pneumatic underwater spearguns with a piston, but that it can be used more generally for any arm requiring perfect isolation from the external environment, with the same advantages as described above.

Claims

1. A watertight loading device for spearguns with a piston (4) comprising a tip (1) arranged for being mounted on a barrel (2) of a speargun and suitable for a spear (3) to pass through, **characterized in that** elastic sealing means (8), arranged for cooperating by friction with said spear (3) to obtain a watertight seal, are associated with said tip (1).

2. A device according to claim 1, **characterized in that** said tip (1) comprises a head (6) and a terminal element (7) arranged for being coupled by means of the interposition of said elastic sealing means (8).

3. A device according to claim 1, **characterized in that** said elastic sealing means (8) comprise at least one seal (8', 8").

4. A device according to claim 2, **characterized in that** the coupling between the head (6) and the terminal element (7) is achieved by means of reciprocal rotation.

5. A device according to claim 2, **characterized in that** said head (6) comprises a seat (9) with a stop surface (10), said terminal element (7) comprises a thrust surface (11), and their coupling by rotation causes the compression of the elastic sealing means (8).

6. A device according to claim 1, **characterized in that** said tip (1) comprises a muzzle (5) arranged for being associated with a first end to the barrel (2) and with a second end to the head (6).

7. A device according to claim 6, **characterized in that** said muzzle (5) comprises damping means (16), arranged for reducing the impact between the piston (4) and the head (6).

8. A device according to claim 7, **characterized in that** said damping means (16) comprise a cylindrical bushing (16"), elastically yielding and coaxial with a more rigid, perforated plunger (16') with a T-section, arranged for acting as a stop for said piston (4).

9. A device according to claim 7, **characterized in that** said damping means (16) are held in position in the muzzle (5) by a screw-nut coupling between said muzzle (5) and said head (6).

10. A device according to the previous claims, **characterized in that** a shaped bottom (18) without corners can be associated with the spear (3).

11. A watertight speargun **characterized in that** it comprises a watertight loading device according to the previous claims.

Fig. 1
Prior art

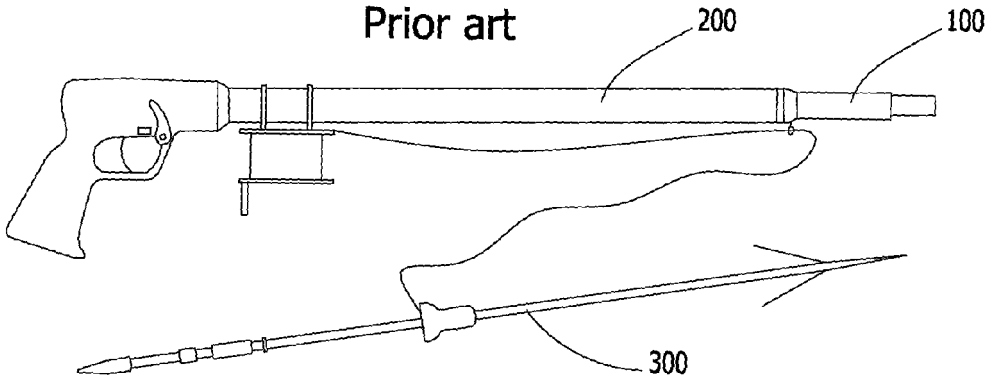


Fig. 2

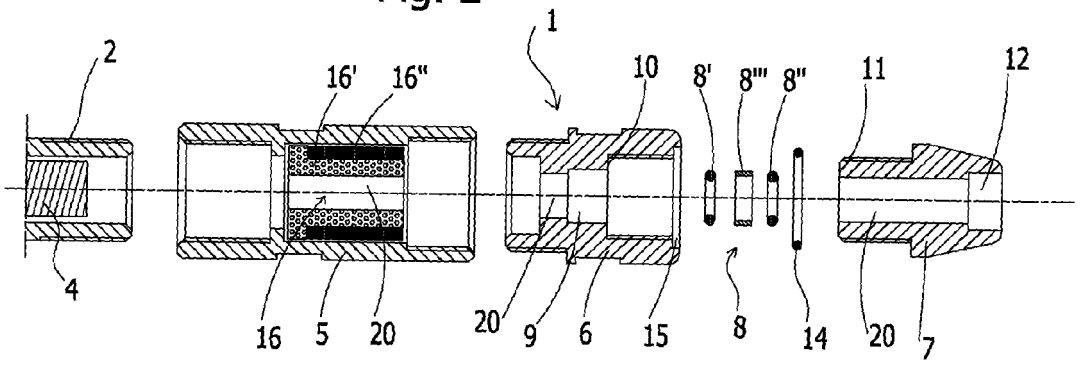


Fig. 3

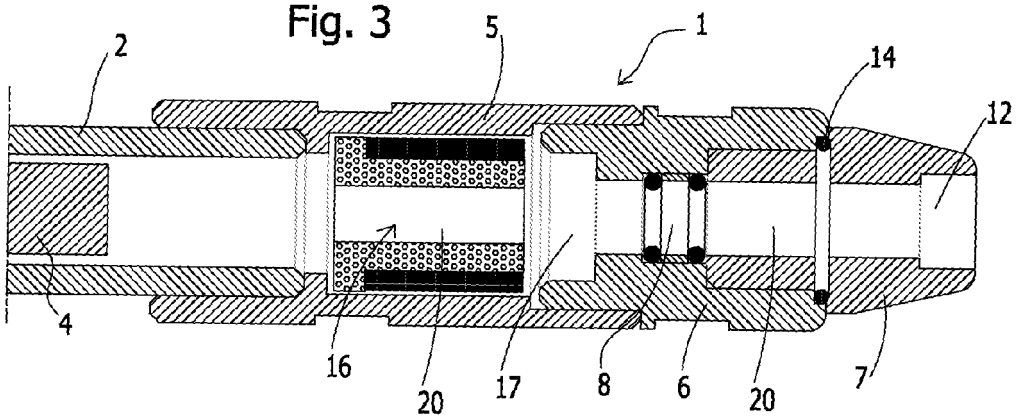
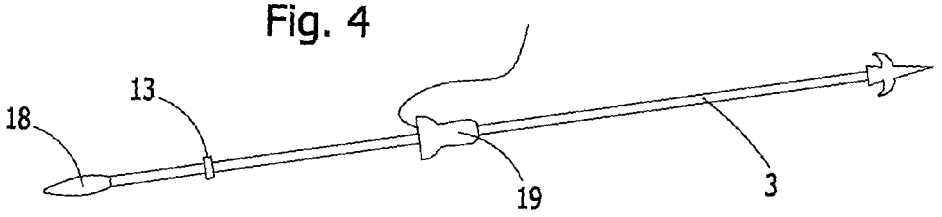


Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 09 18 0065

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			TECHNICAL FIELDS SEARCHED (IPC) F41A F41B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 March 2010	Beaufumé, Cédric

CATEGORY OF CITED DOCUMENTS

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