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(54) Title: EYE SURGICAL INSTRUMENT

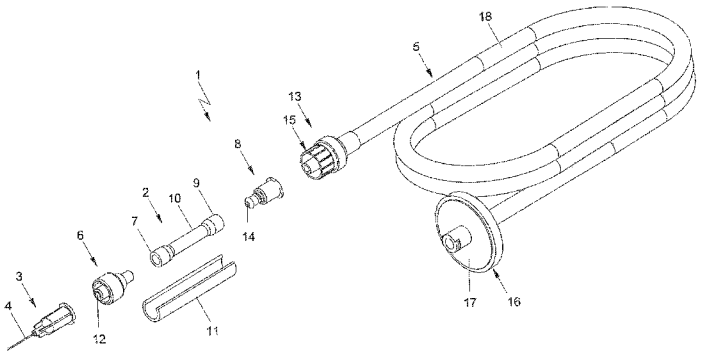

Fig. 1

(57) Abstract: Eye surgical instrument for postoperatively pressurizing an eye with the aid of a fluid, comprising a handle provided with a hollow duct through which the fluid can flow, an instrument head provided with a hollow needle couplable to a first end of the handle for introducing the fluid into the eye, and a connecting element couplable to a second end of the handle for connection to a pressure pump for bringing the fluid to a preset pressure.

Title: Eye surgical instrument

The invention relates to an eye surgical instrument for pressurizing an eye.

At completion of a surgical procedure in the eye, the eye, before the cannula is removed, is pressurized. Usually, the ophthalmologist feels by hand whether there is sufficient pressure on the eye. After that, the cannula is removed and the incision through which the cannula was introduced is closed. However, during removal of the cannula and/or during closure of the incision, pressure loss may occur in the eye, as a result of which the pressure in the eye lowers. In a number of patients a reduced eye pressure can lead to problems. Since the eye has already been closed after the procedure, there is usually no possibility of doing anything about it anymore. However, there is a clear need to still adjust such a reduced eye pressure.

The invention contemplates providing an eye surgical instrument that can offer a solution to the above-mentioned problem.

To this end, the invention provides an eye surgical instrument for postoperatively pressurizing an eye with the aid of a fluid, comprising a handle provided with a hollow duct through which the fluid can flow; a hollow needle couplable to a first end of the handle for introducing the fluid into the eye, and a connecting element couplable to a second end of the handle for connection to a pressure pump for bringing the fluid to a preset pressure.

By providing an instrument that can be introduced into a closed eye in a postoperative situation, the pressure in the eye can still be adjusted, even when the cannula has been removed from the eye and the incision has been closed. In the context of the invention, postoperative is understood to refer to a situation in which the procedure in the eye has been terminated, the cannula has been removed from the eye, and the eye has

been closed. The instrument according to the invention has been especially developed for use *after* the operation, i.e., for postoperative use.

On one side, the instrument is provided with a hollow needle through which the fluid can be introduced into the eye. On the other side, the instrument is provided with a connecting element for connection to a pressure pump by which the fluid can be pumped into the eye with a preset substantially constant pressure. By use of the instrument, a relatively precise postoperative intraocular pressure can be obtained after, for example, the trocars have been removed from the eye. The desired pressure in the eye is, for example, some 20 to 30 mmHg. By making use of the instrument according to the invention, the desired pressure can be pre-set and be relatively accurately achieved.

The fluid may be air, or may be a salt solution, better known as BSS (Balanced Salt Solution). The pressure pump can be a relatively simple pump that is suitable to bring the fluid to, and keep it at, a required pressure, but can also be a vitrectomy system. A vitrectomy system is known and is commercially available. Applicant brings, for one thing, a vitrectomy system "Associate ®" on the market. Such a vitrectomy system usually has several outputs. The connecting element of the eye surgical instrument according to the invention can be connected to the output that provides a constant pressure.

The instrument furthermore comprises a handle by which the doctor can hold and/or operate the instrument. To a first end of the handle the hollow needle is couplable and to a second end of the handle the connecting element is couplable.

The handle comprises a hollow duct through which the fluid can flow. The hollow duct is connectable adjacent the first end of the handle to the hollow needle and is connectable adjacent the second end of the handle to the connecting element, so that, when the instrument is connected to the pressure pump, the fluid can be guided via the connecting element and the

hollow duct of the handle to the hollow needle. The hollow duct can be connected to the handle as an external tubelet, or can extend through the handle.

Advantageously, the hollow duct comprises a depressible part that is at least partly depressible. The depressible part of the hollow duct can be directly depressible, with the doctor engaging the hollow duct and depressing it at least partly. The depressible part of the hollow duct may also be indirectly depressible. In that case the hollow duct may be surrounded at least partly by the handle. Adjacent the depressible part of the hollow duct, the handle is then also elastic to be depressible. The doctor then engages the handle, whereby, by depressing the handle, the hollow duct can also be depressed.

The depressible part can be depressed by the doctor who controls the instrument, so that extra pressure can be exerted on the hollow duct, on top of the pressure supplied by the pressure pump. Such temporary extra pressure may be necessary, for instance, to remove obstructions in the hollow needle. For example, small lumps of tissue may wholly or partly close off the exit of the hollow needle. By temporarily exerting an extra pressure via the depressible part, such small lump can, as it were, be blown away.

After all, the instrument is introduced into the eye directly after the operation, to pressurize the eye. As a consequence, it may happen that the hollow needle gets clogged up by, for example, a vitreous clot, or a tissue particle or a small lump of tissue. The pressure with which the fluid is pumped through the duct is usually insufficient to blow away and/or remove such a blocking particle. To be able yet to clear the needle of the blocking particle, the depressible part of the hollow duct is provided. The doctor controlling the instrument can exert extra pressure on the depressible part by wholly or partly depressing the depressible part with a finger. By wholly or partly depressing the depressible part of the hollow duct with the finger, the passage of the hollow duct is temporarily reduced, as a result of which,

on top of the pressure provided by the pump, an extra pressure is exerted. Such extra pressure usually does suffice to blow away the blocking particle from the hollow needle and to clear the hollow needle again. By additionally providing a non-return valve, see also further down, the effect achieved is that the manual pressure applied to the depressible part by the surgeon propagates only towards the eye and not towards the pump, so as to achieve sufficient pressure buildup to blow away the blocking particle. The depressible part therefore provides for the so-called back flush function of the instrument.

Preferably, the depressible part of the hollow duct is configured as at least a part of the handle. The hollow duct is then elastic such that it can be depressed by the fingers of a doctor. By making the hollow duct, at least adjacent the handle, of elastic design configured as the depressible part, the doctor can directly press the hollow duct wholly or partly shut, so that the doctor can transmit the exerted force onto the hollow duct better and dose the exerted force better.

The depressible elastic part can extend over substantially the whole length of the handle or over a part thereof that is readily accessible to the doctor.

Advantageously, the depressible part is partly surrounded by a stiff sleeve. The sleeve has a stiffness that is greater than the stiffness of the depressible part of the handle and/or of the depressible part of the hollow duct, so that it is simpler for the doctor to exert force to press the hollow duct wholly or partly shut. By providing the stiff sleeve, the doctor can press the hollow duct wholly or partly shut against the sleeve, allowing the doctor to exert a temporary pressure on the elastic hollow duct still more easily.

Advantageously, the eye surgical instrument is provided with a non-return valve. The non-return valve is positioned between the depressible flexible part of the handle and an end of the connecting element that is couplable to the pressure pump. The non-return valve may be

provided adjacent the second end of the handle, or may be provided in the connecting element, for instance, in the end of the connecting element that is couplable with the handle. By providing the non-return valve, it can be accomplished that the temporary extra pressure that the doctor exerts by depressing the flexible depressible part is guided to the hollow needle and does not go to the pressure pump. What can also be accomplished is that when the doctor lets go of the depressible part, the pressure wave propagates towards the eye and does not go back towards the pressure pump.

By providing a 32 gauge needle, the instrument can be placed in the closed-up eye and be removed from it again without sutures being necessary. The site where the needle has entered the eye heals naturally.

Further advantageous embodiments are represented in the subclaims.

The invention will be elucidated in more detail on the basis of an exemplary embodiment which is represented in a drawing. In the drawing:

Fig. 1 shows a schematic perspective exploded view of an exemplary embodiment according to the invention.

It is noted that the figure is only a schematic representation of the invention.

For the purposes of this disclosure it is pointed out that the technical features specifically described may be susceptible of a functional generalization. Furthermore, it is pointed out that – as far as not explicitly indicated – such technical features can be seen separately from the context of the exemplary embodiment given and furthermore can be seen separately from the technical features with which they cooperate in the context of the example.

Fig. 1 shows an eye surgical instrument 1 according to the invention. The eye surgical instrument comprises a handle 2, an instrument head 3 provided with a hollow needle 4, and a connecting element 5. The

hollow needle 4 of the instrument head 3 has a relatively small diameter so that the eye heals naturally after the needle 4 has been removed from the eye. Preferably, the hollow needle 4 has a diameter of 32 gauge.

The instrument head 3 is couplable via a first coupling element 6 to a first end 7 of the handle 2. The connecting element 5 is couplable via a second coupling element 8 to a second end 9 of the handle 2.

The handle 2 is here designed as a hollow duct 10 through which fluid such as air or a salt solution, known as BSS, can be conducted. The hollow duct 10 is an elastic duct which is at least partly depressible. The hollow duct 10 in this exemplary embodiment is further partly surrounded by a stiff sleeve 11.

The first coupling element 6 is designed such that the hollow duct 10 can be coupled via the coupling element 6 with the hollow needle 4. The coupling element 6 is provided with a fluid passage 12 for passing fluid between the hollow duct 10 and the hollow needle 4.

The connecting element 5 is provided at a first end 13 with a coupling piece 15 which is couplable via the second coupling element 8 to the second handle end 9. The coupling element 8 is here provided with a fluid passage 14 for passing fluid between the connecting element 5 and the handle 2. A second end 16 of the connecting element 5 is couplable to a pressure pump (not shown). The pressure pump can be a vitrectomy system, while the second end 16 of the connecting element 5 is configured to couple with the constant pressure output of the vitrectomy system. The second end 16 of the connecting element 5 may be provided with a machine-dependent coupling piece 17.

In this exemplary embodiment the coupling piece 15 at the first end 13 of the connecting element 5 is provided with a non-return valve. The non-return valve is in the coupling piece 15 and is not shown here. The non-return valve can have any conceivable and current design. Possibly, the non-

return valve may also be in the coupling element 8 or in the second end 9 of the flexible duct 10.

The connecting element 5 is here designed as a relatively long flexible hose 18 which can bridge a distance between a patient and a pressure pump. The flexible hose 18 can thus be up to a few meters long.

At completion of an operation in the eye, the eye is repressurized via the cannula. The ophthalmologist usually feels by hand whether the eye has the desired pressure. After that, the cannula is removed from the eye and the incision, through which the cannula was introduced, is closed. Should too great a pressure drop have arisen, as a result of which the pressure in the eye has become too low, then the eye surgical instrument according to the invention can be introduced into the eye.

Owing to the relatively small diameter, preferably 32 gauge, of the hollow needle, the eye surgical instrument can be brought into and out of the eye without causing injuries to the eye. The eye can heal itself.

After the eye surgical instrument 1 has been introduced into the eye and the connecting element 5 has been coupled to a pressure pump, the pressure pump can be set into operation. The desired pressure has been set on the pressure pump. This pressure can be, for example, 30 mmHg, but the doctor may set a different desired pressure, depending on the patient. The pressure pump pumps the fluid, air or BSS, with the preset pressure through the instrument 1 into the eye. Thus, the desired intraocular pressure can be achieved postoperatively in a relatively accurate manner.

It may be that the relatively small hollow needle 4 can get wholly or partly obstructed by a piece of tissue or otherwise, as a result of which the pressure build-up of the eye is rendered more difficult. The ophthalmologist can then, for example with a finger, temporarily depress the hollow elastically depressible duct 10 of the handle 2 to momentarily create a high pressure which can, as it were, blow the obstruction away, on top of the pressure delivered by the pump. To prevent this momentary

higher pressure spreading towards the pressure pump, the instrument 1 is provided with a non-return valve between the handle and the end 16 of the connecting element 5 couplable to the pressure pump.

After the eye has been brought to the desired pressure, the instrument 1 can be removed from the eye. Owing to the small diameter of the hollow needle 4, the eye heals naturally.

The invention is not limited to the exemplary embodiment represented here. Many variants are possible. Thus, the connecting elements may be designed differently, or the hollow duct may be designed differently. Also, the handle may be of integral design, whereby only a part of the handle is elastic in order to be depressed. Also, the instrument is shown here as being built up from different loose parts. In another embodiment, the instrument may also be of integral design or be manufactured as a whole. Such variants will be clear to one skilled in the art and are understood to be within the scope of the invention as set forth in the following claims.

CLAIMS

1. An eye surgical instrument for postoperatively pressurizing an eye with the aid of a fluid, comprising

- a handle provided with a hollow duct through which the fluid can flow;
- an instrument head provided with a hollow needle couplable to a first end of the handle for introducing the fluid into the eye, and
- a connecting element couplable to a second end of the handle for connection to a pressure pump for bringing the fluid to a preset pressure.

2. An eye surgical instrument according to claim 1, wherein the hollow duct comprises a depressible part which is at least partly depressible.

3. An eye surgical instrument according to claim 2, wherein a depressible part of the hollow duct is designed as at least a part of the handle.

4. An eye surgical instrument according to claim 2 or 3, wherein the depressible part is partly surrounded by a stiff sleeve.

5. An eye surgical instrument according to any one of the preceding claims, furthermore comprising a non-return valve positioned between the depressible part and an end of the connecting element couplable to the pressure pump.

6. An eye surgical instrument according to claim 5, wherein the non-return valve is in an end of the connecting element couplable to the handle.

7. An eye surgical instrument according to any one of the preceding claims, wherein the hollow needle is a 32 gauge needle.

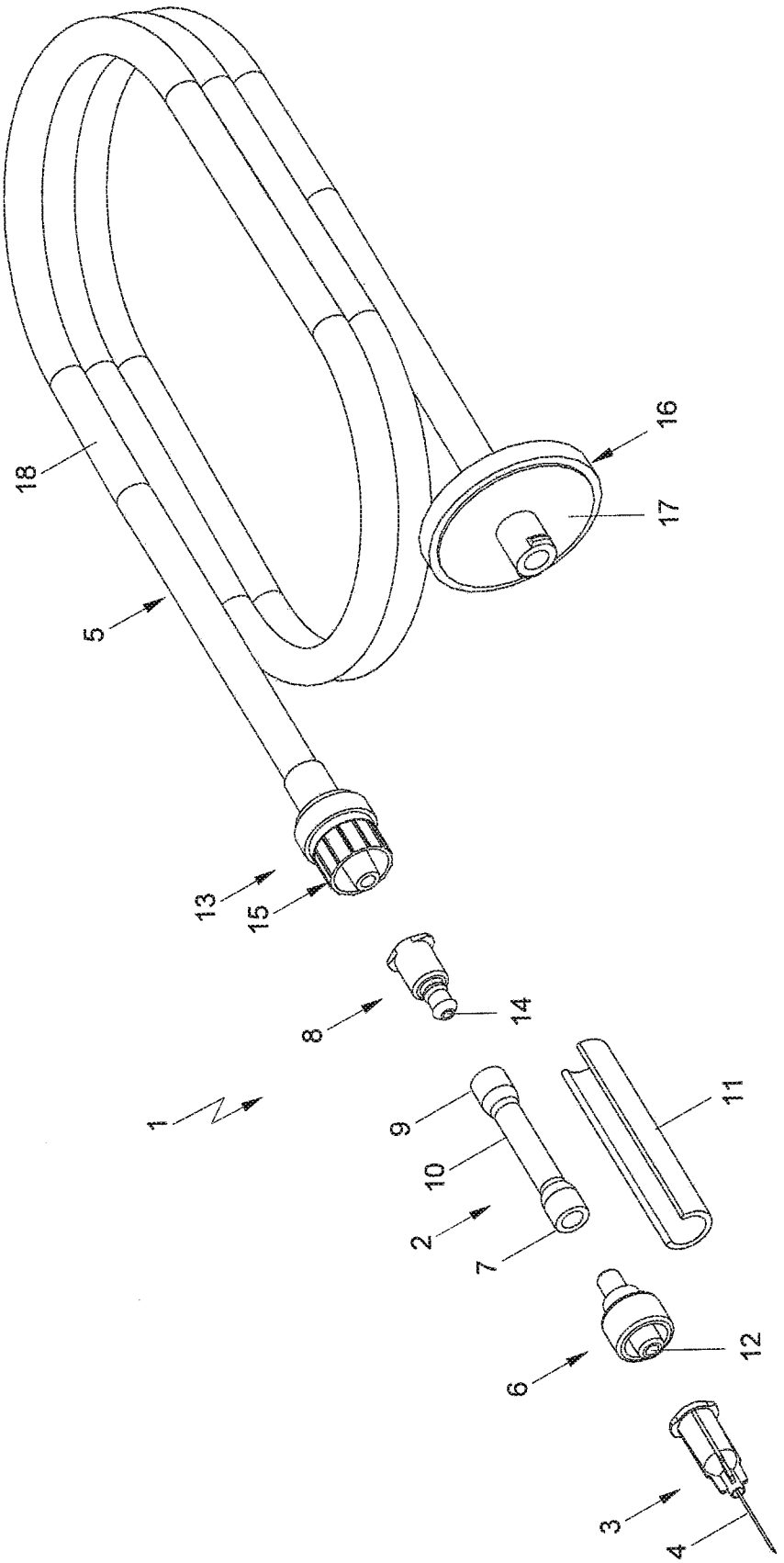

Fig. 1

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2013/050151

A. CLASSIFICATION OF SUBJECT MATTER
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ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61F A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA/	Authorized officer
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PCT/NL2013/050151

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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