



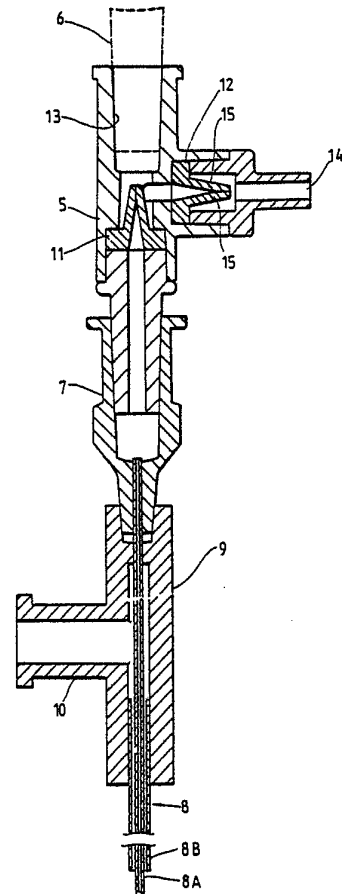
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(54) Title: OPTHALMIC ASPIRATING/IRRIGATING DEVICE

(57) Abstract

Ophthalmic device for irrigating and removing debris from the eye. It comprises a needle (8) formed of two parallel tubes (8A and 8B) the open ends of which are close to one another, one tube (8A) being connectible to a syringe by way of a valve device (5) containing two one way valves one of which (11) provides passage only in the direction from the tube (8A) to a syringe (1) and the other of which (12) provides passage only in the direction from the syringe (1) to a discharge opening (14) and the other tube (8B) being connectible to a supply of irrigating liquid. The device is used by inserting the needle into the chosen part of the eye, allowing irrigating liquid to flow into the eye then operating the syringe first to withdraw liquid and contained debris from the eye into the syringe through the one valve (11) and then to discharge the liquid and contained debris to the discharge opening (14) through the valve (12).



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OPHTHALMIC ASPIRATING/IRRIGATING DEVICE

The subject of this invention is an ophthalmic aspirating/irrigating device.

In the performance of some operations to the eye it is necessary to remove cortical fragments and/or other débris from behind the iris, such action being preferably followed by an irrigating action in which irrigating fluid is introduced behind the iris to ensure that the place from which the cortical fragments had been removed is clear. The instrument which has been developed to perform this operation comprises a syringe attached to a double needle having two passages one of which is open at the proximal end to the barrel of the syringe and the other of which is connectible at the proximal end to a source of supply of irrigating liquid and the distal ends of the two passages are open and close to one another. In operation of the aspirating/irrigating device the piston of the syringe is advanced and the distal end of the double needle is introduced into the eye and manoeuvred into the position in which the distal end of the needle is in the portion of the eye containing the cortical fragments and/or other débris. Irrigating liquid is allowed to flow into the eye cavity containing the débris and the piston of the syringe is then withdrawn to draw the irrigating liquid containing the cortical fragments and/or other débris through the tube connected to the barrel of the syringe. It usually happens that at the first withdrawal of the plunger not all the débris is removed and it may be necessary to remove the device from the eye several times so that débris which has been withdrawn from the eye may be discharged from the syringe along with irrigating liquid, the needle then being re-inserted into the eye to remove

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remaining débris. It has been found that this action may have to be performed as often as three or four times.

5 The repeated insertion of a needle into the eye is highly undesirable and it is an object of the present invention to provide an aspirating/irrigating device which requires only one insertion into an eye to remove all the débris and irrigate the eye.

10 According to the invention an ophthalmic aspirating/irrigating device incorporating a needle comprising two tubes in close proximity and terminating close to one another at what in use will be the distal end of the device, the distal end of the
15 needle being insertable into an eye to be treated and the proximal end of one tube arranged for connection to a syringe and the proximal end of the other tube arranged for connection to a source of irrigating liquid is characterized in that the needle tube
20 connectible to the syringe is connectible thereto, by way of a valve device containing two one-way valves one of which provides passage only in the direction from the needle tube to the syringe and the other of which provides passage in the direction
25 only from the syringe to a discharge opening.

The invention also comprises the combination of a device as described and a syringe to which the device is fitted.

30 Each one way valve may be formed as two flexible lips which are normally in contact with one another and forming together an acute angle so that the lips can be moved apart by a pressure

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rise across the valve in one direction and will be forced together by a pressure rise across the valve in the other direction.

5 The two valves may be incorporated within a body having a straight tubular portion containing the valve providing one way access from the needle tube to the syringe and a branch containing the valve providing one way access from the syringe to a discharge opening.

10 For a reason to be explained later it may be desirable to locate the valves such that when the device is in a vertical position with the needle projecting downwardly the tip of the valve providing passage only from the syringe to the discharge opening
15 is located a distance below the level of the tip of the other valve providing passage only in the direction from the needle tube to the syringe. Said distance may be about 1 mm or less.

20 The straight tubular portion may be so arranged that the end adjacent the downstream end of the one way valve in said straight portion is a push fit on the nozzle of a syringe while the other end is formed as a spigot which is a push fit on a socket carrying the needle.

25 For ease both of manufacture and assembly all the parts of the valve device may be moulded to be a push fit in one another.

30 A practical embodiment of the invention is illustrated in the accompanying drawings in which Fig. 1 shows a device according to the invention fitted to a surgical syringe and Fig. 2 is a section of the device of the invention drawn to a much

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enlarged scale.

In the drawings 1 denotes a syringe incorporating a barrel 2 and a plunger 3 loaded by a spring 4 fitted as an addition to the syringe so that the plunger 3 tends to move to its withdrawn position. 5 denotes a valve device attached to the nozzle 6 of the syringe 1. 7 denotes a socket a press fit on the end of the valve device 5 remote from that arranged to receive the nozzle 6 of the syringe. 10 The socket 7 supports the inner tube 8A of a needle 8 which comprises said inner tube 8A and an outer tube 8B surrounding the inner tube 8A. The inner tube 8A which is open at its distal end, i.e. the end remote from the socket 7, is thus connected 15 through the socket 7 and by way of the valve device 5 to the interior of the barrel 2 of the syringe 1. The outer tube 8B terminates slightly short of the inner tube 8A at the distal end of the needle 8 and is open to the interior of a sleeve 9 formed 20 with a branch connection 10 connectible to a supply of irrigating liquid. The valve device 5 incorporates two one way valves 11 and 12 so arranged that the valve 11 provides passage only in a direction towards the syringe. The nozzle 6 of the syringe 1 fits 25 into the socket 13 provided in the valve device 5. The valve 12 is arranged in the branch of the valve device and is so arranged that it provides passage only in the direction from the interior of the valve device to a discharge passage 14. 30 Each valve comprises two lips 15 of flexible material which come together at an acute angle and are arranged to be normally in contact with one another, being maintained in contact by their own resilience.

In practice, when the device is to be used

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on an eye it is fitted as described to a surgical syringe and the branch connection 10 is connected to a supply of irrigating fluid. The plunger 3 of the syringe is first advanced and the needle 5 8 is then inserted into the eye usually with the distal end in the space behind the iris where cortical fragments and other débris tend to gather. Irrigating fluid passes through the tube 8B in the annulus between the tubes 8A and 8B into said space behind 10 the iris. On releasing the plunger the spring 4 withdraws the plunger and the suction in the barrel 2 causes the valve 11 to open i.e. the two lips 15 separate and irrigating fluid which is now filling said space behind the iris and cortical fragments 15 and other débris are sucked from the eye into the syringe barrel through the tube 8A. When the plunger has been withdrawn to its fullest extent it is again advanced compressing the spring 4. This time the rise of pressure in the barrel 2 causes the lips 20 15 of the valve 11 to come together rapidly although they tend to do so anyway by their own resilience as soon as pressure is equalized on both sides of the valve. At the same time the rise of pressure on the upstream side of the valve 12 causes the 25 lips 15 of the valve 12 to open so that the irrigating fluid and fragments and débris in the syringe are expelled through the valve 12 and out of the discharge passage 14. Without removing the device from the eye the plunger may now be released for a second 30 time so that irrigating fluid and other cortical fragments and débris which had not been removed from the eye in the first operation are withdrawn into the syringe barrel 2 and then expelled as before through the passage 14. This operation may 35 be performed as often as is necessary until no more

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cortical fragments and débris remain in the eye. The device is removed from the eye only when the operation is complete, i.e. when all cortical fragments and débris are removed. The operation can thus
5 be performed with only one insertion of the syringe into the eye.

It is sometimes found during use of the instrument when withdrawing irrigating liquid and any fragments of débris that the suction created
10 causes the posterior chamber capsule of the eye, usually referred to as the capsular bag, to be sucked against the orifice of the needle. Withdrawal of the liquid and contained fragments must be stopped immediately so that damage to the capsular bag does
15 not occur. The capsular bag must then be moved away from the needle to clear the needle orifice. This cannot normally be done by merely depressing the plunger of the syringe because the rise of pressure would simply close the valve 11 so that no pressure
20 would be applied from within the needle, also the slight pressure of the irrigating liquid entering through the branch connection 10 is sufficient to keep the capsular bag pressed against the needle. To avoid such a happening the tip of the discharge
25 valve 12 may as previously described be located a distance below the level of the tip of the inlet valve 11 an amount which is preferably not more than 1 mm. By this expedient it is possible by momentarily depressing the plunger by a minute extent
30 to generate a small pressure wave which passes through the valve 11 before it has had time to close and, since the valve 11 is above the level of the valve 12 and thus receives the pressure wave a small fraction of a second before the valve 12 receives the pressure
35 wave, before the valve 12 has had time to open and

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nullify the effect. This extremely small rise of pressure momentarily occurring within the tube 8A is sufficient to move the capsular bag away from the orifice in the needle without damage to the capsular bag. The operation of removing cortical fragments and debris may then be continued.

The ophthalmic device of the invention particularly incorporating two valves as illustrated has been found to be very effective because of the feature that an extremely small pressure difference across each valve causes it either to open or close according to the side on which pressure is higher. There is thus immediate response by the valves to movement of the piston 3 and also virtually no reverse flow through the valves. Other types of valves tend to be slower in action and also to permit some amount of reverse flow so that cortical fragments and debris removed from the eye can be forced back into the eye. It may be remarked that the plunger withdrawal spring has been fitted to the syringe so that the syringe may be operated with one hand. This is highly desirable in eye operations. The device may however be used without the addition of a plunger withdrawal spring.

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CLAIMS

1. An ophthalmic aspirating/irrigating device incorporating a needle (8) comprising two tubes (8A and 8B) in close proximity and terminating close to one another at what in use will be the distal end of the device, said distal end of the needle (8) being insertable into an eye to be treated and the proximal end of one tube (8A) arranged for connection to a syringe (1) and the proximal end of the other tube (8B) arranged for connection (at 10) to a source of irrigating liquid which is characterized in that the needle tube (8A) connectible to the syringe (1) is connectible thereto by way of a valve device (5) containing two one way valves one of which (11) provides passage only in the direction from the needle tube (8A) to the syringe and the other of which (12) provides passage in the direction only from the syringe (1) to a discharge opening (14).

2. A device according to claim 1, characterized in that each one way valve (11 and 12) is formed as two flexible lips (15) which are normally in contact with one another and forming together an acute angle the lips being movable apart by a pressure rise across the valve in one direction and being forced together by a pressure rise across the valve in the other direction.

3. A device according to claim 1, characterized in that the two valves are incorporated within a body having a straight tubular portion containing the valve providing one way access from the needle tube to the syringe (1) and a branch containing the valve providing one way access from the syringe

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to a discharge opening.

4. A device according to claim 1, characterized in that the valves are so located that when the device is in a vertical position with the needle
5 (8) projecting downwardly the tip of the valve (12) providing passage only from the syringe (1) to the discharge opening is located a distance below the level of the tip of the other valve (11) providing passage only in the direction from the needle tube
10 (8A) to the syringe.

5. A device according to claim 3, characterized in that the straight tubular portion (5) is so arranged that the end adjacent the downstream end of the one way valve (11) in said straight portion is a
15 push fit on the nozzle (6) of a syringe while the other end is formed as a spigot which is a push fit on a socket (7) carrying the needle.

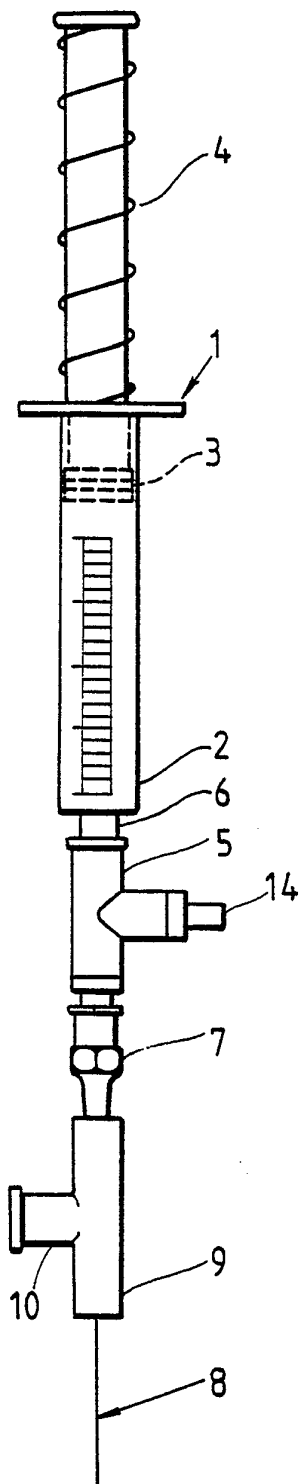


Fig. 1

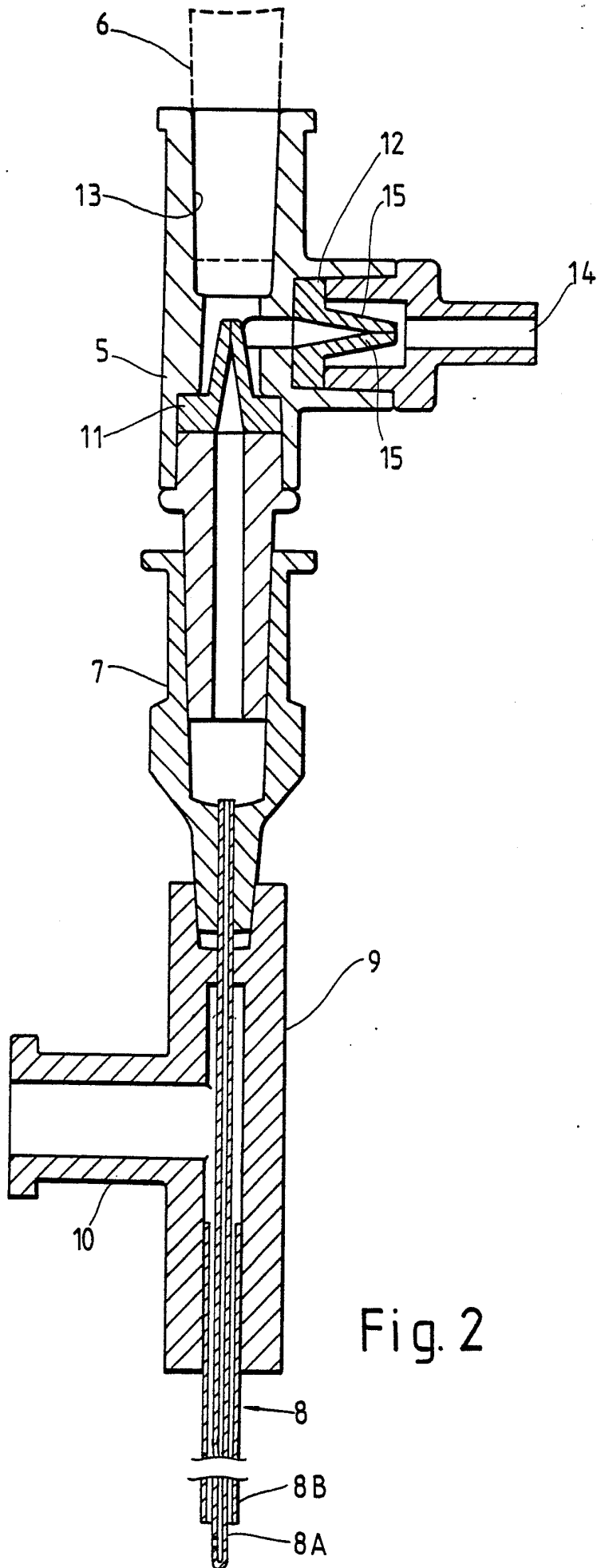
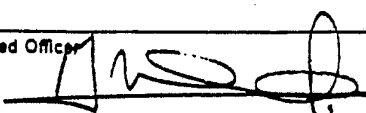


Fig. 2

INTERNATIONAL SEARCH REPORT

International Application No **PCT/GB 87/00291**

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ⁴ : A 61 F 9/00		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC ⁴	A 61 F; A 61 M	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	US, A, 3957052 (TOPHAM, S.C.) 18 May 1976 see figures 1,2; abstract --	1
A	US, A, 2224575 (PONCE, J.L.M.-G.) 10 December 1940 see figures 1-6 --	1
A	US, A, 3776238 (PEYMAN, G.A.) 4 December 1973 see abstract -----	1
<p>⁹ Special categories of cited documents: 10</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
10th July 1987		5 AUG 1987
International Searching Authority EUROPEAN PATENT OFFICE		Signature of Authorized Officer M. VAN MOL 

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/GB 87/00291 (SA 17076)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 21/07/87

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 3957052	18/05/76	None	
US-A- 2224575		None	
US-A- 3776238	04/12/73	None	

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