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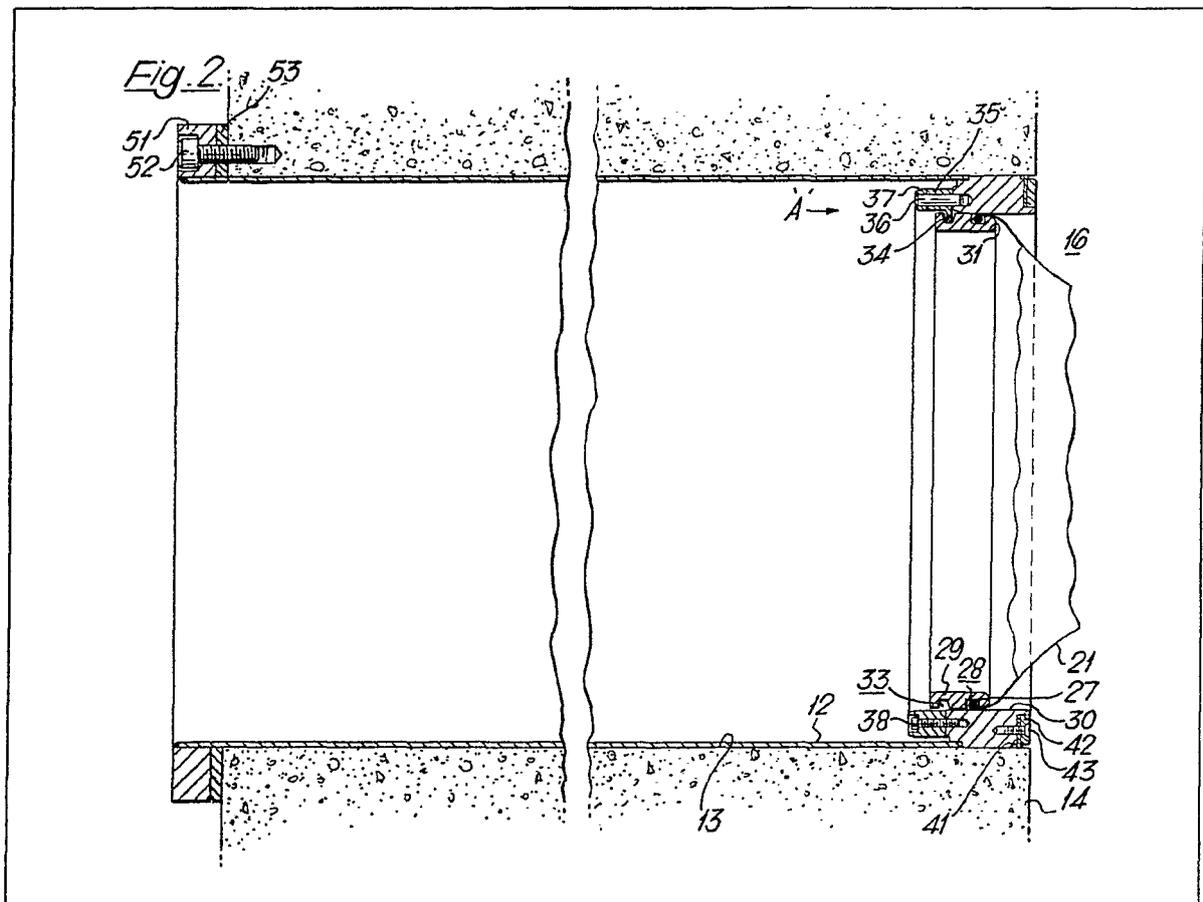
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(54) Seals

(57) An aperture 13 through a biological shield is sealed by a flexible sheath 21 having a beading 27 at one end located on an annular member 29 slidable in the aperture 13 such that

the beading 27 bears in sealing engagement against the sides of the aperture 13. The annular member 29 is retained by a retractable latch 34, and can be rejected by pushing it out of the aperture 13 using a replacement annular member 29 with a replacement sheath 21 thereon to butt against the annular member 29 to be rejected.

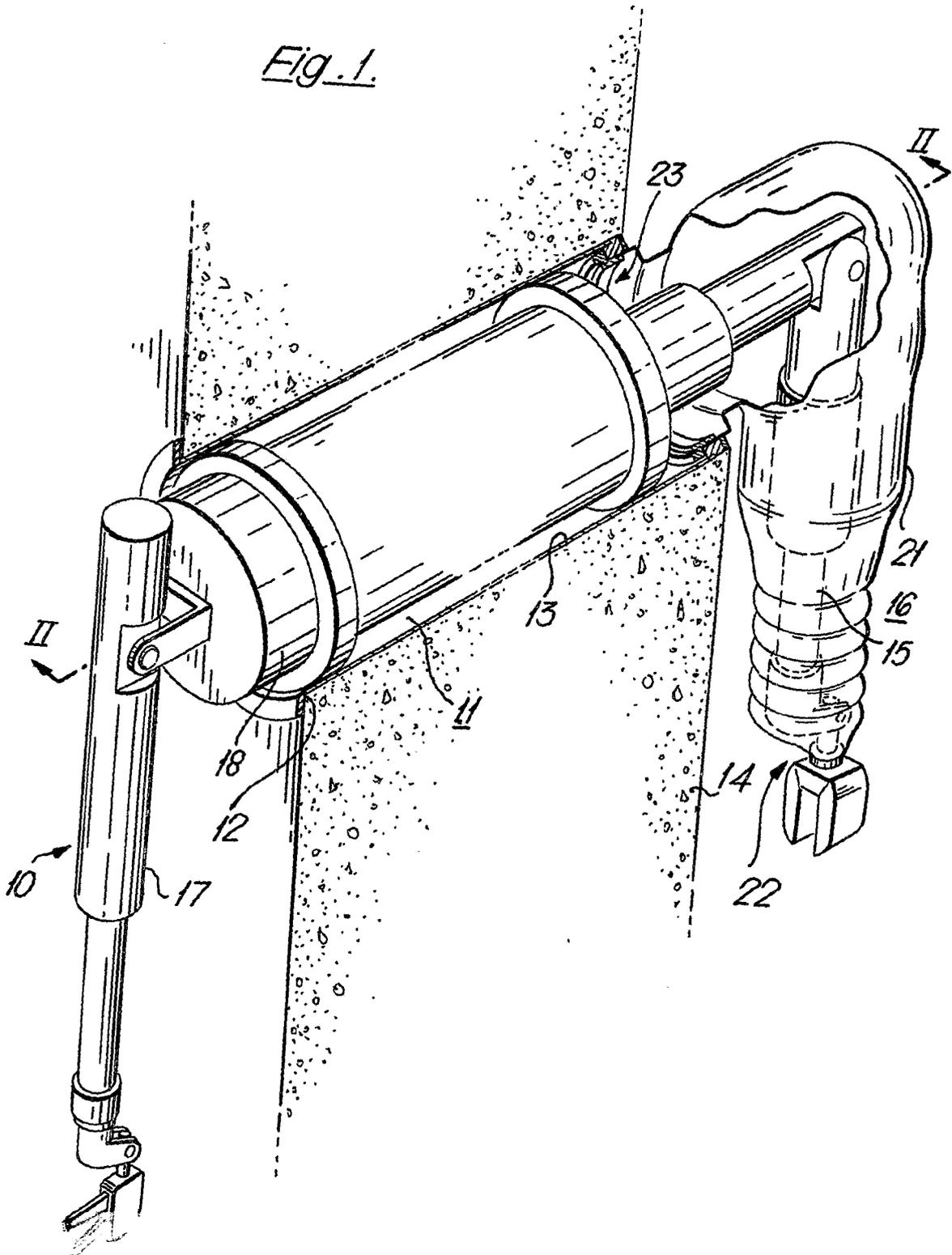
The replacement annular member 29 may be mounted on a tubular device (62, Fig. 3, not shown) having an outer co-axial member (75) for operating the latch 34 when the replacement annular member 29 butts against the annular member 29 to be rejected.



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Fig. 1.



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Fig. 2a.

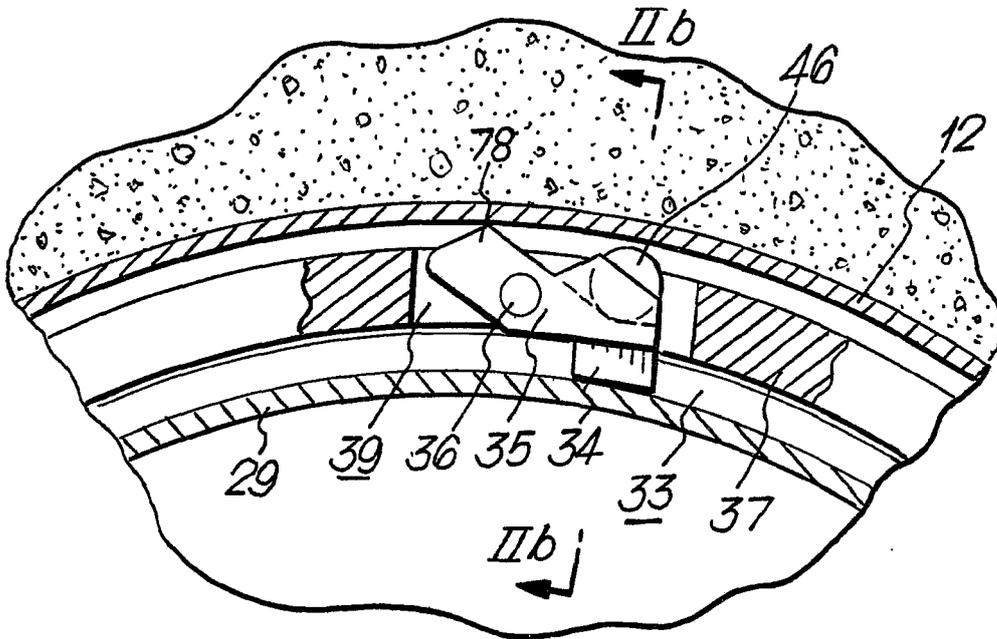
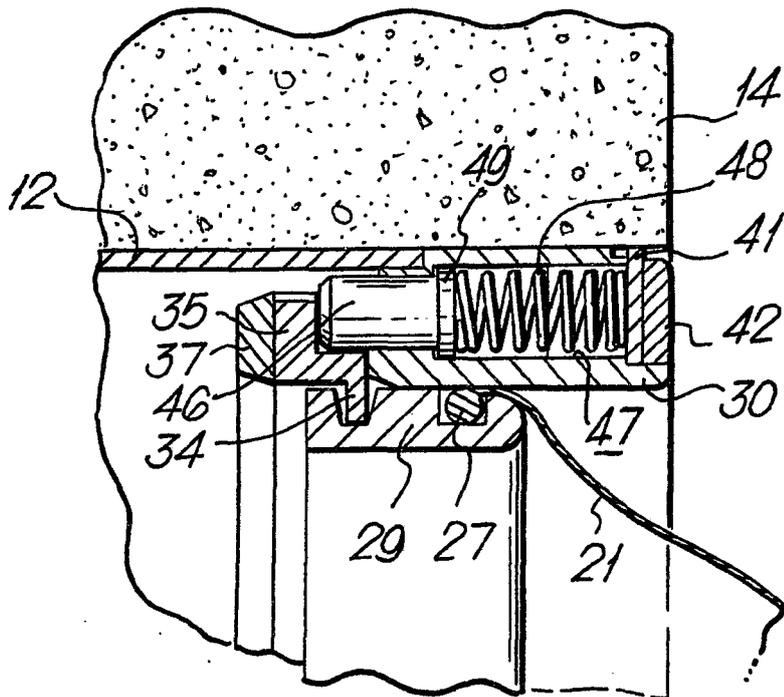
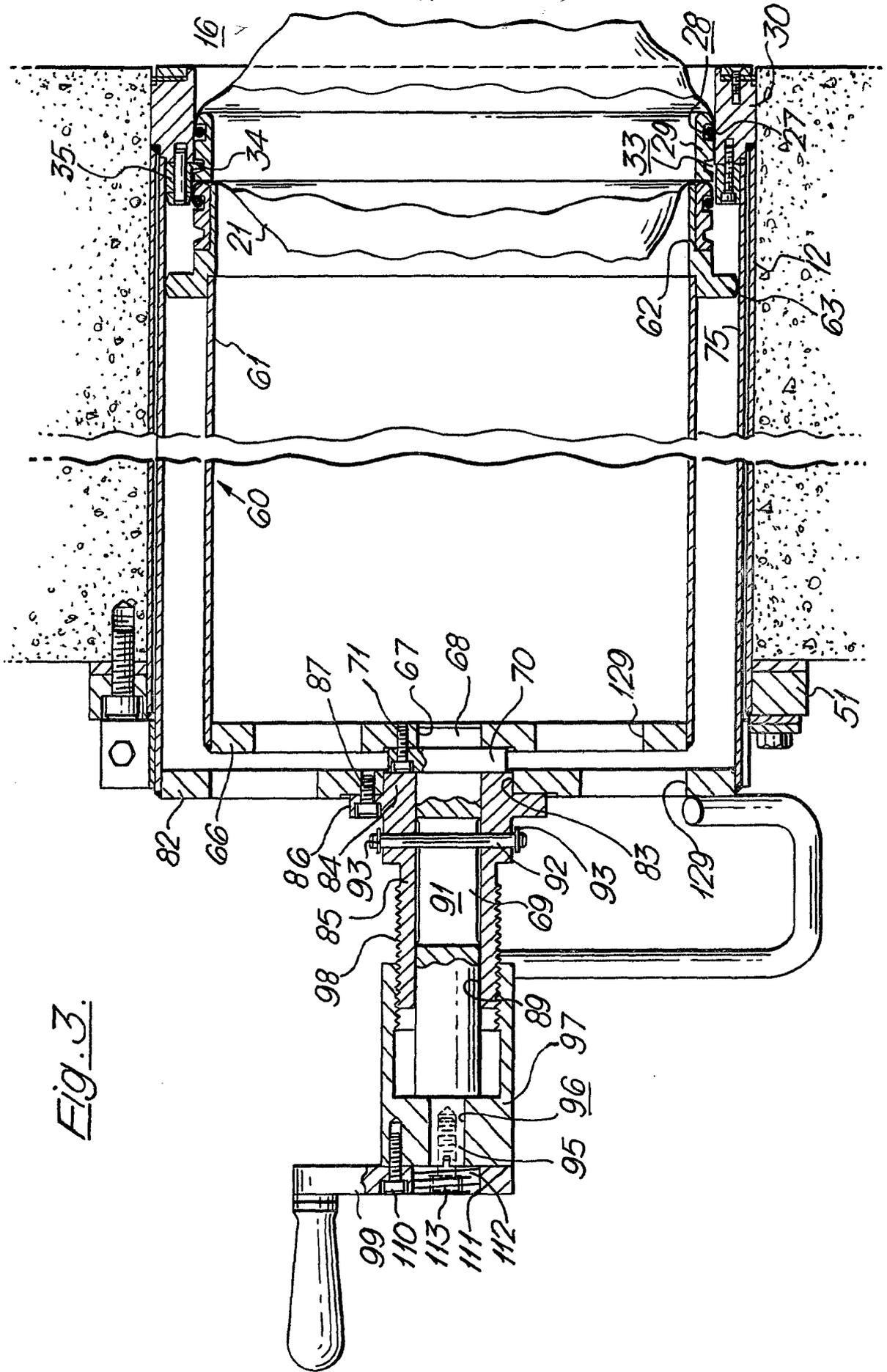


Fig. 2b.



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Fig. 3b.

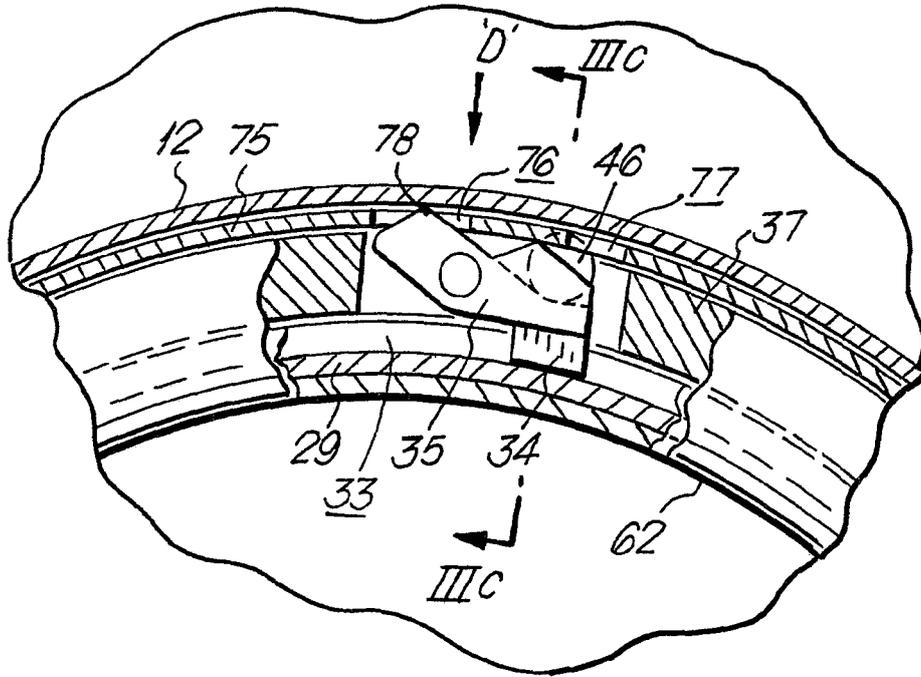


Fig. 3c.

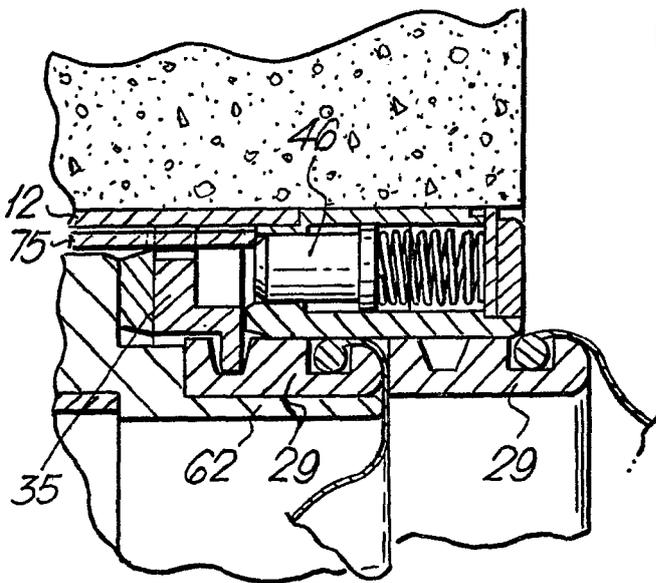
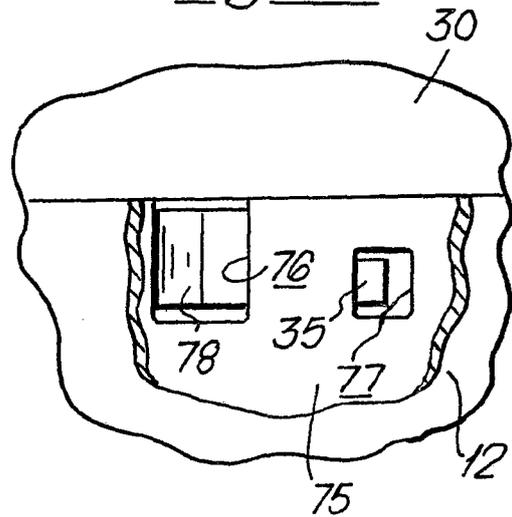


Fig. 3d.



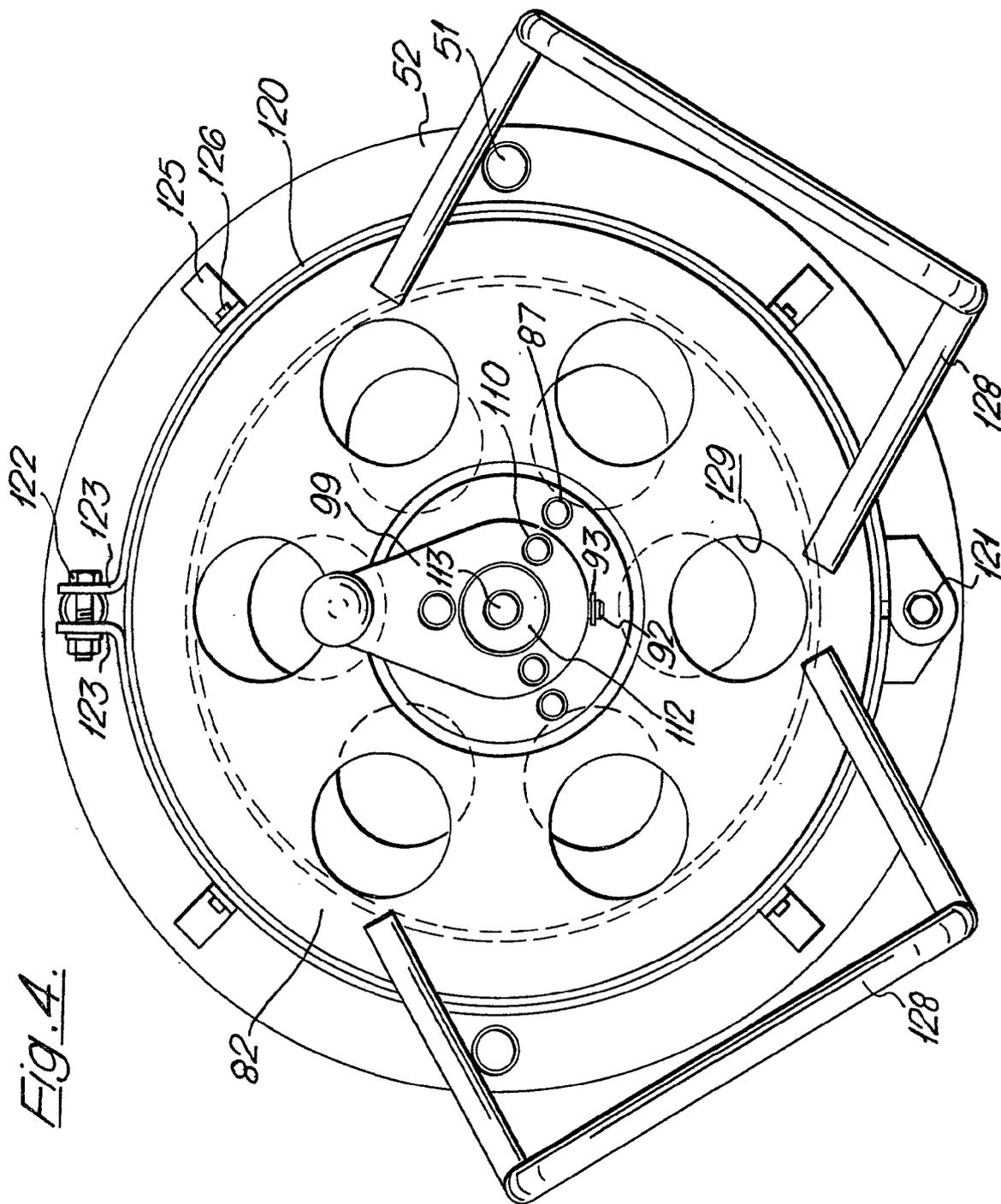


Fig. 4.

SPECIFICATION

Improvements in or relating to seals

This invention relates to an apparatus for effecting a seal between a remote handling equipment and a wall through which the equipment extends. The remote handling equipment might comprise a tong or a master/slave manipulator for handling items in an enclosure defined by the wall and containing a hostile environment.

Air tight seals are usually necessary between the remote handling equipment and the wall, and although it might be relatively straightforward to replace those seals readily accessible from the outside of the enclosure, those seals at or near the inside of the enclosure present difficulties in replacement since access to them from within the enclosure may be severely restricted or even impossible.

Commonly, part of the equipment that extends into the enclosure is arranged to be sheathed in a flexible gaiter or a tubular bellows, and if such gaiters or bellows become damaged it is necessary to replace them without an unacceptable leakage from the enclosure of the hostile environment.

According to the present invention, there is provided an apparatus for sealing an aperture through a wall, the apparatus comprising an annular member slidably locatable in the aperture and shaped to provide a location for a flexible sheath for sealing the space inside the annular member, means for providing a seal between the annular member and the wall, and latching means for retaining the annular member in the aperture.

Preferably, the sealing means comprises a circumferential groove provided in the annular member for locating an annular seal at one end of the sheath so as to present said annular seal in sealing engagement with the wall.

Desirably, the latching means comprises at least one latch movable into the aperture, and a catch for receiving the latch and provided by the annular member.

The apparatus of the invention enables a sheath to be replaced from outside the enclosure since a replacement annular member with a sheath located thereon can be abutted against the annular member to be rejected and the latch withdrawn from the catch of the rejected annular member to enable the rejected annular member to be subsequently pushed out of the aperture into the enclosure by the replacement annular member, the latch then being released to engage the catch of the replacement annular member.

Thus the invention further includes a device for expelling from an aperture through a wall having therein an apparatus of the invention, a said annular member, and for inserting a replacement said annular member in the aperture, the device comprising a mounting for the replacement annular member, means for operating the latching means of the apparatus, and means for moving the mounting in a manner to cause the

replacement annular member thereon to butt against and expel from the aperture the said annular member.

Preferably, the operating means is of elongate tubular form having a shaped end to cooperate with a pivotable latch of the latching means such that rotation of the operating means pivots the latch. The shaped end may be adapted to cooperate with the latch to interlock with the latch when the latch is withdrawn from the catch.

Desirably, the means for moving the mounting comprises screw thread means connected at one end to the operating means and at the other end to the mounting means.

In order to ensure accurate positioning of the replacement annular member in the aperture, stop means are desirably provided to limit the longitudinal movement of the mounting means in the aperture.

The invention will now be further described by way of example only with reference to the accompanying drawings, in which:—

Figure 1 shows a perspective view of a master/slave manipulator installed in an aperture of a biological shield;

Figure 2 shows to an enlarged scale a sectional view on the line II—II of Figure 1 but with the manipulator removed;

Figure 2a shows a fragmentary partly cut-away view in the direction of arrow 'A' of Figure 2;

Figure 2b shows a fragmentary sectional view on the line IIb—IIb of Figure 2a;

Figure 3 shows a sectional view of a device for changing a sheath in the aperture of Figure 2;

Figure 3a shows a fragmentary sectional view of a stage in the operation of the device of Figure 3;

Figure 3b shows a fragmentary partly cut-away view in the direction of arrow 'B' of Figure 3a;

Figure 3c shows a fragmentary sectional view on the line IIIc—IIIc of Figure 3b;

Figure 3d shows a fragmentary partly cut-away view in the direction of arrow 'D' of Figure 3b; and

Figure 4 shows a view in the direction of arrow 'X' of Figure 3.

Referring now to Figure 1, a conventional master/slave manipulator 10 is shown extending through a circular aperture 11 in a steel liner 12 which extends through a circular aperture 13 in a concrete biological shield 14. A slave arm 15 of the manipulator 10 extends in an enclosure 16 held at a negative pressure and containing a hostile environment e.g. a radioactive enclosure, and is connected to a master arm 17 by a through tube assembly 18.

A sheath in the form of a flexible gaiter 21 of a plastics film material such as PVC, or polyurethane, is joined at one end to a wrist portion 22 of the slave arm 15 in a conventional manner, and at its other end is joined to a sealing apparatus 23 constructed in accordance with the invention and shown in greater detail in Figures 2 and 2a to which reference is now made.

In Figures 2 and 2a from which the manipulator 10 has been omitted for clarity, the gaiter 21 has a

beading 27 which is trapped in a circumferential groove 28 in an annular member 29 so as to be pressed against the inside surface of a steel rim 30 extending from the liner 12, the annular

5 member 29 having a rounded end 31 to reduce any likelihood of the gaiter 21 snagging on the annular member 29. A circumferential groove 33 having outwardly diverging sides is also provided in the annular member 29 and locates a latch in
10 the form of a tang 34 of three equi-spaced pawls 35 (only one is shown) which are pivotable about a respective pin 36 located at one end in the rim 30 and at its other end in a steel clamping plate 37 secured to the rim 30 by a plurality of screws
15 38 (only one is shown), the pawls 35 being located in respective spaces 39 in the clamping plate 37.

A sealing member 41 of elastomeric material (e.g. rubber) is trapped by a steel clamping plate
20 42 secured by screws 43 (only one is shown) to the rim 30 so as to bear against the shield 14 in the circular aperture 13.

As shown in Figure 2*b*, a plunger 46 having a shoulder 49 trapped in a cavity 47 in the rim 30 is
25 biased by a spring 48 against a respective pawl 35 to inhibit free pivotal movement of the pawl 35.

Referring again to Figure 2, the liner 12 has a flange 51 at that end of the liner remote from the enclosure 16 and secured by screws 52 (only one
30 is shown) to the shield 14, a gasket 53 (e.g. rubber) providing a seal between the flange 51 and the shield 14. Thus the liner 12 can be removed from the aperture 13 by removing the screws 52 and withdrawing the liner 12. However,
35 it is not necessary to do so to change the gaiter 21 on the annular member 29 as shown in Figures 3 to 4 to which reference is made.

Figures 3 and 4 show the arrangement of Figure 2 but with the addition of a device 60 for
40 changing the gaiter 21 of Figure 2. The device 60 comprises an aluminium alloy inner tube 61 having at one end an annular mounting 62 on which a replacement annular member 29 is located, and has a shoulder 63 which butts
45 against the clamping plate 37 when the inner tube 61 is fully inserted in the liner 12 (see Figure 3*a*). An end plate 66 at the other end of the inner tube 61 has an axial aperture 67 in which a spigot 68 from a rod 69 locates, and a flange 70 of the rod
50 69 is secured to the end plate 66 by screws 71 (only one is shown).

An outer tube 75 of an aluminium alloy extends co-axially with the inner tube 61 and when fully
55 inserted in the liner 12 butts at one end thereof against the rim 30 (see Figure 3*a*) thereby pushing the plunger 46 into the cavity 47 (see Figure 3*c*). As shown more clearly in Figures 3*b* and 3*c*, a slot 76 and rectangular recess 77 are provided in the
60 outer tube 75 at each pawl 35 position such that the outer tube 75 can be fully inserted through the liner 12 with the slots 76 aligned with a tail 78 of each pawl 35 and the outer tube 75 subsequently turned anti-clockwise to depress the tail 78 and thereby withdraw the tangs 34 from the groove
65 33, the rectangular recesses 77 providing a

location for the pawls 35 and interlocking the outer tube 75 with the pawls 35, thus trapping the outer tube 75 in the fully inserted position inside the liner 12.

70 An end plate 82 at the other end of the outer tube 75 has an aperture 83 in which a spigot 84 of a housing 85 locates, a flange 86 from the housing 85 being secured to the end plate 82 by three screws 87 (only one is shown). The housing
75 85 has a bore 89 in which the rod 69 is slidably located, and an axial slot 91 in the rod 69 locates a pin 92 extending radially across the housing 85 and retained by a circlip 93 at each end to inhibit rotation of the rod 69 and thus of the inner tube
80 61. A journal portion 95 of the rod 69 locates in a bore 96 of an internally threaded member 97 which engages a correspondingly externally threaded portion 98 of the housing 85 and is rotatable thereon by use of a handle 99 secured
85 by three screws 110 to the member 97, the handle 99 having an aperture 111 in which an end piece 112 locates and is secured to the journal 95 by a screw 113 so as to retain the member 97 on the journal 95.

90 A split band 120 having a hinge 121 fits around the outer tube 75 and is clamped thereon by a bolt 122 across outwardly directed ends 123 of the band 120. Four equi-spaced stops 125 are each secured by two screws 126 to the band 120 so as
95 to bear against the flange 51 and line up the outer tube 75 with the rim 30 and the pawl 35. Two handles 128 are each welded to the end plate 82 to facilitate handling of the device 60, and a plurality of lightening holes 129 are provided in
100 the end plates 82, 66, similar lightening holes (not shown) also being provided in the inner tube 61 and the outer tube 75.

To replace an annular member 29 with its gaiter 21 thereon, the gaiter 21 is detached at the
105 wrist 22 from the manipulator 10 in a known conventional manner and the manipulator 10 withdrawn from the biological shield 14. A replacement gaiter 21 is fitted in the groove 28 of a replacement annular member 29 which is then fitted onto the annular mounting 62 of the inner
110 tube 61 of the device 60. The device 60 is inserted into the aperture 11 with the inner tube 61 in the fully retracted position until the stops 125 bear against the flange 51 with the slots 76 in the outer tube 75 aligned with the respective
115 tails 78 of the tangs 34, the replacement member 29 being presented adjacent to the annular member 29 being rejected. The outer tube 75 is then turned anti-clockwise using the handles 99 to depress the tails 78 and pivot the pawls 35
120 anti-clockwise, thus withdrawing the tangs 34 from the annular grooves 33 and interlocking the pawls 35 with the outer tube 75. The handle 99 is rotated clockwise to cause the rod 69 to move towards the end plate 82 and thus move the inner
125 tube 61 towards the rim 30 until the shoulder 63 butts against the plate 37 and the rim 30. The replacement annular member 29 therefore butts against the rejected annular member 29 which is consequently pushed along the rim 30 until the
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beading 27 of the rejected annular member 29 clears the rim 30 and the suction provided by the negative pressure in the enclosure 16 pulls the rejected annular member 29 into the enclosure

5 16. For a short period the beadings 27 of both the gaiters 21 are in contact with the rim 30 to ensure that no leakage from the enclosure 16 occurs during the operation. The outer tube 61 is turned clockwise to pivot the pawls 35 clockwise so that
10 the tangs 34 are inserted in the groove 33 of the replacement annular member 29 and the handle 99 then turned anti-clockwise to withdraw the mounting 62 from the replacement annular member 29, the device 60 subsequently being
15 withdrawn from the aperture 11. The manipulator 10 is replaced in the aperture 11, and the new gaiter 21 attached to the wrist 22 of the manipulator 10 in a conventional manner.

It will be understood that the manipulator 10 is
20 a conventional master/slave manipulator and known attachments are used for the gaiter 21 at the wrist 22.

It can be seen from the aforescribed example of the invention, that a gaiter at the hostile end of
25 an aperture through a wall enclosing a hostile environment may be changed in accordance with the invention without the need for personnel to enter the hostile environment.

Although the seal between the annular member
30 29 and the rim 30 is desirably provided by the beading (e.g. a trapped elastomeric 'O' ring) at the end of a gaiter 21, alternative sealing means may be used.

The invention has been described in relation to
35 an aperture for a master/slave manipulator, but can also be incorporated in an aperture through a lead shielding wall for a remote handling tong.

CLAIMS

1. An apparatus for sealing an aperture through
40 a wall, and comprising an annular member slidably locatable in the aperture and shaped to provide a location for a flexible sheath for sealing the space inside the annular member, means for providing a seal between the annular member and the wall,
45 and latching means for retaining the annular member in the aperture.

2. An apparatus as claimed in Claim 1, wherein the sealing means comprises a circumferential groove provided in the annular member for
50 locating an annular seal at one end of the sheath, so as to present said annular seal in sealing engagement with the wall.

3. An apparatus as claimed in Claim 1 or Claim 2, wherein the latching means comprises at least
55 one latch movable into the aperture, and a catch for receiving the latch and provided by the annular member.

4. An apparatus as claimed in Claim 3, wherein the latching means includes a resiliently biased
60 member arranged to cooperate with the latch for inhibiting free movement of the latch when the latch is located in the catch.

5. An apparatus as claimed in Claim 4, wherein the resiliently biased member is arranged to locate
65 in a cavity in the latch so as to inhibit said free movement of the latch.

6. An apparatus as claimed in any one of Claims 3 to 5, wherein the latch is pivotally mounted in the aperture.

7. An apparatus as claimed in any one of Claims 3 to 6, wherein the catch is provided by a circumferential groove in the annular member.

8. An apparatus as claimed in any one of Claims 3 to 7, including a liner for the aperture,
75 and wherein the latch and the resiliently biased member are supported by the liner.

9. An apparatus as claimed in Claim 8, wherein the seal is provided between the liner and the annular member.

10. An apparatus as claimed in any one of Claims 3 to 9, including means for withdrawing the latch from the catch, the latch being shaped to cooperate with the withdrawing means.

11. A device for expelling from an aperture
85 through a wall having therein an apparatus as claimed in any one of Claims 1 to 9, a said annular member of the apparatus, and for inserting a replacement said annular member in the aperture, the device comprising a mounting for the replacement annular member, means for operating the latching means of the apparatus, and means for moving the mounting in a manner to cause the replacement annular member thereon to butt against and expel from the aperture the
90 said annular member of the apparatus.

12. A device as claimed in Claim 11, wherein the operating means is of elongate tubular form having a shaped end to cooperate with a pivotable
100 latch of the latching means such that rotation of the operating means pivots the latch.

13. A device as claimed in Claim 12, wherein the shaped end is adapted to cooperate with the latch to interlock with the latch when the latch is withdrawn from the catch.

14. A device as claimed in Claim 13, wherein the interlock is provided by a portion of the latch being locatable in a recess in the shaped end.

15. A device as claimed in any one of Claims 11 to 14, wherein the means for moving the mounting comprises screw thread means connected at one end to the operating means and at the other end to the mounting means.

16. A device as claimed in any one of Claims 11 to 15, including stop means for limiting longitudinal movement of the mounting means in the aperture.

17. Apparatus for sealing an aperture through a wall, substantially as hereinbefore described with reference to Figures 1, 2, 2a, and 2b of the accompanying drawings.

18. A device for cooperating with an apparatus as claimed in Claim 17, substantially as hereinbefore described with reference to Figures 3, 3a, 3b, 3c, 3d and 4 of the accompanying drawings.