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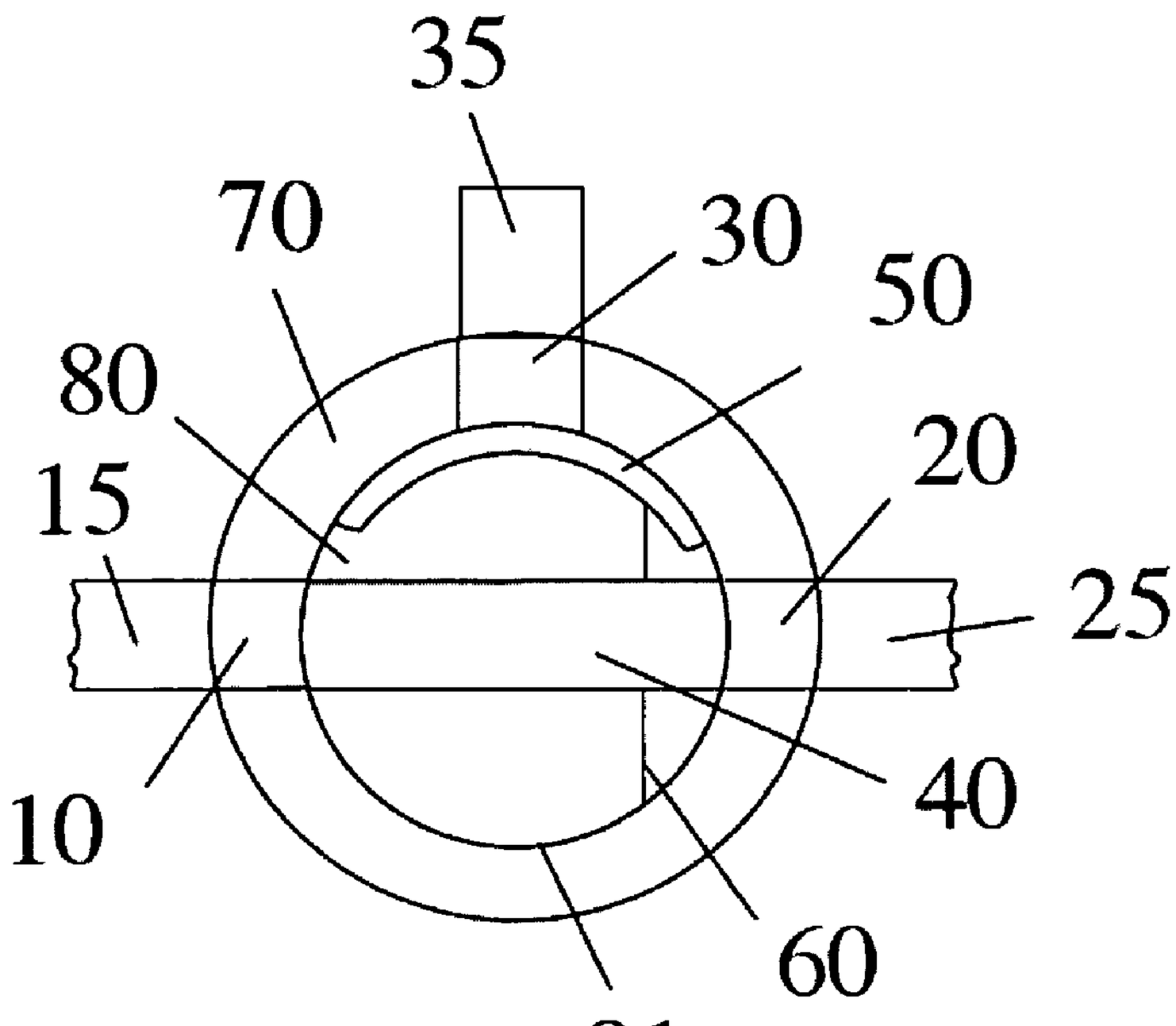


Fig. 1

(57) Abrégé/Abstract:
The invention relates to a multifunction valve (1) comprising at least three connections (10, 20, 30), wherein a first connection (10) can be connected to a catheter, a second connection (20) to an infusion, and a third connection (30) to a pressure transducer. In a

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(57) Abrégé(suite)/Abstract(continued):
first position, the first and second connections (10, 20) are connected to each other via a first channel (40); in a second position, the first and third connections (10, 30) are connected to each other via a second channel (50), and the second and third connections (20, 30) are connected to each other via a third channel (60, 61); and in a third position, the second and third connections (20, 30) are connected to each other via the second channel (50), and the first connection(10) is closed. The third channel (60, 61) has a smaller diameter than the second channel (50).

(54) Title: MULTIFUNCTION VALVE

(57) Abstract: A multifunction valve (1) comprising at least three connections (10, 20, 30), wherein a first connection (10) can be connected to a catheter, a second connection (20) to an infusion and a third connection (30) to a pressure transducer, wherein in a first position the first and second connections (10, 20) are connected to each other via a first channel (40), in a second position the first and third connections (10, 30) are connected via a second channel (50), and the second and third connections (20, 30) are connected to each other via a third channel (60, 61), in a third position the second and third connections (20, 30) are connected to each other via the second channel (50), and the first connection (10) is closed, and the third channel (60, 61) has a smaller cross-section than the second channel (50).

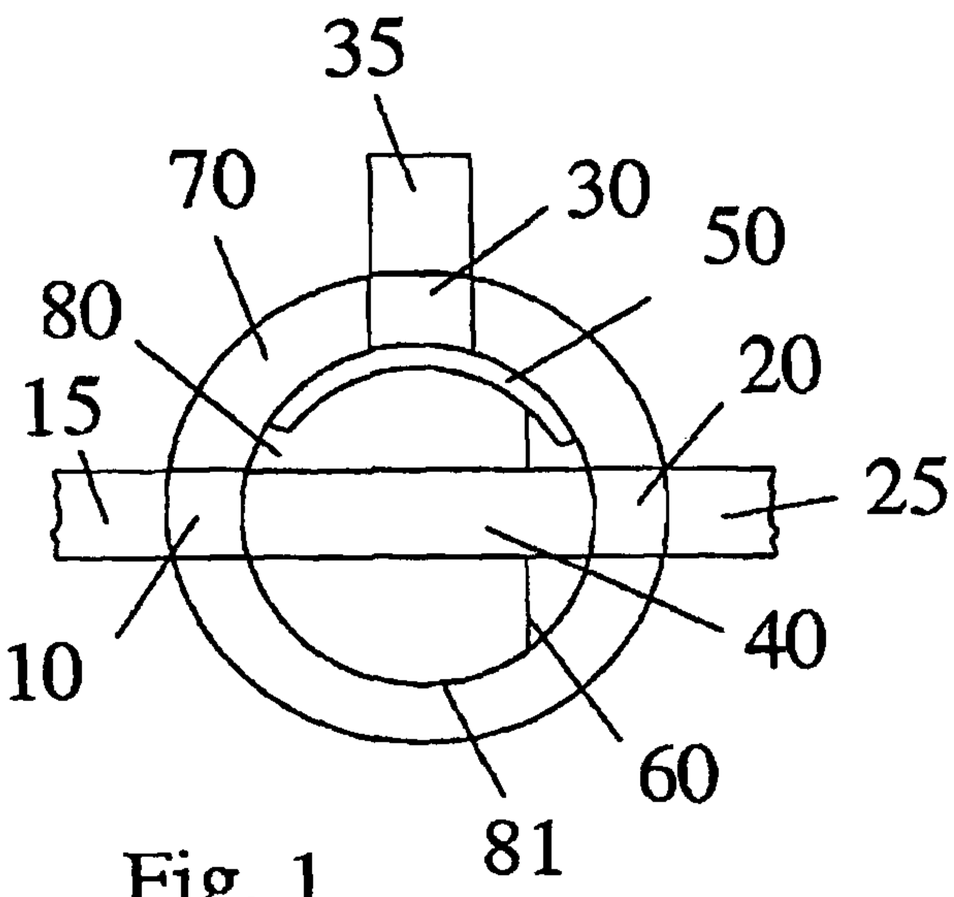


Fig. 1

Multifunction valve

The invention relates to a multifunction valve comprising at least three connectors.

A stopcock comprising a housing defining at least three connectors is known in the prior art from WO 2006/025054 A2.

Mounting pressure transducers on a retaining plate which is located at a distance of approximately 150 cm away from a patient is known in the prior art. This requires that an at least equally long pressure line be provided. However, the measurement results become inaccurate due to effects of this long pressure line. Touching the pressure line can also distort the measurement results.

It is not possible to connect a pressure transducer in such a way using standard components that a pressure signal can be recorded with high accuracy and precision close to the catheter tube, without detriment to basic functions of such a measuring system, such as flushing and blood withdrawal.

This gives rises to the object of providing a device with which a pressure signal can be recorded with high accuracy and precision, and which simultaneously provides basic functions, such as flushing, blood withdrawal and zeroing of the pressure transducer.

This object is achieved by a multifunction valve comprising at least three connectors, wherein a first connector can be connected to a catheter, a second connector to an infusion and a third connector to a pressure transducer, wherein in a first position the first and second connectors are connected to each other via a first channel, in a second position the first and third connectors are connected via a second channel, and the second and third connectors are connected to each other via a third channel, in a third position the second and third connectors are connected to each other via the second channel, and the first connector is closed, and the third channel has a smaller cross-section than the second channel. It is advantageous that the pressure transducer be protected when a wire is pushed between the second and first connectors. The wire is guided in the first channel, which in the first position has no connection to the pressure transducer, thus preventing any contact between the wire and the pressure transducer. The introduction of gel by the wire into the catheter from a gel transfer membrane of a pressure sensor is also prevented in this manner.

The multifunction valve preferably used is a multipath stopcock which controls flow between three connectors. It is particularly preferred to use a stopcock which can block one or several paths connected to it.

The connectors are preferably biocompatible. The connectors are preferably liquid-tight as well, so that they can be connected to hypodermic needles, syringes, infusion tubes, catheters and/or pressure transducers. The connectors are preferably provided with a thread and a cap nut in order to secure and lock the connector against inadvertent release. The connectors are preferably cylindrical, particularly preferably cone-shaped. The connectors on the multifunction valve are preferably internal cones or internal cylinders. In another preferred embodiment, the connectors on the multifunction valve are external cones or external cylinders. The connector is preferably connected by pushing together it and the components to be connected. The connectors of the multifunction valve are preferably blunt and configured for adhesive connection. Likewise preferred is a connection produced by squeezing or clamping. This connection is opened and closed particularly preferably by one turn, and most highly preferably by one half-turn. The connectors are particularly preferably configured as Luer lock connectors.

The catheter used can be any catheter that has an open lumen. It is preferable to use heart catheters or vein catheters and it is especially preferred to use arterial catheters. The catheters used are capillaries or tubes with which hollow organs can be probed, evacuated, filled and/or flushed, or with which the pressure is said hollow organs can be measured.

The infusion fluids are preferably administered intravenously or intra-arterially. The fluids preferably used are flushing solutions, blood, blood substitutes, plasma substitutes, electrolyte solutions, non-ionic solutions and/or pharmaceuticals. Glucose solution, saline solution and Ringer's lactate solution are particularly preferably used.

The pressure transducer preferably measures the absolute pressure, and particularly preferably the pressure differential. The size of the pressure transducer is preferably between 1/10 mm and 10 cm.

The first channel is preferably a recess in the multifunction valve, particularly preferably a through hole. The second channel is preferably a through hole, particularly preferably a recess in the multifunction valve. The third channel is preferably a recess in the multifunction valve, particularly preferably a through hole.

In the second position, the pressure of the gas and/or fluid fed through the second channel can be measured via the third connector, while the multifunction valve is simultaneously flushed via the third channel. Since the third channel has a smaller cross-section than the second channel, flushing has a minimal influence on the pressure.

The cross-sectional area of the channels correspond to the area of the surface exposed with a cut at an angle of 90° to the longitudinal axis of the channel.

The first and second connectors lie preferably opposite one another. As a result, gases and/or fluids can proceed from the first into the second connector, or vice versa, without changes in the direction of flow. Energy losses due to friction and/or turbulence on the part of the gases and/or fluids flowing through the connectors are minimized as a result.

The first and second connectors are preferably open towards opposite sides of a plane which extends between the first and second connectors. A particularly preferred embodiment is one in which the angle between the first and second connectors is greater than 90°. It is particularly preferred that the angle between the first and second connectors is 180°.

The multifunction valve preferably has a housing. The housing protects the interior of the multifunction valve and seals off the interior of the multifunction valve against the ambient surroundings. The housing is preferably liquid-tight, so that fluids are unable to escape from the interior to the ambient surroundings.

Markings for one or several switch positions are preferably provided on the housing of the multifunction valve. In addition, the housing preferably has catches for one or several switch positions. It is particularly preferred that the housing has stops for one or several switch positions.

The pressure transducer is preferably connected to the housing, and it is particularly preferred that the pressure transducer is mounted directly in or on the housing. By this means, the pressure can be measured directly in or on the multifunction valve. In this way, measurements with high temporal resolution can be achieved. This measurement is therefore especially suitable for analyzing the natural shape of a pressure curve. Negative effects of additional tube lines are also eliminated in this way.

The third channel is particularly preferably a capillary. As a consequence, the effect of flushing on the result of pressure measurement is especially slight.

The capillary is preferably a very fine, elongated cavity. A particularly preferred embodiment is one in which the capillary is a glass capillary or a lasered hole.

The length of the capillary is preferably between 1/10 mm and 12 mm, and the diameter is preferably between 1/100 mm and 4/10 mm. Flow volumes of between 2 and 20 ml per hour can thus be achieved when the flushing solution is impinged with standard pressures of approximately 300 mm Hg.

The first channel, the second channel and the third channel are preferably arranged in a switching mechanism that can be turned inside the housing. The connectors are thus connected in a simple manner via the channels and according to the different positions. The third channel is provided particularly preferably in the housing, or partly in the housing and partly in the switching mechanism. If the third channel is provided partly or completely in the housing, it is preferably embodied as a capillary.

The switching mechanism is preferably adapted to influence the direction or strength of throughflow. This is particularly preferably achieved by means of a mechanical component that can influence the flow by its position or change of position. It is particularly preferred that the switching mechanism can be turned inside the housing. The switching mechanism can preferably be turned about one of its own axes. It is particularly preferred that the switching mechanism is in two parts, since this allows it to be produced in a particularly simple manner.

The first channel preferably has slight kinks with an angle of less than 6°. The first channel is embodied particularly preferably as a through hole. As a result, the first and the second connectors can be connected in a simple manner in the first position. This also makes it easier to use a guide wire. In the case of kinks with angles greater than 6°, the guide wire might suffer damage or cause abrasion in the lumen. This also prevents changes in the direction of a gas or liquid flowing through the first channel.

The through hole preferably has openings at the two opposite ends of its longitudinal axis. A particularly preferred embodiment is one in which the openings are both as large as the cross-section of the through hole. It is particularly preferred that the cross-section of the through hole is equal in size in all regions of the through hole.

The first channel preferably runs transversely through the switching mechanism. In this way, the first and second connectors can be connected to each other in a particularly simple manner.

The first channel preferably runs non-parallel to the turning axis of the switching mechanism. In a particularly preferred embodiment, the first channel extends in a direction that is perpendicular to the turning axis of the switching mechanism. It is particularly preferred that the first channel intersects the turning axis of the switching mechanism.

A direction vector of the first channel, a direction vector of the third channel and a vector which points from a reference point of the first channel to a reference point of the third channel are preferably linearly independent. A direction vector of the first channel is a vector which points in the first position

of the multifunction valve in the direction of flow of a fluid from the first connector to the second connector. A direction vector of the first channel is a vector which points in the second position of the multifunction valve in the direction of flow of a fluid from the third connector to the second connector.

Linearly independent preferably means that none of the vectors can be depicted as a linear combination of the other vectors.

The first channel and the third channel are preferably not connected to each other. This prevents the first channel from being filled via the third channel in the second and third positions.

There is preferably no way for fluids to pass through between the first and the third channel, and it is particularly preferred that there is no way for gases to pass through.

The second channel is preferably embodied as a groove in the switching mechanism. This means that the second channel can be produced in a particularly simple manner.

The groove is preferably a recess in the switching mechanism. A particularly preferred embodiment is one in which the groove is an elongated recess.

The second channel preferably runs substantially in the circumferential direction of the switching mechanism. This makes it possible for connectors that are arranged in the circumferential direction to be connected to each other in a simple manner.

The second channel preferably extends along more than 50% of its length in the circumferential direction of the switching mechanism. It is particularly preferred that it extends along more than 70% of its length in the initial direction of the switching mechanism.

The second and third channels are preferably connected to each other. This makes it possible to connect three connectors to each other.

The second and third channels are preferably connected by a passage for gases, and particularly preferably by a passage for fluids.

The second channel preferably has a dilation in an end portion and is connected in the region of the dilation to the third channel. This makes it particularly simple to guide the third channel past the first channel.

The dilation of the second channel preferably extends in the end portion in the longitudinal direction of the switching mechanism. The third channel

preferably ends in the region of the channel that extends in the longitudinal direction of the switching mechanism.

The second channel is preferably embodied as a through hole. In this way, the wetted sealing faces between the housing and the switching mechanism are small when measuring the pressure. The formation of deposits can be prevented particularly well in this way.

The cross-section of the second channel is preferably identical over the entire length of the channel. It is particularly preferred that the channel has a round cross-section. As a result, the flow characteristics of a fluid flowing through the channel are modified to a particularly small extent.

A catheter system preferably has a multifunction valve that can be connected to a catheter tube. In this way, a catheter system is provided that can be connected via the catheter tube to the body of a patient and which can be connected via the multifunction valve to medical apparatus.

A catheter system is a system that preferably has a plurality of components, wherein one of the components is a catheter tube.

A catheter tube is a tube made of metal, glass or preferably plastic, and particularly preferably of silicone, polyethylene or polyurethane, with which hollow organs can be probed, evacuated, filled or flushed, or with which the pressure therein can be measured. The tube is preferably deformable.

The catheter system preferably has a multifunction valve to which a pressure transducer can be connected. By this means, the pressure in the catheter tube can be measured. The measured pressure values are particularly accurate and precise because measurements are carried out very close to the section of the patient's circulation that is of interest.

The catheter system preferably has a pressure transducer to which a plug connector can be connected. By this means, it is possible for apparatus to be connected to the pressure transducer. These apparatus are preferably alarm devices that generate an optical, preferably acoustical alarm when the pressure exceeds and/or falls below a critical pressure. These apparatus are particularly preferably recording devices for recording the pressure. The pressure is preferably recorded as a printout, particularly preferably in electronic, analog, digital or numerical form and particularly preferably in the form of a graph.

A plug connector is a connector with which electricity, preferably optical signals, particularly preferably electrical signals are transferred from one module to another module.

A device preferably has a catheter system that can be connected to a blood withdrawal port. In this way, blood can be withdrawn from a patient in a particularly simple manner. Preferably, the catheter system is not open to the atmosphere. This prevents any contamination of the patient's blood by bacteria and viruses.

A blood withdrawal port is a closable opening for removing blood. The blood withdrawal port is embodied as a screw connection with a cover, preferably as a plug connector with a cover, and particularly preferably as a component that can be pierced through. The piercable material is made of a tough material such as plastic, preferably gel. The piercable component can be pierced by a needle and preferably closed again as soon as the needle is pulled out.

The device preferably has a catheter system that can be connected to a reservoir that has a movable piston. By this means, pharmaceuticals can be administered to a patient in a particularly simple manner.

The reservoir with movable piston is a cavity for receiving substances. The substances can preferably be moved from the cavity by means of the movable piston. The reservoir with movable piston is preferably a syringe. The syringe is preferably provided with a thread on its end. In this way, the syringe can be replaced. The syringe preferably has glass components, and it is particularly preferred that the syringe is made of plastic.

The device preferably has a catheter system that can be connected to a calibration or zero adjustment device. This allows a compensating pressure on the pressure transducer to be generated.

The calibration device is preferably a bypass stopcock with a least two connectors. One of the connectors is preferably connected to the catheter system. The second connector is preferably open to the atmosphere. The bypass stopcock can preferably be put into different positions, wherein the catheter system is preferably connected to the atmosphere in at least one of the positions. It is particularly preferred that the calibration device has a third connector to which a safety valve is preferably connected. In the position of the bypass stopcock in which the catheter system is connected to the atmosphere, the pressure transducer is exposed to atmospheric pressure so that it can be calibrated. There are special pressure sensors which are so accurate by default that calibration with a special calibration device i not necessary.

The device preferably has a catheter system that can be connected to a safety valve. By this means, the device can be closed in a simple manner.

The safety valve is a valve with which a flow in the device can be limited; when injecting, in particular, any reflux into the flush bag can thus be prevented.

The safety valve is preferably provided with a flushing capillary. This ensures continuous flushing of the device, in particular with fluids such as NaCl solution, and also allows the administration of fluid.

The device preferably has a catheter system that can be connected to a drip chamber.

The drip chamber is a device for channeling fluids and which preferably interrupts the film of fluid. The drip chamber is a container with preferably two connectors. A drip generator is preferably connected to the first connector. The fluid is preferably introduced dropwise into the drip chamber by the droplet generator. The fluid is preferably collected in the drip chamber. The fluid is preferably dispensed again from the drip chamber.

The device preferably has a catheter system that can be connected to a flush bag. In this way, it is possible to flush the device in a simple manner by means of a flushing solution device.

The flushing solution device is preferably a syringe pump, particularly preferably a pressurized flush bag or bottle.

The flush bag is a bag that is preferably adapted to receive a flushing solution. The flush bag consists preferably of plastic, particularly preferably of transparent plastic. This enables the filling level to be seen. The flush bag preferably has at least one connector for connecting it to other components. The flush bag is preferably deformable and pressure is pneumatically applied to it by means of a surrounding hollow bag. By this means, fluid can be dispensed from the flush bag without another fluid having to be added.

The invention shall now be described with reference to the attached Figures, in which

Fig. 1 shows a cross-section of a three-way stopcock according to the invention, in a first position;

Fig. 1a shows a side view of the switching mechanism of the three-way stopcock shown in Fig. 1;

Fig. 2 shows a cross-section of the inventive three-way stopcock shown in Fig. 1, in a second position;

Fig. 3 shows a cross-section of the inventive three-way stopcock shown in Fig. 1, in a third position;

Fig. 4 shows a cross-section through a second embodiment of a three-way stopcock according to the invention;

Fig. 4a shows a side view of the switching mechanism of the three-way stopcock shown in Fig. 4;

Fig. 5a shows a cross-section through a third embodiment of a three-way stopcock according to the invention, in the first position;

Fig. 5b shows a cross-section through the third embodiment of the three-way stopcock according to the invention, in the second position; and

Fig. 5c shows a cross-section through the third embodiment of the three-way stopcock according to the invention, in the third position;

Fig. 5d shows a side view of the switching mechanism of the three-way stopcock shown in Figs. 5a, 5b and 5c;

Fig. 6 shows a schematic view of a monitoring catheter set;

Figs. 7a-c show a schematic illustration of a fourth embodiment of the three-way stopcock;

Figs. 8a-c show a schematic illustration of a fifth embodiment of the three-way stopcock;

Fig. 9 shows a cross-section through a schematic illustration of a sixth embodiment of the three-way stopcock;

Figs. 10a-b show views of a lever;

Figs. 11a-b show views of a second lever;

Fig. 12a-d show views of a slide mechanism;

Fig. 13a-d show views of a mechanism for turning the halves of the housing counter to each other and

Figs. 14a-f show views of a rocker switch.

Fig. 1 shows a three-way stopcock in a first position. Three-way stopcock 1 has a housing 70 of annular cross-section and made of plastic. The diameter of housing 70 is 6 mm. Housing 70 has three connectors 10, 20, 30. The three

connectors 10, 20, 30 lie in the same cross-sectional plane. The first and second connectors 10, 20 lie opposite one another. The third connector 30 lies on the cross-section of the housing and in a position of 90° rotation relative to the two other connectors.

The first connector is provided for connection to a catheter 15. Here, catheter 15 is an arterial catheter 15 which can be introduced into a patient's artery using the Seldinger technique.

This involves puncturing the artery at the respective place (e.g. in the neck, leg or arm) with a kind of temporary needle or trocar. After removing the needle, the actual wire is inserted via the plastic tube that now located in the blood vessel. The tube is then removed in such a way that the guide wire remains in its intravenous position. The arterial catheter is now inserted over the wire into the blood vessel. The guide wire is then removed and the catheter is flushed.

The second connector 20 is connected to an infusion 25. Here, the infusion 25 is a saline solution.

The third connector 30 is connected to a pressure transducer 35.

A switching mechanism 80 is located inside housing 70. The cross-section of switching mechanism 80 is circular. Switching device 80 abuts on the inner side of housing 70 an. It has a first channel 40 which is embodied as a through hole which extends transversely through switching mechanism 80. In the position shown in Fig. 1, the first channel 40 connects the first connector 10 to the second connector 20. The cross-section of channel 40 is the same throughout and corresponds to the cross-section of the first and second connectors 10, 20.

The second channel 50 is embodied as a recess in switching mechanism 80. The second channel 50 extends in the circumferential direction on switching mechanism 80 and has a dilation 51 at one end, as can be seen in Fig. 1a. In the position shown in Fig. 1, the second channel 50 lies against the third connector 30. The third channel 60 is embodied as a lasered capillary. It extends from the dilation of the second channel 50, past the first channel 40 to the outer surface 81 of switching mechanism 80.

In the position shown in Fig. 1, catheter 15 is connected to infusion 25. The third connector 30 to pressure transducer 35 is closed.

In this position, fast flushing of the three-way stopcock 1 with saline solution is carried out. In this position, a blood sample could also be taken on the infusion side. To this end, a blood withdrawal means flushed with 30 ml/hr is

provided on the infusion line. In addition, insertion of the guide wire into the arterial catheter using the Seldinger technique can be carried out in this position.

Fig. 2 shows the three-way stopcock 1 of Fig. 1 in a second position. In relation to the position shown in Fig. 1, switching mechanism 80 has been turned 45° anti-clockwise about its own axis. The first connector 10 and the third connector 30 are connected by a second channel 50. The third channel 60 connects the third connector 30 to the second connector 20.

In this position, a pulse contour analysis is carried out. Pulse contour analysis is a method for determining the cardiac volume. The arterial blood pressure is measured over time, from which the stroke volume of the heart is then computed. In order to perform this method with valid results, it is essential that the derived pressure curve is of good quality. In the position shown in Fig. 2, the pressure transducer is connected to catheter 15. The mean pressure in catheter 15 is 100 mm Hg. A saline solution flows through the third channel 60 from infusion 25 to pressure transducer 35. The pressure in infusion 25 is 300 mm Hg, which means that the saline solution is able to flow through the three-way stopcock 1 into the blood. The formation of deposits is prevented because the saline solution continuously flushes the three-way stopcock 1 during realistic pressure measurement.

The cross-section of the third channel 60 is so thin that less than 5 ml of saline solution per hour flows through it. This amount is so small that it has no effect on pressure measurement.

Since pressure transducer 35 is located immediately adjacent the three-way stopcock 1, any effects of tubing on pressure measurement are prevented. In this way, pressures are measured very accurately and precisely.

In Fig. 3, the three-way stopcock 1 is shown in a third position. In this position, switching mechanism 80 is turned 45° clockwise in comparison to the position shown in Fig. 1. The second channel 50 connects the third connector 30 to the second connector 20. The first connector 10 is closed.

In this position, the zero adjustment of the pressure transducer is carried out by opening the latter to the atmosphere.

In Figs. 4 and 4a, a second embodiment of the three-way stopcock 1 according to the invention is shown. Here, a third channel 61 embodied as a groove runs on the outer surface 81 of switching mechanism 80. As can be seen in Fig. 4a, it runs from the dilation of the second channel 50, around the first channel 40 and then in the circumferential direction of switching mechanism 80.

Here, the third channel 61 has a particularly small cross-section. Due to the small channel being provided on the outer surface 81 of switching mechanism 80, it is nevertheless possible to produce switching mechanism 80 in a simple manner as a molded plastic part.

Fig. 5a shows a cross-section through a third embodiment of a three-way stopcock 1 according to the invention, in the first position. In deviation from the embodiment shown in Figs. 4 and 4a, the second channel 52 is embodied here not as a recess in switching mechanism 80, but as a through hole. The second channel 52 runs parallel to the first channel 40. As in the previous embodiments, the second channel 52 is connected to capillary 61.

In the first position, both openings 53 of the second channel 52 abut on the inner side of housing 70. The second channel 52 is closed.

Fig. 5b shows a cross-section through the third embodiment of the three-way stopcock 1 according to the invention, in the second position. Here, switching mechanism 80 is turned 45° anti-clockwise, with the result that the second channel 52 connects the first connector 10 to the third connector 30.

As in the embodiments described in the foregoing, the pressure can be measured in this position. It is possible to carry out continuous flushing of the second channel 52 via capillary 61. The flow volume channeled through capillary 61 is 3 ml/hr.

Fig. 5c shows a cross-section through the third embodiment of the inventive three-way stopcock 1 in the third position. Here, switching mechanism 80 is turned 45° clockwise, with the result that the second channel 52 connects the third connector 30 to the second connector 20.

As in the embodiments described above, it is possible in this position to carry out zero adjustment of pressure transducer 35.

Due to the second channel 52 being embodied here as a through hole, the sealing regions of the second channel 52 between switching mechanism 80 and housing 70 have been reduced in size. This makes it even simpler to prevent the formation of deposits in the sealing regions of channel 50.

Figure 5d shows a side view of the switching mechanism of the three-way stopcock shown in Figures 5a, 5b and 5c. Here it is shown how the third channel is guided from the second channel (52) around the first channel (40).

Figure 6 shows a schematic view of a monitoring catheter set 90. The monitoring catheter set 90 has a sensor catheter or catheter system 100, which includes a three-way stopcock 1, a catheter tube 110 connected to the

first connector 10 of the three-way stopcock 1, and a pressure transducer 35. A plug connector 36 is connected by cable 37 to pressure transducer 35.

Monitoring catheter set 90 also has a flushing and blood removal device 120. The flushing and blood removal device 120 has a first tube line 125, a blood withdrawal port with silicone membrane 130, a syringe 135, a retaining plate 145 provided with a calibration device 140 having a hydrophobic seal 150, a safety valve provided with a flushing capillary 155, a second tube line 160, a drip chamber 165 and a flush bag 170. A first end of the first tube line 125 is connected via a Luer cone connector to the second connector 20 of the three-way stopcock 1. The blood withdrawal port with silicone membrane 130 is connected to the first tube line 125. Seen from the three-way stopcock 1 behind blood withdrawal port 130, syringe 135 is connected to the first tube line 125. The second end of the first tube line 125 is connected to the calibration device 140. The calibration device 140 is fixed to retaining plate 145, which is located at the level of the patient's heart. Compensation device 140 is provided with a hydrophobic seal 150. A second tube line 160 is connected to calibration device 140. The safety valve with flushing capillary 155 is connected to said tube line.

Seen from calibration device 140, drip chamber 165 is provided behind safety valve 155 on the second tube line 160. Flush bag 170 is connected to drip chamber 165. A pressure of 300 mmHg is applied to the flush bag.

Continuous measurement of the pressure of a patient's pulse can be carried out using the monitoring catheter set when the three-way stopcock 1 is in a second switching position. During pressure measurement, the monitoring catheter set is continuously flushed with a solution placed in flush bag 170.

Pressure transducer 35 may be coupled to and decoupled from catheter tube 110 by means of the three-way stopcock 1 and can be calibrated when the three-way stopcock 1 is in the third switching position. To calibrate pressure transducer 35, the three-way stopcock 1 is firstly brought into its third position. After that, the second tube line 160 on calibration device 140 is opened to the atmosphere. Atmospheric pressure is applied as a result to pressure transducer 35.

In the first switching position of the three-way stopcock 1, blood can be withdrawn through blood withdrawal port 130. In this switching position, pharmaceuticals may be administered to the patient by means of syringe 135.

In order to use monitoring catheter set 90, sensor catheter 100 is put in place by means of guide wire, in accordance with the Seldinger technique. When this is being done, the three-way stopcock 1 is in the first switching position.

The flushing and blood removal device 120 is then connected to sensor catheter 100.

The formation of deposits is prevented due to the continuous flushing of monitoring catheter set 90.

Because pressure transducer 35 is provided close to the patient, and the pressure signals are not attenuated by soft components, the pressures in catheter 110 are measured with particular accuracy and precision.

Due to a blood withdrawal port 130 and a syringe 135 being provided on monitoring catheter set 90, is it possible in a simple manner to withdraw blood from the patient and to supply pharmaceuticals to the patient.

Fig. 7 shows an embodiment of the three-way stopcock in which the third channel 65 is embodied as a U-shaped groove in the outer surface 81 of switching mechanism 80. The two parallel regions 66, 67 of the U-shaped third channel 65 also run parallel to the turning axis of switching mechanism 80. The first parallel region 66 of the third channel 65 and the second channel 50 form an "L". The second channel 50 is embodied as a recess in switching mechanism 80 and extends in the circumferential direction on switching mechanism 80.

Because the first parallel region 66 of the third channel 65 and the second channel form an "L", it is possible to flush the three-way stopcock in such a way that flushing solution runs directly over pressure transducer 35.

In the embodiment of the three-way stopcock shown in Fig. 8, the third channel is embodied as a glass capillary 63. Connector 20 is guided via a groove perpendicularly into a different plane and is connected to a through hole. Said through hole contains glass capillary 63. On the opposite side, glass capillary 63 is connected via a C-shaped groove to connector 30.

In the embodiment shown in Figure 9, the capillary is realized as a lasered hole 64 in a web. In this embodiment, fast flushing can be realized by having the flushing solution flow over the web. This fast flushing can be triggered by actuating a sealing element that can be operated externally by means of a rubber operating lever 180. Due to use of rubber operating lever 180, permanent actuation of the fast flushing is not possible. This prevents any potential mistakes by users.

Continuous flushing runs through the pot of the three-way stopcock. The infusion is channeled via a groove which runs parallel to the axis of the three-way stopcock. Due to the reduced cross-section in the grooves, the rate of flushing in the grooves is reduced.

The three-way stopcock can be operated in several ways. In Figures 10a and 10b, a lever for operating the three-way stopcock is shown.

Figures 11a and 11b show another embodiment of a lever for operating the three-way stopcock. Figures 12a-d show a slide mechanism with which the valve can be turned by means of a gear rack or similar.

Figures 13a-d show a housing that can be separated by turning the housing halves counter to each other. By turning the housing halves, the various switching positions are realized.

Figures 14a-f show a rocker switch for operating the three-way stopcock. This rocker switch converts a linear movement into a rotatory movement, thus operating the valve.

List of reference signs

1 Three-way stopcock

10 First connector

15 Catheter

20 Second connector

25 Infusion

30 Third connector

35 Pressure transducer

36 Plug connector

37 Cable

40 First channel

50 Second channel

51 Dilation

52 Second channel

53 Opening of the second channel

60 Third channel

61 Third channel

63 Glass capillary

64 Lasered hole

65 Third channel

66 First parallel region

67 Second parallel region

70 Housing

80 Switching mechanism

81 Outer surface

90 Monitoring catheter set

100 Sensor catheter

110 Catheter tube

120 Flushing and blood removal device

125 First tube line

130 Blood withdrawal port

135 Syringe

140 Calibration device

145 Retaining plate

150 Hydrophobic seal

155 Flushing capillary

160 Second tube line

165 Drip chamber

170 Flush bag

Claims

1. A multifunction valve (1) comprising at least three connectors (10, 20, 30),

characterized in that

a first connector (10) can be connected to a catheter, a second connector (20) to an infusion and a third connector (30) to a pressure transducer, wherein in a first position the first and second connectors (10, 20) are connected to each other via a first channel (40),

in a second position the first and the third connectors (10, 30) are connected to each via a second channel (50), and the second and third connectors (20, 30) are connected to each other via a third channel (60, 61),

in a third position the second and third connectors (20, 30) are connected to each other via the second channel (50), and the first connector (10) is closed, and

the third channel (60, 61) has a smaller cross-section than the second channel (50).

2. A multifunction valve (1) according to claim 1, characterized in that the first and second connectors (10, 20) are opposite one another.

3. A multifunction valve (1) according to any of the preceding claims, characterized in that the multifunction valve (1) has a housing (70) and the pressure transducer (35) is mounted directly on the housing (70).

4. A multifunction valve according to any of the preceding claims, characterized in that the third channel (60, 61) is a capillary.

5. A multifunction valve (1) according to any of claims 3 to 4, characterized in that the first channel (40), the second channel (50) and the third channel (60, 61) are arranged in a switching mechanism (80) which can be turned inside the housing (70).

6. A multifunction valve (1) according to any of the preceding claims, characterized in that the first channel (40) is configured as a through hole.

7. A multifunction valve (1) according to any of claims 5 or 6, characterized in that the first channel (40) extends transversely through the switching mechanism (80).

8. A multifunction valve (1) according to any of the preceding claims, characterized in that a direction vector of the first channel (40), a direction vector of the third channel (60, 61) and a vector which points

from a reference point of the first channel (40) to a reference point of the third channel (60, 61) are linearly independent.

9. A multifunction valve (1) according to any of the preceding claims, characterized in that the first channel (40) and the third channel (60) are not connected to each other.

10. A multifunction valve (1) according to any of the preceding claims, characterized in that the second channel (50) is configured as a groove in the switching mechanism (80).

11. A multifunction valve (1) according to any of the preceding claims, characterized in that the second channel (50) extends substantially in the circumferential direction of the switching mechanism (80).

12. A multifunction valve (1) according to any of the preceding claims, characterized in that the second and the third channels (50, 60, 61) are connected to each other.

13. A multifunction valve (1) according to any of the preceding claims, characterized in that the second channel (50) has a dilation in one end portion and is connected in the region of the dilation to the third channel (60, 61).

14. A multifunction valve (1) according to any of the preceding claims, characterized in that the second channel (52) is configured as a through hole.

15. A catheter system (100) provided with a multifunction valve (1) according to any of the preceding claims, wherein the multifunction valve (1) can be connected to a catheter tube (110).

16. A catheter system (100) according to claim 15, wherein a pressure transducer (35) can be connected to the multifunction valve (1).

17. A catheter system (100) according to any of claims 15 or 16, in which a plug connector (36) can be connected to the pressure transducer (35).

18. An apparatus (120) provided with a catheter system (100) according to any of claims 15 to 17, wherein the catheter system (100) can be connected to a blood withdrawal port (130).

19. An apparatus (120) according to claim 18, wherein the catheter system (100) can be connected to a reservoir with a movable piston (135).

20. An apparatus (120) according to any of claims 18 or 19, wherein the catheter system (100) can be connected to a calibration device (140).

21. A device (120) according to any of claims 18 to 20, wherein the catheter system (100) can be connected to a safety valve (155).

22. A device (120) according to any of claims 18 to 21, wherein the catheter safety valve (155) is provided with a flushing capillary.

23. A device (120) according to any of claims 18 to 22, wherein the catheter system (100) can be connected to a drip chamber (165).

24. A device (120) according to any of claims 18 to 23, wherein the catheter system (100) can be connected to a flushing solution device (170).

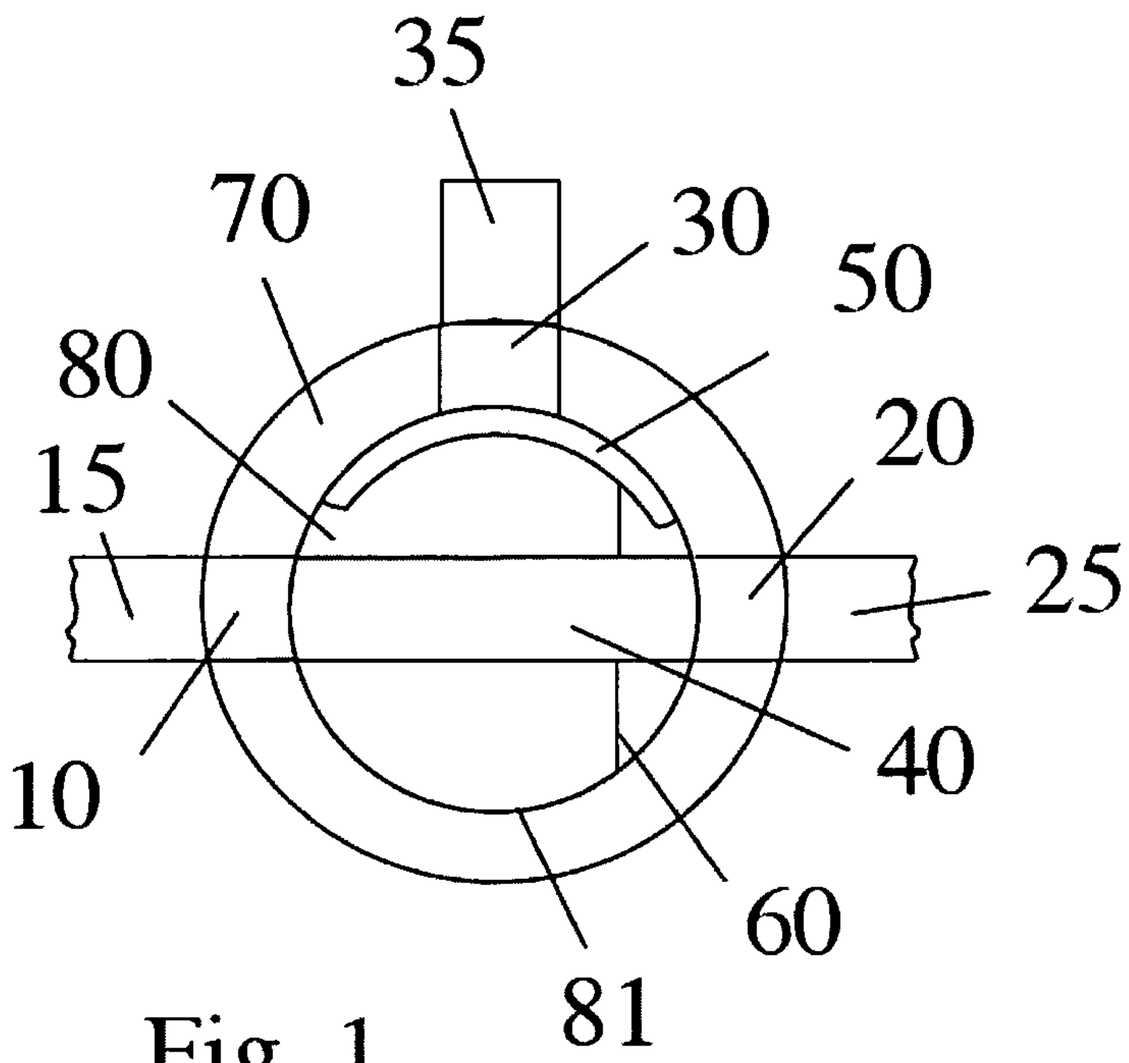


Fig. 1

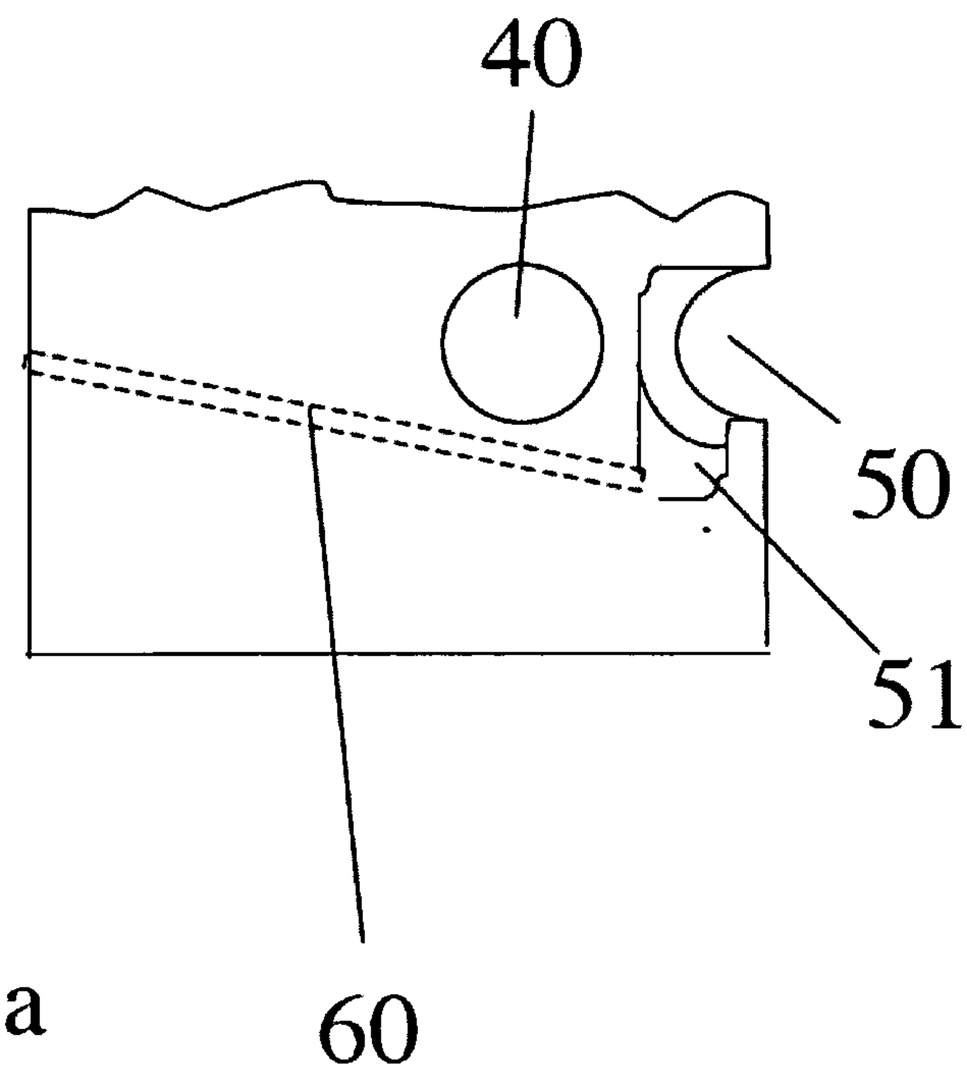


Fig. 1a

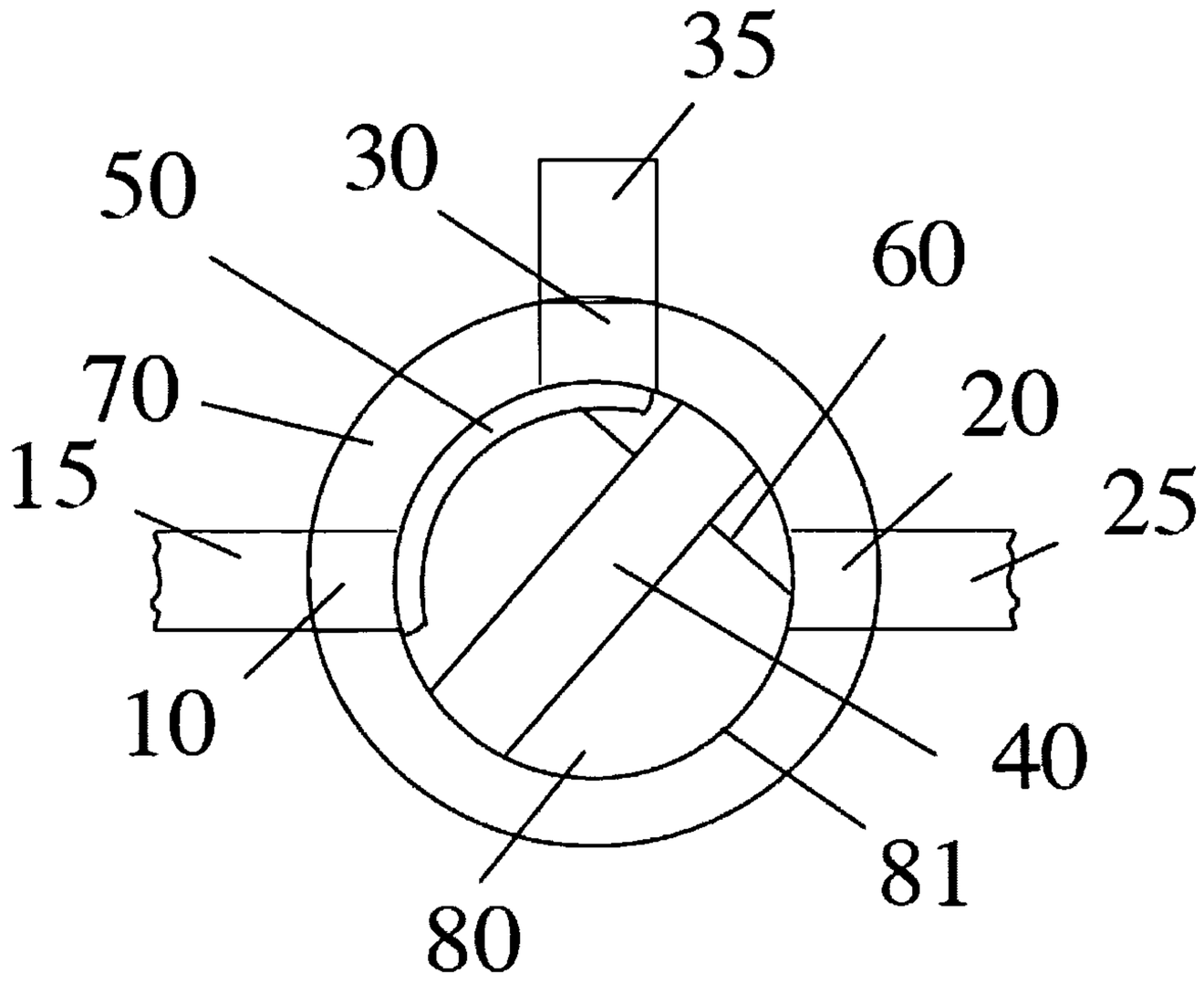


Fig. 2

1

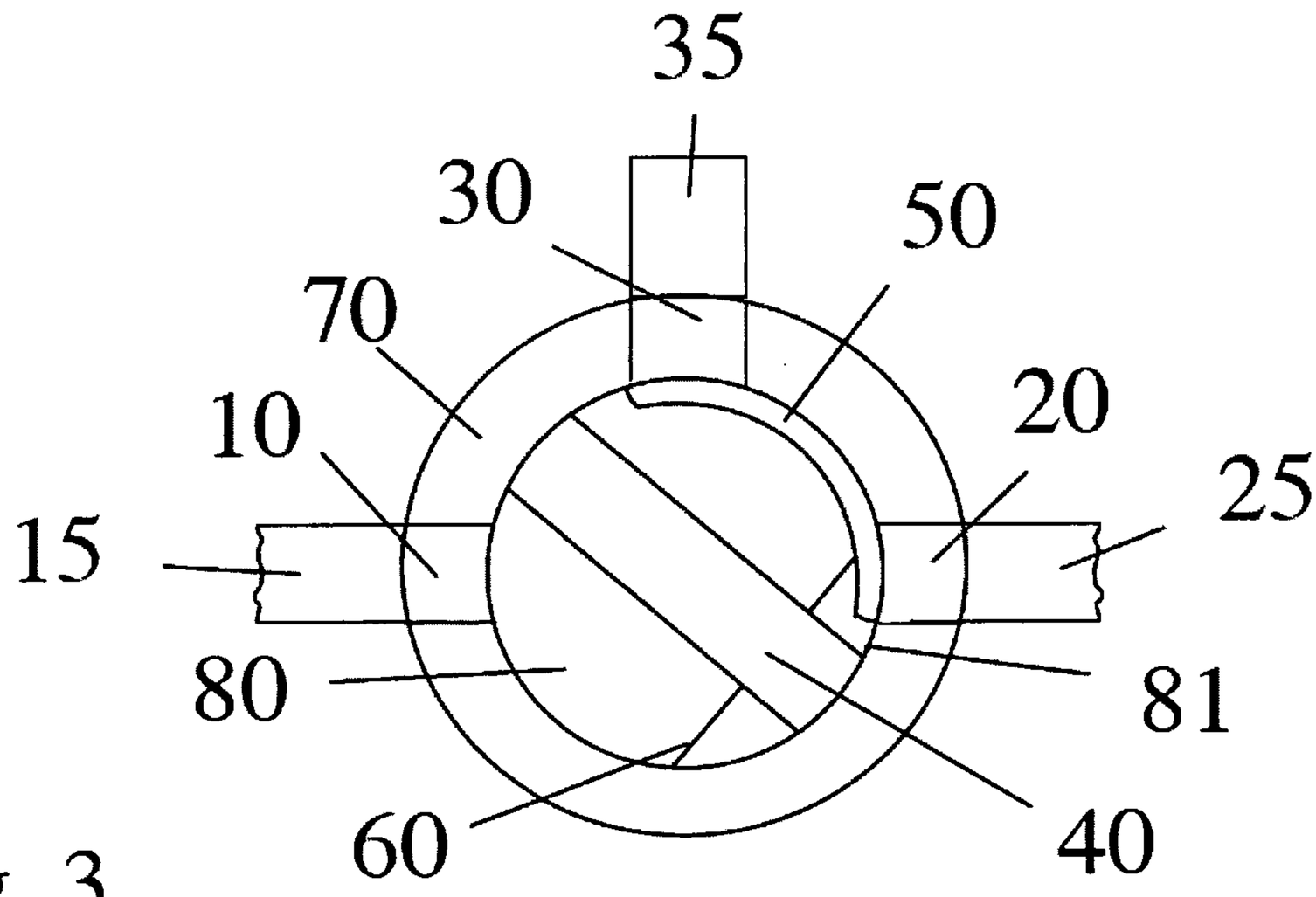


Fig. 3

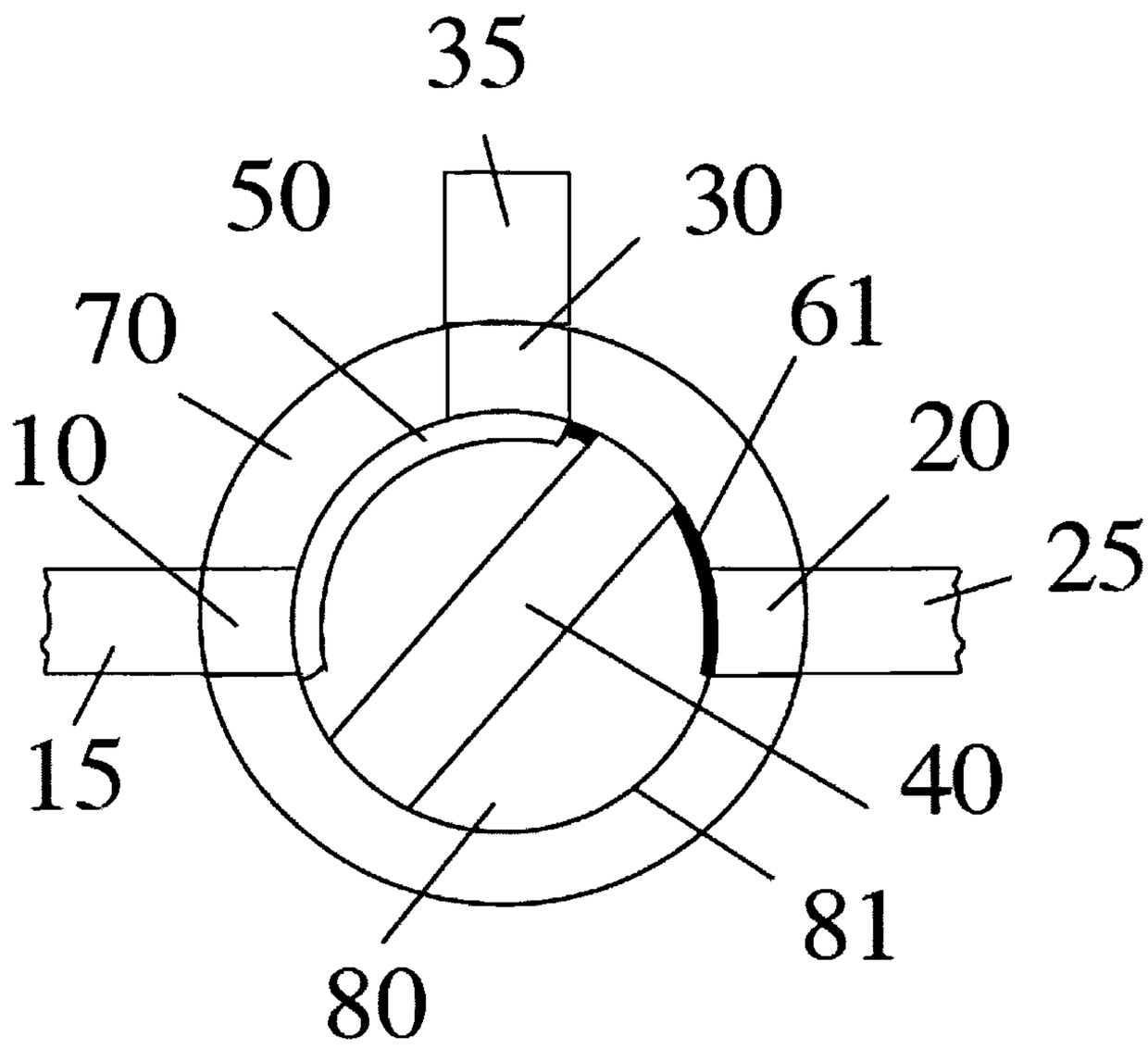


Fig. 4

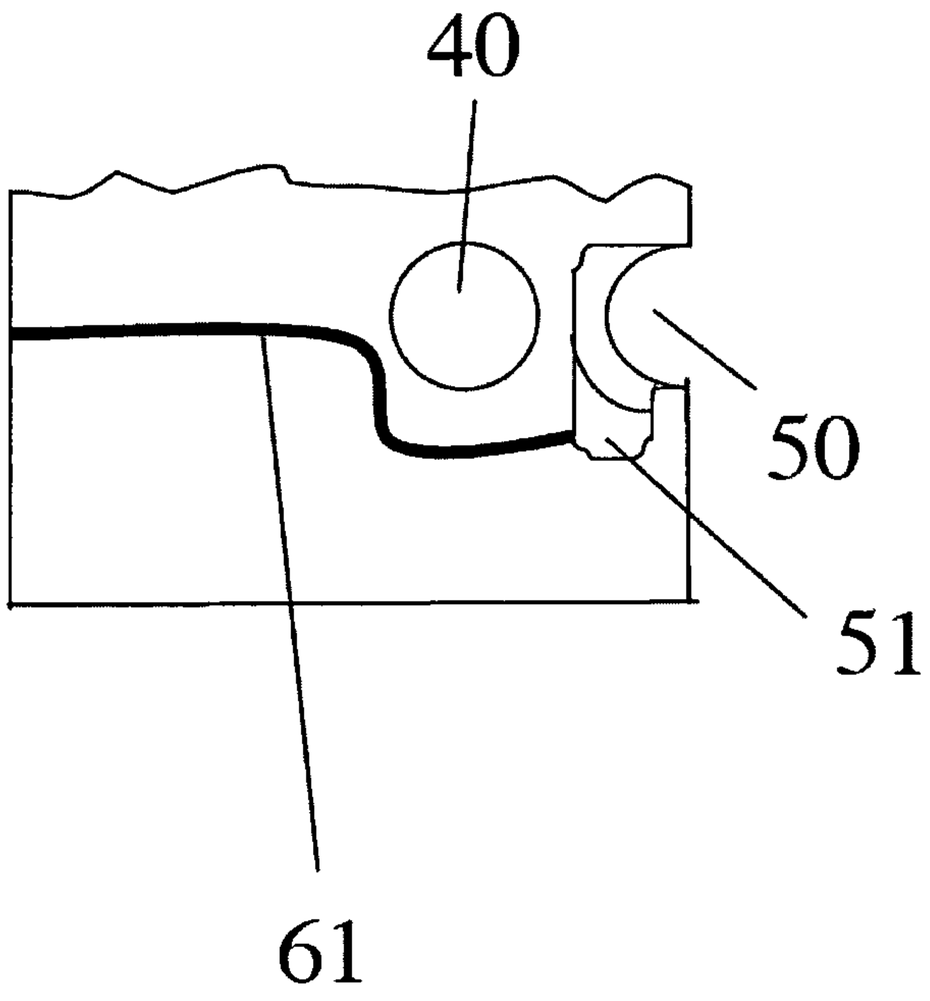


Fig. 4a

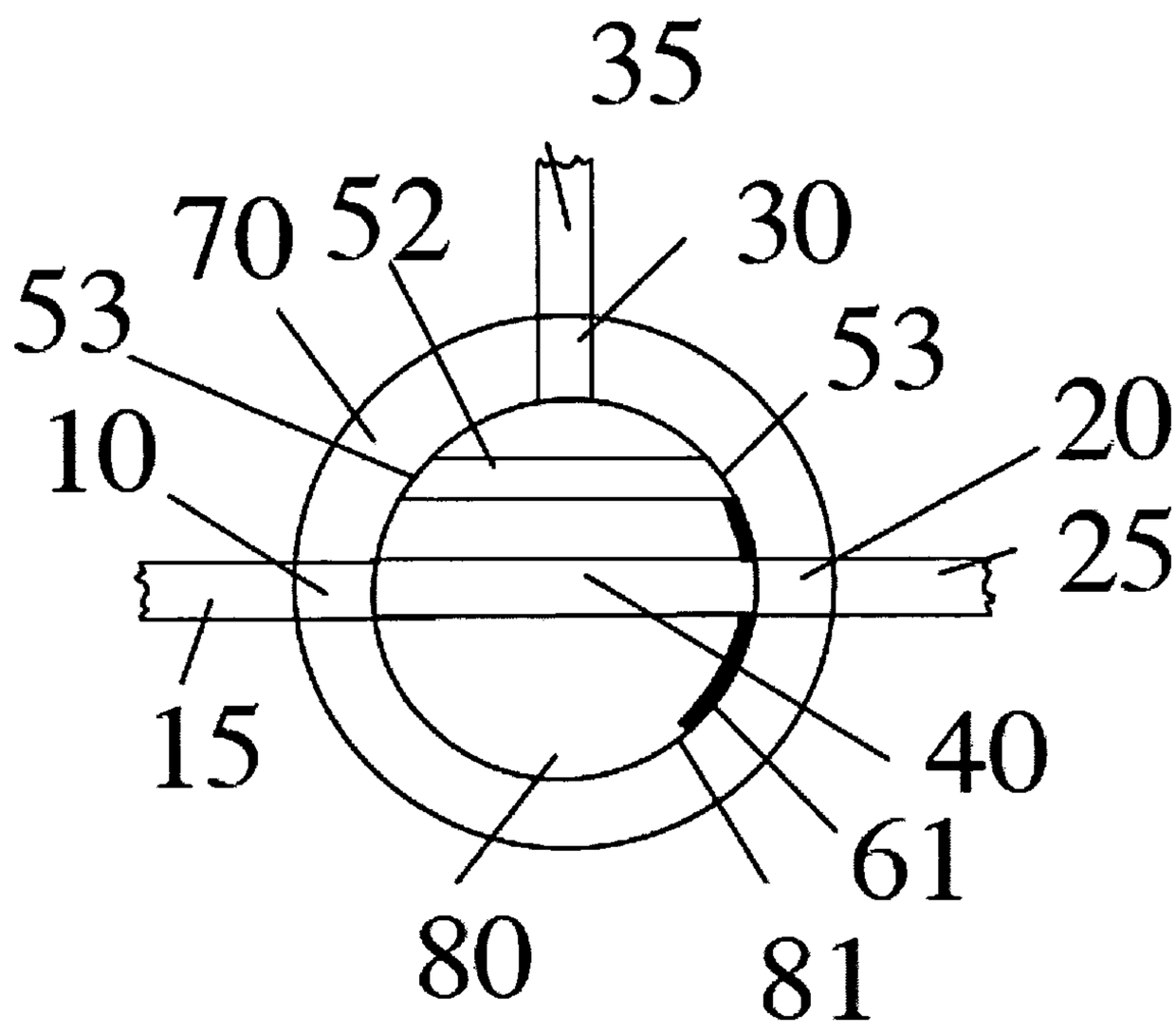

35
70
52
30
53
53
10
20
25
15
40
61
80
81

Fig. 5a

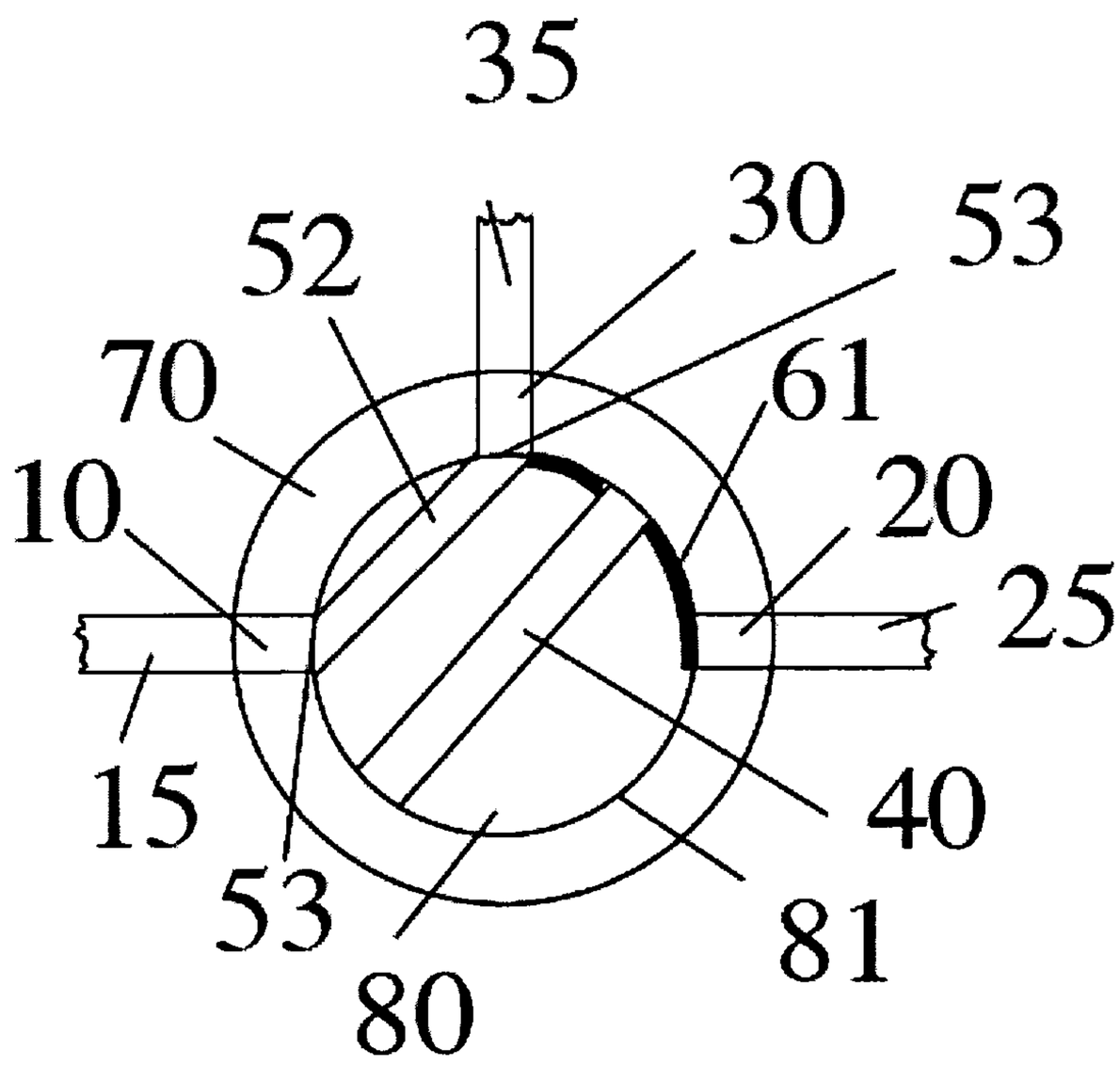

35
52
30
53
70
61
10
20
25
15
40
53
81
80

Fig. 5b

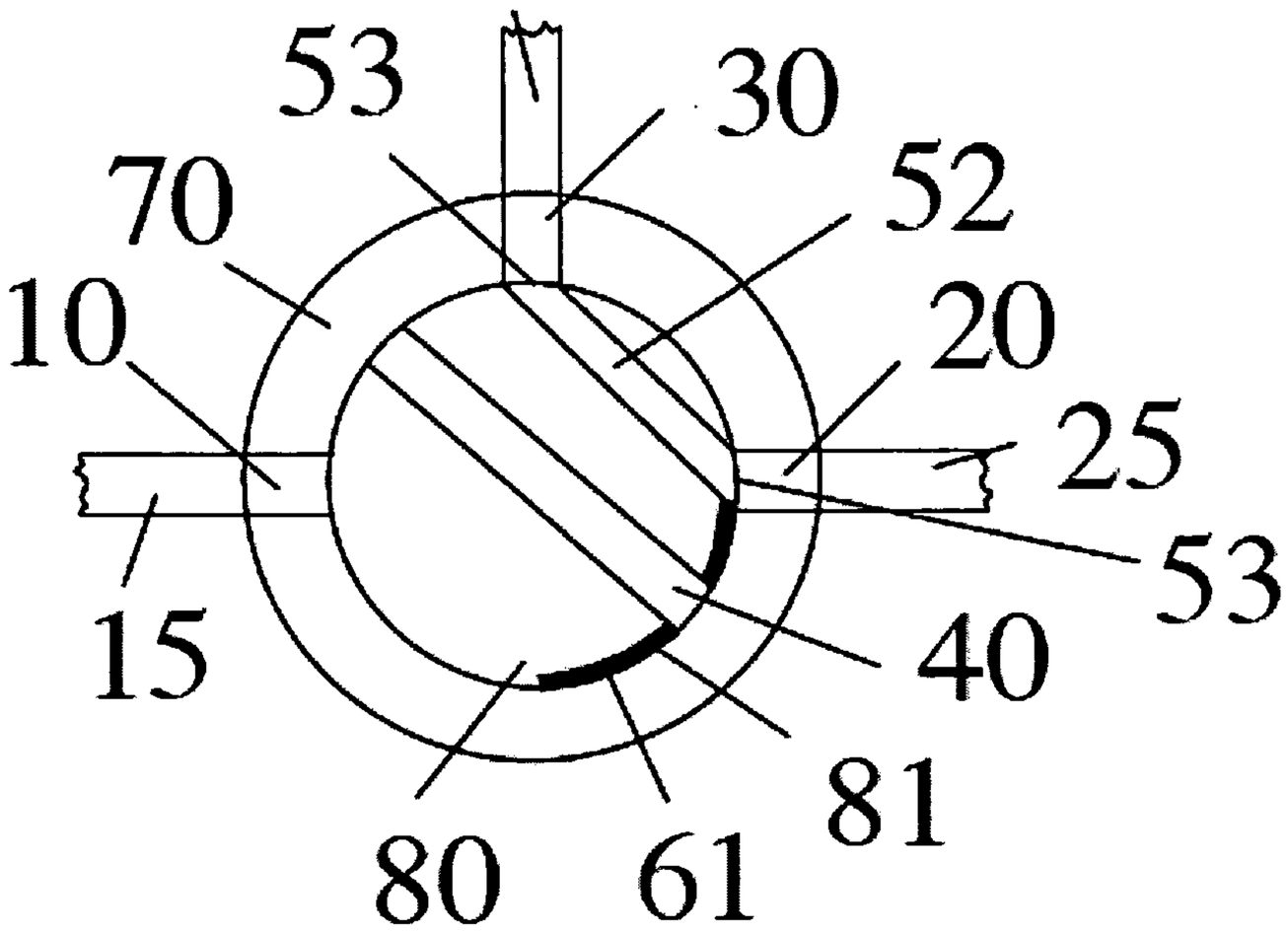


Fig. 5c

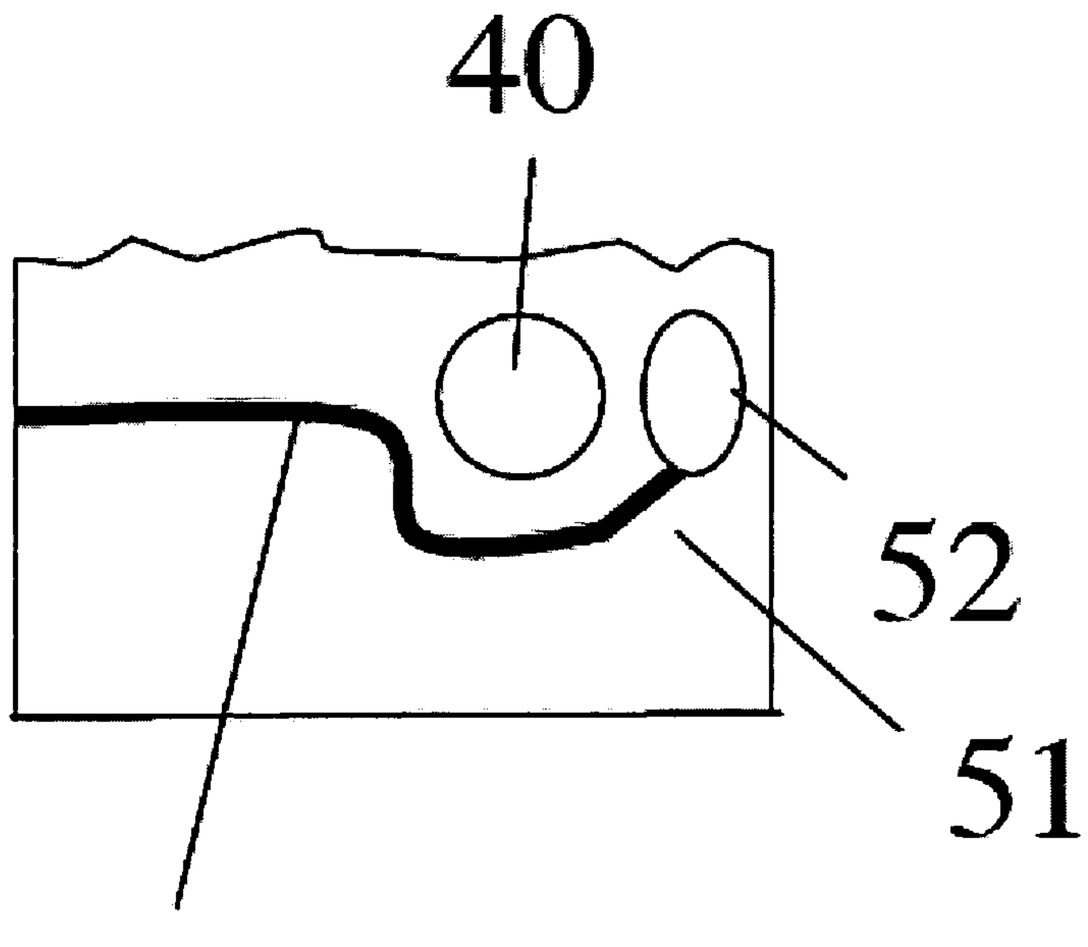


Fig. 5d

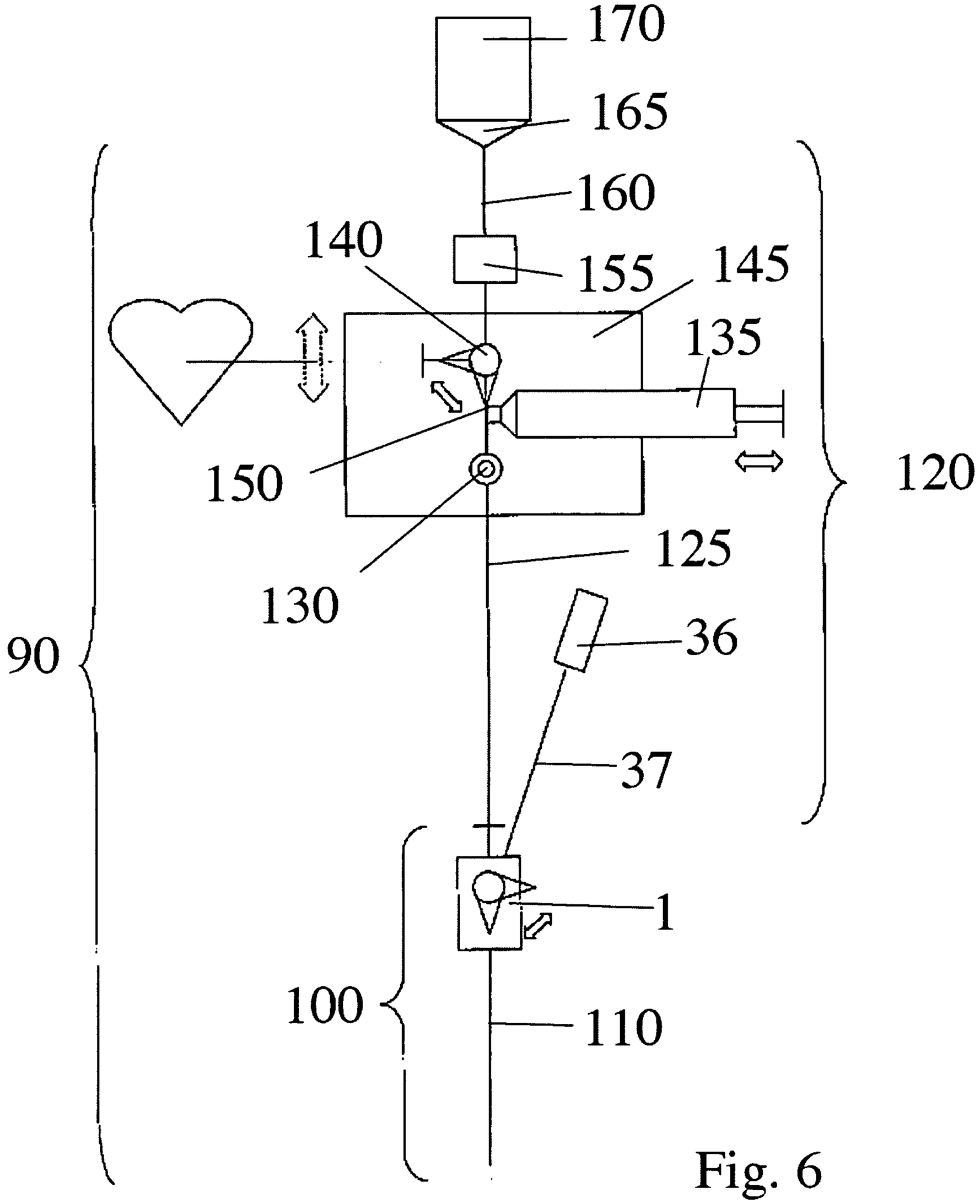


Fig. 6

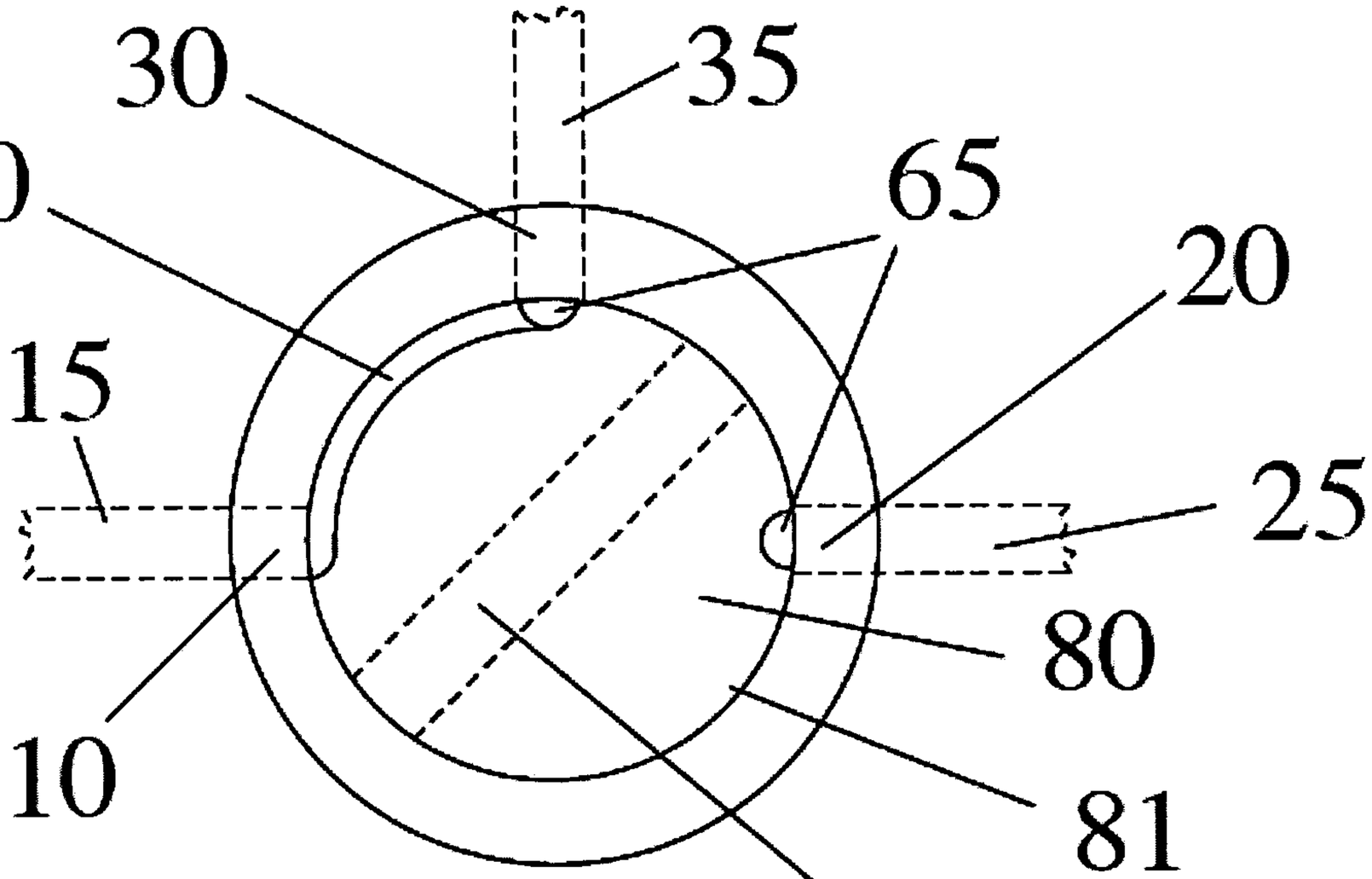


Fig. 7a

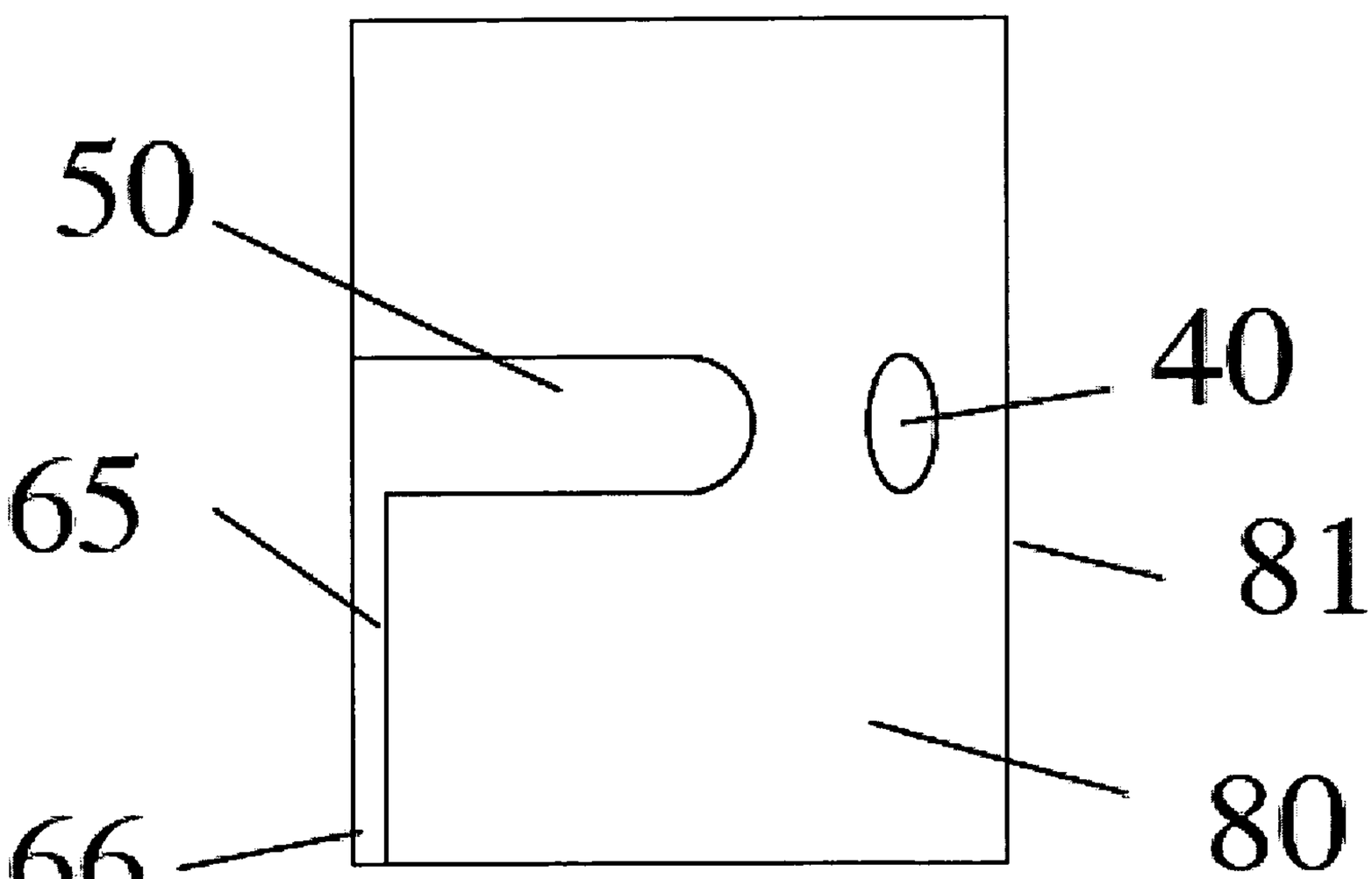


Fig. 7b

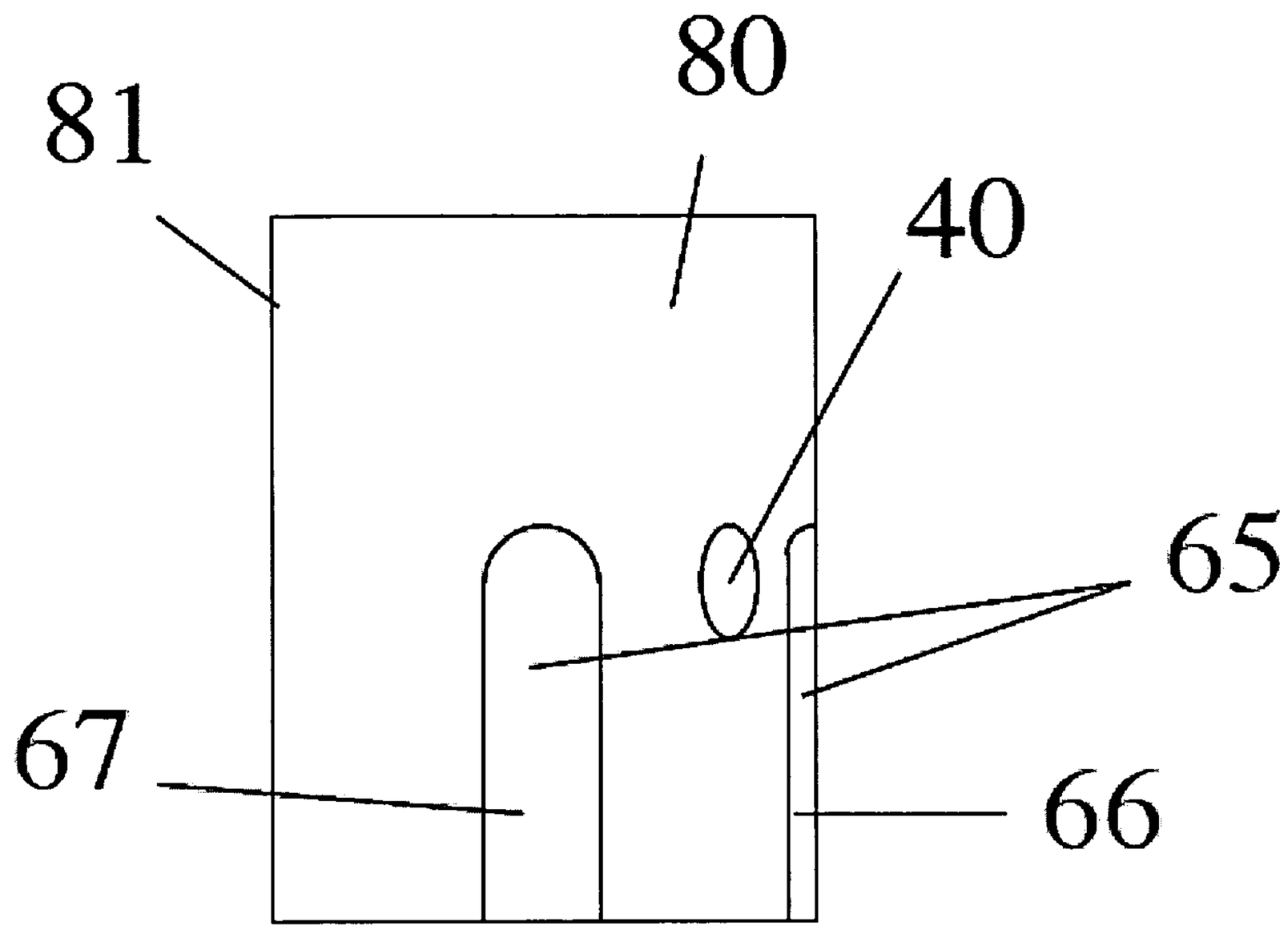


Fig. 7c

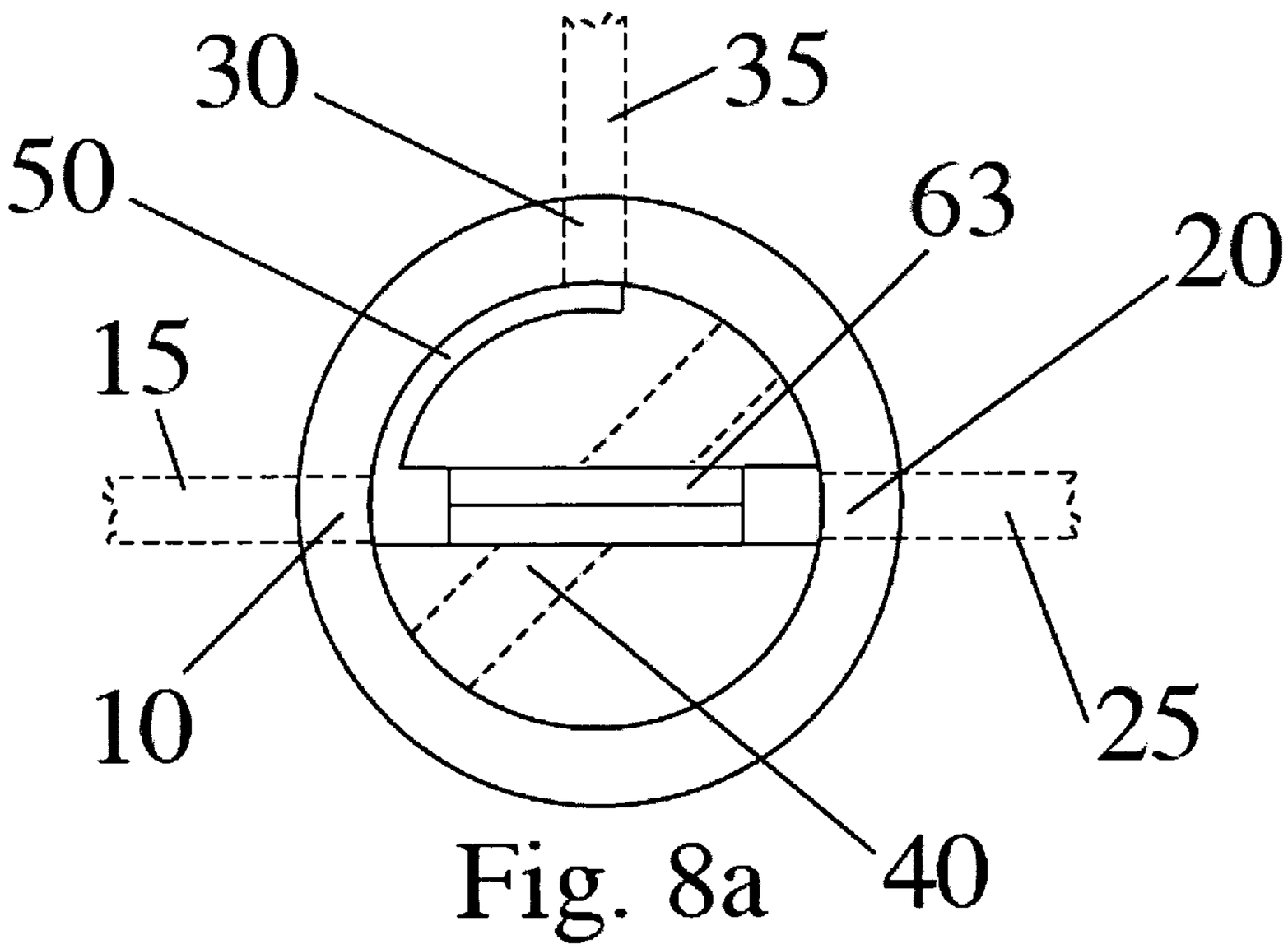


Fig. 8a

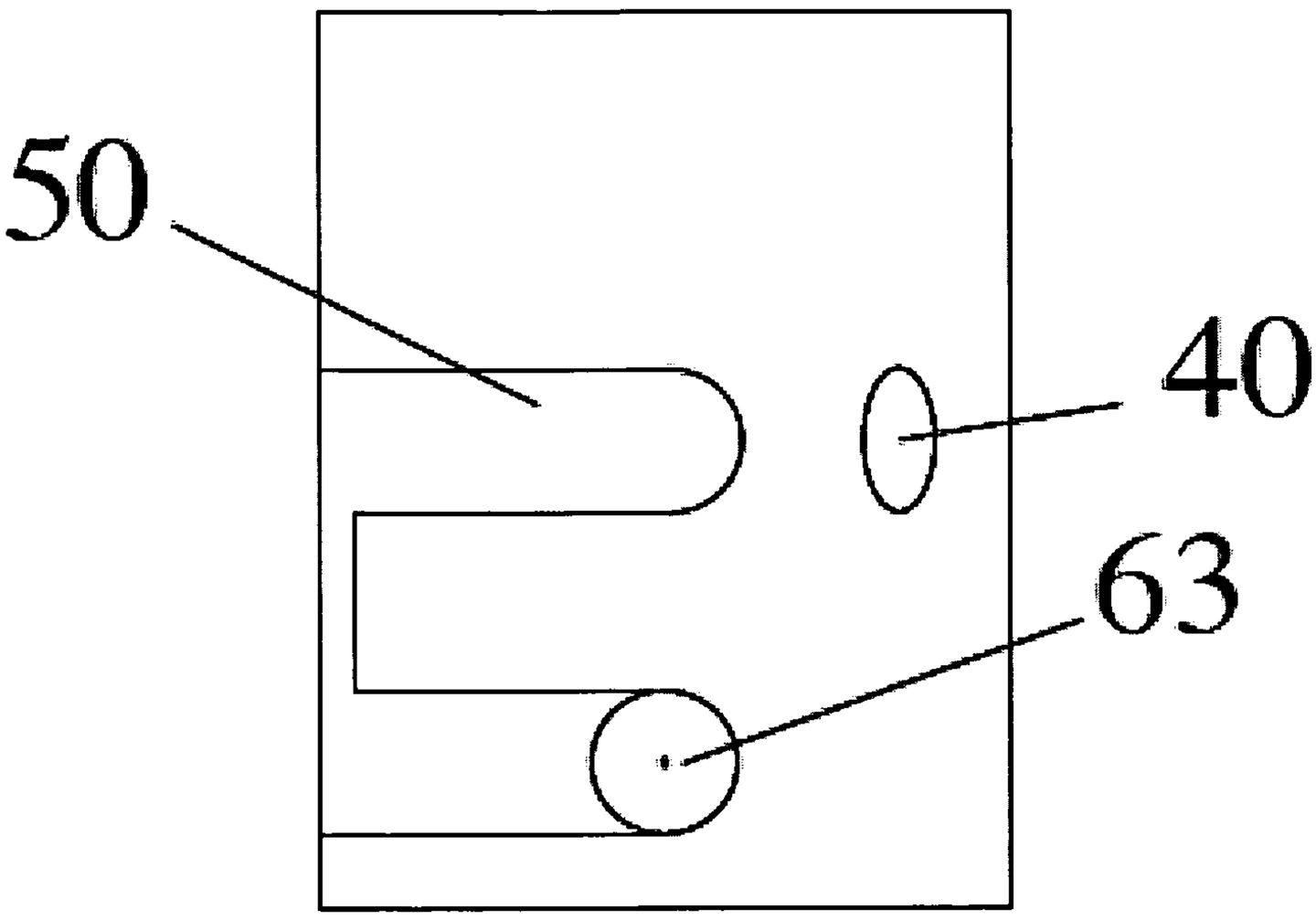


Fig. 8b

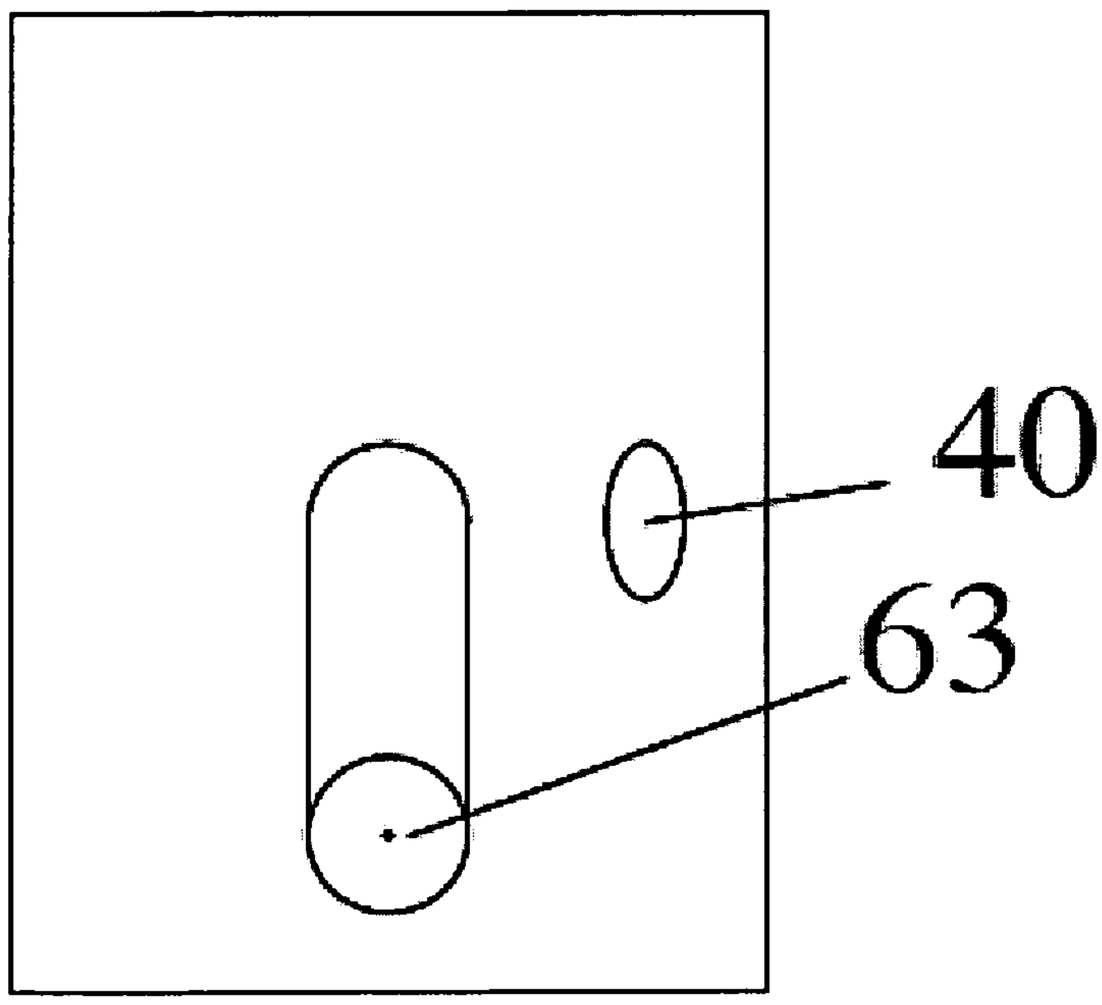


Fig. 8c

64 Dritter Kanal / gelasert
180 Gummibedienhebel

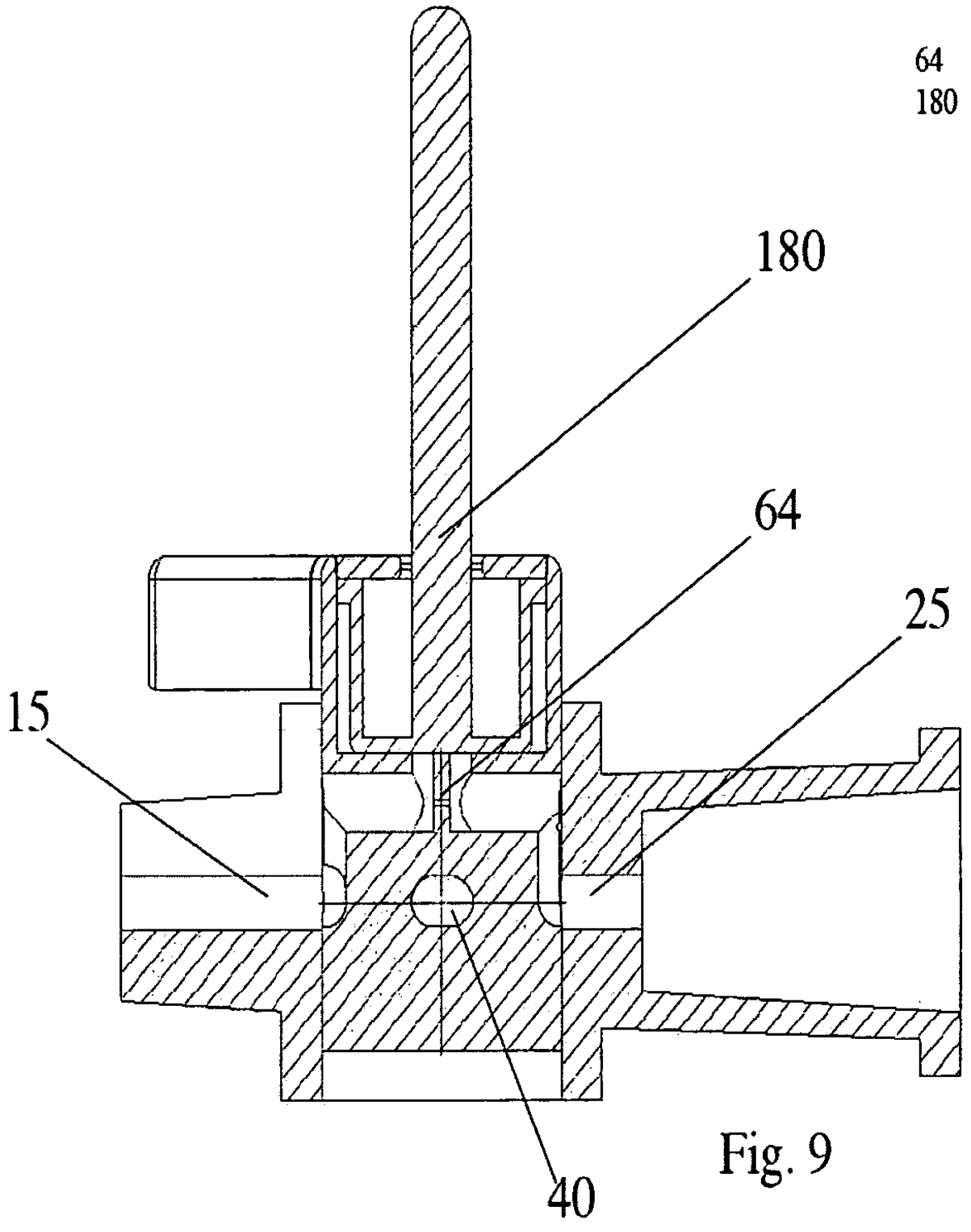


Fig. 9

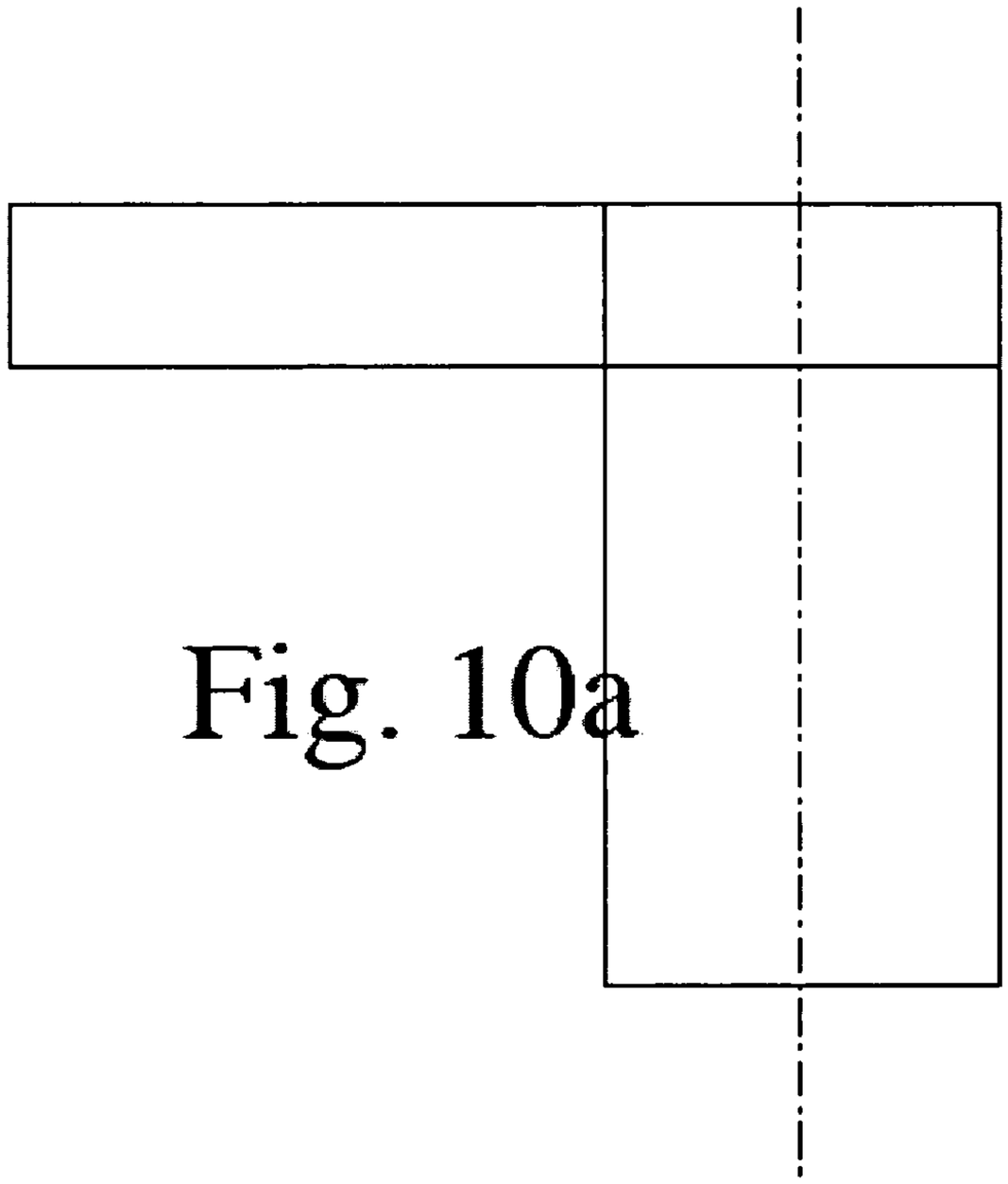


Fig. 10a

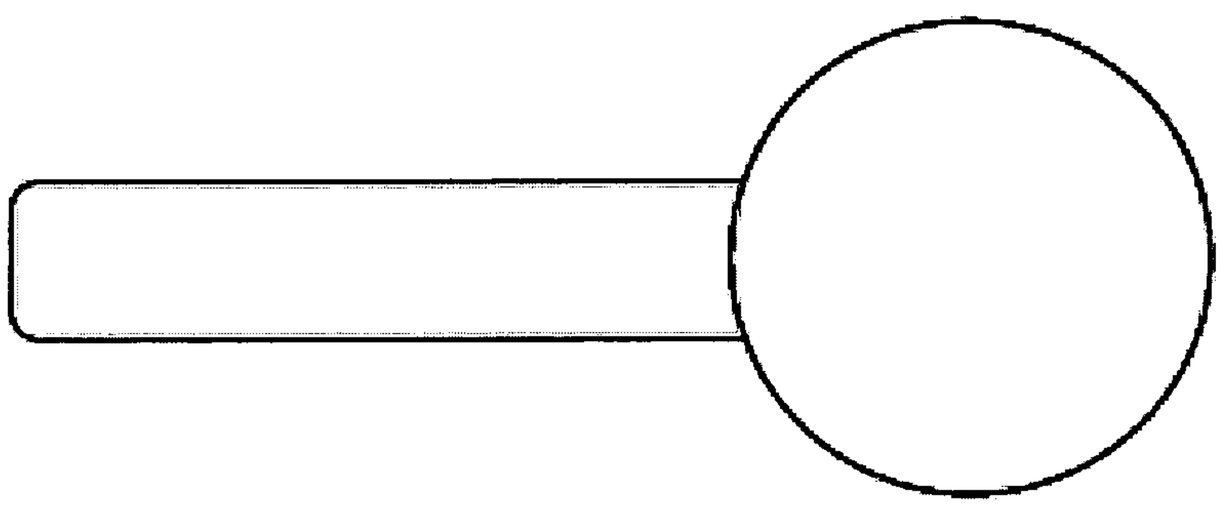


Fig. 10b

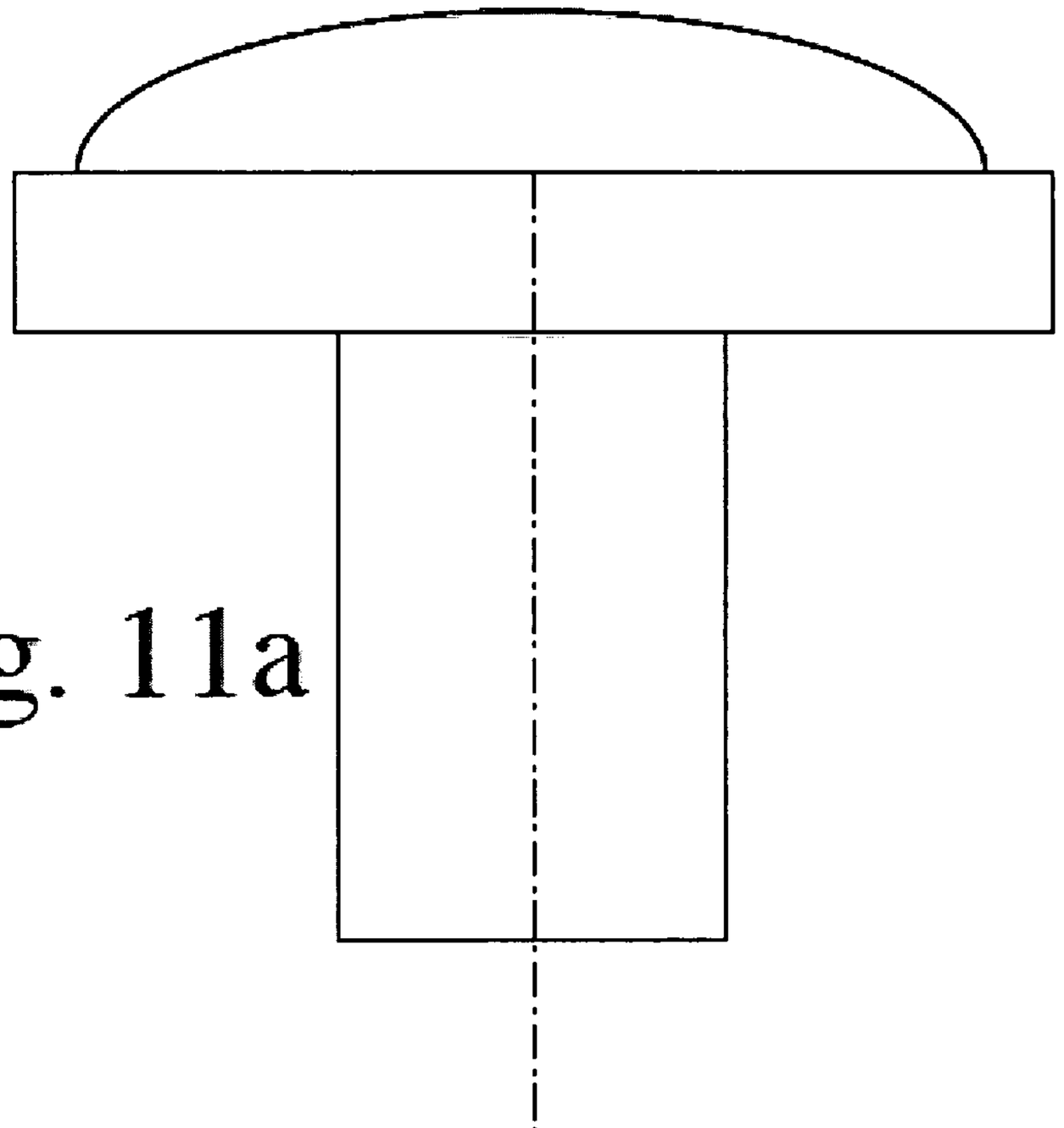


Fig. 11a

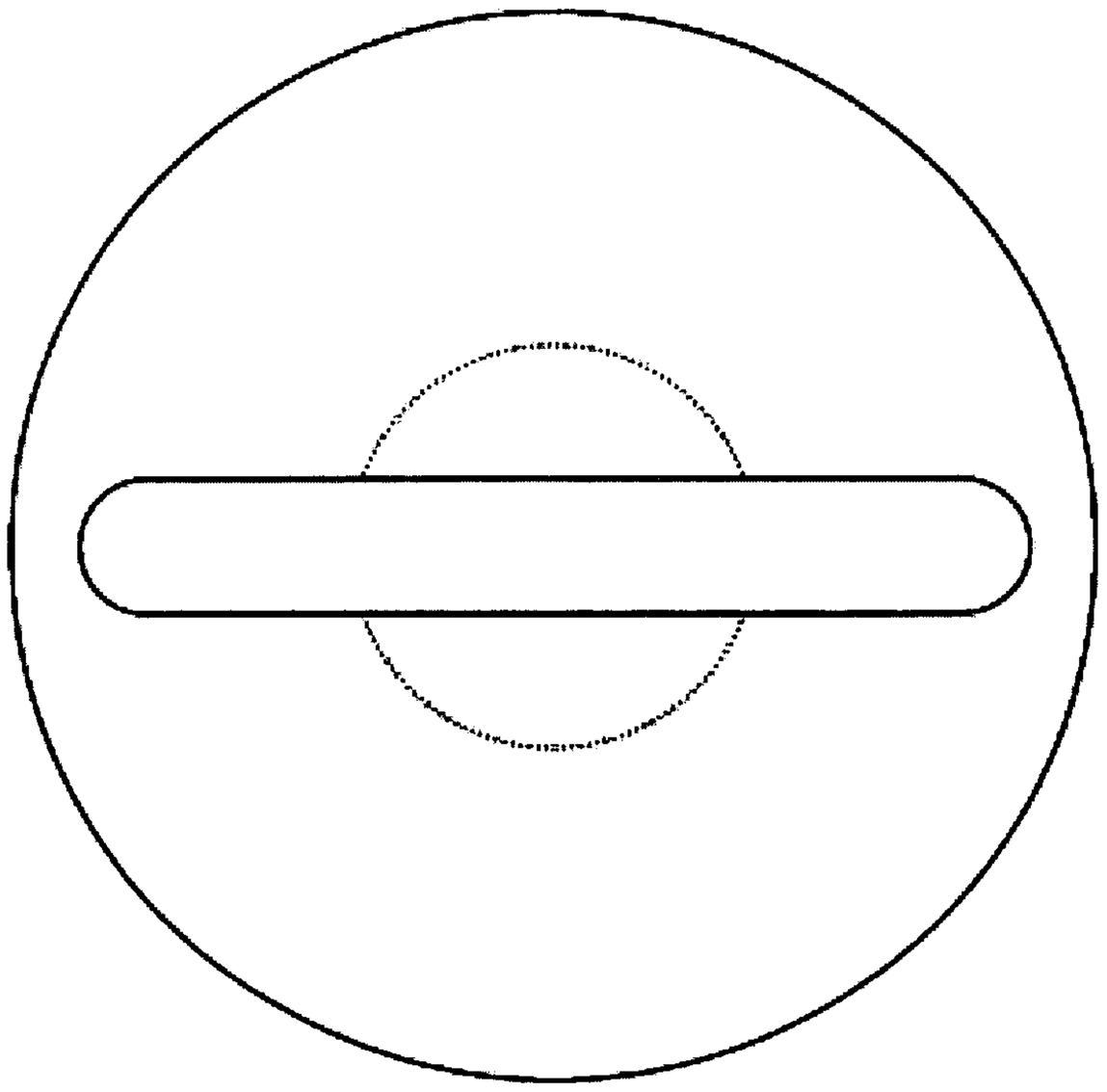


Fig. 11b

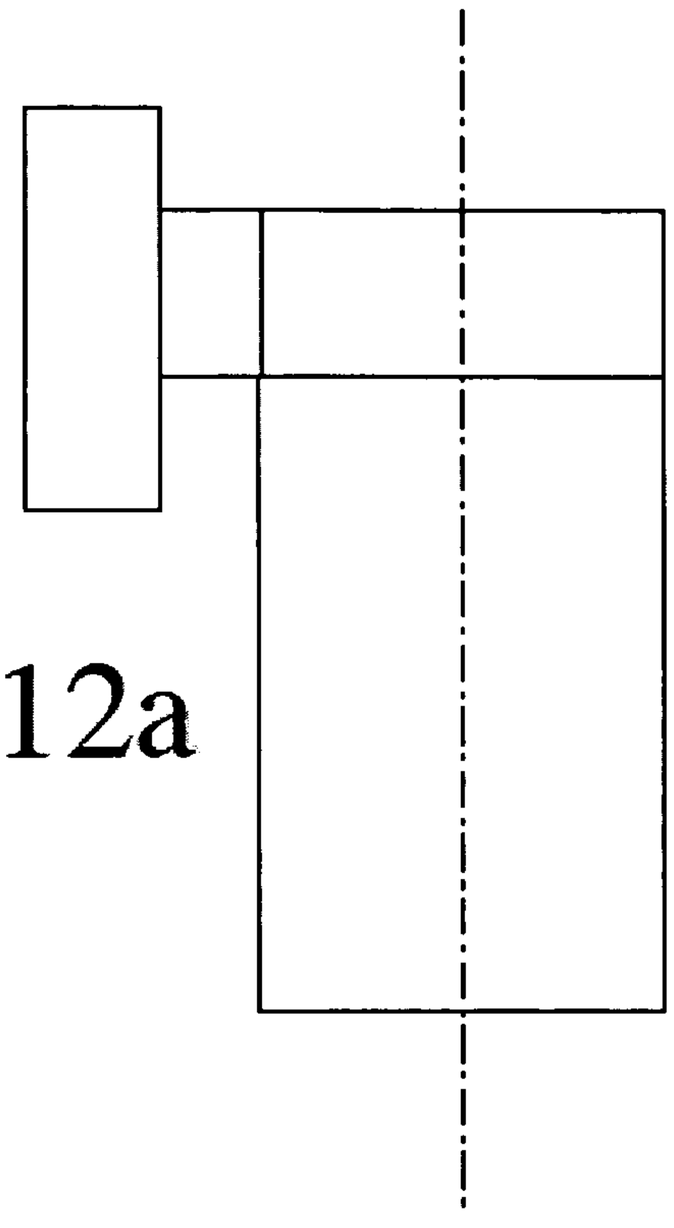


Fig. 12a

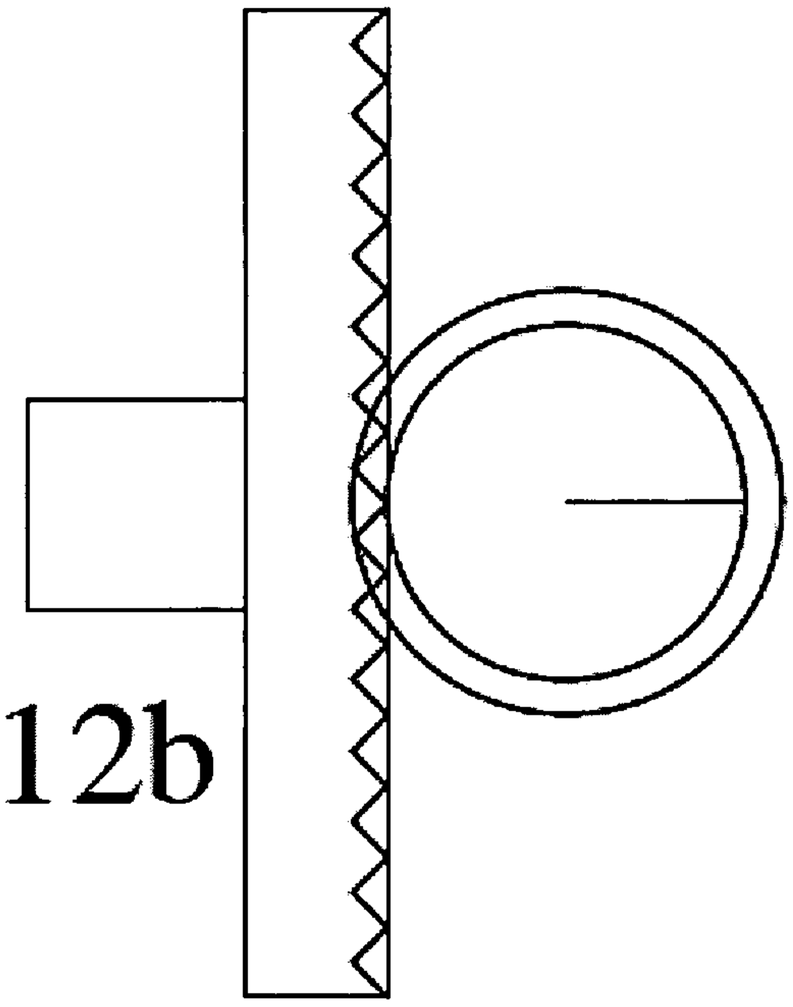


Fig. 12b

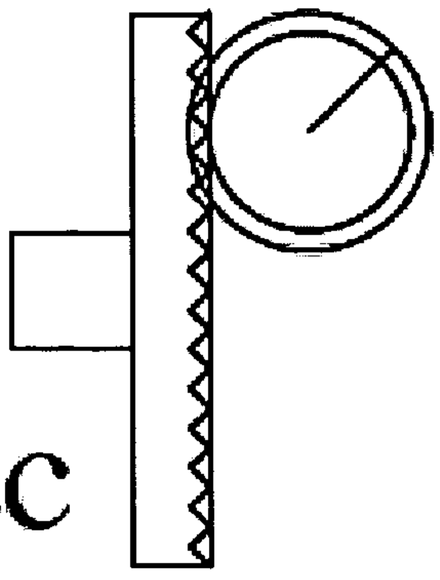


Fig. 12c

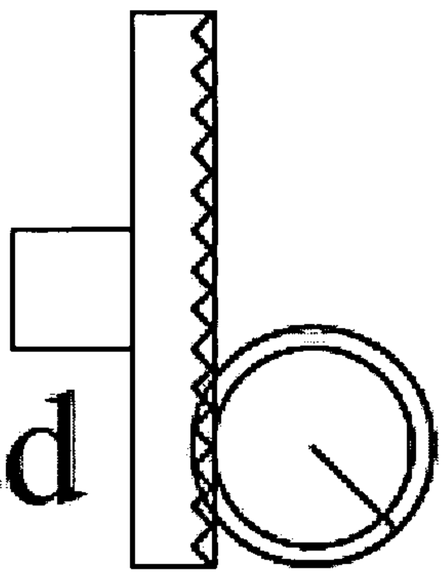


Fig. 12d

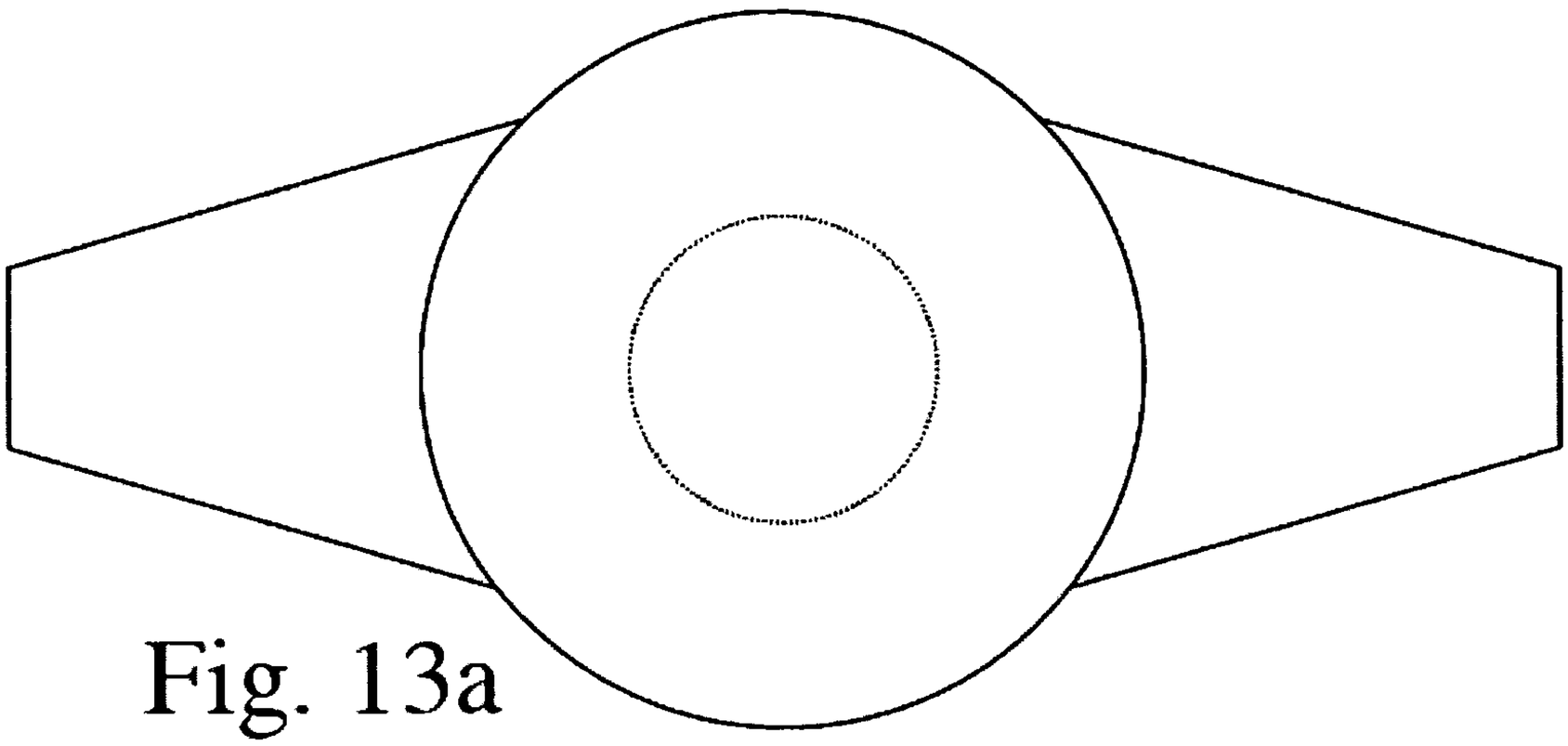


Fig. 13a

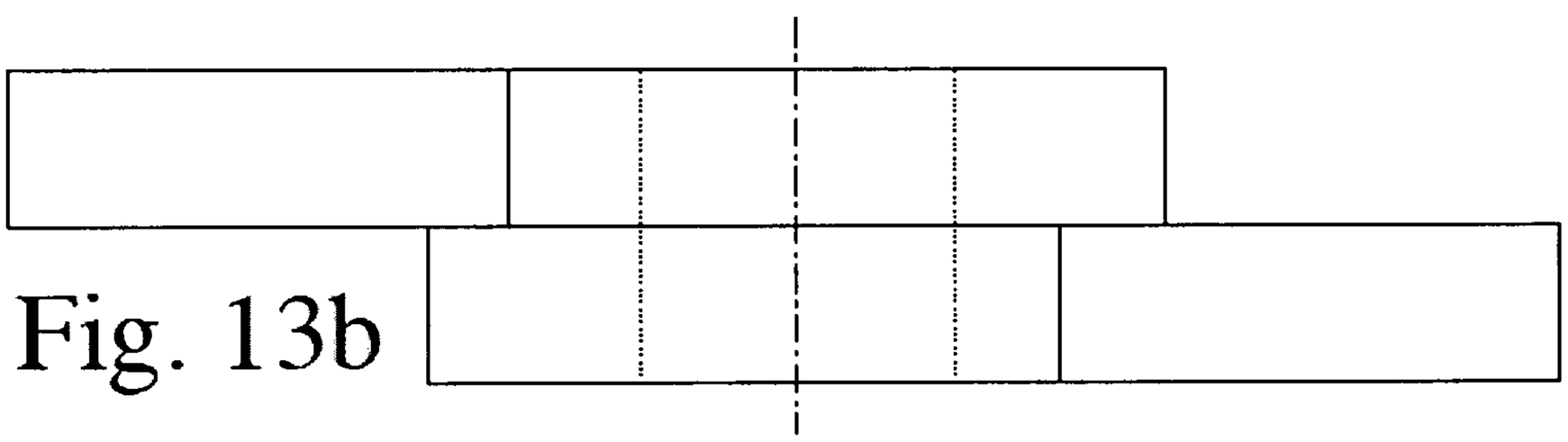


Fig. 13b

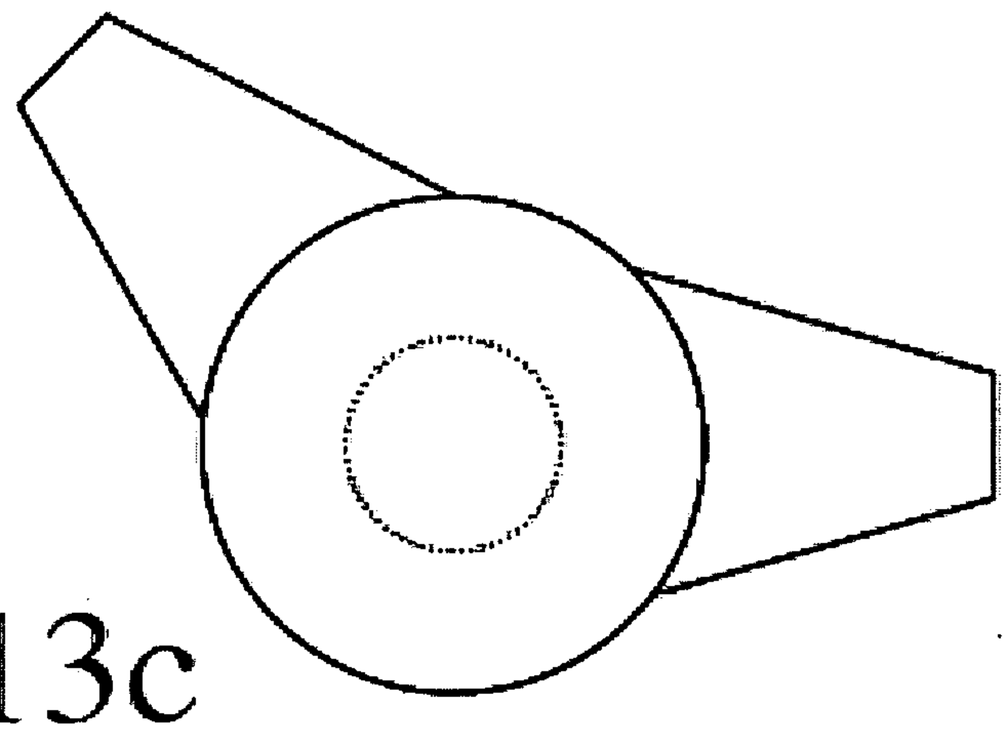


Fig. 13c

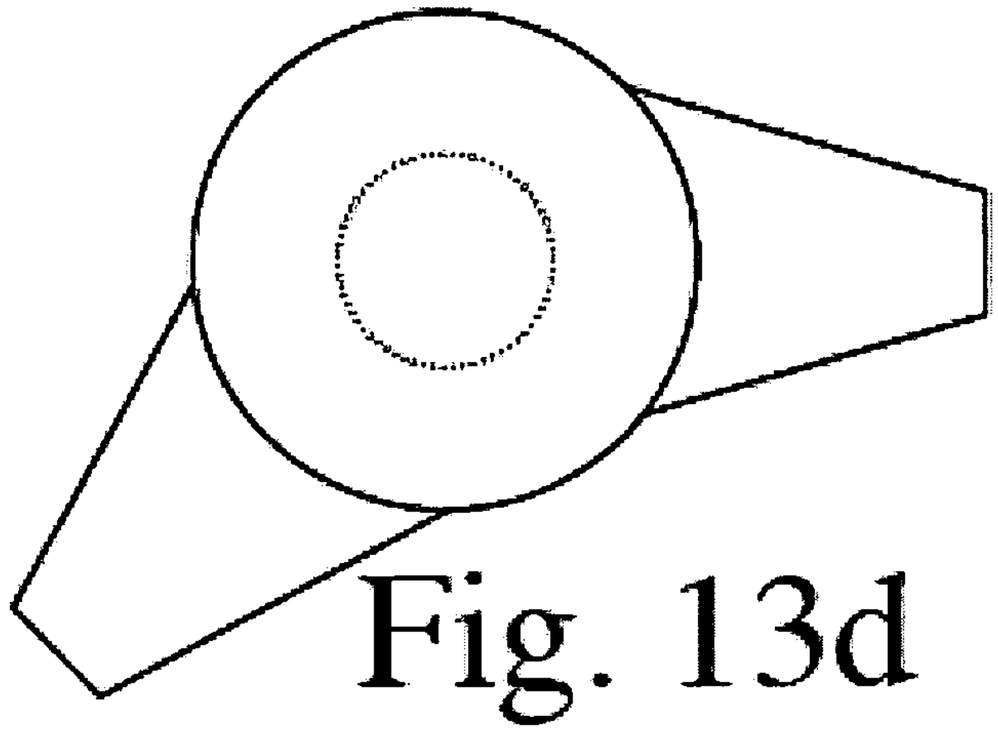


Fig. 13d

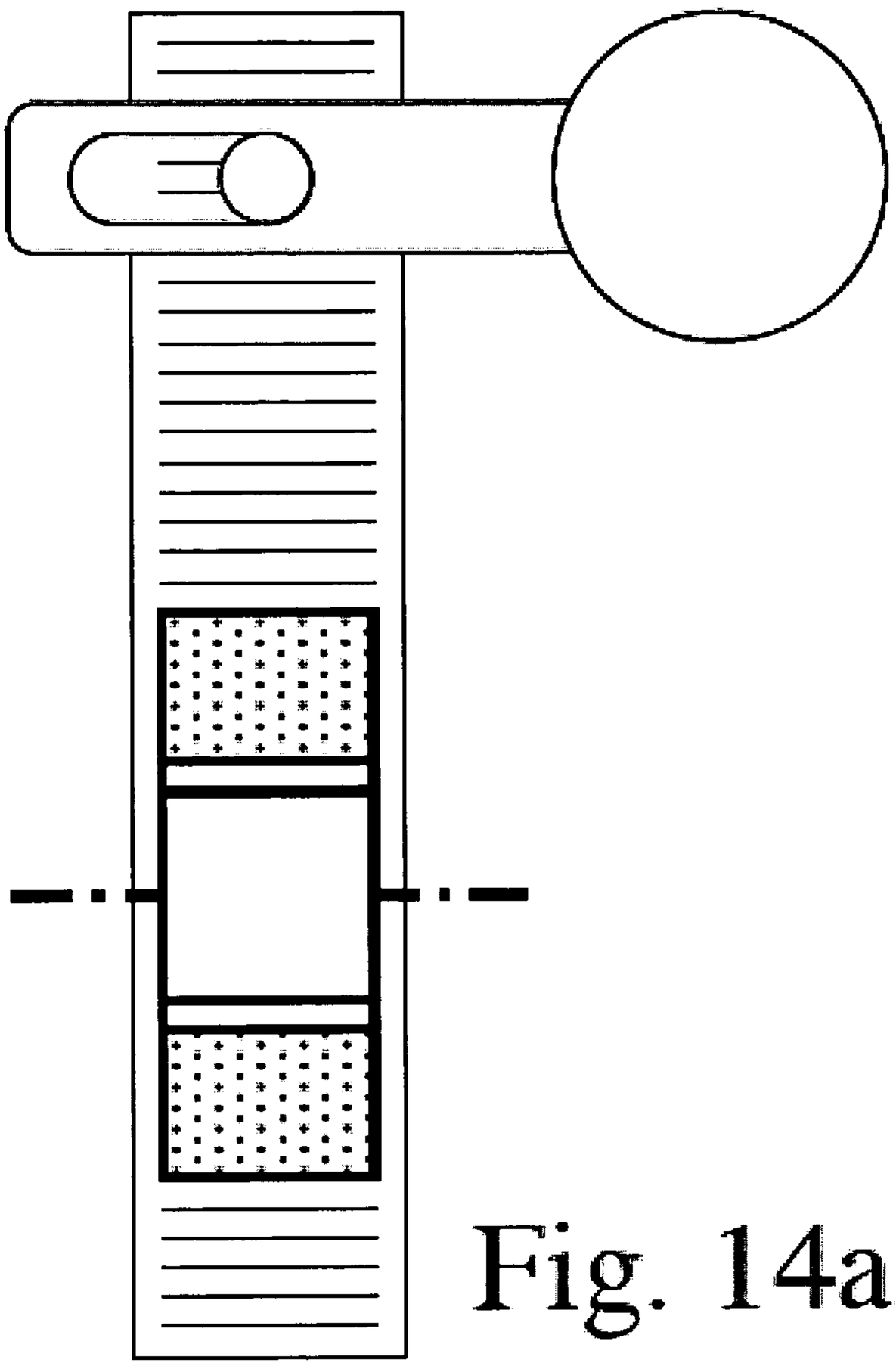


Fig. 14a

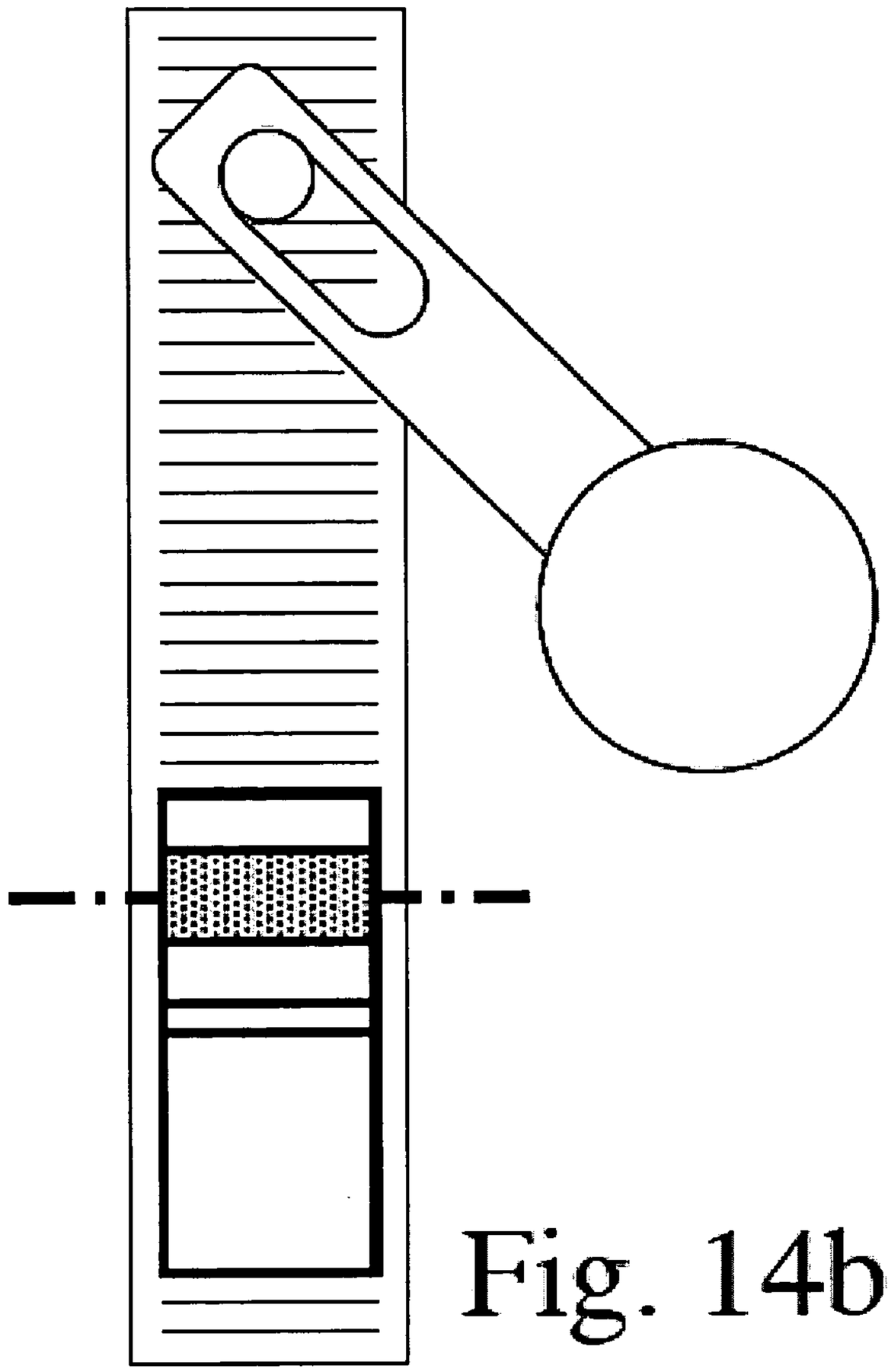


Fig. 14b

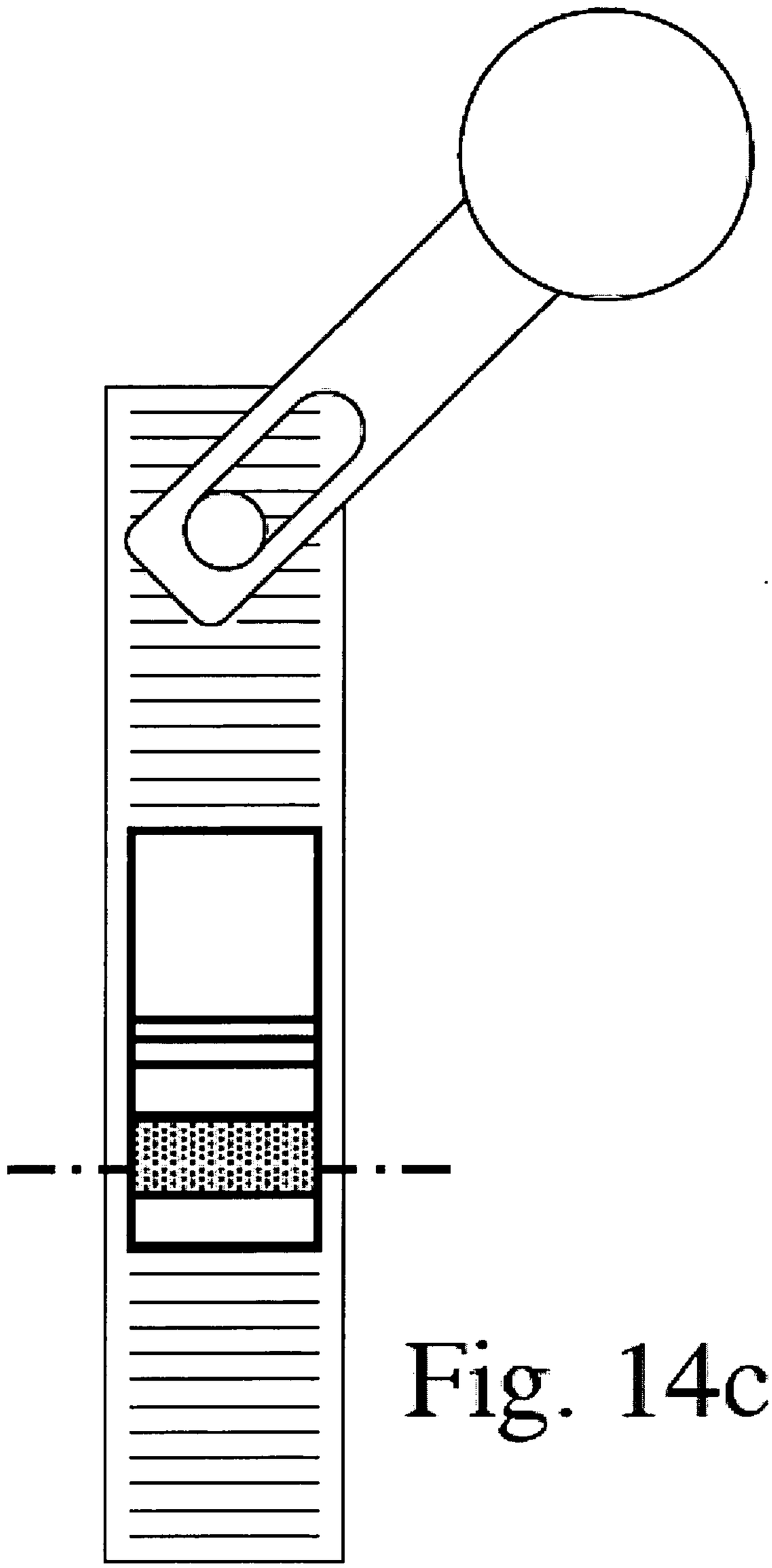


Fig. 14c

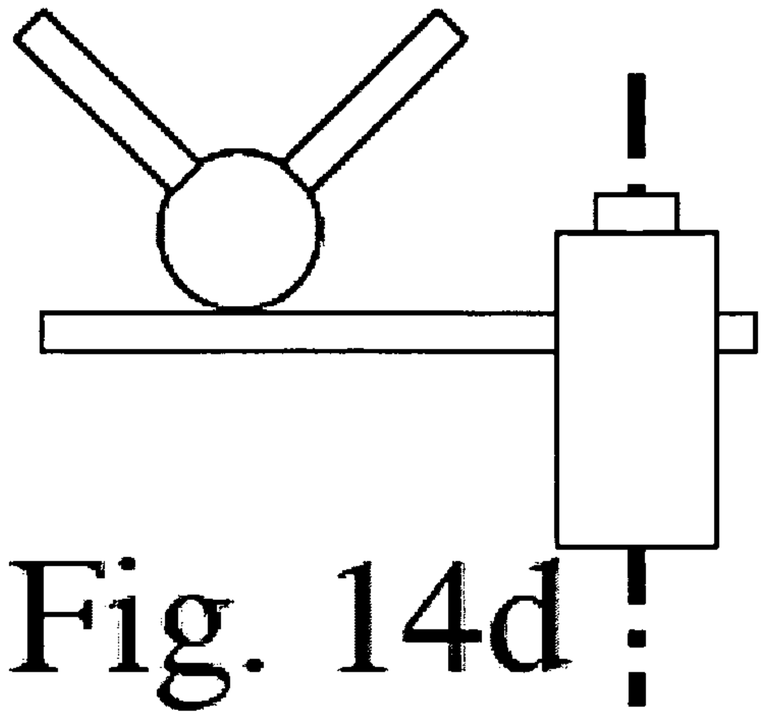


Fig. 14d

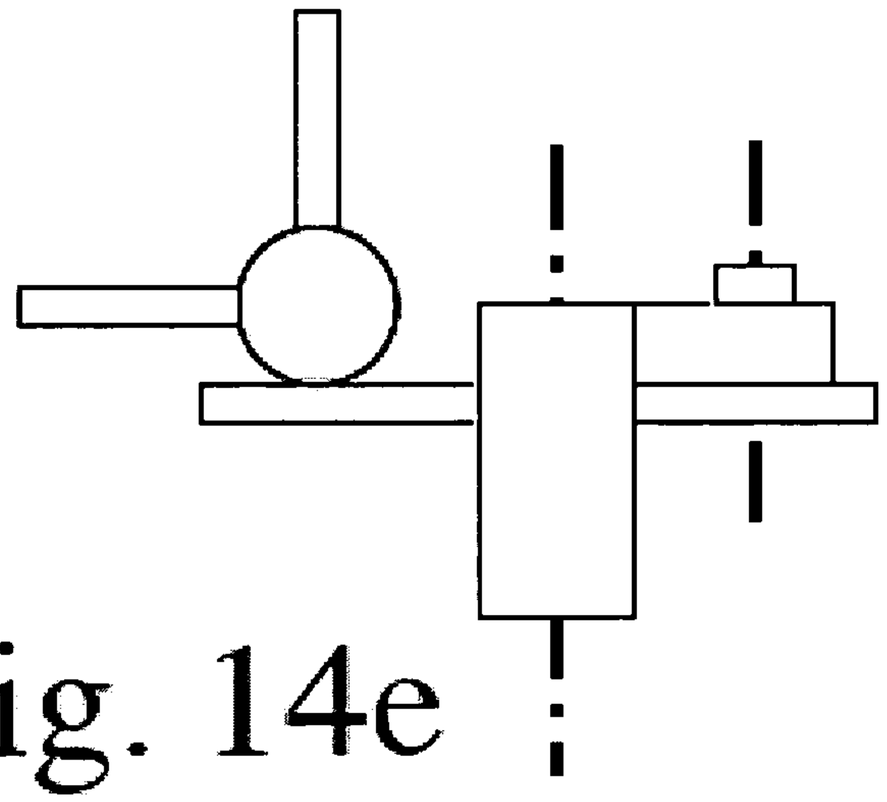


Fig. 14e

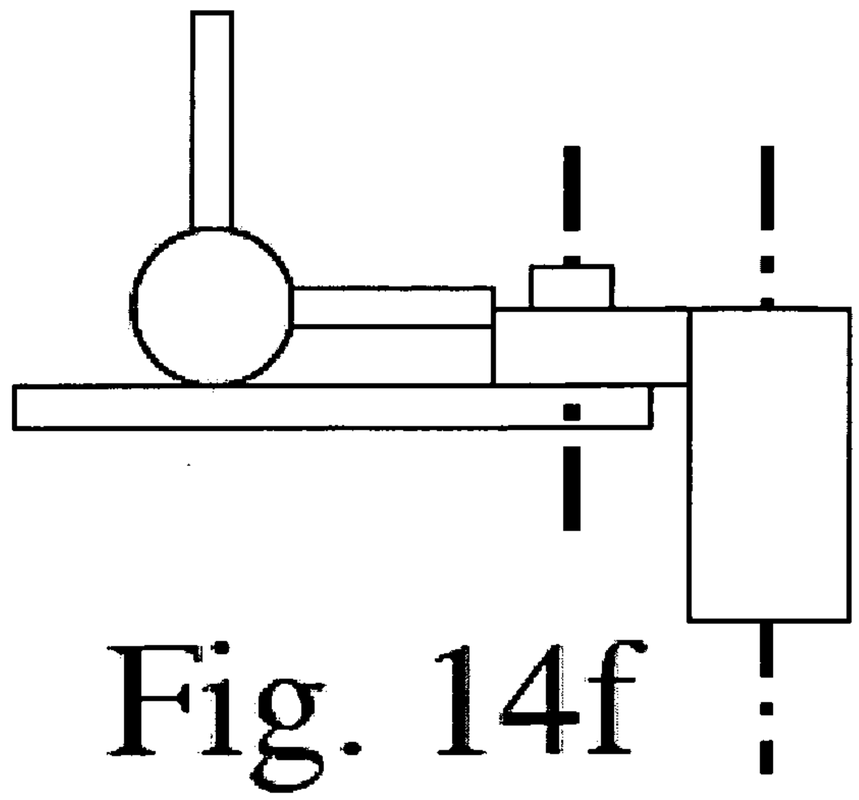


Fig. 14f

Fig. 1