A laboratory pump unit (1) for pipetting, filtering, and exhausting a gaseous or liquid fluid is provided. The laboratory pump unit (1) includes a pump (3), which can be connected on the suction side and/or the pressure side to a pipette (4) or other fluid receiver, for suctioning or ejecting the fluid. The laboratory pump unit includes, among other elements, a secondary tube (9, 10) that is connected to the suction tube and/or pressure tube (6, 7) that is connected to the pipette (4) or fluid receiver on the one hand and the pump (3) on the other hand, and is open to the atmosphere, and includes a throttle (11, 12) for limiting the amount of air drawn in or ejected. The laboratory pump unit (1) is operated in "open" pump operation on the suction side and pressure side with a precisely adjusted tube pressure in the suction tube or pressure tube (6, 7), which cannot be exceeded or fallen below by the pump (3).
LABORATORY PUMP UNIT

BACKGROUND

[0001] The invention relates to a laboratory pump unit, with a pump to which a pipette or the like fluid receiver can be releasably connected on the suction side and/or the pressure side for drawing in or ejecting a fluid.

[0002] Laboratory pump units of the kind mentioned at the beginning are already known, for use in a laboratory in order to be able to suction into a pipette, for example, bacteria, viruses and the like sources of illness and other, liquids contaminated with life-endangering contents for further investigation without endangering the life and health of the investigating laboratory personnel.

[0003] Thus a laboratory pump unit is already known, for example, in which the associated current supply independent of the mains supply, and the operating elements needed for controlling the pump and the suction process are installed in a housing of pistol grip type. This known pump unit is however heavy, so that the investigating laboratory personnel cannot constantly operate it for a long period.

[0004] A laboratory pump unit has therefore already been provided which is functionally divided into a hand portion and a pump portion, in order to be able to configure the hand portion as light and correspondingly favorable for operation as possible.

[0005] In a few of the previously known laboratory pump units, the pump power is adapted, by a cross section change in the suction tube, to the comparatively small maximum intake volume of the pipette or like fluid receiver. Such a narrowing of the cross section however then permits only a little play in order to be able to undertake fine regulation by means of a regulating valve interposed in the suction tube.

[0006] Laboratory pump units whose components are located in a housing of the pistol grip type furthermore have the disadvantage that the liquid drawn into the pipette is removed from the pipette after performing investigations and has to be removed from the pipette and individually disposed of as samples from the laboratory pump unit.

SUMMARY

[0007] The object therefore is to provide a laboratory pump unit of the kind mentioned at the beginning, which permits substantially simpler simplification, convenient for the user.

[0008] A solution of this object according to the invention provides in particular that a secondary tube is connected to the suction and/or pressure tubes connected to the pipette or the like fluid intake, on the one hand, and to the pump on the other hand; that is open to the atmosphere; and has a throttle for limiting the amount of air drawn in or expelled. By the at least one secondary tube provided according to the invention, the suction and/or expulsion speed in the suction and/or pressure tube is limited to a maximum value. Namely, for accurate pipetting, the suction speed should not exceed a maximum value; therefore the reduced pressure required for suctioning is limited to a maximum value in the laboratory pump unit according to the invention. This reduced pressure can be reduced and kept constant by the throttle which is provided in the secondary tube leading to the suction tube. In order also not to allow in particular a liquid sample to spurt into the surroundings in an emptying process, the ejection speed should also not exceed a maximum value. The excess pressure required for ejection is therefore also limited to a maximum value. This excess pressure is produced and kept constant by the throttle which is provided in the secondary tube leaving the pressure tube. The pump of the laboratory pump unit according to the invention is thus operated in an "open" operation on the suction side and the pressure side, with a precisely set tube pressure in the suction and/or pressure tube, which pressure cannot be exceeded or respectively fallen below.

[0009] In order to adapt the suction speed to the various sizes of pipettes, it is advantageous if a control valve is arranged in the suction tube, in the flow direction before the tube node connected to the secondary tube, permitting as a throttle valve a cross sectional change in the suction tube.

[0010] In order also when emptying the pipettes or like fluid receivers to be able to adapt the ejection speed to the different sizes of pipettes, it is appropriate if a control valve is arranged in the pressure tube, in the flow direction after the tube node connected to the secondary tube, permitting a cross sectional change in the pressure tube. The pipetting speed can thus be precisely adjusted between zero and a maximum or minimum value set by the throttle.

[0011] It is particularly advantageous if an air filter and/or noise damper is provided in the tube end region, open to the atmosphere, of the secondary tube(s). A noise damper is particularly recommended in the laboratory region, in order not to unnecessarily trouble investigating laboratory personnel due to a high noise level.

[0012] According to a further significant aspect of the invention, having its own importance and suitable for protection, it is particularly provided that the pump can be connected on the suction side selectively to the pipette or like fluid receiver, or to a suction tube which is connected to a collecting container and/or to a filtering device. By means of this laboratory pump unit, not only can pipetting take place, i.e., suction of the sample into the pipette and emptying of the sample from the pipette, but also this sample can be immediately stored after the investigation in the collecting container and subsequently conveniently disposed of.

[0013] Very often, particularly in a biochemical laboratory, culture media are purified, i.e. filtered. With corresponding pneumatic circuitry, the laboratory pump unit according to the invention can also be used as a vacuum unit for filtering processes, when the suction tube is connected to a filtering device necessary for this. Thereafter the culture solution is pipetted, for example, and brought onto a sample solution, in order, by means of this sample, to test the effectiveness of various antibiotics or other active materials.

[0014] The easy manipulation of the laboratory pump unit according to the invention is favored if a two-way or multi-way valve is interposed in the suction tube, and selectively connects the pump on the suction side either to the pipette or the like fluid receiver, or to the suction tube.

[0015] In order to further simplify the easy manipulation of the laboratory pump unit according to the invention, it is suitable for the suction aperture of the suction tube and the outlet opening of the pressure tube to be arranged in an
adapter which can be connected to the pipette or like fluid receiver and which preferably is of a pistol grip form, and for the adapter to have at least one valve for selective connection of the pipette or like fluid receiver to the suction tube or the pressure tube.

[0016] A preferred embodiment of the invention provides that the pump is formed as a diaphragm pump, particularly as a shaped diaphragm pump. Such a diaphragm pump is distinguished by its low running noise and is therefore particularly suitable for the laboratory field.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Further features of the invention will become apparent from the following description of an exemplary embodiment example according to the invention in connection with the claims, and also the accompanying drawing. The individual features can be realized according to the invention singly or plural in an embodiment according to the invention.

[0018] The drawing FIGURE is a schematic representation of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0019] In the single FIGURE there is shown a laboratory pump unit 1, which is functionally divided into a pistol grip shaped hand portion 2 and pump portion. By this functional division, the hand portion 2 can be made especially light and convenient to manipulate.

[0020] The laboratory pump unit 1 shown is intended for suctioning up a gaseous or liquid fluid contaminated with disease-producing or other contents dangerous to life, and has for this purpose a pump 3, preferably configured as a shaped diaphragm pump, which can be releasably connected on the suction side to a pipette 4 or the like fluid receiver.

[0021] The laboratory pump unit 1 shown here has a suction tube 6 connected to the suction side of the pump 3 and a pressure tube 7 connected to the pressure side of the pump 3. Both the intake aperture of the suction tube 6 and also the outlet aperture of the pressure tube 7 are arranged in the hand portion 2 acting as an adapter and releasably connectable to the pipette 4 or the like fluid receiver. A check valve is respectively interposed in the tube sections of the suction and pressure tubes 6, 7 before they enter into the hand portion, which check valves can be operated alternately.

[0022] If the check valve interposed in the suction tube 6 to the hand portion 2 is closed, the pressure tube 7 is simultaneously switched open, in order to eject the fluid contained in the pipette 4 or the like fluid receiver. If in contrast the check valve arranged in the pressure tube 7 is closed, the suction tube 6 is simultaneously opened, in order to suction the liquid or gaseous sample into the pipette 4 or the like fluid receiver. Secondary tubes 9, 10 are respectively connected to the suction and pressure tubes 6, 7 connected to the pipette 4 or the like fluid receiver on the one hand, and the pump 3 on the other hand, and have a respective throttle 11, 12 for limiting the amount of air drawn in or ejected. The suction speed in the suction tube 6 and respectively the ejection speed in the pressure tube 7 are limited to a maximum value by the secondary tubes 9, 10 and the throttles 11, 12 contained therein. Namely, for exact pipetting the suction speed in the suction tube 6 should not exceed a maximum value, so that the reduced pressure needed for suctioning is limited to a maximum value (x through y mbar), for example to 100 mbar. This reduced pressure in the suction tube is produced and kept constant by the throttle 11.

[0023] So that the fluid sample present in the pipette cannot be squirted into the surroundings during the ejection process, the ejection speed in the pressure tube 7 should not exceed a maximum value. Therefore the excess pressure required for ejection is also limited to a maximum value (x-y mbar), for example to 50 mbar. This excess pressure in the pressure tube 7 is produced and kept constant by the throttle 12.

[0024] During the suctioning process, the liquid to be investigated is drawn into the pipette 4 via the suction tube 6, with the air being ejected via the pressure tube 7 and the secondary tube 10 through the throttle 12 and the noise damper 15 allocated to it. During the emptying of the pipette 4, the air required for emptying is drawn in through the throttle 11 and the noise damper 15 allocated to it through the secondary tube 9 and the suction tube 6, and is blown through the pressure tube 7 into the pipette 4 releasably connected to the hand portion 2.

[0025] A control valve 13 is arranged in the suction tube 6, in the flow direction before the tube node connected to the secondary tube 9. The cross section in the suction tube 6 can be varied by means of the control valve 13 so that the suction speed in the suction tube 6 can be adapted, or is to be adapted, to the different sizes of pipettes or the like fluid receivers.

[0026] A control valve 14 is also arranged in the pressure tube 7 after, in the flow direction, the tube node connected to the secondary tube 10, and is intended for changing the cross section in the pressure tube 7 and for adapting the ejection speed to the various sizes of pipette.

[0027] The noise dampers 15 are arranged in the region of the tube end regions of the secondary tubes 9, 10 open to the atmosphere, and can also be formed as air filters.

[0028] The pump 3, on the suction side, can be selectively connected to the pipette 4 or the like fluid receiver or to an suction tube 8 by means of a multi-way valve 5 interposed in the suction tube 6, in order to connect a drop separator and/or collecting container 16. With corresponding switching of the multi-way valve 5, the laboratory pump unit 1 can also be used as a vacuum unit for general filtration processes when the suction tube 8 is connected at its tube end away from the pump 3 to a filtering device. The dash-dot lines indicate that this filtering device can also be arranged, according to need, before the collecting container 16 in the flow direction. It is appropriate if a control valve, not further shown here, is interposed between the collecting container 16 and the filtering device.

[0029] The intake aperture of the suction tube 6 and the outlet aperture of the pressure tube 7 are arranged in the hand portion configured as an adapter formed as a pistol grip. By changing over the valve provided in the hand portion 2 and operable by means of two press buttons, either the suction process or the emptying process can be begun or concluded.
While the hand portion 2 in the form of a pistol grip is made light and suitable for manipulation, the pump portion can for example be integrated under the laboratory table and/or formed as a traveling mobile station. By a visible indication of function and by advantageously designed and positioned operating elements, the easy operability of the laboratory pump unit 1 is favorable for both right-handed and left-handed use. By the secondary tubes 9, 10 allocated to the suction and pressure tubes 6, 7, and the throttles 11, 12 located therein, in the laboratory pump unit 1 shown here, the pipetting speed can be varied particularly easily and precisely in a comparatively large adjustment region.

The pipetting speed is individually adjustable for each size of pipette or the like fluid receiver used such that the optimum filling and ejection speed is always quickly and conveniently found. The high power of the laboratory pump unit 1 and the light construction of its hand portion 2 without a pump or battery integrated into the hand portion 2 favors working without becoming tired.

Since the pump portion of the laboratory pump unit can be integrated under the laboratory table and also for example connected to an electric main supply, no loading phases for loading a battery are required. Since the laboratory pump unit 1 permits ejection of the investigated samples into the collecting container 16, a high safety standard can be attained. This high safety standard is further favored if the collecting container 16 is provided as safe from pouring out and/or autoclavable glass bottle. It is advantageous if the laboratory pump unit 1 has a sterile filter so that the suction of liquid into the laboratory pump unit 1, and particularly into its pump portion, is prevented.

An embodiment is preferred in which the laboratory pump unit 1 has a chemical-resistant and correspondingly long life diaphragm pump 2, which is also distinguished by its quiet operation. It is an especially advantageous for the laboratory pump unit 1 shown here that this permits both pipetting and also the ejection of the used liquid samples and the disposal of these samples after investigation has been performed, and thus combines three devices in one device unit.

The laboratory pump unit 1 is operated in “open” pump operation with a precisely adjusted tube pressure in the suction and/or pressure tube (6, 7) which cannot be exceeded or fallen below by the pump (3).

1. Laboratory pump unit (1) comprising a pump (3) which is connectable on a suction side and/or a pressure side with a pipette (4) or fluid receiver by a suction tube and a pressure tube, respectively, for drawing in or ejecting a fluid, a secondary tube (9, 10) is connected to at least one of the suction tube and the pressure tube (6, 7), and is connected to atmosphere, and a throttle (11, 12) is provided on the secondary tube for limiting a drawn in or ejected amount of air.

2. The pump unit according to claim 1, wherein a control valve (13) is arranged in the suction tube (6) before, in the flow direction, a tube node connected to the secondary tube (9).

3. The pump unit according to claim 1, wherein a control valve (14) is arranged in the pressure tube (7) after, in the flow direction, a tube node connected to the secondary tube (10).

4. The pump unit according to claim 1, wherein at least one of an air filter and a noise damper is provided in a region of a tube end of the secondary tube (9, 10) open to the atmosphere.

5. The pump unit according to claim 1, wherein the pump (3) can be selectively connectable on the suction side to the pipette (4) or fluid receiver or to an suction tube (8), which is connected to at least one of a collecting container (16) and a filtering device.

6. The pump unit according to claim 5, wherein a two-way or a three-way valve (5) is interposed in the suction tube (6) and selectively connects the pump (3) either to the pipette (4) or the like fluid receiver or to the suction tube (8).

7. The pump unit according to claim 1, wherein a suction aperture for the suction tube (6) and an outlet aperture of the pressure tube (7) are arranged in an adapter (2) which is connectable to the pipette (4) or the fluid receiver, the adapter having a pistol grip form; and wherein the adapter (2) has at least one valve for selective connection of the pipette (4) or the fluid receiver to the suction tube or the pressure tube (6, 7).

8. The pump unit according to claim 1, wherein the pump (3) comprises a diaphragm pump.