Oct. 27, 1942. H. H. SCHULZ 2,299,769

PUMP, SYRINGE, AND LIKE APPLIANCE FOR SURGICAL AND MEDICAL AND OTHER PURPOSES

Filed Dec. 3, 1938

Fig. 1.

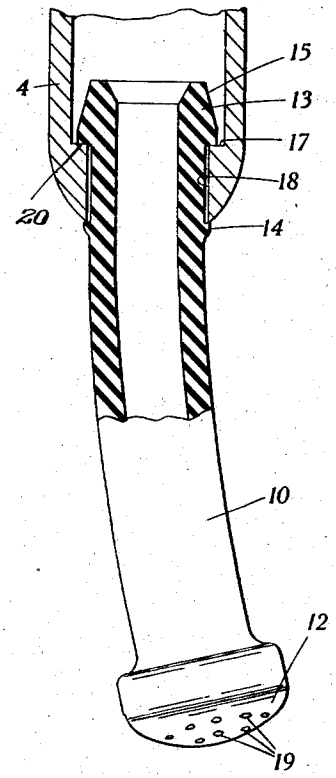


Fig. 2.

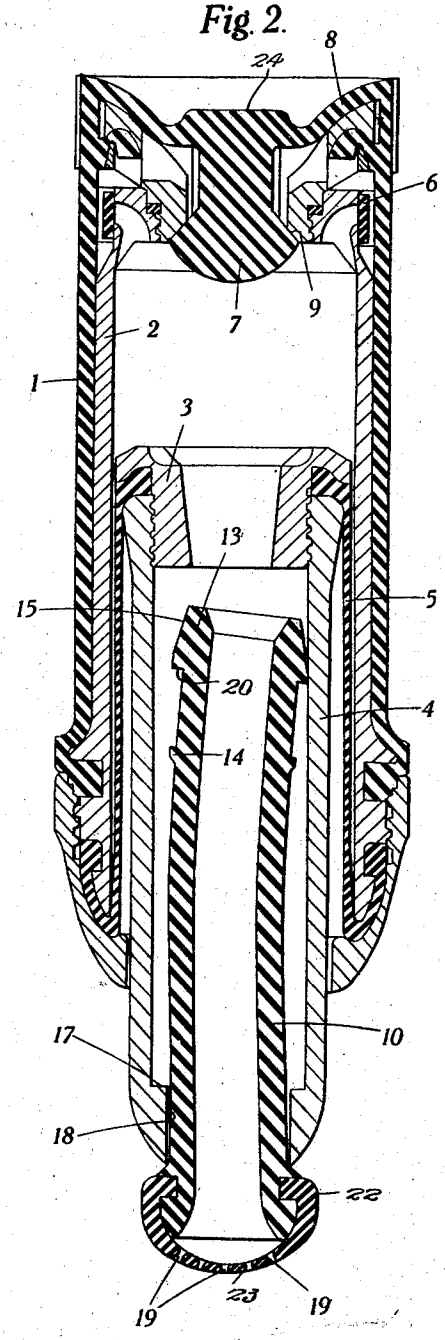
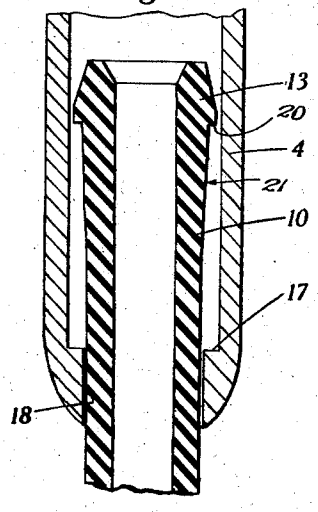


Fig. 3.



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Patented Oct. 27, 1942

2,299,769

UNITED STATES PATENT OFFICE

2,299,769

PUMP, SYRINGE, AND LIKE APPLIANCES FOR SURGICAL AND MEDICAL AND OTHER PURPOSES

Hans Herbert Schulz, Wembley, England

Application December 3, 1938, Serial No. 243,735
In Great Britain December 8, 1937

7 Claims. (Cl. 128—232)

The invention relates to pumps, syringes and like appliances for surgical and medical and other purposes, and it has particular reference to appliances that comprise an elastic fluid storage chamber and a self-contained pumping apparatus for charging the chamber. The charge is held under the pressure of the elastic wall which exerts the discharging force to establish a continuous flow under the control of a suitable hand-actuated valve.

The invention has particular reference to appliances of this nature having a long projecting nozzle tube which for convenience in packing or stowage is made so that it can be retracted when the appliance is not in use, or is made in two retractible parts which are movable one into the other in telescope fashion.

The invention aims to minimise the number of parts and to simplify manufacture and ease of operation of the nozzle tube to bring this into and out of operative position.

To these ends the present invention broadly consists in constructing the syringe with a rubber nozzle tube and a housing into which the tube is retractible, these parts having co-operating means whereby the tube can be sprung into, or elastically retained in, a position in which it will remain extended whilst the syringe is in use and the nozzle being so constructed that after the tube has been retracted, the nozzle will close the syringe when the latter is pressed nozzle-end first against a support so that fluid in the pump cylinder can be forced into the storage chamber and will open the syringe when the pressure thereon is released upon the suction stroke of the pump to enable a fresh charge to enter the cylinder.

The tube may be provided with a shoulder adapted to spring past a retaining shoulder on the housing so as to keep the nozzle tube extended when the syringe is in use or the nozzle tube may be tapered or provided with a tapered portion which enables the tube elastically to grip the housing when the tube has been extended sufficiently, so as to keep the nozzle tube extended when the syringe is in use. In either case the tube can be retained by the simple act of extending the tube.

In order that the invention may be the more readily understood, reference is made to the accompanying drawing, in which:

Fig. 1 is a longitudinal sectional view through the syringe with the nozzle tube extended and Fig. 2 is a sectional view showing the nozzle tube retracted.

Fig. 3 is a sectional view of a modified form of locking device for retaining the nozzle tube in its extended position.

The syringe may be constructed in accordance with my prior Patent No. 2,134,291 in which a fluid storage chamber is formed by an elastic wall 1 of a rubber bag or sac and a rigid inner member 2 over which the sac is fitted. This inner member 2 forms a cylinder for the piston 3 of the pump, the piston being connected directly to or forming a part of an outlet tube 4 and being secured by way of an extensible rubber sleeve 5 to the cylinder member 2. A non-return valve 6 is provided between the cylinder member 2 and the surrounding wall 1 of the sac and a discharge valve 7 is formed integrally with the end wall 8 of the sac to co-operate with an internal seating 9 so that the valve can be opened by pressure applied through the wall of the sac.

For carrying out the present invention, use may be made of a thick-walled rubber nozzle tube 10 with a nozzle head 12 at one end and shaped at its other end with an enlargement 13 and with a collar or bead 14 situated near to such enlargement. The enlargement may be cylindrical preferably with a conical end 15. The discharge end of the outlet tube 4 of the syringe may be internally shouldered at 17 to form a passage 18 of sufficient diameter to enable the nozzle tube to pass freely through it but of less diameter than the collar 14 and of a length substantially equal to the distance between the collar 14 and the shoulder 20 formed by the junction of the cylindrical enlargement of the nozzle tube 10 with the main part of the tube. The conical end 15 permits the tube 10 to be forced through the constricted passage 18 for initially assembling the tube 10 in the tube 4.

When the tube is pulled out to its operative position as shown in Fig. 1, the collar 14 is deformed and squeezed through the passage but springs out in front of the leading end of the outlet tube, whilst the shoulder 20 of the nozzle tube is brought up to the interior shoulder 17 on the outlet tube. Consequently the nozzle tube is held in position, as the collar on the one hand and the shoulder engagement on the other prevent movement in either direction.

This axial retainment of the tube can be overcome by pressing the rubber tube towards the outlet tube with a sufficient pressure to squeeze the collar again through the constricted passage in the outlet tube.

In the form shown in Fig. 3 the collar is dispensed with and the nozzle tube tapers some-

what from the shoulder of the enlargement 13 towards the nozzle end of the tube so that when the tube is extended a widening part 21 of this tube engages the shoulder 17 of the housing tube and elastically grips the latter sufficiently to keep the nozzle tube extended during the use of the syringe.

The nozzle is proportioned so that when the tube is retracted into its housing tube 4 the nozzle seats against the leading end of the tube and it is provided with a plurality of passages 19 leading to the interior of the rubber tube and so situated within the margin of the nozzle that when the nozzle end of the syringe is inserted in a vessel of liquid or against a suitable surface and the pumping started, the nozzle acts as a valve, closing the syringe by pressure of the latter, nozzle end first, against the floor of the vessel or other engaging surface upon the compression stroke to allow liquid from the vessel, or air if the nozzle is pressed against any surface exposed to the air, to be forced past the valve 6 so as elastically to expand the rubber wall 1 of the sac and fill the storage chamber and opening upon the suction stroke when the pressure is released. The pressure is achieved by pressing the syringe nozzle end first against such surface and advancing the cylinder towards such surface against the resistance to extension of the rubber sleeve 5. A single e. g., central passage 19 may be employed.

The front face of the nozzle may be of conical, conoidal or spherical form so that the rubber has to be deformed by pressure of the appliance against the resisting surface in order to close the nozzle apertures and the open end of the outlet tube 4 during the compression stroke and elastically reacts to resume its normal conical, conoidal or spherical form to allow the ready inflow of fluid into the pump cylinder during the suction stroke. The wall of the hollow conical, conoidal or spherical nozzle head is of such thickness as to facilitate the deformation thereof when the syringe is to be closed during pumping. The illustrated formation of the nozzle head is advantageous as multiple passages 19 may be provided in it at such angles to the axis thereof as to produce a series of outward jets when the discharge valve 7 is opened by thumb or finger pressure on the face 24. In the forms shown the conical, conoidal or spherical nozzle head 22 is of considerably thinner and softer rubber than the rubber tube and is notably thinner at the part 23 in which the apertures 19 are formed. This enables the nozzle head to be readily deformed when it is to seal off the syringe during pumping.

The syringe operates as follows:

The syringe is filled by first retracting the nozzle tube 10 into the housing 4. The syringe is then pressed nozzle end first on the bottom of a vessel containing the liquid to be ejected, or on any other suitable surface exposed to the air if air is to be ejected, and the sac 1 with the cylinder 2 are gripped and moved downwards when the sleeve 5 is extended. When the pressure producing the downward movement is released the sleeve 5 recovers and the cylinder rises relatively to the piston 3 and fluid is drawn in through the apertures 19 in the nozzle head. Downward pressure being then again applied, the thin part of the nozzle head is pressed against the bottom of the vessel or other surface and the interior of the syringe is closed from exterior communication through apertures 19 while the fluid drawn in during the previous stroke is now compressed and it forces open the non-return valve 6 and expands the cylindrical wall of the sac 1. This downward pressure stroke followed by the upward draw in stroke is repeated until the sac has been expanded sufficiently and a sufficient charge of fluid is held in the expansible chamber. The elastically expanded wall of the sac always tends to force the contained fluid out of the expanded chamber but it cannot do so until thumb or finger pressure is applied to the surface 24 which moves inwards the valve 7 off its seating so that the fluid is then forced out continuously past the valve and through the open housing 4 and nozzle tube 10, the latter having been previously extended to bring its collar 14 or widened part 21 into position to retain it in the extended position.

The rubber tube may be moulded in one piece with the nozzle, collar and the enlarged retaining end but in the form shown in Fig. 3 it is preferred to solution or vulcanise together the conical nozzle head and the tube. It is convenient and advantageous to mould the tube with its axis slightly curved or so situated in relation to the retaining end that when extended it assumes an inclined position in relation to the axis of the outlet tube of the syringe. The slight deformation which the curved tube undergoes when forced back into the surrounding tube assists in retaining the nozzle tube in its retracted position.

I claim:

1. A syringe or the like comprising a rigid cylinder member, a piston member in said cylinder member, an elastic member secured to said cylinder member in a fluid tight manner so as to lie normally in close proximity to the external surface of said cylinder member, said elastic member being capable of being elastically expanded by fluid pressure to provide a variable storage chamber around said cylinder member, said cylinder and piston members being relatively longitudinally displaceable, a fluid inlet from the interior of said cylinder member to said chamber, a one-way valve controlling said inlet whereby to permit fluid to enter said chamber and expand said elastic member and to be retained in said chamber, an outlet from said storage chamber and valve means by which said fluid can be released when desired through said outlet from said chamber, said piston member having a rigid tubular part, an elastically deformable rubber tube partially housed in said tubular part, co-operating means between said rigid tubular part and said elastically deformable rubber tube which permit said tube, when drawn outwards from its housing, to be elastically deformed to secure it in the desired extended position during the use of the syringe, the outer end of said tube comprising an enlarged nozzle portion having at least one discharge opening, said portion being arranged to be brought against the outlet end of said tubular part and being elastically deformable when pressed against a support to seal the interior of the cylinder member from exterior communication by way of said discharge opening and to seal said end of the tubular part thereby to complete the sealing of the interior of the cylinder member, so that by displacing the cylinder member towards the support the fluid in the cylinder member is forced to expand said elastic wall and remain in storage in said chamber, and said nozzle portion being adapted to relax again when the pressure is released and the cylinder

member is to return to enable a fresh charge to be sucked into the cylinder member.

2. A syringe or the like comprising a rigid cylinder member, a piston member in said cylinder member, an elastic member secured to said cylinder member in a fluid tight manner so as to lie normally in close proximity to the external surface of said cylinder member, said elastic member being capable of being elastically expanded by fluid pressure to provide a variable storage chamber around said cylinder member, said cylinder and piston members being relatively longitudinally displaceable, a fluid inlet from the interior of said cylinder member to said chamber, a one-way valve controlling said inlet whereby to permit fluid to enter said chamber and expand said elastic member and to be retained in said chamber, an outlet from said storage chamber and valve means by which said fluid can be released when desired through said outlet from said chamber, said piston member having a rigid tubular part provided with a local internal portion projecting towards the axis of said part, an elastically deformable rubber tube partially housed in said tubular part, an external protrusion on said tube which, when the tube is drawn outwards from its housing, is first elastically deformed by said internal portion and then relaxes to engage the other side of said portion, a second external protrusion on said tube adapted to engage said internal projecting portion when the first external protrusion has been sprung past the internal portion so as to secure the tube in the desired extended position during the use of the syringe against either complete withdrawal or retraction, the outer end of said tube comprising an enlarged nozzle portion having at least one discharge opening, said portion being arranged to be brought against the outlet end of said tubular part and being elastically deformable when pressed against a support to seal the interior of the cylinder member from exterior communication by way of said discharge opening and to seal said end of the tubular part thereby to complete the sealing of the interior of the cylinder member, so that by displacing the cylinder member towards the support the fluid in the cylinder member is forced to expand said elastic wall and remain in storage in said chamber, said nozzle portion being adapted to relax again when the pressure is released and the cylinder member is to return to enable a fresh charge to be sucked into the cylinder member.

3. A syringe or the like comprising a rigid cylinder member, a piston member in said cylinder member, an elastic member secured to said cylinder member in a fluid tight manner so as to lie normally in close proximity to the external surface of said cylinder member, said elastic member being capable of being elastically expanded by fluid pressure to provide a variable storage chamber around said cylinder member, said cylinder and piston members being relatively longitudinally displaceable, a fluid inlet from the interior of said cylinder to said chamber, a one-way valve controlling said inlet whereby to permit fluid to enter said chamber and expand said elastic member and to be retained in said chamber, an outlet from said storage chamber and valve means by which said fluid can be released when desired through said outlet from said chamber, said piston member having a rigid tubular part provided with a local internal portion projecting towards the axis of said part, an elastically deformable rubber tube partially housed in said tubular part, said tube having at least locally a tapering external surface which, when the tube is drawn outwards from its housing, is elastically compressed and gripped by said internal portion, said tube having an external protrusion adapted to engage said local internally projecting portion and limit the outward movement of said tube when said tube has been compressed sufficiently to secure the tube in the desired extended position, the outer end of said tube comprising an enlarged nozzle portion having at least one discharge opening, said portion being arranged to be brought against the outlet end of said tubular part and being elastically deformable when pressed against a support to seal the interior of the cylinder member from exterior communication by way of said discharge opening and to seal said end of the tubular part thereby to complete the sealing of the interior of the cylinder member so that by displacing the cylinder member towards the support the fluid in the cylinder member is forced to expand said elastic wall and remain in storage in said chamber, said nozzle portion being adapted to relax again when the pressure is released and the cylinder member is to return to enable a fresh charge to be sucked into the cylinder.

4. A syringe or the like comprising a rigid cylinder member, a piston member in said cylinder member, an elastic member secured to said cylinder member in a fluid tight manner so as to lie normally in close proximity to the external surface of said cylinder member, said elastic member being capable of being elastically expanded by fluid pressure to provide a variable storage chamber around said cylinder member, said cylinder and piston members being relatively longitudinally displaceable, a fluid inlet from the interior of said cylinder to said chamber, a one-way valve controlling said inlet whereby to permit fluid to enter said chamber and expand said elastic member and to be retained in said chamber, an outlet from said storage chamber and valve means by which said fluid can be released when desired through said outlet from said chamber, said piston member having a rigid tubular part provided with a local internal portion projecting towards the axis of said part, an elastically deformable rubber tube partly housed in said tubular part, said tube having a portion adapted to engage said internally projecting portion as the tube is drawn out of its housing and to be elastically compressed and gripped by said internal portion, said tube having an external enlargement to engage said local internally projecting portion and limiting the outward movement of said tube when the latter has been compressed sufficiently to secure the tube in the desired position, said external enlargement tapering towards the inner end of the tube so as to permit the tube to be forced past said internally projecting portion for initially assembling the tube in the rigid tubular part, the outer end of said tube comprising an enlarged nozzle portion having at least one discharge opening, said portion being arranged to be brought against the outlet end of said tubular part and being elastically deformable when pressed against a support to seal the interior of the cylinder member from exterior communication by way of said discharge opening and to seal said end of the tubular part thereby to complete the sealing of the interior of the cylinder member, so that by displacing the cylinder member towards the sup-

port the fluid in the cylinder is forced to expand said elastic wall and remain in storage in said chamber, and said nozzle portion being adapted to relax again when the pressure is released and the cylinder member is to return to enable a fresh charge to be sucked into the cylinder member.

5. A syringe according to claim 1, having a hollow nozzle head having an externally convex perforated discharging wall, said wall being substantially thinner than the wall of the tube so as to facilitate the elastic deformation of the nozzle head during the charging stroke of the cylinder member.

6. A syringe according to claim 1, having a hollow nozzle head constructed of softer rubber than the tube, the head and the tube being united together.

7. A syringe according to claim 1, in which the rubber tube is curved so that when extended it assumes an inclined position in relation to the axis of the rigid tubular part and so as to be elastically flexed when pressed into said rigid tubular part in order to retain the rubber tube frictionally in said rigid tubular part.

HANS HERBERT SCHULZ.