

A device for metered supply of a fluid and a knitting machine equipped therewith

This invention relates to a device according to the pre-characterizing part of claim 1 and a knitting machine according to the pre-characterizing part of claim 17.

5 Known devices for supplying liquids, especially oil, to a knitting machine, especially a circular knitting machine, serve to lubricate and/or clean selected machine parts, e.g. the needle cylinder grooves or the tracks formed in the cam box ring for the knitting needle butts (e.g. DE 3 609 440 A1, DE 3 624 982 A1, DE 4 104 793 A1, EP 0 549 871 A1). In all of these, pumps of various kinds are
10 provided to feed the oil, in conjunction with magnetic valves or the like, which serve for timed distribution of the supplied oil to selected feed points. A problem with such devices lies in that many oils which have good lubricating and cleaning properties also have aggressive characteristics and in the course of time cause damage to the pumps, valves, associated monitoring devices or the like. The same
15 applies to pressure limiting valves which may be present and are frequently provides, in order to ensure that, when there are fluctuating pump loads, substantially constant amounts of oil per unit time are delivered to the feed points.

In addition, devices of the kind initially defined are already known (DE-OS 2 543 913) in which these problems are avoided in that compressed air is
20 used to feed the oil, because the use of pumps and pressure limiting valves through which oil flows is then superfluous. In these known devices there is however the disadvantage that the oil supply in the pressure container subjected to compressed air decreases all the time with prolonged oil feed. Accordingly ever greater amounts of compressed air are needed to build up the desired feed pressure,
25 especially when it is desired to vent the pressure container after each feed phase, in order to relieve the distributor circuits connected to the feed line during those phases in which no oil is fed and thereby protect them. Moreover, on account of the decreasing amount of oil in the pressure container, ever greater intervals of time are needed to build up the feed pressure, since the space above the current oil level
30 must firstly be filled with compressed air. A consequence of this is that additional measures are necessary in order to feed constant amounts of oil per unit time to the lubricating points independently of the oil level in the pressure container. Finally, with this known device the pressure chamber can only ever be refilled at times in

which oil is not fed to any feed point, which is practically the same as saying that the knitting machine or the like has to be stopped for filling the pressure container. Apart from this a pressure container of this kind has to be very robust and the more robust the larger its surfaces which are subjected to pressure.

5 The invention is therefore based on the object of so designing the device of the last-mentioned kind that rapid response times with substantially constant feed pressure are automatically obtained and used oil can also be added during running operation of the device.

 The characterizing features of claims 1 and 17 serve to meet this object.

10 Further advantageous features of the invention appear from the dependent claims.

 The invention will now be explained in more detail in relation to an embodiment, with reference to the accompanying drawings, in which:

 Figure 1 is a schematic, partially sectioned side view of a first embodiment
15 of the device according to the invention;

 Figure 2 is front view in particular of a part of the device according to the invention including a pressure container and an oil supply tank, in section along a line II-II in Figure 3 and to a larger scale;

 Figure 3 is a plan view of the part of the device according to Figure 2;

20 Figure 4 is a schematic view of a second embodiment of the device according to the invention;

 Figures 5 and 6 are horizontal sections through a further embodiment of the invention in different operating positions of a control valve; and

 Figures 7 and 8 are horizontal sections through two further embodiments of
25 the invention.

 The device according to Figure 1 includes a supply tank 1 for a liquid, especially oil, on the bottom of which is arranged a pressure container 3. The supply tank 1 is preferably closed all round but is provided at the side with a filler neck 4, which can be opened and closed by means of a cover 5. The supply tank 1
30 is filled with liquid or oil before operating the device, e.g. up to a maximum specified liquid level 6.

 The pressure container 3 is preferably provided at its bottom 7 with a

passage 8, which connects its interior to the interior of the supply tank 1. A non-return valve 10 provided with a ball 9 for example is fitted in this passage 8. The arrangement is such that the ball 9 is normally lifted from a valve seat by the force of a spring 11 and oil can thus flow in the direction of an arrow v (Figure 1) from the oil supply tank 1 into the pressure container 3. If however a higher pressure builds up in the interior of the pressure container 3, the ball 9 is entrained by the flowing oil stream and forced against the bias of the spring 11 on to the valve seat, so that the non-return valve 10 or the passage 8 is closed, in order to prevent further reverse flow of oil into the oil supply tank 1.

The pressure container 3 is moreover preferably provided on its cover 12 with a further passage 14, which is connected to an external pressure line 15. A float valve 17 is connected on to this passage 14, being provided with a ball 16 and arranged vertically at the upper end of the pressure container 3. The arrangement is such that the ball is pressed into an upper position in Figures 1 and 2, against a valve seat at a maximum specified liquid level 18 in the pressure container 3 by the force of the oil or the like, so that the passage 14 is held closed. At the same time a plurality of openings 19 formed in the sidewall of the float valve 17 are thereby separated from the passage 14. The openings 19 serve to connect the passage 14 to the interior of the pressure container 3 and preferably open at places which adjoin directly below its cover 12. If however the liquid level 18 in the pressure container 3 falls below the level seen in Figures 1 and 2, e.g. to a level 18a, the ball 16 falls by gravity on to a stop in the float valve 17, which is so chosen that the passage 14 is now freed and connected through the openings 19 to the interior of the pressure container 3. Furthermore, the ball 16 slides in this movement into a channel 20 of the float valve 17 also open to the interior of the pressure container 3, so that it is lifted by the oil level as this rises again and can again close the passage 14.

The feed line 21 serves to feed the oil in the pressure container 3 and has one end preferably formed as a riser pipe 22 projecting into the pressure container 3 with its free opening close to its bottom 7. The other end of the feed line 21 is connected according to Figure 1 through at least one magnetic valve 23 to at least one distributor block 24 which has a distributor channel 25 which is connected to distributor lines 27 preferably through a plurality of non-return valves 26 which are

built into the distributor block 24. The distributor lines have respective nozzles 28 at their free ends, which represent feed points not shown in more detail and are directed to parts of a knitting machine or the like to be lubricated or cleaned. Such distributor devices and their monitoring devices which are associated therewith when required are generally known, e.g. from DE 3 624 982 A1 and DE 4 021 557 A1, so that these references are made subject matter of the present disclosure for the sake of simplicity.

According to Figure 1 the pressure line 15 is connected through a three-way valve 29 to a line 30, which is connected to the outlet of a pressure regulating valve 31. This is connected to a schematically represented source of compressed air 32, which consists for example of the 6 bar pressure line usually provided in factories and is preferably provided with a control switch, which switches off the machine to be supplied with oil when the air pressure at the outlet of the pressure regulating valve 31 falls below a set value of 2.5 bar for example.

The manner of operation of the described device is as follows, with the assumption that the supply tank 1 and the pressure container 3 are filled with liquid up to the liquid levels 6 and 18 respectively, i.e. the maximum specified liquid level 6 in the supply tank 1 is higher than the maximum specified liquid level 18 in the pressure container 3:

If oil is to be fed to the nozzles 28, the pressure regulating valve 31 is firstly switched on and the three-way valve 29 is put in the position seen in Figure 1. Compressed air is thereby forced through the pressure line 15 and the passage 14 into the float valve 17, so that its ball 16 is forced off the valve seat and the passage 114 is opened to each available opening 19. The outlets of all the openings 19 open into a space above the oil level 18 in the pressure container 3, so that, as a result of the air pressure built up above the oil level 18, on the one hand the ball 9 of the non-return valve 10 is pressed hard against the associated valve seat against the force of the spring 11 and the line 8 to the oil supply tank 1 is thus closed tight. On the other hand, during such a feed phase, oil is fed out of the pressure container 3 into the riser pipe 22 and thence in the direction of the arrow into those distributor blocks 24 whose magnetic valves 23 are already open in accordance with Figure 1. Accordingly oil under pressure is delivered through the nozzles 28 to the

selected feed points.

After a selected interval of time, other magnetic valves not shown in Figure 1 can be opened and the magnetic valves 23 seen in Figure 1 be closed, in order to feed the oil to other places. When no oil feed is required any more, all open
5 magnetic valves 23 are advantageously closed first, in that their valve bodies are turned through 90° , in order thereby to prevent the distributor blocks and the parts connected thereto running empty. The three-way valve 29 is then brought out of the position according to Figure 1 by rotating its valve body through 90° in the anticlockwise sense into a position in which the pressure line 15 is connected to an
10 outlet 33 leading to the atmosphere and is isolated from the pressure regulating valve 31. On the one hand the space above the oil level in the pressure container 3, which has fallen in the meantime to the level 18a or even lower, is vented and on the other hand the ball 9 is lifted from the valve seat of the non-return valve 10 under the influence of the spring 11 and the oil column present in the supply tank 1.
15 As a result of this, oil flows out of the supply tank 1 into the pressure container 3, so that this is refilled, until its oil level again reaches the level 18 and the ball 16 raised by the oil blocks the passage 14 again. This ensures at the same time that the pressure container 3 is only filled to the indicated oil level 18 and a space serving for the feed of the compressed air remains free above the same. The
20 pressure regulating valve 31 can then be closed and the whole device be relieved of pressure for protection of its parts.

The described method steps are repeated if a further lubrication or cleaning operation is desired.

The described device leads to many advantages. In the first place it is
25 possible to keep the volume of the pressure container 3 as small as is just sufficient for a one-shot feed phase, since the pressure container 3 is automatically refilled after such a phase to the original liquid level 18. At the same time the supply tank 1 can be made comparatively large and less robust, since it serves only for the periodic filling of the pressure container 3 but does not participate in the actual feed
30 process and its inner surfaces are not subjected to any large pressure forces. For the same reason the supply tank can also be filled with the device in operation. The filling can be effected with fresh oil but also with already used oil, which is caught

after dripping off the treated parts, subjected if necessary to a recycling operation and then reused.

In relation to the sensitivity of response and the air volumes fed into the pressure container 3 there is the further advantage that the same initial conditions
5 exist before each feed phase. The device therefore always acts in the same way in each feed phase, independent of the current oil level in the supply tank 1, so that no additional measures are necessary to modify the sensitivity to response and the amounts of oil fed per unit time to the nozzles 28 in dependence on the current oil level. Furthermore only the comparatively small pressure container 3 has to be
10 made pressure-fast (e.g. up to 6 bar) and be made from 2.5 mm thick steel for example, while the supply tank 1 can be of normal construction. Finally it is advantageous that only the magnetic valve 23 is traversed by oil while the other sensitive parts of the control (29, 31) only convey compressed air and pumps are avoided completely. The device therefore has only a few parts subject to wear and
15 is overall robust, not liable to disturbance and simple to handle.

In the embodiment according to Figure 4, in which the same parts are given the same references as in Figures 1 to 3, the pressure container 3 is outside and above the supply tank 1 or so arranged that its maximum specified liquid level lies above the maximum specified liquid level in the supply tank 1. The passage 8
20 (Figures 1, 2) provided at the bottom of the pressure container 3 but not shown in Figure 4, is connected to the supply tank 1 through a line 34, which opens at the upper end into the supply tank 1 for example and is there formed as a riser pipe reaching to its bottom.

Since oil cannot in this case flow under gravity out of the supply tank 1 into
25 the pressure container 3, means are associated with the latter to create a vacuum, which generates a vacuum preferably at a place above the instantaneous liquid level during the filling phases. As soon therefore as the pressure in the pressure container 3 is sufficiently low, oil is sucked through the line 34 out of the supply tank 1 into the pressure container 3.

30 In the embodiment the means for creating a vacuum include a Venturi nozzle 35, while a controllable valve 36, e.g. in the form of a 5/3-way valve, is provided in place of the valve 29 according to Figures 1 to 3, having three inlets a, b, c and

two outlets d and e. The pressure line 15 is connected to the outlet e, the line 30 to the inlet b, a vacuum outlet of the Venturi nozzle 15 to the inlet c and an input of the Venturi nozzle 35 to the outlet d. The inlet a is closed in all positions of the valve 36. Moreover, during the feed phases the inlet b is connected to the outlet e and the inlet a to the outlet d and during filling phases the input b is connected to the outlet d and the input c to the outlet e. According the compressed air source 32 is connected through the ports b, e directly to the pressure line 15 during the feed phases, bypassing the Venturi nozzle 35, so that compressed air is fed to the pressure container 3. However, during the filling phases, the compressed air source 32 is connected through the ports b, d to the inlet of the Venturi nozzle 35 and the pressure line 15 is connected through the ports c, e to the suction outlet of the Venturi nozzle 35. A vacuum thus results in the pressure container 3, with the consequence that oil is sucked out of the supply tank 1 into the pressure container 3, until the float valve 17 (Figures 1, 2) closes. The operation of the embodiment according to Figure 4 is otherwise like that according to Figures 1 and 3.

The embodiment of the invention at present considered the best is shown in Figures 5 and 6 in a section like that of Figure 1, like parts being given the same references as in Figures 1 to 3. In this embodiment the maximum specified liquid level 6 in the supply tank is again above the maximum specified liquid level 18 in the pressure container 3, which is arranged in the supply tank 1 as in Figures 1 to 3. Moreover mating means are provided to open and close a passage 38 preferably provided at the bottom 7 of the pressure container 3 and through which the pressure container 3 is connected to the supply tank 1. The connection can be effected as in Figures 1 to 3 through an oil filter 39 connected to the passage 38 and arranged in the supply tank 1.

Within the pressure container 3 according to Figures 5 and 6 there is arranged a control valve 40, which includes for example a cylinder 41 and a piston 43 with a piston rod 42. The piston 43 and the piston rod 42 are arranged coaxial with the passage 14 and so that the piston 43 closes the passage 14 tightly in its upper position seen in Figure 5, while the piston rod 42 projects therefrom down in the direction of the passage 38 and is arranged with its lower end in an opening located in the bottom 44 of the cylinder 41. The arrangement is further such that the

passage 38 is arranged directly below this opening and transverse thereto and has such a cross-section that it is completely closed by the lower end of the rod on lowering the piston rod 42 from the position according to Figure 5 into the position according to Figure 6. The piston 43 is biased into the position according to Figure 5 by a compression spring 45 fitted on the piston rod 42 and supported between the piston and the bottom 44.

A wall of the cylinder 41 directed towards the interior of the pressure container 3 has, axially spaced, an inlet opening 46 opening into the pressure container 3 and likewise a venting opening 47. A further opening in a cylinder wall directed towards the supply tank 1 and lying axially below the vent opening 47 is connected to a vent line 48 opening into the supply tank 1, with its free end preferably inside the supply tank 1 and above its maximum specified liquid level 6. A further vent opening 49 is moreover fitted in the top of the supply tank 1.

In the position of the control valve 40 seen in Figure 5, in which the passage 14 is closed and the passage 38 is opened, the inlet opening 46 is covered by the piston 43 while the vent opening 47 is arranged closely below the lower edge of the piston 43. On the contrary, in the position of the control valve 40 seen in Figure 6, the upper passage 14 is opened and the lower passage 38 is closed, the inlet opening 46 being closely above the upper edge of the piston 43 and the vent opening 47 being covered by the piston 43.

The manner of operation of the device shown in Figures 5 and 6 is as follows:

If a feed phase is to be produced, the three-way valve 29 is so set that the line 30 is connected to the pressure line 15. With the pressure regulating valve 31 open, the compressed air in the line 15 thus forces the piston 43 and with it the piston rod 42 down into the cylinder 41. The lower edge of the piston 43 therefore gradually closes the vent line 47 while the piston rod 42 gradually blocks the passage 38. When the vent opening 47 and the passage 38 are completely closed, the inlet opening 46 is gradually opened with further downwards movement of the piston 43, so that the compressed air can flow in the direction of the arrow (Figure 6) into the pressure container 3 and the oil therein can be forced into the feed line 21, whereby a feed phase begins.

The lowermost position of the piston 43 is preferably so selected by means of a stop or the like that the opening in the cylinder 41 leading to the vent line 48 is still open. Accordingly oil possibly present in the cylinder 41 can flow back into the supply tank 1 through the vent line 48.

5 To terminate a feed phase and start a filling phase, the pressure line 15 is connected to the vent line 33 by means of the three-way valve 29, as in Figures 1 to 3. The piston is thereby relieved on its upper side so that it moves back up again under the action of the compression spring 45. The inlet opening 46 is firstly thus closed by means of its upper edge. Then the vent opening 47 is opened by means
10 of its lower edge and at the same time the passage 38 is opened by the piston rod 42. Oil can thus flow under gravity from the supply tank 1 through the passage 38 into the pressure container 3 in the direction of the arrow (Figure 5) and at the same time the air above the present oil level can escape through the vent opening 47 and the vent line 48. The end of the filling phase is attained when the oil has reached
15 approximately the liquid level 18 and pressure of the enclosed air cushion located above the same prevents further inflow of oil.

A receiving opening 50 (Figure 5) for the piston rod 42 is preferably provided in the position of the bottom 7 disposed beneath the piston rod 42 and the passage 38 with its lower end connected through a channel 51 to that section of the
20 passage 38 which lies between the receiving opening 50 and the supply tank 1. This has the advantage that no interfering air or oil cushion, against whose pressure the piston 43 would have to move down, can form under the end of the piston rod 42. A significant advantage of the device described with reference to Figures 5 and 6 consists further in that all opening or passages for the air and oil flow are switched
25 by the piston 43 and the piston rod 42 in a mating manner and the movement of the piston 43 is not affected by the oil pressure, since this is only built up when the passage 38 is closed.

The embodiment according to Figure 7 differs from the embodiment according to Figures 6 and 7 essentially only in that the pressure container 3 is
30 arranged outside the supply tank 1 and in such a way that the maximum specified liquid level 18 in the pressure container 3 lies below the maximum specified liquid level 6 in the supply tank 1. The passage 38 is connected through a line 54 to a

lower outlet opening 55 of the supply tank 1 and the oil filter 39 is arranged in the supply tank 1. Moreover the vent line 48 is extended and connected to an opening 56 in the supply tank 1 which lies above its maximum specified liquid level 6.

5 Otherwise the design and function of the device according to Figure 7 are like that according to Figures 5 and 6.

The embodiments according to Figures 5 to 7 could be modified in that the inlet opening 47 and the outlet vent opening 47 are combined in a single opening 63 in a cylinder 64 (Figure 8). This opening 63 is provided at such a height in the wall of the cylinder 64 that it lies with the passage 14 closed and the passage 38 open
10 below the lower edge of a piston 65 which is axially somewhat shorter than the piston 43 and with the passage 14 open and the passage 38 closed it lies above the upper edge of the piston 65. Accordingly, during the filling phases (position corresponding to Figure 8), oil can flow unhindered from the supply tank 1 into the pressure container 3, while venting takes place through the opening 63 and the vent
15 line 48. At the beginning of each feed phase on the other hand, the passage 38 and the opening 63 are first closed by the downwards movement of the piston 65. With the further downwards movement of the piston 65 the opening 63 is however cleared again by the upper edge of the piston 65, so that compressed air can not flow into the container 3.

20 As Figure 8 shows, the occurrence of air or oil cushions below a piston rod 66 connected to the piston 65 can be avoided also by a channel 67 passing through the bottom 7 of the pressure container 3, insofar as the back pressure associated therewith does not cause disturbance.

The upper end of the vent line 48 advantageously always lies above the
25 maximum specified liquid level 6 in the supply tank 1, so that leakage from the supply tank 1 is avoided. Alternatively the vent line 48 can be provided with a valve corresponding to the float valve 17 according to Figures 1 to 3, in order to avoid leakage of oil under all conceivable operating conditions. Apart from this the vent line 48 could also be done away with entirely, in which case however, possible
30 air bubbles would escape through the opening remaining in the cylinder wall into the part of the supply tank 1 filled with liquid.

The fitting of the piston 43, 65 in the cylinder 41, 64 is preferably effected

without the use of sealing rings or the like and with such play that easy movement of the piston 43, 65 results. Possible losses of oil through the annular gap between the piston 43, 65 and the cylinder 41, 64 can be tolerated. Air flowing past the piston 43, 65 can escape through the vent line 48, even if this is in part filled with oil.

The invention is not limited to the described embodiments, which can be modified in many ways. For example, it is possible to arrange the pressure container 3 in a well formed in the bottom 2 of the supply tank 1 or outside the supply tank 1 in another way than that shown in Figures 4 and 7. There are no kinds of modification to the described function so long as the oil level 6 in the supply tank 1 is maintained above the corresponding oil level 18 in the full state of the pressure container 3. This can for example also be ensured in that the pressure container 3 is mounted spatially below the supply tank 1. In these variants a supply line is additionally needed which connects a sufficiently deep outlet of the supply tank 1 to the passage 8, 38.

Further changes to the described implementation could consist in the pressure container 3 being provided with a safety valve responding at 5 bar for example and like the supply tank 1 being provided with an additional, firmly closing outlet opening for emptying purposes. It would also be possible to provide the supply tank 1 with an oil level sensor, which provides a signal to switch off the lubricated machine or the like if the oil level 6 falls below a critical value.

Apart from this, it will be understood that other components with the same function could be provided in place of the valves 10, 17, 28, 31, 40, etc. and the other functional parts.

It would further be possible to dispense with the float valve 17 in the embodiment according to Figures 1 to 3. The control valve 40 in Figures 5 to 8 can either be an additional individual component built into the pressure container 3 or be so made that the cylinder 41, 64 is formed by suitable wall sections of the pressure container 3.

If the described device for lubricating and cleaning is used in a circular knitting machine with a rotatable needle cylinder and a stationary cam box ring, the intermittent supply of oil to the feed points is preferably effected in such a way that

the feed phases to each feed point are made just the same length as one revolution of the needle cylinder, while following pauses are provided of length corresponding to at least one revolution of the needle cylinder. This leads to the further advantage that no expensive magnetic valves 23 which switch with high precision are needed, so that the cost of the described device can be still further reduced. The nozzles 28 are in this case formed selectively as jet nozzles delivering a stream of oil or as spray nozzles feeding an air/oil mist.

Further modifications of the described embodiments are possible in that the various individual parts are used in other than the illustrated combinations.

Finally, it will be understood that the volume of the pressure container 3 is preferably substantially smaller than the volume of the supply tank 1. The volume of the pressure container 3 can be large enough for one or more complete feed phase(s). Further, two or more pressure containers 3 could be provided, of which at least one serves for the oil supply while at least one further one is filled afresh with oil at the same time.



CLAIMS

1. A device for supply of a liquid, especially oil, to at least one feed point during time-spaced phases, especially in a knitting machine, comprising a closed pressure container (3) for receiving the liquid and which is provided with a feed line (21) for the liquid and with a pressure line (15) having a controllable valve (29) for connection to a compressed air source (32), characterized in that it has a supply tank (1) for the liquid, which serves for reestablishing a predetermined liquid level in the pressure container (3) in filling phases provided between feed phases, and which is connected to the pressure container (3) through a passage (8, 38)) which is closed during the feed phases and is opened during the filling phases.
2. A device according to claim 1, characterized in that the feed line (21) has a section which is formed as riser pipe (22) reaching close to the bottom (7) of the pressure container (3).
3. A device according to claim 1 or 2, characterized in that the pressure line (15) can be connected to a venting line.
4. A device according to claim 4, characterized in that the controllable valve (29) is formed as a three-way valve having an outlet (33) leading to the atmosphere.
5. A device according to any of claims 1 to 4, characterized in that the pressure line (15) is connected to the interior of the pressure container (3) though a float valve (17) closing towards the pressure source (32).
6. A device according to any of claims 1 to 4, characterized in that a maximum specified liquid level in the pressure container (3) is arranged above a maximum specified liquid level in the supply tank (1) and means are provided for creating a reduced pressure in the pressure container (3) during the filling phases.





7. A device according to claim 6, characterized in that the means include a Venturi nozzle (35) and the controllable valve (36) is so arranged that connects the compressed air source (32) to the pressure line (15) during the feed phase while it connects it on the contrary to the Venturi nozzle (36) during the filling phase and at the same time connects the pressure line (15) to a vacuum outlet of the Venturi nozzle (36).
8. A device according to any of claims 1 to 4, characterized in that a maximum specified liquid level of the pressure container (3) is arranged below a maximum specified liquid level of the supply tank (1).
9. A device according to any of claims 1 to 8, characterized in that mating means are provided for opening and closing the passage (8, 38).
10. A device according to claim 9, characterized in that the means include a control valve (40).
11. A device according to claim 10, characterized in that the control valve (40) has a cylinder (41, 64) which is connected to a passage (14) provided in the upper region of the pressure container (3) and has a piston (43, 65) which is connected to a piston rod (42, 66) opening and closing the lower passage (38), wherein the upper passage (14) is closed and the lower passage (38) is opened in a first piston position and in a second piston position the upper passage (14) is opened and the lower passage (38) is closed.
12. A device according to claim 11, characterized in that at least one opening (46, 47 or 63) opening into the pressure container (3) is provided in a wall of the cylinder (41, 64) and serves during filling phases to vent the pressure container (3) and during feed phases to connect the upper passage (14) to the interior of the pressure container (3).





13. A device according to claim 11 or 12, characterized in that an opening which opens into the supply tank (1) is provided in a wall of the cylinder (41, 64) for venting purposes.
14. A device according to any of claims 11 to 13, characterized in that the piston (43, 65) is biased into the first position by a spring (45).
15. A device according to any of claims 1 to 14, characterized in that the pressure container (3) is arranged in the supply tank (1).
16. A device according to any of claims 1 to 15, characterized in that the pressure container (3) has a substantially smaller volume than the supply tank (1).
17. A knitting machine, especially a circular knitting machine with a needle bed, a cam box associated with the needle bed and a drive for producing relative movement between the needle bed and the cam box, characterized in that it comprises at least one device according to one or more of claims 1 to 16.

