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W. LIMBERGER
COPYING APPARATUS

3,203,336

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2 Sheets-Sheet 1

FIG. 1

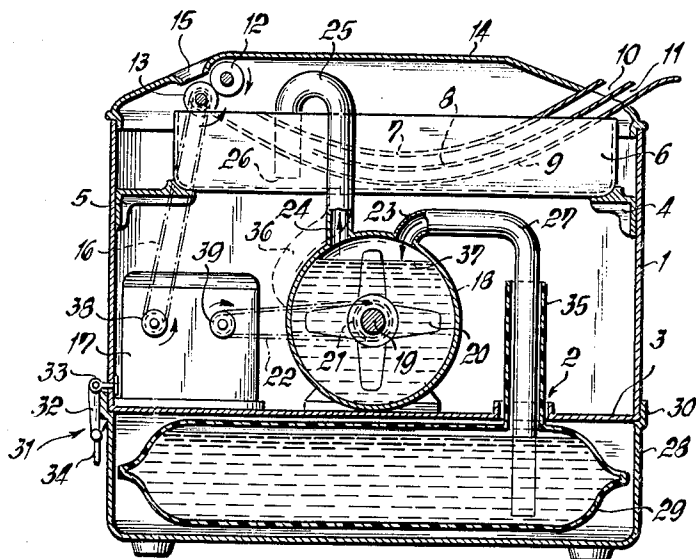
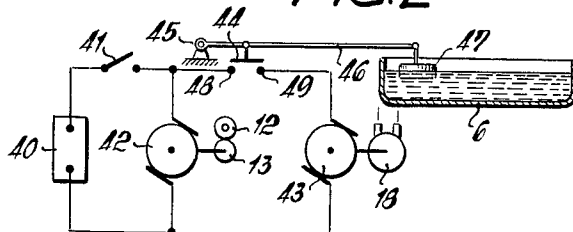


FIG. 2



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FIG. 3

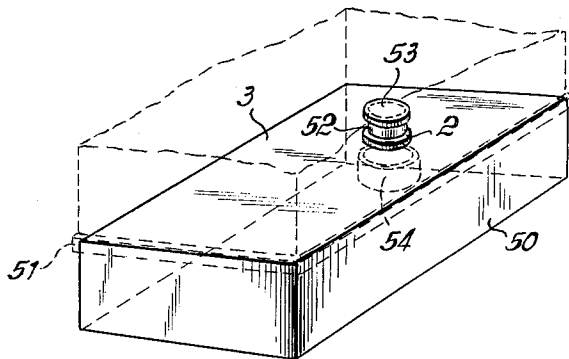


FIG. 4

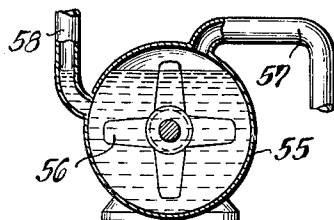
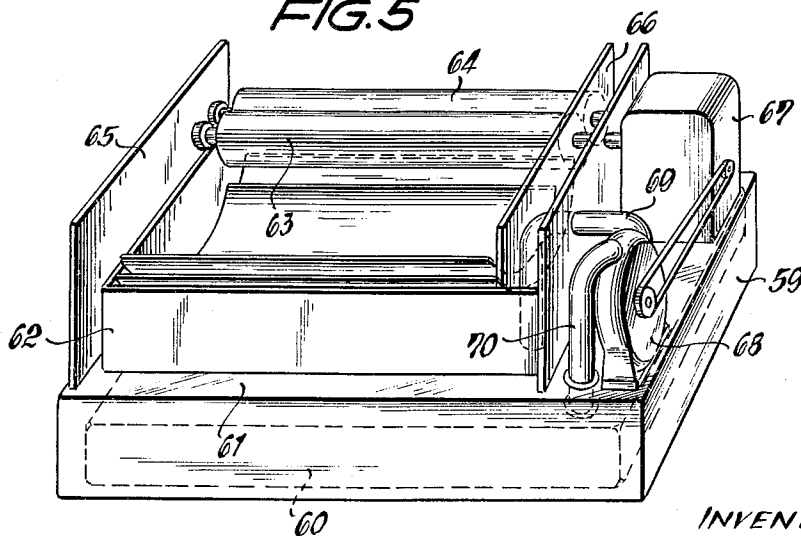


FIG. 5



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10 Claims. (Cl. 95—89)

The present invention relates to a copying apparatus with a treatment tank for the copy material and a reserve container which are connected by means of a supply duct having a non-suction-type pump, which when the pump is non-operative serves as a return duct to the reserve container lying beneath the tank.

In such apparatuses it is known to arrange the pump within the reserve container on the bottom thereof. The exterior of the pump is thereby constantly exposed to the effect of the chemical treatment liquid. Furthermore, this arrangement is not practical in the case of a replaceable reserve container. It is also known to provide such a non-suction type pump beneath the reserve container in a supply duct which extends around the reserve container. This prevents the construction of the apparatus with the associated parts including the pump enclosed, and the arrangement of a special separate stand for accommodating the reserve container beneath the apparatus. This is desirable on one hand because the upper side of the apparatus must be accessible, since operating slots are advantageously provided therein, and on the other hand since if the reverse container should become unsealed it is ensured that the leaking treatment liquid does not enter the apparatus.

The arrangement of a non-suction-type pump in the supply duct is advantageously for providing a simple apparatus construction since only one connection duct needs to be provided through which the filling and discharging take place, so that without additional valve device it is ensured that emptying automatically takes place on stopping of the pump.

It is accordingly an object of the present invention to provide a copying apparatus in which the reserve container lies in the lower part of the apparatus and the disadvantages of such prior apparatuses are avoided.

It is a further object of the present invention to enable accommodation of the reserve container in the lower part of the apparatus in such a way that complicated supply ducts to or around the lower part are avoided.

It is a still further object of the present invention to provide a copying apparatus in which the reserve container is provided in the lower part and adjacent other elements required for the copying apparatus and also pump devices in the upper part of the apparatus, and only one connection duct is arranged between the lower and upper parts of the apparatus.

These objects are fulfilled according to the invention by a non-suction type pump arranged outside the reverse container and higher than the bottom thereof in the supply duct and forming by means of its housing a container for the treatment liquid which is closed in its lower portion.

In the preferred embodiment of the invention the pump is arranged on the reserve container. In this way particularly suitable apparatus combinations can be produced.

In this case, both the suction connection and the pressure connection of the pump open into the upper region of the pump housing, which is located above the reserve container. Preferably at least the connection communicating with the reserve container opens directly into the top of the pump housing.

It is preferred that both connections open into the pump housing substantially in one horizontal plane.

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According to a further preferred embodiment, the pump is arranged near the treatment tank, i.e., at the same height as the treatment tank and higher than the bottom of the treatment tank.

One advantageous embodiment of the invention provides a construction with a releasable stand for accommodating the reserve container, an opening being provided in the intermediate walls or wall between the stand and the apparatus housing through which a duct joined to the inlet connection of a pump extends into the stand and the reserve container disposed therein.

The pump is suitably disposed near the treatment tank, so that a flat arrangement of the apparatus can be obtained.

Other objects and advantageous features of the invention will become more apparent from the teachings of the principles of the invention in the disclosure of the preferred embodiments thereof in the accompanying drawings, in which:

FIGURE 1 shows a copying apparatus in section;

FIGURE 2 shows a schematic circuit diagram of one particular embodiment;

FIGURE 3 shows a perspective view of a stand constructed as a reserve container with a modified formation of the wall part of the upper part;

FIGURE 4 shows a pump construction corresponding to the pump construction of FIGURE 1 but in a different embodiment; and

FIGURE 5 shows in perspective a partial view of an apparatus with its cover removed for explanation of a further pump arrangement.

The embodiments of the invention described below are developer devices. It is however pointed out that a combination in the usual way with an exposure device is possible.

As shown in FIGURE 1, an apparatus housing 1 forms an upper part and has a bottom 3 provided with an opening 2. A treatment tank 6 is supported for example on brackets 4, 5, in the upper section of the apparatus housing and has guide surfaces 7, 8, 9 for guiding copy material on curved paths from inlet slots 10, 11 formed between the guide surfaces to a squeezing and transport roller pair 12, 13. The arrangement is covered at the top by a lid 14 which leaves the inlet slots free and has an outlet opening 15 above the squeezing and transport rollers 12, 13. The squeezing and transport rollers are supported in a manner not shown in detail in side walls extending parallel to the plane of the drawing and are pressed together elastically by means of springs. At least one roller, for example the roller 13, is driven via a transmission 16 from a drive motor unit 17 in the direction indicated by the arrows. The drive motor unit 17 is arranged on the bottom 3.

On this bottom there is also disposed a pump shown in section, the housing 18 of which has an inner space of substantially circular section. In this housing a rotor or impeller 20 is supported for example on a shaft 19 extending through the side walls of the housing. On one projecting end of the shaft 19 there is carried a pulley 21 which is connected to the drive motor unit via a transmission 22 for driving the rotor.

Between the inner surface of the pump housing and the rotor 20 there is advantageously left a radial or axial spacing to allow flow of the treatment liquid on stopping of the rotor. Thus, it is possible to support the rotor eccentrically in the pump housing so that there remains a free liquid flow path at least between the pump connections, i.e., the suction connection 23 and the pressure connection 24. The pressure connection 24 is connected by means of a curved duct 25 to the treatment tank 6, the duct 25 having an open mouth 26 located above the bot-

tom of the treatment tank. The section of the curved duct 25 extending into the treatment tank lies adjacent the guide surfaces 7, 8, 9.

The suction connection 23 is connected to a curved duct 27 which extends downwardly through the opening 2 and terminates in a reserve container 29 arranged in a lower part 28.

The lower part 28 is advantageously open at the top, i.e., it is covered by the bottom 3 on assembly of the lower part 28 and the upper part 1. On the edge of the lower part, at least at the corners thereof, outwardly curved steps 30 can be provided, the upwardly projecting flanges of which guide the walls of the upper part 1 onto the lower part and hold them so that the walls of the upper part and the lower part lie in the same planes. It is possible to arrange between the upper part 1 and the lower part 28 an easily releasable locking device, for example the bayonet lock indicated at 31, the pivot arm 32 of which can be secured by a pin 33 to the upper part 1 and locked by means of a hand grip pivotally connected to the lower part 28.

With this division of the apparatus, the reserve container 29 is easily accessible when the upper part 1 is removed. The reserve container, which for example comprises flexible plastics material, advantageously has a tubular connection piece 35 which extends through the opening 2 and receives the duct 27. In this way a sleeve coupling between the piece 35 and the duct 27 is unnecessary, so that they can be separated merely by raising the upper part 1.

It is important that at least the suction connection 23 is arranged in the upper part of the pump housing. The pressure connection 24 is suitably arranged substantially in the same horizontal plane as the suction connection in the upper part of the pump housing. It is however also possible, in a modified construction, to allow the pressure connection to open into a lower part of the pump housing as shown in broken lines for example at 36.

When the initial operation of the apparatus arranged as above is effected after insertion of the reserve container, for the initial filling of the pump housing 18 a suction ball is for example associated with the conduit 25 for drawing the treatment liquid from the reserve container into the pump housing. When the pump housing is filled in the indicated manner, for example to the liquid level indicated by 37, the apparatus is ready for operation.

After switching-on of the drive motor unit and the rotation of rotor 20 effected thereby, the liquid is supplied through the duct 25 into the treatment tank 6 and a reduced pressure is thereby produced in the pump housing 18 such that the treatment liquid is drawn from the reserve container 29.

After stopping of the rotor 20, the treatment liquid flows by the syphon-like effect of the supply duct 27, 18, 25 back into the reserve container. After emptying of the treatment tank this flow into the pump housing 18 finishes, so that the housing 18 remains full and on further operation of the pump the return of the treatment liquid into the treatment tank 6 is initiated.

It is to be understood that a float control for the pump drive can be provided in the known manner in order to stop the pump after reaching a predetermined liquid level, the further switching-on being automatically effected when the apparatus has been initially switched-on and the liquid falls below a predetermined level. In this case two drive motors are included in the drive unit 27, which in addition includes the required reduction gearing, the drive pulleys of which are indicated by 38 for the transmission 16 and by 39 for the transmission 22.

The operation of this embodiment will now be described with reference to FIGURE 2. A drive motor 42 (with the drive pulley 38 for the squeezing and transport roller pair 12, 13) is connected via a main switch 41 of the apparatus to a power source 40, and a motor 43 (with the drive pulley 39 for the pump 18) is also connected via

the main switch 41 and a further switch to the power source 40. This further switch for the motor 43 has a movable switch contact 44 carried on a lever arm 46 pivotally supported on the housing at 45. This lever arm 46 projects over the treatment tank 6 carries at its free end a float 47. When the switch 41 is closed and the liquid level in the tank falls, the switch contact 44 closes the circuit between the contacts 48, 49 so that the motor 43 is energised and the pump is set in operation. When the liquid in the tank 6 reaches a predetermined level, the switch contact 44 is raised.

The pump shown in FIGURE 4 corresponds in its illustration to the pump shown in FIGURE 1 and can be constructed in the same manner. This pump has a housing 55 in which an impeller 56 is rotatably supported and can be driven from outside the housing 55. The suction connection is indicated by 57 and opens in the same manner as the suction connection 23 in FIGURE 1. The pressure connection 58 however has a different construction to the pressure connection 24 and opens at a lower position into the housing 55.

As shown in FIGURE 5, a reserve container 60 is arranged in a lower part 59. On the base plate 61 of the upper part there stands a bath container 62 with guide elements somewhat similar to the arrangement and illustration according to FIGURE 1. Squeezing and transport rollers 63, 64 are arranged above one end of the bath container. These rollers 63, 64 are supported in side walls 65, 66 and are driven by a connection and driven unit 67. A pump 68 is disposed near the unit 67 and the bath container 62, and has a pressure connection 69 which extends through the side wall 66 into the bath container 62 and a suction connection 70 communicating through the base plate 61 with the reserve container 60. The base plate 61 is, like the bottom 3, arranged substantially horizontally and comprises an at least partly unbroken plate which is provided in the frame of the apparatus. The base plate 61 can also be arranged in a frame which extends to at least one side, and for example above and under the base plate.

According to the embodiment described, there is obtained the advantage that the pump is arranged in the copying apparatus itself. Thus, according to one advantageous construction, the reserve container itself can be constructed as the stand, as shown in FIGURE 3. The support requires no electrical cables or other devices for receiving the pump.

As shown in FIGURE 3, a reserve container 50 is constructed as a substantially rectangular box the area of which corresponds to the upper part 1 of the apparatus. This, as shown, has an outwardly offset edge flange 51 extending below the bottom 3, which allows a secure holding of the upper part on the reserve container 50. It is possible to provide tension locks such as the lock 31 of FIGURE 1 in order to effect a releasable fixing. Suitably, the tension lock is then secured to the upper part and the reserve container 50 is provided with pins corresponding to the pin 33.

At the position of the opening 2 in the bottom 3, the reserve container has an upwardly projecting filling spout 52 which serves to receive the duct 27. The filling spout 52 can be threaded in order to enable a closure of the spout by a cap 53 while the reserve container is stored. To facilitate storage, the bottom of the reserve container is advantageously provided with a sleeve 54 having larger dimensions than the filling spout 52 and the cap 53 to enable close stacking of a plurality of reserve containers.

A non-suction-type pump is one in which the pump element, for example, the impeller, operates with a clearance in the associated housing space so that the liquid can flow past the element, particularly when the pump element is at rest.

I claim:

1. In a copying apparatus, the arrangement of a treat-

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ment tank for the copy material, a reserve container for the treatment liquid to be supplied into the treatment tank, said reserve container being provided beneath said treatment tank, a connection duct between said treatment tank and said reserve container, a non-suction-type pump arranged in said connection duct, said duct serving on stopping of the pump as a return duct to said reserve container provided beneath said tank, said pump being arranged outside said reserve container and higher than the bottom of said reserve container, said pump having a housing, said housing having a lower region forming a closed container for said treatment liquid within said connection duct, said container serving to hold a limited amount of said treatment liquid, drive means for at least intermittent driving of said pump, and switch means for switching on and off said drive means.

2. Copying apparatus as set forth in claim 1, wherein said pump is arranged above said reserve container.

3. Copying apparatus as set forth in claim 2, wherein a frame is provided which has a substantially horizontal division in the form of an at least partly unbroken intermediate wall above which said pump is arranged and under which said reserve container is arranged.

4. Copying apparatus as set forth in claim 1, wherein said pump has a drivable drive element in said housing, and two connection pieces, first and second sections of said connection duct being connected to said connection pieces, said first section being connected at one end of said duct to said reserve container and said second section communicating at the other end of said duct with said treatment tank, said connection pieces opening into the upper region of said housing, which is closed in its lower region.

5. Copying apparatus as set forth in claim 4, wherein at least said connection piece connected to said first duct section opens immediately from above into said pump housing.

6. Copying apparatus as set forth in claim 4, wherein both of said connection pieces open into the top of said housing in substantially the same horizontal plane.

7. Copying apparatus as set forth in claim 4, wherein an enclosure contains said treatment tank, said pump and

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said drive and switching means, said enclosure being provided with a lower part releasable from said enclosure, said lower part receiving said reserve container and being formed as an upwardly open tray, projections being provided on the upper edge of said lower part holding said enclosure, said enclosure having a base provided with an opening through which said first section of said connection duct projects and communicates with said reserve container.

8. Copying apparatus as set forth in claim 7, wherein said reserve container comprises a flexible material, a junction piece being arranged on said reserve container and extending upwardly through said opening in said base, said first section of said connection duct extending into said connection piece.

9. Copying apparatus as set forth in claim 4, wherein an enclosure contains said treatment tank, said pump and said drive and switch means, said enclosure being provided with a lower part releasable therefrom, said lower part being box-shaped and forming said reserve container, said lower part serving as a stand for said enclosure, guide arrangements being provided on one of the members comprising said enclosure and said lower part for effecting a nonsliding connection between said enclosure and said lower part, said enclosure having a base provided with an opening, said box-shaped reserve container having an upwardly projecting filling piece which projects through said opening into said enclosure when said housing is stood on said lower part.

10. Copying apparatus as set forth in claim 2, wherein said pump is arranged near said treatment tank.

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NORTON ANSHER, *Primary Examiner*.