

INK SUPPLIER FOR FEEDING A PRINTER DEVICE

The present invention which is a divisional application from SG 9500685-4 relates in general to printer devices of the so-called "screen print type" which prints on an insulating base board an electric circuit through a screen plate. More specifically, the present invention is concerned with an ink supplier for feeding a printer device with a fresh viscous conductive ink.

Description of the Prior Art

Hitherto, various types of printer systems have been proposed and put into practical use particularly in the field of printed circuit manufacture. Some of them are of a type which employs a so-called "screen print type printer". This type printer device comprises generally a screen plate which is to be set on an insulating base board to be printed, and an ink squeezing device which runs on the screen plate while squeezing a given amount of viscous conductive ink onto the screen plate pressing the same against the insulating base board. With this, on the surface of the insulating base board, there is printed a desired circuit pattern of the conductive ink, which coincides with a perforated print pattern formed in the screen plate. The base board is then heated for fixing the printed circuit pattern. The screen plate is usually constructed of a stainless steel, silk or the like.

For clarifying the present invention, some of conventional printer systems using the screen print type printer device will be described in brief.

5 Japanese Patent Application 2-419135 shows an ink squeezing device usable in such printer devices. The ink squeezing device comprises generally a pair (viz., front and rear) of metal blades which have lower ends contactable with an
10 upper surface of the screen plate, an ink container housing which is located between the paired blades and has an ink outlet opening through which a viscous conductive ink in the housing is squeezed toward the blades, and a
15 shutter mechanism which opens the ink outlet opening when printing is needed and closes the opening when not needed. Only when the ink container housing is advanced for carrying out printing, the lower ends of the paired blades are
20 brought into contact with the upper surface of the screen plate and one of the blades, which is the trailing one, serves as a squeezing blade. However, due to inherent construction, the printer device of the application has some
25 drawbacks which are as follows. First, due to the repeated frictional contact carried out between the metal blades and the screen plate, one or both of them tend to have a marked abrasion within a shorter time, which thus
30 shortens the life time of them. The lift time of them is further shortened when the ink contains pewter particles. In fact, during printing operation, the pewter particles get into a space between the blade tips and the screen plate and
35 thus abrade them. In order to solve this drawback, a measure has been hitherto proposed in which plastic blades are used in place of the conventionally used metal blades. However, in

this measure, due to the nature of the plastic which is the material of the blades, it is difficult to press the tips of the blades against the screen plate with a satisfied pressing force.

5 By this reason, the pewter particles in the ink tend to separate from the flux of the ink during movement of the blades on the screen plate, resulting in that the pewter particles are left in the perforations of the screen plate thereby

10 lowering the printing quality of the printer device. Of course, in order to obtain a satisfied pressing force with which the blades are pressed against the screen place, another measure may be thought out in which both the

15 screen plate and the blades are constructed thicker in size. However, in this case, it becomes very difficult to form the screen plate with a very fine perforated print pattern. Furthermore, if the blade pressing force is

20 extremely high, the perforations of the screen plate are easily deformed and finally broken. Furthermore, the printer device fails to provide the squeezing blade with an stable squeezing operation. In fact, during movement of the

25 squeezing blade on the screen plate, the pressing force of the blade against the screen plate fluctuates markedly, which lowers the printing quality.

Japanese Patent Application 2-419135 as

30 mentioned hereinabove and Japanese Utility Model Application 3-77831 show a roller installed in the ink container housing of the printer, which has two functions, one being to stir up the viscous ink in the ink container housing when the

35 ink outlet opening is closed and the other being to press out the ink when the ink outlet opening is open. However, repeated experiments and tests have revealed that a satisfied stirring of the

ink is not obtained from such roller particularly when the viscosity of the ink is high. In fact, when treating such highly viscous ink, the stirring effect on the ink at a distance from the rotating roller is quite low.

Some Japanese Patents and Patent Provisional Publications show a screen plate cleaning device for cleaning the screen plate, which functions to remove residual of ink left on the screen plate. Some are of a one-way trip type in which sweeping action is carried out once per each cleaning, and some are of a round trip type in which the sweeping action is carried out twice. However, due to the nature of the ink residual, the cleaning devices of these types fail to exhibit a satisfied cleaning performance.

Other Japanese Patents and Patent Provisional Publications show an open type ink containing chamber defined by the ink container housing. That is, the chamber is constructed to be exposed to the open air. However, in this case, the ink in the chamber is easily affected by the surrounding air. In fact, under such open condition, the ink easily loses volatile components and thus the viscosity of the ink changes or increases instantly. Furthermore, the ink is easily oxidized, which changes the nature of the ink.

Other Japanese Patents and Patent Provisional Publications show an ink supplier which feeds the printer device with viscous ink. However, due to inherent constructions, the ink suppliers shown by such documents fail to exhibit a satisfied ink supplying performance.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an ink supplier for feeding a printer device with a fresh viscous ink, which comprises first means for defining a cylindrical chamber in which the fresh viscous ink is to be contained; tube means for providing a fluid connection between the cylindrical chamber and an ink container chamber defined in the printer device; and means for forcing the fresh viscous ink to flow towards the ink container chamber through the tube means.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the inventive ink supplier will be described in conjunction with Figs. 5-19 whereas a printer device for which the inventive ink supplier is designed is illustrated in general in Figs. 1-4. In particular,

Fig. 1 is a perspective view of a printer device into which the inventive ink supplier can be incorporated;

Fig. 2 is a schematically illustrated side view of the printer device shown in Fig. 1;

Fig. 3 is a view similar to Fig. 2, but showing a pair of blades dismantled from a major portion of the printer device;

Fig. 4 is a side view of a unit consisting of two clamp assemblies which hold a squeezing blade of the printer device;

Fig. 5 is a sectional view of an ink supplier of the present invention which can be employed in the printer system;

Fig. 6 is a perspective view of the ink supplier;

Fig. 7 is a view similar to Fig. 2, but showing a measure for automatically feeding a viscous conductive ink to the printer device;

Figs. 8 to 10 are schematic drawings showing one example for connecting an ink feeding tube from an ink supplier to the printer device;

Fig. 11 is a sectional view of a first modification of the ink supplier which is also employable in the printer system;

Fig. 12 is a view of the first modification, but showing an open condition of the same;

Fig. 13 is a view taken from the direction of the arrow "E" in Fig. 12; and

Figs. 14 to 19 are sectional views of second to seventh modifications of the ink supplier.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Figs. 1 to 4 of the drawings, there is shown a printer device with which the ink supplier of the present invention can be used.

In the drawings, particularly in Figs. 1 and 2, denoted by reference "A" is a housing which has an ink container chamber 5 formed therein. The housing 5 has at its bottom portion a laterally extending ink outlet opening 3 through which a viscous conductive ink 4 (or pewter paste) is put out. A pair (viz., front and rear) of blades 2A and 2B are connected to the bottom portion of the housing "A" in a manner to locate therebetween the elongate outlet opening 3 and extend along the same. As will become apparent as the description proceeds,

tips 2A' and 2B' of the blades 2A and 2B are forced to contact with an upper surface of

a screen plate 1 which is arranged below the printer device. Positioned below the screen plate 1 is an insulating base board "P" on which a given circuit pattern is to be printed.

5 A shutter mechanism (not shown) is incorporated with the housing "A", which functions to open the elongate outlet opening 3 when printing is needed and close the opening 3 when not needed. Although not shown in the
10 drawings, a printer device mover is also associated with the housing "A" to move the housing "A" in fore-and-aft direction, that is, in the direction of arrows "X" and "Y" in Fig. 1. As will become apparent as the description
15 proceeds, only when the housing "A" is moved in the direction of the arrow "X" for carrying out the printing, one (viz., the trailing blade 2B) of the blades 2A and 2B serves as a squeezing blade, as will be understood from Fig. 2.

20 As is seen from Figs. 1 and 2, the housing "A" comprises a pair of side walls 6A and 6B, a rear wall 7 having both ends secured to the side walls 6A and 6B, a front wall 8 pivotally held at its upper portion by the side walls 6A and 6B and
25 a lid 9 detachably mounted to upper portions of the four walls 6A, 6B, 7 and 8. Thus, the housing "A" has a chamber 5 defined by the four walls and the lid 9. Designated by numeral 10 in Fig. 1 is a pivot shaft which is held by the side
30 walls 6A and 6B for pivoting the front wall 8.

As is seen from Figs. 2 to 4, the fixed rear wall 7 has a lower portion which extends obliquely downward toward a lower portion of the pivotal front wall 8. The rear wall 7 has a
35 stepped inner surface 7A. The pivotal front wall 8 has a lower portion 8A which extends obliquely downward toward the lower portion of the rear wall 7. As is seen from Fig. 2, the lower

portion 8A has an inclined inner surface 8B which extends to an upper vertical inner surface 8C of the front wall 8 through a curved inner surface 8B'. Designated by numeral 8D is an inclined
5 lower surface of the lower portion 8A, which is generally perpendicular to the inclined inner surface 8B.

As shown, the front blade 2A is secured to the pivotal front wall 8 and the rear blade 2B is
10 secured to the rear wall 7. These front and rear blades 2A and 2B extend obliquely, that is, downward rearward with respect to the direction of the arrow X.

The pivotal front wall 8 is actuated
15 by a shutter mechanism (not shown). Each blade 2A or 2B is constructed of a resilient metal, such as spring steel and the like. Each blade 2A or 2B has a smoothly rounded tip 2A' and 2B' for minimizing the frictional force produced when
20 slidably engaged with the screen plate 1. Preferably, the thickness of each blade 2A or 2B is smaller than 0.5 mm. If the blade is made of a spring steel, the thickness of the blade can be reduced to 0.1 to 0.05 mm.

As is shown in Fig. 3, in order to mount the front blade 2A to the pivotal front wall 8, a first clamp assembly 14 is used, which comprises an outer elongate mounting member 11 of generally L-shaped cross section, an inner elongate
25 mounting member 12 of generally triangular cross section and a plurality of connecting bolts 13. Before being mounted to the front wall 8, the front blade 2A is tightly clamped by the clamp assembly 14, as shown in Fig. 3, and then the
30 clamp assembly 14 is secured to the inclined lower surface 8D of the front wall 8 by screwing the connecting bolts 13 into associated threaded bores (no numerals) formed in the front wall 8.

As is seen from Fig. 2, when the clamp assembly 14 is properly secured to the front wall 8, one surface 11A of the outer elongate mounting member 11 is flush with the inclined inner surface 8B.

5 As is shown in Fig. 3, in order to mount the rear blade 2B to the fixed rear wall 7, a second clamp assembly 18 is used, which comprises an outer elongate mounting member 15 of generally L-shaped cross section, an inner elongate mounting
10 member 16 of generally rectangular cross section and a plurality of connecting bolts 17. Before being mounted to the rear wall 7, the rear blade 2B is tightly clamped by the clamp assembly 18 and then the clamp assembly 18 is secured by
15 means of the connecting bolts 17 to a third clamp assembly 19 which has been secured to the fixed rear wall 7. As shown, the third clamp assembly 19 is neatly set in a recess defined by the stepped inner surface 7A of the rear wall 7. Of
20 course, if desired, as is understood from Fig. 4, before being mounted to the rear wall 7, the two clamp assemblies 18 and 19 may be coupled to constitute one unit 20, and then the unit 20 is secured to the rear wall 7 by means of a
25 plurality of connecting bolts 19a. As shown, the connecting bolts 19a pass through bores formed in the rear wall 7 and are engaged with threaded bores formed in an inner elongate member 27 of the third clamp assembly 19.

30 As is shown in Fig. 4, the third clamp assembly 19 comprises an outer elongate member 29 of generally L-shaped cross section, the inner elongate member 27 of generally rectangular cross section and the connecting bolts 19a. The third
35 clamp assembly 19 has a first partition blade 28 of steel clamped thereby, which extends into the chamber 5 of the housing "A" for the purpose which will be described hereinafter.

As will be understood from Figs. 2 and 3, upon assembly, shorter walls 15A and 29A of the outer elongate mounting members 15 and 29 face to an inclined inner surface which includes the
5 surface 11A of the outer elongate mounting member 11 and the inclined inner surface 8B.

It is to be noted that when the pivotal front wall 8 is pivoted clockwise in Fig. 2 to a given angular position, the surface 11A of the first
10 clamp assembly 14 connected to the front wall 8 becomes in contact with the surface 15A' of the shorter wall 15 of the second clamp assembly 18. Under this condition, the ink outlet opening 3 is closed.

As is seen from Fig. 2, denoted by numeral 30
15 is a second partition blade of steel which extends into the chamber 5 of the housing "A" from the fixed rear wall 7. That is, the second partition blade 30 is bolted to a mounting block
20 31 secured to an inner surface of the rear wall 7. Leading ends 28A and 30A of the first and second partition blades 28 and 30 are pressed against an outer cylindrical surface of an elongate roller 32 which is rotatably held in the
25 chamber 5 of the housing "A".

The roller 32 is coaxially mounted on a rotating shaft which is rotatably held by the side walls 6A and 6B of the housing "A". The shaft has a gear meshed with an output gear driven by a reversible electric motor. Thus, upon energization of the motor, the roller 32 is rotated in the chamber 5.

Thus, as is seen from Fig. 2, a part 32A of the cylindrical outer surface of the roller 32, the partition blade 28, the shorter wall 29A, the shorter wall 15A and the second blade 2B constitute a second guide wall G2. While, the

upper vertical inner surface 8C, the curved inner surface 8B', the inclined inner surface 8B, the surface 11A and the first blade 2A constitute a first guide wall G1. That is, between the first
5 and second guide walls G1 and G2, there is defined a narrow passage 33 which extends from the ink containing chamber 5 toward the first and second blades 2A and 2B.

Accordingly, when, under rotation of the
10 roller 32 in the direction of the arrow "R" (see Fig. 2), the front pivotal wall 8 is pivoted to open the outlet opening 3 by the shutter mechanism "B", the viscous conductive ink 4 in the chamber 5 is forced to flow downward in and
15 along the narrow passage 33 and discharged onto the screen plate 1.

While, when the roller 32 is rotated in a reversed direction, the viscous ink 4 is prevented from making a downward flow in the
20 narrow passage 33 due to interruption by the roller 32. Thus, when the reversed rotation of the roller 32 starts just before the closing of the outlet opening 3, undesired leakage of the ink 4 from the outlet opening 3 is assuredly
25 prevented. If desired, a speed changer may be arranged between the motor "M" and the roller 32.

Thus, when the compressed air supplier is energized, the organic solvent in the container is drawn into the driven cylinder 270 and into the cloth belt 272 through the openings of the driven cylinder 270. This means that the cloth belt 272 becomes wet with the solvent.

When cleaning of the screen plate 1 is needed, the cleaning device is moved rightward or leftward with one scraping blade 262 or 264 raised, as shown. During this movement of the cleaning device, the endless cloth belt 272 is driven by the motor, the driven cylinder 270 is fed with the compressed air from the compressed air supplier, and the suction pump is operated. Thus, the lower surface of the screen plate 1 is much more effectively cleaned.

If desired, the scraping blades 262 and 264 may be equipped with vibration elements, such as piezoelectric vibrators, or the like. In this case, the ink residual scraping effect of the blades 262 and 264 is much improved. One example of this modification is shown in Fig. 45 wherein a plurality of piezoelectric vibrators 280 are mounted on respective spring members 282 by which the scraping blade 262 or 264 is held.

Referring to Figs. 5 and 6, there is shown an ink supplier of the present invention which is employed in the printer system.

The printer supplier shown in the drawings comprises a cartridge holder 310 by which an ink cartridge 312 is detachably held. The holder 310 has an electric motor 314 mounted on one longitudinal end thereof. The motor 314 has an output gear 316 meshed with a larger gear 318 which is rotatably held between two supporting walls 320 and 322 which are connected to the cartridge holder 310 through a base plate 324. For assuring a smoothed rotation of the larger

gear 318 relative to the supporting walls 320 and 322, washers 326 and 328 are disposed therebetween. The larger gear 318 has a threaded center opening (no numeral) through which a threaded rod 330 passes and with which the threaded rod 330 is operatively engaged. Although not shown in the drawings, a stopper is associated with the threaded rod 330 to prevent rotation of the same about its axis. The threaded rod 330 has a pivotal head 332 which is inserted into the ink cartridge 312. Designated by numeral 334 is a piston plate against which the pivotal head 332 abuts, as shown. An ink feeding tube 336 extends from a top of the ink cartridge 312 to the ink inlet opening 42 (see Fig. 1) of the printer device.

Thus, when the motor 314 is energized to run the larger gear 318 in a given direction, the threaded rod 330 and thus the head 332 connected thereto are moved into the ink cartridge 312. With this, the viscous ink 4 is pushed out into the printer device through the tube 336. The motor 314 is controlled by a control unit. That is, when the printer device carries out a given number of printing operations, the control unit issues a signal to the motor 314 to feed the printer device with a given amount of viscous ink 4. If desired, the rotation of the rod 330 may be effected by using another drive mechanism. For example, the drive mechanism may comprise a ratchet wheel connected to the rod 330, a ratchet operatively engaged with the ratchet wheel and an air cylinder for reciprocatively driving the ratchet. Upon energization of the air cylinder, the ratchet is moved reciprocatively and thus turns the rod 330 stepwisely. Thus, the rod 330 is moved into the ink cartridge 312 to push out

the viscous ink 4 into the printer device through the tube 336.

Fig. 7 shows another measure for automatically feeding a viscous conductive ink 4 to the printer device. That is, in this measure, first and second conductive members 350 and 352 are placed at vertically spaced positions in the ink container chamber 5 of the printer device. These two conductive members 350 and 352 are connected to a controller 354 which is, in turn, connected to the motor 314 of the ink supplier (see Fig. 6). That is, when the level of the ink 4 falls below the first conductive member 350, the electric resistance between the two conductive members 350 and 352 changes or increases. Sensing the change, the controller 354 energizes the motor 314 until the level of the ink 4 goes up to the first conductive member 350.

Figs. 8 to 10 show one example for connecting the ink feeding tube 336 to the printer device. As will be seen from Figs. 8 and 10; the tube 336 is connected to the ink inlet opening 42 of the fixed rear wall 7 by means of a connecting nut 360. Behind the rear wall 7, there is installed an elongate block 362 which is formed with an elongate recess 364 having a semicircular cross section. When the block 362 is properly fixed to the rear wall 7 by means of bolts, the ink inlet opening 42 is exposed to the recess 364 of the block 362. The block 362 is formed with a plurality of parallel passages 366 each extending from the recess 364 to the ink container chamber 5 (see Fig. 2). Each passage 366 has a threaded bore (no numeral) which extends vertically therefrom. As is best understood from Fig. 8, the threaded bores receive therein respective adjusting screws 368.

Thus, by turning the adjusting screws 368 in the threaded bores, the area of each passage 366 can be adjusted. Thus, the amount of ink 4 fed to the ink container chamber 5 can be controlled or
5 adjusted by the adjusting screws 368. That is, the viscous ink 4 can be evenly stored in the ink container chamber 5. If desired, in place of the elongate block 362, a slit cylinder may be used for achieving the even storing of the ink 4 in
10 the ink container chamber 5. That is, the slit cylinder (viz., a cylinder member having a longitudinally extending slit formed therethrough) is rotatably disposed behind the fixed rear wall 7 below the ink inlet opening 42,
15 and an elongate chamber member is arranged to cover the slit cylinder. The elongate chamber member has at its lower wall an elongate opening exposed to the ink container chamber 5 of the printer device. The slit cylinder is rotated
20 stepwisely by a suitable electric motor. For a given time, the ink 4 is fed to the chamber member with the slit cylinder keeping its close position. With this, the chamber member is filled with the ink 4. Then, the slit cylinder
25 is turned to its open position causing the ink 4 to flow down through the slit into the ink container chamber 5 of the printer device.

Referring to Figs. 11 to 13, there is shown a first modification of the ink supplier which is
30 also employable in the printer system of the present invention.

As is best understood from Fig. 11, the modified ink supplier comprises a circular holder plate 400 which has a circular opening with which
35 a bottom open end of the cartridge 312 is mated. Another circular plate 402 is pivotally connected to holder plate 400 by means of a known hinge mechanism. The pivotal plate 402 thus has two

angular positions, one being a close position as shown in Fig. 11 wherein the pivotal plate 402 lies on the holder plate 400 and an open position as shown in Fig. 12 wherein the pivotal plate 402 is released from the holder plate 400. The pivotal plate 402 is equipped with a grip 404 and formed with an opening 406. First and second annular seals 408 and 410 are secured to inner surfaces of the two plates 400 and 402 respectively. Thus, when the pivotal plate 402 is in the close position as shown in Fig. 11, the opening 406 is communicated with the bottom open end of the ink cartridge 312. Designated by numeral 420 is a bolt for detachably connecting the pivotal plate 402 to the holder plate 400. A valve 412 is mounted on the pivotal plate 402 which has an outlet connected to the opening 406 through a pipe 414 and an inlet connected to a compressed air source 416 (or compressor) through a tube 418. The valve 412 has a control button 412a for selectively opening and closing a communication between the inlet and outlet of the valve 412.

Thus, when, with the pivotal plate 402 assuming the close position as shown in Fig. 11, the control button 412a is pushed, the compressed air from the compressed air source 416 is fed into the bottom open end of the cartridge 312. With this, the piston plate 334 in the cartridge 312 is forced to move leftward while pushing the viscous ink 4 into the printer device through the tube 336.

Referring to Fig. 14, there is shown a second modification of the ink supplier. This modification comprises a cylindrical member 450 having a cylindrical chamber formed therein. The cylindrical member 450 has at a lower portion an ink inlet opening 451 to which an electric valve

453 is connected. Although not shown in the drawing, a pipe extends from the valve 453 to an ink tank. The cylindrical chamber has a conical outlet portion 452. The cylindrical member 450
5 is tightly held in a casing 454 which has at its upper end an electric fan 456 for making a positive ventilation within the casing 454. A shaft 458 extends in and along the cylindrical chamber, which has an upper end connected through
10 a joint 460 to an output shaft of an electric motor 462 and has a lower end portion equipped with a stirring screw 464. As shown, the stirring screw 464 extends to the conical outlet portion 452. A lower end of the shaft 458 is
15 rotatably supported by a thrust bearing 466. Denoted by numeral 468 is a weight which has a center opening through which the shaft 458 passes freely. Denoted by numeral 470 is a relief valve. The cylindrical member 450 is surrounded
20 by a plurality of thermoelectric heating/cooling elements 472 each being equipped with a heat radiation plate 474. The conical outlet portion 452 has a tube 476 which extends to the ink inlet opening 42 (see Fig. 1) of the printer device.
25 Thus, when, with the viscous ink 4 left in the chamber below the weight 468, the motor 462 is energized to run the shaft 458 in a given direction, the ink 4 is forced to flow toward the tube 476. Due to the work of the weight 468 on
30 the viscous ink 4, the flow of the ink 4 toward the tube 476 is promoted. When the amount of ink 4 in the ink chamber is reduced to a certain level, the electric valve 453 is energized to open for feeding the chamber with fresh ink from
35 the ink tank. Due to provision of the fan 456 and the thermoelectric heating/cooling elements 472, the temperature of the ink 4 can be controlled to a desired level.

Referring to Fig. 15, there is shown a third modification of the ink supplier. Since this ink supplier is similar in construction to the above-mentioned second modification, only different
5 portions will be described in the following.

That is, in this third modification, a plurality of stirring fins 478 are disposed on the shaft 458 in addition to the stirring screw 464. There is no need of using a weight 468.
10 Thus, the ink inlet opening 451 can be positioned at an upper part of the cylindrical member 450.

Referring to Fig. 16, there is shown a fourth modification of the ink supplier. Only portions which are different from those of the above-mentioned second modification of Fig. 14 will be
15 described for ease of description.

In this fourth modification, an ink cartridge 480 is used, which is neatly received in the cylindrical chamber of the cylindrical member
20 450, as shown. Of course, an ink inlet opening 451 and an electric valve 453 connected thereto are not necessary in this modification.

Referring to Fig. 17, there is shown a fifth modification of the ink supplier. This
25 modification is similar to the above-mentioned third modification of Fig. 15. Thus, only different portions will be described in the following.

In this fifth embodiment, an ink cartridge
30 480 is used, which is neatly received in the cylindrical chamber of the cylindrical member 450, as shown. Of course, an ink inlet opening 451 and an electric valve 453 connected thereto are not necessary in this modification.

35 Referring to Fig. 18, there is shown a sixth modification of the ink supplier. In this modification, an ink cartridge 480 is used, which is neatly received in the cylindrical chamber of

the cylindrical member 450. On the level of the viscous ink 4 in the chamber, there is put a piston plate 482. An upper part of the cylindrical chamber of the cartridge 480, which
5 is defined above the piston plate 482, is connected to a compressed air source 484 (or compressor) through a pipe 486, an electric valve 488 and a tube 490.

When the electric valve 488 is energized to
10 open, the compressed air is fed to the upper part of the chamber of the ink cartridge 480. With this, the piston plate 482 pushes the ink 4 toward printer device through the tube 476.

Referring to Fig. 19, there is shown a
15 seventh modification of the ink supplier. In this modification, a plurality of vibration elements 492 are used, which are disposed on an inner wall of the cylindrical chamber of the cylindrical member 450. Due to vibration action
20 applied to the viscous ink 4 by the vibration elements 492, the flow of the ink 4 toward the printer device is smoothly carried out.

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CLAIMS:

1. An ink supplier for feeding a printer device with a fresh viscous conductive ink, comprising:
 - a housing having a cylindrical chamber in which the fresh viscous conductive ink is to be contained;
 - a tube for providing a fluid connection between the cylindrical chamber and an ink container chamber defined in said printer device;
 - and
 - ink drive means for forcing said fresh viscous conductive ink to flow toward said ink container chamber through said tube.
2. An ink supplier as claimed in Claim 1, in which said ink drive means comprises:
 - a piston plate slidably received in said cylindrical chamber; and
 - an electrically actuated drive means for moving said piston plate.
3. An ink supplier as claimed in Claim 2, in which said electrically actuated drive means comprises:
 - a threaded rod (330) having a pivotal head (332) received in said cylindrical chamber (312);
 - a larger gear (315) having a threaded opening with which said threaded rod (330) is meshed;
 - an output gear (316) meshed with said larger gear; and
 - an electric motor (314) for driving said output gear.
4. An ink supplier as claimed in Claim 1, in which said ink drive means comprises:
 - a support means (400, 454) for supporting said housing (312, 480); and
 - compressed air feeding means (416, 484) for feeding the cylindrical chamber of said housing with compressed air.


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5. An ink supplier as claimed in Claim 4, in which said compressed air feeding means comprises:
a compressed air supplier (416);
a valve (412) having an outlet connected to the cylindrical chamber of said housing and an inlet connected to said compressed air supplier;
a control button (312a) for selectively opening and closing a communication between said inlet and outlet.

6. An ink supplier as claimed in Claim 1, in which said ink drive means comprises:
a shaft (458) extending in said cylindrical chamber of said housing and terminating at an outlet opening of said cylindrical chamber;
an electric motor (460) for rotating said shaft about its axis;
a stirring screw (464) mounted on the terminating portion of said shaft;
a weight (468) having an opening through which said shaft freely passes; and
temperature control means (456, 472) for controlling the temperature of said housing.

7. An ink supplier as claimed in Claim 1, in which said ink drive means comprises:
a shaft (458) extending in said cylindrical chamber of said first means and terminating at an outlet opening of said cylindrical chamber;
an electric motor (460) for rotating said shaft about its axis;
a stirring screw (464) mounted on the terminating portion of said shaft;
a plurality of projections (478) formed on said shaft; and
temperature control means (456, 472) for controlling the temperature of said housing.





8. An ink supplier as claimed in Claim 6 or 7, in which said housing comprises an ink cartridge.

9. An ink supplier as claimed in Claim 1, in which said housing comprises an ink cartridge and in which said ink drive means comprises:

a piston plate (482) slidably received in said cartridge (480);

a compressed air source (484);

a tube (490) extending between the interior of said cartridge and said compressed air source; and

an electric valve (488) operatively disposed in said tube.

10. An ink supplier as claimed in Claim 1, in which said ink drive means comprises a plurality of vibration elements (492) which are disposed on an inner surface of the cylindrical chamber of said housing.

