

Description

The present invention relates to a device for use in applying a liquid material consisting of a solder paste, a glue or another viscous liquid or liquid dispersion in discrete small quantities to selected points on a substrate, for instance an electric circuit board, said device comprising a supply of said material, an outlet, connected to said supply by means of a conveying conduit, and means for intermittently forcedly discharging the material in successive small quantities through the outlet and applying each such quantity to a selected point on a substrate, placed in front of the outlet and movable in relation thereto.

Devices of the above kind are previously known, see for instance W0-A-90/00852, which, similar to the device according to the invention, are primarily intended to be used for applying a solder paste or an electrically conductive glue on electric circuit boards before placing components intended to be surface mounted thereon, but which, similar to the device according to the invention, may be used also for applying other viscous liquids or liquid dispersions on any suitable kind of substrate.

A troublesome disadvantage of these known devices has been found to be that, both during the use of the devices as well as, and above all, during interruptions in their use, a sedimentation may easily occur in the conveying conduit extending between the supply and the outlet. This sedimentation may result in that the material discharged through the outlet will have quite another composition than intended. Moreover, the sedimentation in the conveying conduit may also cause heavy cloggings in said conduit, especially in the case of extended breaks in the use of the devices.

The invention has for its purpose to provide a new and improved device of the kind initially specified which avoids the above disadvantages of the known devices in a favourable manner.

The known device, according to the invention proposed for the above purpose, is characterized in that the conveying conduit is formed as a closed loop which contains means for feeding the material in a circulating flow therethrough and past the outlet which comprises a discharge opening, provided in the wall of the conveying conduit and through which the material may be discharged in successive small quantities by the aid of means for intermittently transiently increasing the internal pressure in the conveying conduit within a zone thereof, located in the vicinity of the discharge opening.

By forming the conveying conduit in the above manner, it is possible, in an easy manner, effectively to eliminate the risk of a sedimentation of the material within the conveying conduit, existing in the known devices. Thus, the invention makes it possible to ensure that the material discharged through the outlet

will have the desired composition and that any clogging will not occur in the conveying conduit, even after longer breaks in the discharge of material through the outlet.

The continuous circulation of the material in a closed loop within the conveying conduit also causes a certain homogenization of the material. In order to intensify this homogenization, the means serving to feed the material through the conveying conduit may advantageously be arranged to subject the material to a homogenizing mechanical treatment when it passes said means. For this purpose, the feeding means may preferably be formed by a screw pump or a gear pump.

In order to counteract any tendency of the material to adhere to the conveying conduit, this conduit may suitably be provided with an internal liquid repellent coating which for instance may consist of polytetrafluoroethylene. Alternatively, the entire conveying conduit may consist of a liquid repellent material.

Moreover, in order to make it possible to place the substrate at a longer distance from the outlet than otherwise possible, the outlet may lead into an ejector nozzle by which the material discharged through the outlet may be brought to move at an increased speed towards the substrate.

Said means for intermittently transiently increasing the internal pressure in the conveying conduit within a zone thereof, located in the vicinity of the discharge opening, may suitably comprise means for providing an intermittent transient resilient compression of a portion of the conveying conduit located adjacent to said opening.

These compressing means may preferably comprise an electrically operated impact force generating arrangement which is adapted intermittently to apply an impact force on said portion of the conveying conduit at a location in the vicinity of the discharge opening. This impact force generating arrangement may advantageously be of a magnetostrictive or piezoelectric type.

Below, the invention is further described with reference to the accompanying diagrammatic drawings, in which:-

Figure 1 shows a front view of a device according to a first embodiment of the invention, selected by way of example,

Figure 2 shows a partial view, on an enlarged scale and in section, of said device, and

Figure 3 shows a corresponding partial view of a device according to a second embodiment of the invention, also selected by way of example.

The device shown in Figures 1 and 2 comprises a supply container 10 which contains a material consisting of a viscous liquid or a liquid dispersion. At its lower end, container 10 is provided with a neck portion 11 by means of which it is removably mounted in an inlet pipe connection 12 of a pump 13 to permit a

delivery of said material into said pump. Pump 13 is connected in a conveying conduit 14 for the material delivered into pump 13 from container 10, formed as a closed loop. Said material may hereby be fed in a continuous circulating flow through conveying conduit 14 by means of pump 13.

Pump 13 may preferably consist of a screw pump, a gear pump or any other suitable pump which will subject the material fed through conveying conduit 14 to a homogenizing mechanical treatment when it passes through the pump. Furthermore, conveying conduit 14 may preferably be provided with an internal liquid repellent coating 14' (Figure 2) which counteracts any tendency of said material to adhere to the conveying conduit and which for instance may consist of polytetrafluoroethylene.

Conveying conduit 14 consists of a metal pipe of circular cross section which has been bent to a loop shape shown in Figure 1 and the central lower part of which is provided with a flattened portion 15 having at least approximately flat upper and lower sides. In the centre of the lower side of portion 15 there is provided a discharge opening 17 leading into an outlet 16 which projects in a downward direction from said side.

Reference numeral 18 generally designates an arrangement for intermittently applying impact forces on the upper side of portion 15 of conveying conduit 14 at a central section thereof, located opposite to discharge opening 17 and outlet 16. The active impact force generating member of said arrangement consists of a rod 19 of a magnetostrictive material, e.g. Terfenol-d, which rests against the upper flat side of portion 15 of conduit 14 with a lower end portion 20 of reduced diameter, while, at its upper end, it is provided in contact with a stationary seat 21, located above rod 19 and serving to prevent said rod from moving in an upward direction. In Figure 1, seat 21 has been shown to consist of a horizontal plate which, at two opposite ends thereof, is rigidly mounted on two vertical support plates 22, firmly secured to conveying conduit 14.

In addition to rod 19, arrangement 18 also comprises a winding 23, mounted on said rod. When an electric current is fed through said winding 23, it will generate a magnetic flux through rod 19, causing an elongation of said rod. Hereby, rod 19 will apply an impact force on the upper side of portion 15 of conduit 14 each time a current pulse is fed through winding 23. The magnitude of this force varies in response to the amplitude of the current pulse. Provided that the current pulse has sufficient amplitude, the impact force applied on the upper side of portion 15 will have sufficient influence on the pressure of the material contained in conduit portion 15 behind discharge opening 17 and outlet 16 to cause a forced discharge of a small quantity A of said material through outlet 16. The quantity of material discharged through outlet 16 will be thrown against a substrate 24, placed in front

of outlet 16 and supported at a short distance from outlet 16 on a supporting member 25. In order to permit the discharged material quantity A to be applied to a selected point on substrate 24, supporting member 25 may suitably be movable in relation to outlet 16 in mutually perpendicular horizontal directions.

In order to impart an increased speed in direction towards substrate 24 to the material quantity A discharged through outlet 16, an ejector nozzle 26, which has been shown in dash-dotted lines in Figure 2 and into which outlet 16 leads, may be secured to the lower side of portion 15 of conduit 14. Ejector nozzle 26 is provided with a number of openings 27 through which compressed air may be fed into said nozzle to cause the desired ejector action.

As material is discharged from conveying conduit 14 through outlet 16, new material is supplied from container 10 to maintain a continuously circulating flow of material in the closed loop formed by conduit 14 and pump 13. Supply container 10 may suitably be mounted easily removable in inlet pipe connection 12 of pump 13 so that, when it has been emptied, it may easily be replaced by a fresh filled container.

In the embodiment shown in Figure 3, the impact force generating arrangement 18 of Figures 1 and 2 has been replaced by an arrangement 28, consisting of a stack of disks 29 of a piezoelectric material which are covered by metal layers on their flat sides. Disks 29 are oriented in mutually opposite directions in an alternating manner and are connected electrically in parallel. The stack formed by disks 29 has its upper end provided in contact with seat 21, while, at its lower end, it rests against the upper side of portion 15 of conveying conduit 14 through the intermediary of a pressure head 30. When an electric voltage pulse is applied across piezoelectric disks 29, these disks will be subjected to an electric field causing a transient increase in their thickness whereby pressure head 30 will apply an impact force on the upper side of portion 15.

The devices above described are primarily intended to be used for applying a solder paste or an electrically conductive glue on electric circuit boards. However, they may also be used for many other purposes.

The invention is not restricted to the embodiments above described and shown in the drawings. Instead, many other embodiments are feasible within the scope of the invention. By way of example, it could be mentioned that the supply container may be replaced by a material supply integrated in any suitable manner in the closed loop formed by conduit 14 and pump 13. Moreover, the described impact force generating arrangements 18 and 28, respectively, may be replaced by other means for providing an intermittent discharge of material in successive small quantities through outlet 16.



Claims

1. A device for use in applying a liquid material consisting of a solder paste, a glue or another viscous liquid or liquid dispersion in discrete small quantities to selected points on a substrate (24), e.g. an electric circuit board, said device comprising a supply (10) of such material, an outlet (16), connected to said supply by means of a conveying conduit (14), and means (18; 28) for intermittently forcedly discharging the material in successive small quantities through the outlet (16) and applying each such quantity to a selected point on a substrate (24), placed in front of the outlet (16) and movably supported in relation thereto, characterized in that the conveying conduit (14) is formed as a closed loop which contains means (13) for feeding the material in a circulating flow therethrough and past the outlet (16) which comprises a discharge opening (17), provided in the wall of the conveying conduit (14) and through which the material may be discharged in successive small quantities by the aid of means (18; 28) for intermittently transiently increasing the internal pressure in the conveying conduit (14) within a zone thereof, located in the vicinity of the discharge opening (17).
2. A device according to claim 1, characterized in that the feeding means (13) are arranged to subject the material to a homogenizing mechanical treatment when it passes said means.
3. A device according to claim 2, characterized in that the feeding means (13) are formed by a screw pump or a gear pump.
4. A device according to any of the preceding claims, characterized in that the conveying conduit (14) is provided with an internal liquid repellent coating (14').
5. A device according to any of the preceding claims, characterized in that the entire conveying conduit (14) consists of a liquid repellent material.
6. A device according to any of the preceding claims, characterized in that the outlet (16) leads into an ejector nozzle (26) by which the material discharged through the outlet (16) may be brought to move at an increased speed towards the substrate (24).
7. A device according to any of the preceding claims, characterized in that said means for intermittently transiently increasing the internal pressure in the conveying conduit (14) within a zone thereof, located in the vicinity of the discharge

opening (17), comprise means (18; 28) for providing an intermittent transient resilient compression of a portion (15) of the conveying conduit (14) located adjacent to said opening (17).

8. A device according to claim 7, characterized in that said compressing means comprise an electrically operated impact force generating arrangement (18; 28) which is adapted intermittently to apply an impact force on said portion (15) of the conveying conduit (14) at a point located in the vicinity of the discharge opening (17).
9. A device according to claim 8, characterized in that the impact force generating arrangement (18) is of a magnetostrictive type.
10. A device according to claim 8, characterized in that the impact force generating arrangement (28) is of a piezoelectric type.

Patentansprüche

1. Vorrichtung zum Aufbringen eines aus einer Löt-paste, einem Klebstoff oder einer anderen zähen Flüssigkeit oder flüssigen Dispersion bestehenden flüssigen Materials in gesonderten kleinen Mengen auf ausgewählte Stellen auf einem Substrat (24), beispielsweise eine gedruckte elektrische Schaltung, wobei die Vorrichtung einen Vorrat (10) an einem solchen Material, einen mit dem Vorrat über eine Förderleitung (14) verbundenen Auslass (16) und Mittel (18; 28) umfasst, um das Material kurzzeitig in aufeinanderfolgenden kleinen Mengen durch den Auslass (16) zwangsweise auszustossen und jede dieser Mengen auf eine ausgewählte Stelle eines Substrates (24) aufzubringen, das vor dem Auslass (16) angeordnet und gegenüber diesem beweglich abgestützt ist, dadurch gekennzeichnet, dass die Förderleitung (14) als eine geschlossene Schleife ausgebildet ist, die eine Einrichtung (13) enthält, um das Material in einer Umlaufströmung durch dieselbe zu fördern und am Auslass (16) vorbeizubewegen, der eine Ausstossöffnung (17) umfasst, die in der Wand der Förderleitung (14) ausgebildet ist und durch die das Material in aufeinanderfolgenden kleinen Mengen ausgestossen werden kann mit Hilfe einer Einrichtung (18; 28) zum vorübergehenden kurzzeitigen Vergrössern des Innendruckes in der Förderleitung (14) in einem in der Nähe der Ausstossöffnung (17) befindlichen Abschnitt derselben.
2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, dass die Fördereinrichtung (13) auf das Material eine mechanische Homogenisierungs-



behandlung ausübt, wenn dieses die Fördereinrichtung durchströmt.

3. Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, dass die Fördereinrichtung (13) von einer Schneckenpumpe oder einer Zahnradpumpe gebildet ist. 5
4. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Förderleitung (14) mit einer inneren flüssigkeitsabstossenden Beschichtung (14') versehen ist. 10
5. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die gesamte Förderleitung (14) aus einem flüssigkeitsabstossenden Material besteht. 15
6. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass der Auslass (16) in eine Ausstossdüse (26) führt, mit der das durch den Auslass (16) ausgestossene Material dem Substrat (24) mit einer vergrösserten Geschwindigkeit zugeführt werden kann. 20
7. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Einrichtung zum vorübergehenden kurzzeitigen Vergrössern des Innendruckes in der Förderleitung (14) in einem in der Nähe der Ausstossöffnung (17) befindlichen Abschnitt derselben eine Einrichtung (18; 28) zum vorübergehenden kurzzeitigen elastischen Verengen eines neben der besagten Öffnung befindlichen Bereichs der Förderleitung umfasst. 25
8. Vorrichtung nach Anspruch 7, dadurch gekennzeichnet, dass die Verengungseinrichtung eine elektrisch betätigte Stosskrafterzeugungsanordnung (18; 28) umfasst, die an einer in der Nähe der Ausstossöffnung (17) befindlichen Stelle kurzzeitig eine Stosskraft auf den besagten Bereich (15) der Förderleitung (14) ausüben kann. 30
9. Vorrichtung nach Anspruch 8, dadurch gekennzeichnet, dass die Stosskrafterzeugungsanordnung (18) von der magnetostriktiven Bauart ist. 35
10. Vorrichtung nach Anspruch 8, dadurch gekennzeichnet, dass die Stosskrafterzeugungsanordnung (28) von der piezoelektrischen Bauart ist. 40

Revendications

1. Appareil destiné à être utilisé pour l'application d'une matière fluide constituée d'une pâte de soudage, d'une colle ou d'un autre liquide vis-

queux ou d'une dispersion liquide en petites quantités séparées en des points choisis sur un substrat (24), par exemple une carte de circuit électrique, l'appareil comprenant une réserve (10) de la matière, une sortie (16) connectée à la réserve par un conduit de transport (14), et un dispositif (18 ; 28) destiné à évacuer à force par intermittence la matière en petites quantités successives par la sortie (16) et à appliquer chaque quantité en un point choisi du substrat (24), placé devant la sortie (16) et supporté afin qu'il soit mobile par rapport à elle, caractérisé en ce que le conduit de transport (14) est formé en boucle fermée qui contient un dispositif (13) destiné à faire avancer la matière sous forme d'un courant qui circule dans la boucle et devant la sortie (16) qui comporte une ouverture (17) d'évacuation, formée dans la paroi du conduit de transport (14) et par laquelle la matière peut être évacuée en petites quantités successives à l'aide d'un dispositif (18 ; 28) destiné à augmenter transitoirement et par intermittence la pression interne du conduit de transport (14) dans une zone de celui-ci placée au voisinage de l'ouverture (17) d'évacuation.

2. Appareil selon la revendication 1, caractérisé en ce que le dispositif d'alimentation (13) est destiné à faire subir à la matière un traitement mécanique d'homogénéisation lorsqu'elle passe au niveau du dispositif.
3. Appareil selon la revendication 2, caractérisé en ce que le dispositif d'alimentation (13) est formé par une pompe à vis ou à engrenage.
4. Appareil selon l'une quelconque des revendications précédentes, caractérisé en ce que le conduit de transport (14) porte un revêtement interne (14') d'une matière "chassant" le liquide.
5. Appareil selon l'une quelconque des revendications précédentes, caractérisé en ce que la totalité du conduit de transport (14) est formée d'une matière "chassant" le liquide.
6. Appareil selon l'une quelconque des revendications précédentes, caractérisé en ce que la sortie (16) débouche dans une buse d'éjecteur (26) grâce à laquelle la matière évacuée par la sortie (16) peut se déplacer à une plus grande vitesse vers le substrat (24).
7. Appareil selon l'une quelconque des revendications précédentes, caractérisé en ce que le dispositif destiné à augmenter transitoirement et par intermittence la pression interne dans le conduit de transport (14) dans une zone de celui-ci placée



au voisinage de l'ouverture (17) d'évacuation comporte un dispositif (18 ; 28) destiné à assurer une compression élastique transitoire intermittente d'une partie (15) du conduit de transport (14) placée près de l'ouverture (17).

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8. Appareil selon la revendication 7, caractérisé en ce que le dispositif de compression comporte un ensemble (18 ; 28) générateur de force de choc et commandé électriquement, qui est destiné à appliquer par intermittence une force de choc à ladite partie (15) du conduit de transport (14) en un point qui se trouve au voisinage de l'ouverture d'évacuation (17).

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9. Appareil selon la revendication 8, caractérisé en ce que l'ensemble (18) générateur de la force de choc est du type à magnétostriction.

10. Appareil selon la revendication 8, caractérisé en ce que l'ensemble (28) générateur d'une force de choc est de type piézoélectrique.

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