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(54) **ARRANGEMENT FOR TREATING THE INNER SURFACE OF A METAL TUBE**

VORRICHTUNG ZUR BEHANDLUNG DER INNENOberFLÄCHE EINES METALLROHRES
ENSEMBLE SERVANT A TRAITER LA SURFACE INTERNE D'UN TUBE METALLIQUE

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- **PATENT ABSTRACTS OF JAPAN vol. 5, no. 41 18 March 1981 & JP 55 164 065 A (SUMITOMO METAL IND LTD) 20 December 1980**

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EP 1 575 715 B1

Description

[0001] The invention relates to an arrangement for treating the inner surface of metal tubes, such as copper tubes, defined in the preamble of the independent claim.

[0002] Generally the inner surfaces of metal tubes, such as copper tubes, require various solution treatments before the tubes can be used in the desired way. Typically for example copper tubes are coated by tin, in which case on the inner surface of the tube, there is made a tin layer according to the prevailing regulations. This prevents a harmful dissolution of copper for instance in household water. In order to guarantee that the coating is carried out successfully, the surface to be coated must be carefully pretreated. The purpose of the pretreatment is to remove all lubrication agent and coal films as well as oxidized spots accumulated on the tube surface during the earlier manufacturing steps. Typically the pretreatment with solutions includes the washing of lubricating agents and coal films, pickling and washing prior to the coating proper. In pickling, the metal surface is chemically cleaned of oxidized products, and typically this is carried out in a sulfuric acid-water solution. As is well known, in pretreatment processes there are used acids or other strong solutions combined with the respective washing steps, and the handling of said agents may cause problems as regards both safety at work and the protection of the environment. Consequently, it would be important to achieve a process that is so closed and safe that said problems can be avoided.

[0003] From the publication WO 9937831 there is known a method for manufacturing copper tubes, in which method the inner surface of the copper tubes is tin-coated in electrolysis. According to said method, the tube is immersed in an electrolytic tank and is coated there.

[0004] Arrangements for treating the inner surface of several tubes simultaneously are known from documents US-A-4863555, US-A-5819770, US-A-3765050, G-B-A-2065717, RU-C-2032762 and JP-A-55164065.

[0005] The object of the present invention is to introduce a new solution for treating the inner surface of a metal tube, such as a copper tube, so that the drawbacks of the prior art are avoided, and the process itself is speeded up.

[0006] The invention is characterized by what is set forth in the characterizing part of the independent claim. Other preferred embodiments of the invention are characterized by what is set forth in the rest of the claims.

[0007] Remarkable advantages are achieved by the arrangement according to the invention for treating the inner surface of a metal tube. The invention relates to an arrangement for treating the inner surface of metal tubes, such as copper tubes; said arrangement comprises means for feeding the treatment agent onto the inner surface of the metal tube, and means for removing the treatment agent, which means that the arrangement includes at least a distribution element meant for supplying the treatment agent, by means of which an essentially equal amount of the treatment agent can be applied essentially simultaneously on the inner surfaces of at least two metal tubes. When an equal amount of the treatment agent is fed simultaneously on the inner surface of each metal tube to be treated, the treatment process is made quicker and more precise. According to the invention, the arrangement comprises two distribution elements, a feed end distribution element for feeding the treatment agent in the metal tubes, and an outlet end distribution element for removing the treatment agent from the metal tubes. Now also at the outlet end of the metal tubes, an equal amount of the treatment agent is advantageously removed from each metal tube simultaneously. The metal tubes are preferably arranged in an inclined position with respect to the horizontal level, so that the distribution element of the outlet end is positioned higher than the distribution element of the feed end. According to the invention, the distribution element is provided, in the lengthwise direction thereof, with at least one channel that includes, along the whole length of the distribution element, a point of constriction of the channel diameter. The measures of the diameter constriction point are designed so that when the treatment agent flows therethrough, an equally large pressure loss is created at the end of each metal tube under treatment. Now on the inner surfaces of all metal tubes, an equal amount of the treatment agent is advantageously made to flow simultaneously.

[0008] According to the invention, the distribution element includes at least one liquid channel through which the treatment agent can either be fed into the distribution element or removed therefrom. The liquid channel can be positioned on the outer circumference of the channel of the distribution element, so that any solution pockets are not left on the inner surfaces of the distribution element during the solution discharge step.

[0009] According to a preferred embodiment of the invention the distribution element is provided, in the lengthwise direction thereof, with two channels of different sizes: a first channel with respect to the flowing direction and a second channel with respect to the flowing direction. According to a preferred embodiment, in both distribution elements, the channels that are located first with respect to the flowing direction are mutually identical, and the channels that are located second with respect to the flowing direction are mutually identical. When the channels are positioned in the lengthwise direction of the distribution element, the treatment agent is fed, throughout the whole length of the distribution element, simultaneously to all metal tubes under treatment. The channels provided in the distribution element are in mutual liquid connection by intermediation of a constriction point arranged in between the channels. In the lengthwise direction, the distribution element is provided with spaced-apart tube channels for each metal tube under treatment. The metal tube under treatment is preferably arranged either with respect to the flowing direction of the first channel, or with respect to the flowing direction of the second channel.

[0010] According to the invention, the treatment agent is arranged to proceed in the distribution element first into the channel that is located first with respect to the flowing direction, from which channel it is transferred, through the constriction point, to the channel that is second with respect to the flowing direction. In the distribution element of the feed end, the metal tube is connected, by intermediation of its tube channel, to the second channel with respect to the flowing direction, in which case said channel is located above the channel that is first with respect to the flowing direction. In the distribution element of the outlet end, the metal tube is connected through its tube channel to the channel that is first with respect to the flowing direction, in which case said channel is located above the channel that is second in the flowing direction. In this way, there is achieved an optimal circulation for the treatment agent in the metal tubes.

[0011] According to the invention, the measures of the channel that is first in the flowing direction are designed so that there is room for at least as much treatment agent as can altogether be fitted onto the inner surfaces of all metal tubes under treatment. According to a preferred embodiment of the invention, the first channel in the flowing direction is in its transversal area essentially larger than the total sum of the transversal areas of all metal tubes under treatment. Advantageously the metal tubes are sealed at least by one sealing element in the vicinity of the tube channel, so that the sealing element extends as far as the end of the metal tube. This prevents the treatment agent from leaking onto the outer surface of the metal tube.

[0012] According to a preferred embodiment of the invention, the arrangement includes a suction arrangement for absorbing the treatment agent through the metal tubes. According to another preferred embodiment, the arrangement includes a pressure arrangement for applying the treatment solution onto the inner surfaces of the metal tubes. At least in one of the distribution elements, there can be arranged a channel for replacement air, by means of which channel there is preferably brought replacement air into the arrangement in order to enable the emptying of said arrangement. The arrangement includes a processing unit for the treatment agent. Into said processing unit, there is conducted, after reactions that have taken place in the metal tubes, treatment agent to be discharged from the metal tubes. The arrangement can be connected to at least one essentially similar arrangement, so that the treatment agent can be circulated therebetween. Now it is possible to combine several arrangements as one unit and thus to enhance the treatment process by circulating for example the washing solution in one unit and simultaneously the tinning solution in the other, in which case each pressure or suction arrangement, such as a solution pump, can be operated continuously. According to a preferred embodiment of the invention, the treatment agent is a tinning solution. According to another preferred embodiment of the invention, the treatment agent is a pickling solution. According to yet another preferred embodiment, the treatment agent is a degreasing solution. According to a preferred embodiment, the treatment agent is a washing solution. According to a preferred embodiment, the treatment agent is drying gas. By means of the arrangement according to the invention, the treatment of the inner surfaces of metal tubes is made easier, and the making of several flow adjustment units individually for each pipe is avoided by applying the present invention. The arrangement according to the invention enables an unhindered flowing of precipitable solutions and an efficient washing of metal tubes by liquids or gases.

[0013] The invention is described in more detail below with reference to the appended drawings.

Figure 1 An arrangement according to the invention

Figure 2 A cross-sectional view of figure 1

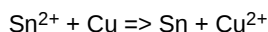
Figure 3 A cross-sectional view of figure 1

[0014] Figures 1, 2 and 3 illustrate an arrangement according to the invention for treating the inner surface of a metal tube, such as a copper tube. According to the example, the inner surfaces of metal tubes 2 are tin-coated by means of the arrangement, in which case the employed treatment agent 8 is a tinning solution. Figure 1 illustrates the feed end distribution element 3 for feeding the tinning solution 8 onto the inner surfaces of the metal tubes, and the outlet end distribution element 4 for discharging the tinning solution 8 into the processing unit 9 after the tinning process, said distribution elements 3 and 4 of the arrangement 1 being positioned on both sides of the metal tubes 2. Figures 2 and 3 are cross-sectional illustrations of the distribution elements 3 and 4 when observing figure 1 along the line A - A. In the distribution element there are, in the lengthwise direction thereof, made two channels of different sizes, i.e. the first channels 5 and 18 with respect to the flowing direction, and the second channels 6 and 17 with respect to the flowing direction. In cross-section, said channels can be either round or angular. In both distribution elements 3, 4, the first channels 5 and 18 in the flowing direction are mutually identical, and the second channels 6 and 17 in the flowing direction are mutually identical. In between the channels, both distribution elements are provided with a constriction point 7, through which the channels are in liquid connection. The measures of the constriction point 7 of the diameter are designed so that as the treatment agent flows therethrough, at the end 14 of each metal tube under treatment, there is created an equally large pressure loss. According to the example, the channels 5 and 18 are essentially larger in transversal area than the summed-up transversal area of all the metal tubes 2 to be tinned.

[0015] The required number of metal tubes 2 to be tinned is arranged in liquid connection with the channels of the distribution element. In both distribution elements, there is made, at given intervals 15 in the lengthwise direction thereof, tube channels 10, 19, for each metal tube. In the distribution element, in the lengthwise direction thereof, there is arranged

as many tube channels as there are metal tubes to be tinned. According to the invention, the metal tubes to be tinned are arranged adjacently in parallel and connected, by intermediation of the tube channels 10 and 19 of each tube, to the distribution elements 3 and 4. The metal tubes are arranged in between the distribution elements, so that they are arranged in an inclined position and form an angle of for instance 0 - 90 degrees with respect to the horizontal level, in which case the outlet end distribution element 4 is located higher than the feed end distribution element 3. When the metal tubes are positioned at a given angle, the removal of the bubbles from the metal tubes in the flowing direction of the treatment agent is made easier. In the distribution element 3 of the feed end of the arrangement, the metal tube 2 is connected, by intermediation of its tube channel 10, to the channel 6 that is second in the flowing direction, in which case the channel 6 is in the flowing direction located above the first channel 5. In the distribution element 4 of the outlet end, the metal tube 2 is connected, via its tube channel 19, to the channel 18 that is first in the flowing direction, so that the channel 18 is in the flowing direction located above the second channel 17.

[0016] The tinning solution is started to be absorbed into the metal tubes 2 by means of a suction arrangement 11 connected to the arrangement through the feed end distribution element 3. The tinning solution 8 is distributed evenly through the liquid channel 12 made in the distribution element 3 to the channel 5 that is first in the flowing direction, until it is filled, and flows further through the constriction point 7 to the channel 6 that is second in the flowing direction. From the channel 6, there flows through the tube channel 10 an equally large amount of the tinning solution onto the inner surface of each metal tube 2 to be tinned, and the tinning reactions take place on the inner surfaces of the tubes. Onto the inner surface of the metal tube, there is created a tinning layer for example according to the following reaction:



in which case the tin ions contained in the tinning solution are reduced on the inner surface of the copper tube at the same time as the copper is dissolved.

[0017] After the tinning reactions have taken place in the metal tubes, the tinning solution 8 flows from the tube channel 19 located in the distribution element 4 of the outlet end to the channel 18 and further through the constriction point 7 to the channel 17. When the arrangement should be emptied of the tinning solution, the replacement air channel 20 made in the distribution element of the outlet end is opened, in which case the tube system between the distribution element 4 of the outlet end and processing unit 9 is emptied of the tinning solution through the liquid channel 16 into the processing unit 9. Thereafter the liquid channel 16 is closed, so that both the distribution element 4, the metal tubes 2 and the distribution element 3 are emptied through the liquid channel 12 to the processing unit 9.

[0018] The liquid channels 12 and 16 that can be closed when necessary are, according to the example, arranged underneath in the distribution element. They can, however, also be made so that they are located at the side of the distribution element. In a similar way as the tinning solution is circulated, the arrangement can be used for circulating washing liquid such as water, pickling solution, degreasing solution or drying gas. The flowing of the treatment agent may take place continuously or in batches. In the arrangement, there can be connected a necessary amount of flow adjusting elements, such as valves or other elements that affect the circulation of the treatment agent. The arrangement according to the invention can be connected to at least one similar arrangement.

[0019] In the metal tube fastening points 13 provided in the tube channels 10 and 19, there is arranged a required number of sealing elements 21, so that the sealing elements 21 surround the metal tube 2 and the tube channel to be tinned. The number of said sealing elements is at least one, and it is arranged so that it extends to outside the end 14 of the metal tube to be tinned; when necessary, also the end of the metal tube is thus insulated from the tin solution.

[0020] For a man skilled in the art it is obvious that the various preferred embodiments of the invention are not restricted to the above described examples only, but they may vary within the scope of the appended claims.

Claims

1. An arrangement (1) for treating the inner surface of a plurality of metal tubes (2), such as copper tubes, which arrangement is provided by elements for feeding treatment agent (8), for pickling, cleaning, coating or drying, onto the inner surface of the metal tube, and by elements for removing the treatment agent, whereby the arrangement comprises at least two distribution elements, a feed end distribution element (3) for feeding the treatment agent (8) into a plurality of metal tubes (2) and an outlet end distribution element (4) for removing the treatment agent from metal tubes, where the distribution elements (3, 4) are provided, in the lengthwise direction thereof, with at least one channel including a constriction point (7) of the channel diameter for the whole length of the distribution element and the measures of the diameter constriction point are designed so that when the treatment agent flows therethrough, at the end of each metal tube (2) to be treated, there is created an equally large pressure loss, and in the lengthwise direction thereof, with two channels; a first channel (5, 18) with respect to the flowing direction, and a second channel (6, 17) with respect to the flowing direction, and whereby the channels are provided in the distribution elements in

mutual liquid connection by means of a constriction point (7) arranged in the channels, the treatment agent (8) is arranged to proceed in the distribution element (3, 4) into the channel (5, 18) that is first with respect to the flowing direction, from which it is transferred, through the constriction point (7), to the channel (6, 17) that is second with respect to the flowing direction, by means of which the feed end distribution element (3) supplies an essentially equal amount of the treatment agent (8) essentially simultaneously onto the inner surfaces of at least two metal tubes.

2. An arrangement according to claim 1, **characterized in that** the metal tubes are positioned in an inclined position with respect to the horizontal level, so that the outlet end distribution element (4) is located higher than the feed end distribution element (3).
3. An arrangement according to any of the preceding claims, **characterized in that** each distribution element (3, 4) is provided with at least one liquid channel (12, 16), through which the treatment agent (8) can be either fed to the distribution element or removed therefrom.
4. An arrangement according to claim 3, **characterized in that** in both distribution elements (3, 4), the first channels (5, 18) in the flowing direction are mutually identical, and the second channels (6, 17) in the flowing direction are mutually identical.
5. An arrangement according to any of the claims 1 - 4, **characterized in that** each distribution element is provided, in the lengthwise direction thereof, with tube channels (10, 19) arranged at certain intervals (15) for each metal tube (2) to be processed.
6. An arrangement according to claim 5, **characterized in that** each metal tube (2) under treatment is arranged in direct liquid connection by intermediation of the tube channel (10, 19) either with the first channel (5, 18) provided in the flowing direction in the distribution element (3, 4) or with the second channel (6, 17) provided in the flowing direction.
7. An arrangement according to claim 5 or 6, **characterized in that** in the distribution element (3) of the feed end, each metal tube (2) is connected through its tube channel (10) to the channel (6) that is second with respect to the flowing direction, in which case the channel (6) is located above the channel (5) that is first in the flowing direction.
8. An arrangement according to claim 5 or 6, **characterized in that** in the distribution element (4) of the outlet end, each metal tube (2) is connected, through its tube channel (19), to the channel (18) that is first with respect to the flowing direction, in which case the channel (18) is located above the channel (17) that is second in the flowing direction.
9. An arrangement according to claim 1, 4, 6, 7 or 8, **characterized in that** the measures of the first channel (5, 18) in the flowing direction are designed so that in the channel, there can be fitted at least as much treatment agent as there is altogether room for on all the inner surfaces of each of the metal tubes (2) to be treated.
10. An arrangement according to claim 1, 4, 6, 7, 8 or 9, **characterized in that** in the transversal area, the first channel (5, 18) in the flowing direction is essentially larger than the total sum of the transversal areas of all the metal tubes (2) to be treated.
11. An arrangement according to claim 5, 6, 7 or 8, **characterized in that** the metal tubes (2) are sealed by at least one sealing element (21) in the vicinity of the tube channel (10, 19), so that the sealing element extends as far as the end (14) of the metal tube.
12. An arrangement according to any of the preceding claims, **characterized in that** the arrangement includes a suction element (11) for absorbing the treatment agent (8) through the metal tubes.
13. An arrangement according to any of the claims 1 - 11, **characterized in that** the arrangement includes a pressure arrangement for supplying the treatment solution onto the inner surfaces of the metal tubes.
14. An arrangement according to any of the preceding claims, **characterized in that** at least in one of the distribution elements, there can be arranged a channel (20) for replacement air.
15. An arrangement according to any of the preceding claims, **characterized in that** the arrangement includes a

processing unit (9) for the treatment agent.

16. An arrangement according to any of the preceding claims, **characterized in that** the arrangement can be connected to at least one essentially similar arrangement, so that the treatment agent can be circulated therebetween.
17. An arrangement according to any of the preceding claims, **characterized in that** it is suitable for use with a treatment agent (8) that is a tinning solution.
18. An arrangement according claims 1 - 16, **characterized in that** the treatment agent (8) is a pickling solution.
19. An arrangement according to any of the preceding claims 1 - 16, **characterized in that** it is suitable for use with a treatment agent (8) that is a degreasing solution.
20. An arrangement according to any of the preceding claims 1 - 16, **characterized in that** it is suitable for use with a treatment agent (8) that is a washing liquid.
21. An arrangement according any of the preceding claims 1 - 16, **characterized in that** it is suitable for use with a treatment agent (8) that is drying gas.

Patentansprüche

1. Einrichtung (1) zum Behandeln der Innenfläche einer Mehrzahl von Metallrohren (2), wie beispielsweise Kupferrohre, welche Einrichtung mit Elementen zum Zuführen eines Behandlungsmittels (8) zum Beizen, Reinigen, Beschichten oder Trocknen auf die Innenfläche des Metallrohres versehen ist, sowie mit Elementen zum Entfernen des Behandlungsmittels, wobei die Einrichtung mindestens zwei Verteilerelemente umfasst, ein Zufuhrendverteilerelement (3) zum Zuführen des Behandlungsmittels (8) in eine Mehrzahl von Metallrohren (2) und ein Auslassendverteilerelement (4) zum Entfernen des Behandlungsmittels aus den Metallrohren, wobei die Verteilerelemente (3, 4) in deren Längsrichtung mit mindestens einem Kanal versehen sind, der einen Verjüngungspunkt (7) im Kanaldurchmesser über die gesamte Länge des Verteilerelements aufweist, wobei die Maße des Durchmessers des Verjüngungspunktes so bestimmt sind, dass an dem Ende eines jeden zu behandelnden Metallrohres (2) ein gleichmäßig großer Druckverlust geschaffen ist, wenn das Behandlungsmittel hier hindurchströmt, sowie versehen mit zwei Kanälen in der Längsrichtung hiervon; ein erster Kanal (5, 18) mit Bezug auf die Strömungsrichtung, und ein zweiter Kanal (6, 17) mit Bezug auf die Strömungsrichtung, wobei die Kanäle in den Verteilerelementen in gegenseitiger Liquidverbindung mittels eines Verjüngungspunktes (7) stehen, der in den Kanälen vorgesehen ist, wobei das Behandlungsmittel (8) zum Durchströmen des Verteilerelements (3, 4) in den Kanal (5, 18) bestimmt ist, der hinsichtlich der Strömungsrichtung der Erste ist, von wo aus es durch den Verjüngungspunkt (7) an den hinsichtlich der Strömungsrichtung zweiten Kanal (6, 17) transferiert wird, wodurch das Zufuhrendverteilerelement (3) eine im Wesentlichen gleichförmige Menge an Behandlungsmittel (8) im Wesentlichen gleichzeitig auf die Innenflächen von mindestens (2) Metallrohren zuführt.
2. Einrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Metallrohre in einer geeigneten Position bezüglich der Horizontalen positioniert sind, so dass das Auslassendverteilerelement (4) höher angeordnet ist, als das Zufuhrendverteilerelement (3).
3. Einrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** jedes Verteilerelement (3, 4) mit mindestens einem Flüssigkeitskanal (12, 16) versehen ist, durch den das Behandlungsmittel (8) entweder an das Verteilerelement geführt oder hiervon entfernt werden kann.
4. Einrichtung gemäß Anspruch 3, **dadurch gekennzeichnet, dass** in beiden Verteilerelementen (3, 4) die ersten Kanäle (5, 18) in der Strömungsrichtung zueinander identisch sind, und die zweiten Kanäle (6, 17) in der Strömungsrichtung zueinander identisch sind.
5. Einrichtung nach einem der Ansprüche 1-4, **dadurch gekennzeichnet, dass** jedes Verteilerelement in dessen Längsrichtung mit Rohrkanälen (10, 19) versehen ist, die zu bestimmten Intervallen (15) für jedes zu behandelnde Metallrohr (2) angeordnet sind.
6. Einrichtung nach Anspruch 5, **dadurch gekennzeichnet, dass** jedes sich in der Behandlung befindliche Metallrohr

(2) in direkter Liquidverbindung durch Zwischenanschluss des Rohrkanals (10, 19), entweder mit dem ersten Kanal (5, 18), der in der Strömungsrichtung in dem Verteilerelement (3, 4) vorgesehen ist, oder mit dem in der Strömungsrichtung vorgesehenen zweiten Kanal (6, 17), angeordnet ist.

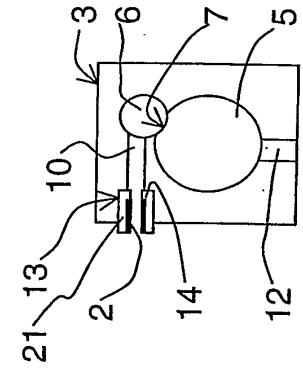
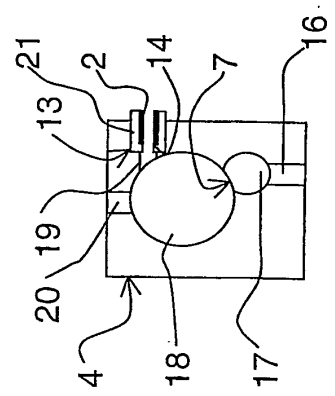
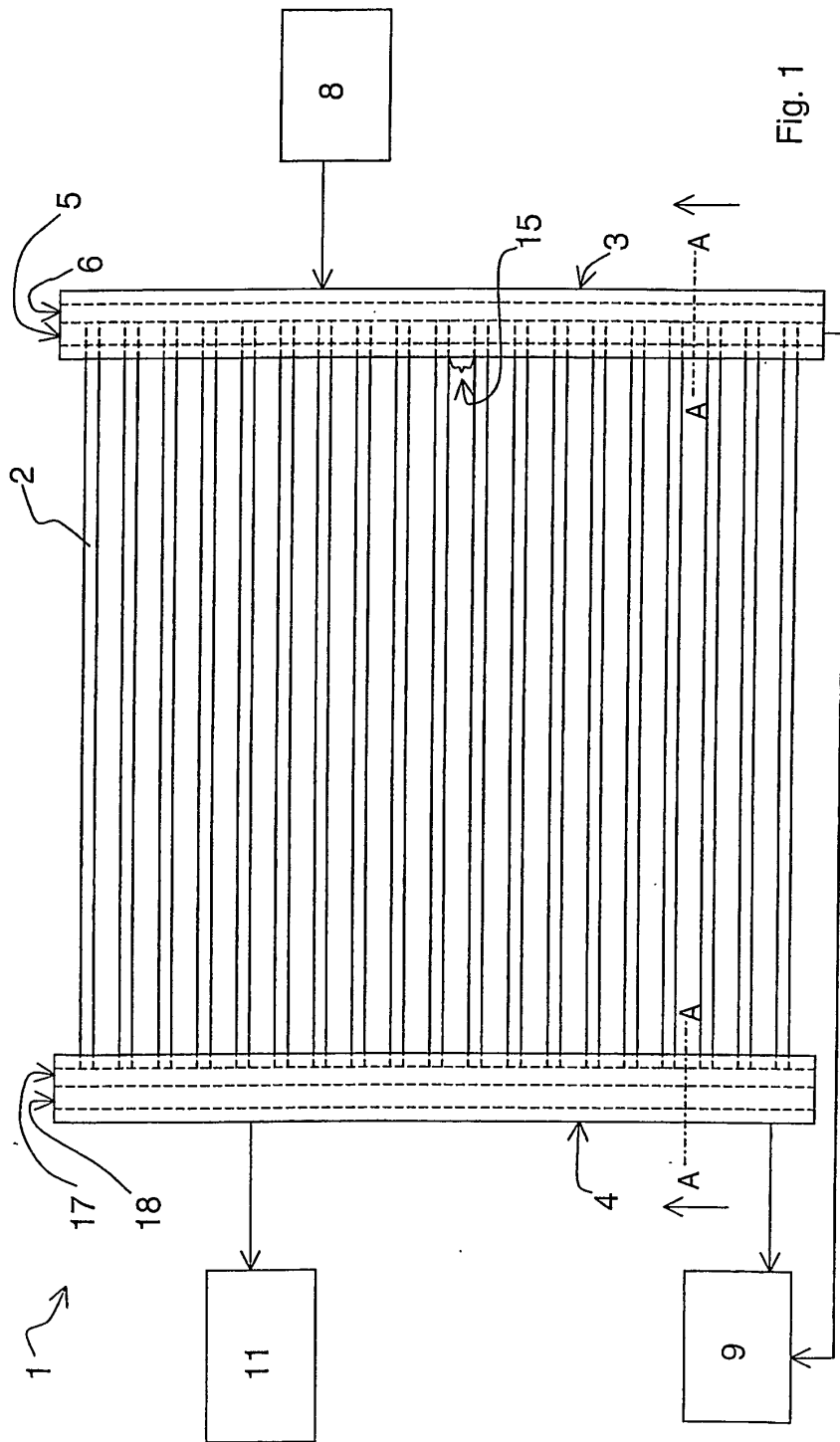
- 5 7. Einrichtung nach Anspruch 5 oder 6, **dadurch gekennzeichnet, dass** in dem Verteilerelement (3) des Zuführendes jedes Metallrohr (2) durch seinen Rohrkanal (10) an den Kanal (6) angeschlossen ist, der bezüglich der Strömungsrichtung der Zweite ist, in welchem Fall der Kanal (6) oberhalb des Kanals (5) platziert ist, der der Erste in der Strömungsrichtung ist.
- 10 8. Einrichtung nach Anspruch 5 oder 6, **dadurch gekennzeichnet, dass** in dem Verteilerelement (4) des Auslassendes jedes Metallrohr (2) durch seinen Rohrkanal (19) an dem bezüglich der Strömungsrichtung ersten Kanal (18) angeschlossen ist, in welchem Fall der Kanal (18) oberhalb des Kanals (17) platziert ist, der in der Strömungsrichtung der Zweite ist.
- 15 9. Einrichtung nach Anspruch 1, 4, 6, 7 oder 8, **dadurch gekennzeichnet, dass** die Maße des ersten Kanals (5, 18) in der Strömungsrichtung so in dem Kanal gewählt sind, dass zumindest so viel Behandlungsmittel eingeführt werden kann, wie insgesamt Raum für auf all den Innenflächen eines jeden zu behandelnden Metallrohres (2) vorliegt.
- 20 10. Einrichtung nach Anspruch 1, 4, 6, 7, 8 oder 9, **dadurch gekennzeichnet, dass** in dem Querbereich der erste Kanal (5, 18) in der Strömungsrichtung im Wesentlichen größer ist als die Gesamtsumme der Querbereiche aller zu behandelnder Metallrohre (2).
- 25 11. Einrichtung nach Anspruch 5, 6, 7 oder 8, **dadurch gekennzeichnet, dass** die Metallrohre (2) durch mindestens ein Dichtelement (21) in der Nähe des Rohrkanals (10, 19) abgedichtet sind, so dass sich das Dichtelement soweit bis zum Ende (14) des Metallrohres erstreckt.
12. Einrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Einrichtung ein Saugelement (11) zum Absorbieren des Behandlungsmittels (8) durch die Metallrohre aufweist.
- 30 13. Einrichtung nach einem der Ansprüche 1 bis 11, **dadurch gekennzeichnet, dass** die Einrichtung eine Druckeinrichtung zum Zuführen der Behandlungslösung auf die Innenflächen der Metallrohre aufweist.
14. Einrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** in zumindest einem der Verteilerelemente ein Kanal (20) zum Abführen von Luft angeordnet ist.
- 35 15. Einrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Einrichtung eine Prozessoreinheit (9) für das Behandlungsmittel aufweist.
- 40 16. Einrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Einrichtung an eine zumindest im Wesentlichen ähnliche Einrichtung angeschlossen werden kann, so dass das Behandlungsmittel zwischen ihnen zirkuliert werden kann.
17. Einrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** sie zur Verwendung mit einem Behandlungsmittel (8), das eine Zinnlösung ist, geeignet ist.
- 45 18. Einrichtung gemäß Ansprüchen 1 - 16, **dadurch gekennzeichnet, dass** das Behandlungsmittel (8) eine Beizlösung ist.
19. Einrichtung gemäß einem der vorangehenden Ansprüche 1 - 16, **dadurch gekennzeichnet, dass** sie zur Verwendung mit einem Behandlungsmittel (8) geeignet ist, das ein Fettlösemittel ist.
- 50 20. Einrichtung nach einem der vorangehenden Ansprüche 1 - 16, **dadurch gekennzeichnet, dass** sie zur Verwendung mit einem Behandlungsmittel (8) geeignet ist, das eine Waschlösung ist.
- 55 21. Einrichtung gemäß einem der vorangehenden Ansprüche 1- 16, **dadurch gekennzeichnet, dass** sie zur Verwendung mit einem Behandlungsmittel (8) geeignet ist, das ein Trocknungsgas ist.

Revendications

- 5 1. Ensemble (1) servant à traiter la surface interne d'une multitude de tubes métalliques (2), tels que des tubes de cuivre, l'ensemble disposant d'éléments destinés à envoyer l'agent de traitement (8), à décaper, nettoyer, enduire ou sécher, sur la surface interne du tube métallique, et d'éléments destinés à retirer l'agent de traitement, l'ensemble comportant au moins deux organes de distribution, un organe de distribution de l'extrémité d'alimentation (3) destiné à envoyer l'agent de traitement (8) dans une multitude de tubes métalliques (2) et un organe de distribution de l'extrémité de sortie (4) destiné à retirer l'agent de traitement des tubes métalliques, dans lequel les organes de distribution (3, 4) sont munis, dans le sens de leur longueur, d'au moins un canal contenant un point d'étranglement (7) du diamètre du canal pour toute la longueur de l'organe de distribution et les mesures du diamètre du point d'étranglement sont conçues de telle sorte que quand l'agent de traitement circule à travers celui-ci, à l'extrémité de chaque tube métallique (2) devant être traité, une perte de pression de valeur égale est créée, et munis, dans le sens de leur longueur, de deux canaux ; un premier canal (5, 18) par rapport au sens de circulation, et un second canal (6, 17) par rapport au sens de circulation, et les canaux étant disposés dans les organes de distribution en communication liquide mutuelle au moyen d'un point d'étranglement (7) disposé dans les canaux, l'agent de traitement (8) étant prévu pour progresser dans l'organe de distribution (3, 4) à l'intérieur du canal (5, 18) qui est le premier par rapport au sens de circulation, d'où il est transféré, à travers le point d'étranglement (7), au canal (6, 17) qui est le second par rapport au sens de circulation, au moyen duquel l'organe de distribution de l'extrémité d'alimentation (3) fournit une quantité essentiellement égale de l'agent de traitement (8) essentiellement simultanément sur la surface interne d'au moins deux tubes métalliques.
- 25 2. Ensemble selon la revendication 1, **caractérisé par le fait que** les tubes métalliques sont positionnés en position inclinée par rapport au niveau horizontal, de telle sorte que l'organe de distribution de l'extrémité de sortie (4) est situé plus haut que l'organe de distribution de l'extrémité d'alimentation (3).
- 30 3. Ensemble selon l'une quelconque des revendications précédentes, **caractérisé par le fait que** chaque organe de distribution (3, 4) est muni au moins d'un canal liquide (12, 16), à travers lequel l'agent de traitement (8) peut être soit amené à l'organe de distribution soit en être retiré.
- 35 4. Ensemble selon la revendication 3, **caractérisé par le fait que** dans les deux organes de distribution (3, 4), les premiers canaux (5, 18) dans le sens de circulation sont identiques entre eux, et les seconds canaux (6, 17) dans le sens de circulation sont identiques entre eux.
- 40 5. Ensemble selon l'une quelconque des revendications 1 à 4, **caractérisé par le fait que** chaque organe de distribution est muni, dans le sens de la longueur de celui-ci, de canaux tubulaires (10, 19) disposés à certains intervalles (15) afin de traiter chaque tube métallique (2).
- 45 6. Ensemble selon la revendication 5, **caractérisé par le fait que** chaque tube métallique (2) soumis au traitement est disposé en communication liquide direct par l'intermédiaire du canal tubulaire (10, 19) soit avec le premier canal (5, 18) dans le sens de circulation dans l'organe de distribution (3, 4) soit avec le second canal (6, 17) monté dans le sens de circulation.
- 50 7. Ensemble selon la revendication 5 ou 6, **caractérisé par le fait que** dans l'organe de distribution (3) de l'extrémité d'alimentation, chaque tube métallique (2) est relié par son canal tubulaire (10) au canal (6) qui est en seconde position par rapport au sens de circulation, auquel cas le canal (6) est situé au-dessus du canal (5) qui est en première position dans le sens de circulation.
- 55 8. Ensemble selon la revendication 5 ou 6, **caractérisé par le fait que** dans l'organe de distribution (4) de l'extrémité de sortie, chaque tube métallique (2) est relié par son canal tubulaire (19) au canal (18) qui est en première position par rapport au sens de circulation, auquel cas le canal (18) est situé au-dessus du canal (17) qui est en seconde position dans le sens de circulation.
9. Ensemble selon la revendication 1, 4, 6, 7 ou 8, **caractérisé par le fait que** les mesures du premier canal (5, 18) dans le sens de circulation sont conçues de sorte que, dans le canal, au moins autant d'agents de traitement peuvent être mis en place qu'il y a de place dans le dispositif pour toutes les surfaces internes de chacun des tubes métalliques (2) devant être traités.

EP 1 575 715 B1

10. Ensemble selon la revendication 1, 4, 6, 7, 8 ou 9,
caractérisé par le fait que dans la zone transversale, le premier canal (5, 18) dans le sens de circulation est essentiellement plus important que la somme totale des zones transversales de tous les tubes métalliques (2) devant être traités.
11. Ensemble selon la revendication 5, 4, 6, 7 ou 8,
caractérisé par le fait que les tubes métalliques (2) sont scellés par au moins un élément d'étanchéité (21) à proximité du canal tubulaire (10, 19), de telle sorte que l'élément d'étanchéité s'étend jusqu'à l'extrémité (14) du tube métallique.
12. Ensemble selon l'une quelconque des revendications précédentes,
caractérisé par le fait que l'ensemble contient un élément d'aspiration (11) destiné à absorber l'agent de traitement (8) à travers les tubes métalliques.
13. Ensemble selon l'une quelconque des revendications 1 à 11,
caractérisé par le fait que l'ensemble contient un dispositif de pression destiné à alimenter la solution de traitement sur les surfaces internes des tubes métalliques.
14. Ensemble selon l'une quelconque des revendications précédentes,
caractérisé par le fait qu'au moins dans un des éléments de distribution, un canal (20) peut être prévu pour l'air de renouvellement.
15. Ensemble selon l'une quelconque des revendications précédentes,
caractérisé par le fait que l'ensemble contient une unité de traitement (9) destinée à l'agent de traitement.
16. Ensemble selon l'une quelconque des revendications précédentes,
caractérisé par le fait que l'ensemble peut être relié à au moins un ensemble essentiellement similaire, de telle sorte que l'agent de traitement peut être mis en circulation entre ces deux ensembles.
17. Ensemble selon l'une quelconque des revendications précédentes,
caractérisé par le fait qu'il est adapté à l'utilisation avec un agent de traitement (8) sous forme de solution d'étamage.
18. Ensemble selon l'une des revendications 1 à 16,
caractérisé par le fait que l'agent de traitement (8) est une solution de décapage.
19. Ensemble selon l'une quelconque des revendications précédentes 1 à 16,
caractérisé par le fait qu'il est adapté à l'utilisation avec un agent de traitement (8) sous forme de solution de dégraissage.
20. Ensemble selon l'une quelconque des revendications précédentes 1 à 16,
caractérisé par le fait qu'il est adapté à l'utilisation avec un agent de traitement (8) sous forme de liquide de lavage.
21. Ensemble selon l'une quelconque des revendications précédentes 1 à 16,
caractérisé par le fait qu'il est adapté à l'utilisation avec un agent de traitement (8) sous forme de gaz de séchage.



REFERENCES CITED IN THE DESCRIPTION

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