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(54) **Head for the digital decoration of ceramic products**

(57) The head (1) for the digital decoration of ceramic products, comprises:

- a body (2) inside which a channel (3) is defined for the transit of at least a ceramic glaze and having an inlet port (3a) and an outlet port (3b) for the glaze;
- at least a clogging element (4) fitted inside the transit channel (3) and alternatively moving between a closing position and an opening position of the outlet port (3b), the clogging element (4) comprising at least one ferromagnetic element (6a, 6b);
- opening means (7) which can be controlled between an active configuration, wherein they generate a first magnetic field able to attract the clogging element (4) towards the opening position, and an inactive configuration, wherein they interrupt the first magnetic field itself;
- return means (8) able to generate a second permanent magnetic field to attract the clogging element (4) towards the closing position with the opening means (7) in an inactive configuration,

where the clogging element (4) comprises at least two ferromagnetic elements (6a, 6b) arranged spaced apart from one another, of which at least a first and a second ferromagnetic elements (6a, 6b) arranged, with the clogging element (4) in closing position, in correspondence to the opening means (7) and in the proximity of the return means (8), respectively.

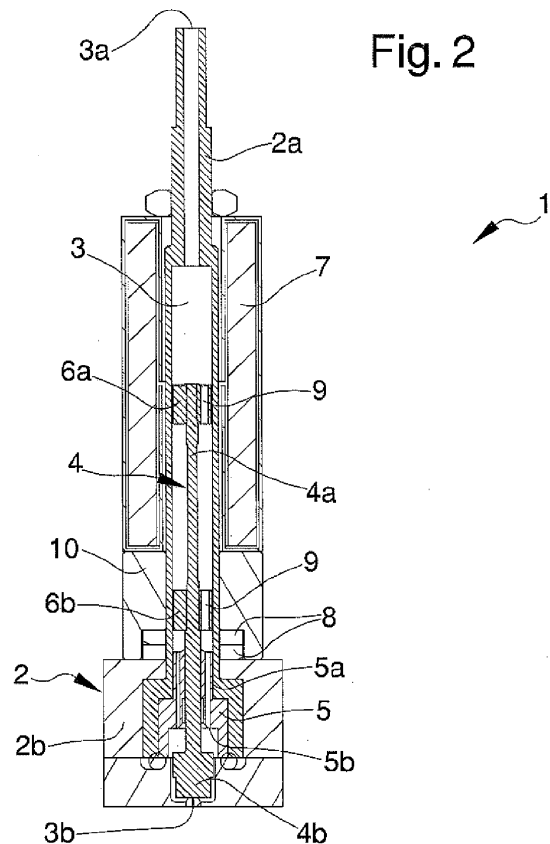


Fig. 2

Description

[0001] The present invention relates to a head for the digital decoration of ceramic products.

[0002] The technique of decorating ceramic tiles by digital printing is widespread over time now.

[0003] The machines for digital printing available on the market nowadays generally comprise a plurality of print heads able to dispense a particular type of ink. In particular, the heads of known type used for the decoration of ceramic tiles comprise a body inside which a channel for the transit of ink is obtained and which has with an inlet port and an outlet port of the ink itself.

[0004] Because the outlet port is very small, in correspondence to the same a flexible blade is arranged that is activated from time to time to control the ink outflow. Such blade is therefore able to exert a mechanical action on the ink in order to apply the force necessary to allow the outflow to the outside.

[0005] These heads of known type have however a number of drawbacks.

[0006] In fact, they are not usable with the glazes generally employed in the ceramic industry which, due to their density, would obstruct the outlet port of the heads themselves thus making them unusable.

[0007] It follows, therefore, that the heads currently used in the ceramic industry enable the dispensing of only very small amount of ink and, as a consequence, the application of a surface "veil" which produces a decoration which is often unsatisfactory.

[0008] It is also known, in particular in the field of bar codes marking and printing, the use of print heads provided with a clogging element movable between a closing position and an opening position of the outlet port. More in detail, to shift the clogging element from the closing position towards the opening position a magnetic field is generated from time to time which is able to attract the clogging element itself away from the outlet port.

[0009] These heads of known type then provide for the presence of a spring associated with the clogging element and which is able to exert a return action on it to bring it back to the closing position following the interruption of the magnetic field mentioned above.

[0010] These heads used in the field of bar codes printing and the like also have a number of drawbacks.

[0011] In fact, they are not able to work at high frequencies, i.e. when a high number of displacements of the clogging element over the unit of time is required (as in the ceramic sector), since the return spring tends to go in resonance causing the head itself to malfunction.

[0012] Furthermore, since the ceramic glazes are significantly more aggressive from the chemical point of view compared to those used in the marking field, it follows that the return spring undergoes a very fast erosion and wear action thus causing the breakage of the same and the malfunction of the head.

[0013] The main aim of the present invention is to provide a head for the digital decoration that allows the use

of ceramic glaze generally used in traditional ceramic decorations and that at the same time allows to obtain a high quality decoration.

[0014] In particular, one object of the present invention is to enable the dispensing of a greater amount of glaze compared to the heads used in the ceramic sector up to now, in order to obtain a better decoration from a quality point of view.

[0015] Yet another object is to provide a head for the digital printing that it is able to operate in a precise and safe way at both low and high frequencies. Not the latest object of the present invention is to provide a head that is durable over time and which, therefore, requires a number of maintenance jobs significantly reduced compared to the heads of known type.

[0016] Another object of the present invention is to provide a head for the digital decoration of ceramic products which allows to overcome the above mentioned drawbacks of the prior art within a simple, rational, easy and effective to use as well as economic solution.

[0017] The above mentioned objects are achieved by the present head for the digital decoration of ceramic products, according to the contents of claim 1.

[0018] Other characteristics and advantages of the present invention will become evident from the description of a preferred, but not exclusive, embodiment of a head for the digital decoration of ceramic products, illustrated by way of an indicative, but not limitative example in the accompanying drawings wherein :

Figure 1 is an axonometric view of a head according to the invention;

Figure 2 is a sectional view of the head of Figure 1.

[0019] With particular reference to such figures, globally indicated by reference number 1 is a head for the digital decoration of ceramic products.

[0020] The head 1 comprises a body 2 inside which a channel 3 is defined for the transit of a ceramic glaze having an inlet port 3a and an outlet port 3b for the glaze itself.

[0021] More particularly, the channel 3 has an elongated shape and the inlet and outlet ports 3a and 3b are defined in correspondence to its opposite longitudinal extremities.

[0022] As shown in the embodiment represented in the figures, the inlet port 3a and the outlet port 3b are defined in correspondence to the upper extremity and the lower extremity of the transit channel 3, respectively. Suitably, the channel 3 is under pressure, approx. 1-2 bar.

[0023] In the preferred embodiment shown in the figures, the body 2 comprises a tubular element 2a having an elongated shape and at least a base element 2b, which can be accomplished in one or more parts, associated with the lower extremity of the tubular element 2a. The tubular element 2a and the base element 2b define the inlet port 3a and the outlet port 3b, respectively.

[0024] Inside the channel 3 is housed a clogging ele-

ment 4 which is movable between a closing position, wherein it blocks the outlet port 3b to prevent the glaze outflow, and an opening position, wherein it releases the outlet port itself to enable the dispensing of glaze. More particularly, the clogging element 4 cooperates with the body 2 in the closing position to block the outlet port 3b, while it is moved away from the latter in the opening position in order to allow the outflow of glaze.

[0025] Advantageously, the clogging element 4 is movably sliding in a longitudinal direction, inside the channel 3.

[0026] To enable the dispensing of the glaze contained in the channel 3, the clogging element 4 is then moved longitudinally inside the channel itself from the closing position towards the opening position. Since, in use, the head 1 is arranged vertically, it follows that in the opening position the clogging element 4 is raised with respect to the closing position and vice versa.

[0027] As shown in the embodiment represented in figure 1, the clogging element 4 comprises a stem 4a with which is associated, in correspondence to its lower extremity, a closing element 4b able to cooperate with the body 2 in order to block or release the outlet port 3b. Suitably, the closing element 4b has a larger cross section than the stem 4a.

[0028] The clogging element 4 then comprises at least one ferromagnetic element 6a, 6b. More in detail, the ferromagnetic element 6a, 6b is integrally associated with the stem 4a.

[0029] Inside the channel 3 is also arranged a guide element 5 for guiding the clogging element 4. More particularly, the guide element 5 has a through hole inside which is inserted the stem 4a and one or more glaze transit ducts 5a communicating with the channel 3.

[0030] The guide element 5 also defines an abutment surface 5b of the closing element 4b able to limit the shift of the clogging element 4 away from the outlet port 3b. The end-of-stroke stops of the clogging element 4 are therefore defined in one direction by the abutment surface 5b described above and in the opposite direction by the body 2 against which the closing element 4b rests in the closing position.

[0031] The ferromagnetic element 6a, 6b is arranged on the side opposite the closing element 4b with respect to the guide element 5.

[0032] The head 1 also comprises opening means 7, which can be activated to generate a magnetic field able to exert a force of attraction on the clogging element 4, and in particular on its ferromagnetic element 6a, 6b, to bring it to the opening position.

[0033] More particularly, the opening means 7 can be controlled between an active configuration, wherein they generate a first magnetic field able to attract the clogging element 4 to cause it to shift towards the opening position, and an inactive configuration, wherein they interrupt the first magnetic field and, consequently, also the force applied on the clogging element 4.

[0034] Preferably, the opening means 7 are arranged

externally to the body 2 to surround at least a first portion of the channel 3. The opening means 7 are therefore fitted around a first portion of the channel 3.

[0035] The opening means 7 are composed, e.g., of an electromagnet. As known to the expert in the field, the electromagnet consists in a core made of ferromagnetic material on which a solenoid is wrapped (in figure 2 only the interspace is visible obtained in the ferromagnetic core and intended to house the solenoid).

[0036] In the embodiment shown in Figure 2, the electromagnet 7 has a tubular shape and is arranged around the aforesaid first portion of the channel 3 coaxially to it. It follows, therefore, that the electromagnet 7 is crossed along its entire longitudinal extension by the channel 3, so that the glaze contained within the latter also performs a cooling function of the electromagnet itself.

[0037] The head 1 also comprises return means 8 able to generate a second magnetic field, of the permanent type, to attract the clogging element 4 towards the closing position with the opening means 7 in the inactive configuration. In particular, the second magnetic field generated by the return means 8 exerts a force of attraction on the ferromagnetic element 6a, 6b.

[0038] Even the return means 8 are arranged externally to the body 2 to surround at least a second portion of the channel 3. The return means 8 are composed, e.g., of at least a permanent magnet, two in the embodiment represented in figure 2, having annular shape and fitted inside the aforesaid second portion of the channel 3.

[0039] The opening means 7 and the return means 8 are sized in such a way that the force exerted by the first magnetic field on the clogging element 4 is of greater intensity than that exerted on the clogging element itself by the second magnetic field.

[0040] The clogging element 4 therefore returns to the closing position only after the deactivation of the opening means 7, i.e. when the first magnetic field is interrupted and the only force acting on it is that due to the second magnetic field.

[0041] Preferably, the opening means 7 are arranged on top of (with reference to the direction taken, in use, by the head 1) the return means 8. In other words, the opening means 7 are arranged on the side of the inlet port 3a, while the return means 8 are arranged on the side of the outlet port 3b. Advantageously, the clogging element 4 comprises at least two ferromagnetic elements 6a, 6b which are spaced apart from one another. More particularly, the clogging element 4 comprises a first ferromagnetic element 6a and a second ferromagnetic element 6b integrally associated with the stem 4a and longitudinally spaced apart from one another. The first and the second ferromagnetic elements 6a and 6b are arranged, with the clogging element 4 in the closing position in correspondence to the opening means 7 and in the proximity of the return means 8, respectively. This arrangement of the ferromagnetic elements 6a and 6b causes each of them being within the magnetic field generated by the opening means 7 and the return means 8,

respectively.

[0042] As can be seen from Figure 2, the ferromagnetic elements 6a and 6b have a larger cross section than that of the stem 4a. More in detail, each ferromagnetic element 6a, 6b is arranged substantially snugly inside the channel 3 and has a respective through hole 9 able to allow the outflow of the glaze through it.

[0043] Advantageously, the head 1 also comprises a spacing element 10 arranged between the opening means 7 and the return means 8. Such a spacing element 10 is made of an insulating material, this term referring to a material which is impervious to the magnetic field.

[0044] The spacing element 10 is particularly able to space apart longitudinally the return means 8 from the opening means 7 in such a way as to reduce the interference between the magnetic fields generated by the same. In particular, the spacing element 10 is able to increase the distance between the first ferromagnetic element 6a and the return means 8, so as to reduce the effect of the second magnetic field on the first ferromagnetic element itself.

[0045] The first ferromagnetic element 6a is therefore arranged, with the clogging element 4 in closing position, at a distance from the return means 8 so as not to be affected by the second magnetic field generated by the same.

[0046] In the embodiment represented in the figures, the spacing element 10 is interposed between the opening means 7 (arranged above) and the base element 2b (arranged below).

[0047] The operation of the present invention is as follows.

[0048] Under normal operating conditions, the clogging element 4 is in the closing position, in which it blocks the outlet port 3b with its closing element 4b. More in detail, in this use configuration, the clogging element 4 is maintained in closing position due to the force of attraction exerted by the second magnetic field generated by the return means 8.

[0049] When the outflow of glaze contained within the channel 3 is required, the opening means 7 are activated by making electric power to circulate inside the relative electromagnet. Due to the effect of this activation the opening means 7 generate a relative magnetic field which exerts a force of attraction on the first ferromagnetic element 6a of such an intensity to cause the displacement thereof away from the outlet port 3b. As already anticipated above, the force applied on the first ferromagnetic element 6a by the magnetic field generated by the opening means 7 is of greater intensity than that exerted on the second ferromagnetic element 6b by the permanent magnetic field generated by the return means 8.

[0050] In other words, following the activation of the opening means 7, the clogging element 4 is raised with respect to the closing position so as to allow the outflow of glaze.

[0051] Following the opening of the outlet port 3b, the glaze outflows to the outside due to the pressure inside

the channel 3.

[0052] To finish the glaze dispensing, the circulation of electric power is interrupted in the electromagnet 7, thus interrupting consequently the first magnetic field, so that the clogging element 4 is promptly brought back to the closing position.

[0053] More particularly, as soon as the first magnetic field generated by the opening means 7 is interrupted, only the second magnetic field generated by the permanent magnets 8 remains active and exerts a return force on the clogging element 4 towards the closing position.

[0054] It is easy to understand how the dispensing of the ceramic glaze is carried out by energizing the electromagnet 7 and how the clogging element 4 then automatically returns to the closing position due to the permanent magnetic field generated by the return means 8.

[0055] It is found in practice that the described invention achieves the proposed objects and in particular the fact is stressed that the head, which is the subject of the present invention, allows the use of traditional ceramic glazes and, at the same time, a safe and precise operation over time.

[0056] In particular, the use of one or more permanent magnets arranged outside the glaze transit channel and able to draw the clogging element towards the closing position allows to adjust at will the opening time of the outlet port, and therefore the quantity of dispensed glaze, as well as to prevent the high aggressiveness of the glaze itself from affecting the return means thus impairing the operation of the head itself.

[0057] Furthermore, the magnetic start of the clogging element, both in the opening and closing condition, allows the use of the head at any working rate and significantly increases the duration compared to those of known type, there being no moving parts mechanically connected to each other.

Claims

1. Head (1) for the digital decoration of ceramic products, comprising:
 - a body (2) inside which a channel (3) is defined for the transit of at least a ceramic glaze and having an inlet port (3a) and an outlet port (3b) for the glaze;
 - at least a clogging element (4) fitted inside said transit channel (3) and alternatively moving between a closing position and an opening position of said outlet port (3b), said clogging element (4) comprising at least one ferromagnetic element (6a, 6b);
 - opening means (7) which can be controlled between an active configuration, wherein they generate a first magnetic field able to attract said clogging element (4) towards the opening position, and an inactive configuration, wherein they

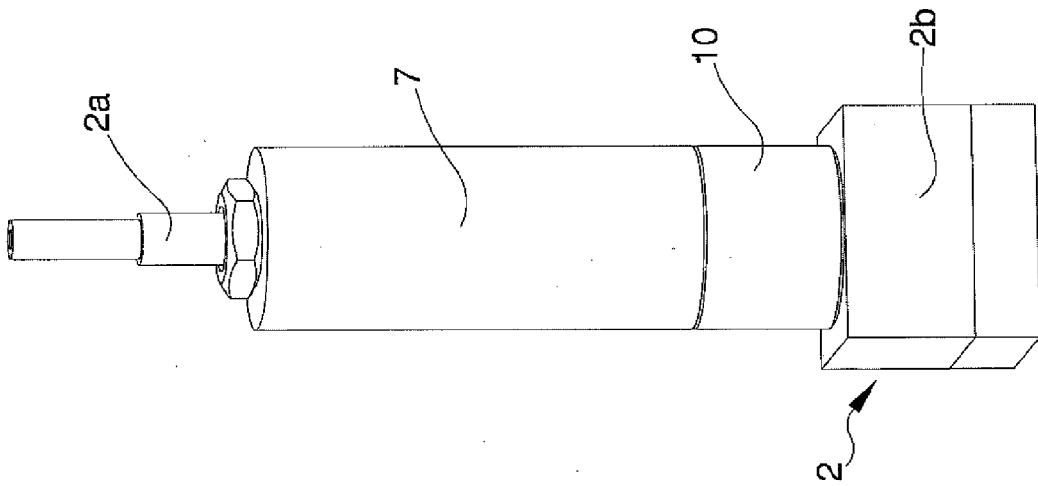
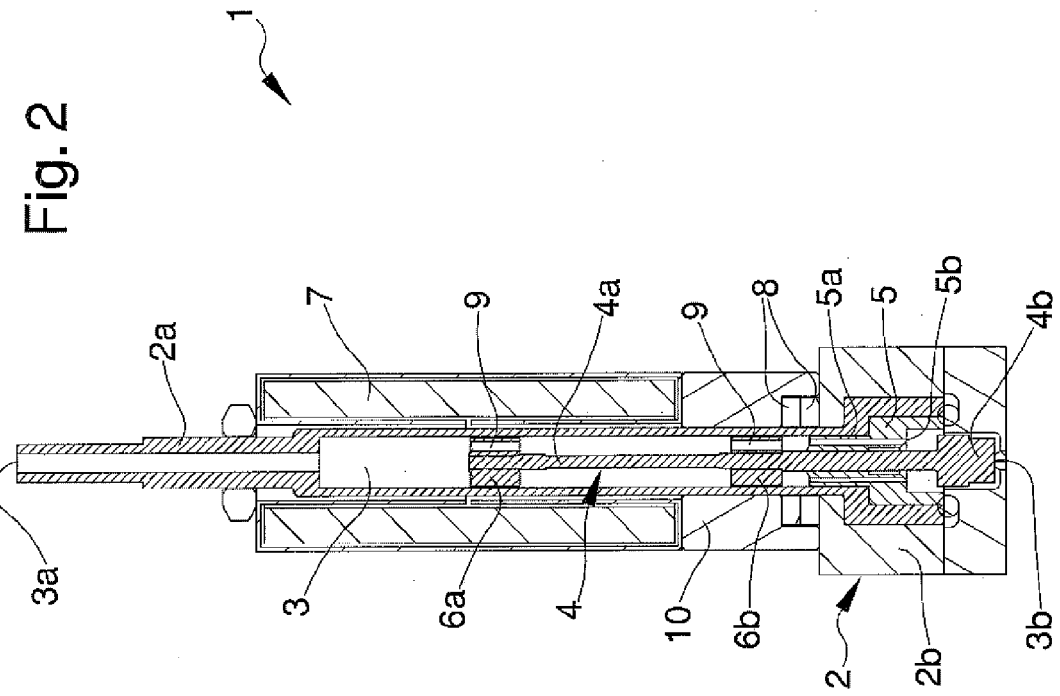
interrupt the first magnetic field itself;
 - return means (8) able to generate a second permanent magnetic field to attract said clogging element (4) towards the closing position with said opening means (7) in an inactive configuration,

characterized in that said clogging element (4) comprises at least two ferromagnetic elements (6a, 6b) arranged spaced apart from one another, of which at least a first and a second ferromagnetic elements (6a, 6b) arranged, with said clogging element (4) in closing position, in correspondence to said opening means (7) and in the proximity of said return means (8), respectively.

2. Head (1) according to claim 1, **characterized in that** said transit channel (3) has a longitudinal extension and that said inlet and outlet ports (3a, 3b) are defined, respectively, in correspondence to the opposite longitudinal extremities of the transit channel itself.
3. Head (1) according to claim 2, **characterized in that** said inlet port (3a) and said outlet port (3b) are defined in correspondence to the upper extremity and the lower extremity of said transit channel (3), respectively.
4. Head (1) according to one or more of the preceding claims, **characterized in that** said opening means (7) are arranged externally to said body (2) and are fitted around a first portion of the transit channel itself.
5. Head (1) according to one or more of the preceding claims, **characterized in that** said opening means (7) comprise an electromagnet.
6. Head (1) according to one or more of the preceding claims, **characterized in that** said opening means (7) are arranged, in use, on top of said return means (8).
7. Head (1) according to one or more of the preceding claims, **characterized in that** said return means (8) are arranged externally to said body (2) and are fitted around a second portion of said transit channel (3).
8. Head (1) according to one or more of the preceding claims, **characterized in that** it comprises at least a spacing element (10) placed between said opening means (7) and said return means (8).
9. Head (1) according to claim 8, **characterized in that** said spacing element (10) is made of a material which is impervious to the magnetic field.
10. Head (1) according to one or more of the preceding

claims, **characterized in that** said return means (8) comprise at least a permanent magnet.

11. Head (1) according to one or more of the preceding claims, **characterized in that** said first ferromagnetic element (6a) is arranged, with said clogging element (4) in closing position, at a distance from said return means (8) so as not to be affected by the second magnetic field generated by the same.





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EP 14 15 8258

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