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(54) **Mold for the unidirectional pressing of ceramic articles**

Form zum unidirektionalem Pressen von keramischen Gegenständen

Matrice pour le pressage unidirectionnel d'articles en céramique

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Description

[0001] The present invention relates to a mold for the unidirectional pressing of ceramic articles, according to the preamble of claim 1.

[0002] It is known that the production cycle of ceramic articles entails a step of pressing powders loaded inside a mold in order to achieve the forming of an article. Such mold is substantially constituted by a containment rim in which one or more receptacles are defined for forming respective articles, which are closed above and below by respective upper male punches and lower male punches of the rigid or isostatic type.

[0003] In the pressing cycle of an article there are, in the following order, an initial step of loading the loose powders into the receptacle, a step of closing the mold by means of the male punches actuated by the pressing elements, a preliminary pressing step of controlled intensity and duration so as to facilitate the expulsion of the air trapped among the powder granules loaded into the receptacle, a deaeration step that consists in reopening the mold at least partially in order to allow the escape of the air, one or more pressing steps in order to achieve the forming of the article and a final step for extracting the obtained article from the mold.

[0004] It is quite evident that the need to evacuate the air enclosed by the powders loaded into the receptacle in order to allow adequate compaction thereof and avoid the forming of defective articles entails the need to perform some dedicated steps (preliminary pressing and deaeration), which prolong cycle times and complicate the programming and management of the functions of the press.

[0005] Moreover, in the deaeration step the outflow of the air mixed with powders through the perimetric opening defined between the at least partially spaced male punches causes early wear of the components of the mold.

[0006] In order to obtain deaeration of the powders loaded into the receptacle without the necessity of performing dedicated steps in the pressing cycle and without compromising the functionality and durability of the molds, molds are also known which are modified in order to allow the evacuation of the air directly during the pressing for forming the article.

[0007] A first type of these molds is cited in US 2,026,940, which discloses a mold that comprises a male punch provided with a plurality of holes that have an end facing the inside of the receptacle and an opposite end associated with a suction system.

[0008] These holes are dimensioned so as to have a diameter which is small enough with respect to the average particle size of the loaded powders, so as to prevent such powders from being sucked into the holes.

[0009] Moreover, the holes have a reduced length with respect to the diameter to prevent any aspirated powder granules from settling inside them and blocking them.

[0010] In particular, the suction system has a duct

which is associated with each hole and has a much larger diameter than such hole, so as to prevent the settling of powder inside it.

[0011] However, even this type of mold is not free from drawbacks, because the need to contain the diameter of the holes in order to reduce the possibility of aspirating powders, which by settling might block them, complicates its production and reduces suction efficiency, unless a large number of holes is provided with the consequent risk of weakening the mold and obtaining an unsatisfactory quality of the article.

[0012] Moreover, such mold is not provided with a system for the self-cleaning of its internal parts from the aspirated powders.

[0013] A second type of mold that allows deaeration of the powders loaded during the forming pressing is disclosed in EP 1.882.571 A1, which describes a mould according to the preamble of claim 1 and more specifically an isostatic male punch, the metallic structure of which is provided, at the ribs for separating the various membranes, with a plurality of holes which communicate with a suction system. A respective flow control element is accommodated inside each hole and allows evacuating the air and limiting the aspiration of powders.

[0014] In order to allow the removal of any powders aspirated into the holes there is an auxiliary hydraulic circuit, which is isolated from the air suction circuit and adapted to press on the flow control elements, making them protrude toward the inside of the receptacle so as to allow access to the holes for their cleaning.

[0015] This type of mold, too, is not free from drawbacks because it has a considerable structural complexity with subsequent difficulties in production, high manufacturing costs and the need of frequent interventions for maintenance in use.

[0016] Moreover, such mold allows the removal of any aspirated powders only at the end portion of the holes facing toward the inside of the receptacle and requires the intervention of an operator in order to perform this cleaning intervention.

[0017] The aim of the present invention is to eliminate the above-mentioned drawbacks of the background art, by devising a mold for the unidirectional pressing of ceramic articles that allows an effective deaeration of the powders directly during the forming of the article, without entailing structural, installation and maintenance problems.

[0018] Within this aim, an object of the present invention is to allow efficient and quick cleaning of all the internal parts of the mold that have come in contact with any aspirated powder, so as to keep suction performance constant over time without requiring the intervention of workforce to perform this intervention.

[0019] Another object of the present invention is to preserve the main components of the mold from wear phenomena linked to the entrainment of powders during deaeration of the powders, so as not to compromise their durability and functionality.

[0020] A further object of the present invention is to be flexible in application both in presses that are already operating in production facilities and in newly manufactured presses and also to be adaptable both for rigid molds and for isostatic molds.

[0021] Another object of the present invention is to have a simple structure, which is relatively easy to provide in practice, safe to use, effective in operation and has relatively low costs.

[0022] This aim and these and other objects which will become better apparent hereinafter are achieved by the present mold for the unidirectional pressing of ceramic articles in accordance with the features of claim 1.

[0023] Further characteristics and advantages of the present invention will become better apparent from the following detailed description of some preferred but not exclusive embodiments of a mold for unidirectional pressing of ceramic articles, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figures 1, 2 and 3 are respective partially sectional schematic views of a first embodiment of the mold according to the invention installed on a conventional press during a pressing cycle;

Figure 4 is a partially sectional schematic view of a second embodiment of the mold, according to the invention, installed on a conventional press;

Figure 5 is a sectional schematic view of a portion of a mold according to the invention of the rigid type; Figure 6 is a sectional schematic view of a portion of a mold according to the invention of the isostatic type;

Figure 7 is a schematic view of the male punches provided with holes and of the corresponding connections to the suction means and delivery means in a multiple mold according to the invention;

Figure 8 is an enlarged-scale schematic view of a detail of Figure 7.

[0024] With reference to the figures, a mold for the unidirectional pressing of ceramic articles is generally designated by the reference numeral 1.

[0025] The mold 1 comprises a containment rim 2, which defines at least one receptacle 3, into which powdered ceramic material C is loaded to form an article M, and at least one pair of mutually opposite male punches 4 for delimiting such receptacle, one of which is arranged in a lower region to define the bottom of the receptacle 3 and the other one is arranged in an upper region in order to define the top of such receptacle.

[0026] The mold 1 is designed to be paired with a conventional press P, not described in detail because it is of a known type; in particular, the male punches 4 are fixed to respective beams of the press P so that they can move with alternating translational motion in a vertical direction.

[0027] At least one of the male punches 4 is provided with a plurality of holes 5, each one of which has a first end 5a in communication with the inside of the receptacle

3 and a second end 5b, arranged opposite the first one, which is associated with air suction means 17, which are not described in detail because they are of a traditional type.

[0028] Moreover, the holes 5 are also associated with means 18 for delivering a pressurized fluid, preferably of the type of air, through the corresponding second ends 5b, so as to be able to perform a self-cleaning step of the mold 1, the delivery means 18 not being described in detail because they are of a traditional type.

[0029] The mold 1 can be connected to the suction means 17 and to the delivery means 18 already present directly on board the press P or in any case at the production site where it is installed or to dedicated suction means 17 and delivery means 18. The suction means 17 can be provided with a system for separating air from any aspirated powder granules.

[0030] Generally, the male punch 4 provided with holes 5 is the one designed to form the masonry side of the article M.

[0031] The male punch 4 provided with holes 5 may be equally the one arranged in an upper region in the press P (Figures 1-3) or rather the one arranged in a lower region (Figure 4).

[0032] There are valve means 6 for selective flow control which are interposed between the holes 5 and the suction means 17 and the delivery means 18 and are operated by means of a conventional electronic management and control unit, not shown, which opens and closes them.

[0033] The electronic unit is interfaced preferably with means for detecting the relative position of the male punches 4 for activating the opening and closing of the valve means 6 as a function of the current condition of the mold 1. These detection means can be dedicated and provided together with the mold 1 and then installed on the press P or they can be already present on the press P for detecting the current position of the upper beam with respect to the lower beam and for interfacing with the electronic unit according to methods known to the person skilled in the art.

[0034] The electronic unit, for example, can manage the opening and closing of the valve means 6 as a function of the current condition of the mold 1 and/or on the basis of a duration of the individual preset pressing steps.

[0035] The valve means 6 provide at least two distinct electric valves driven for opening and closure by the electronic unit: a first electric valve 7 interposed between the holes and the suction means 17 and a second electric valve 8 interposed between such holes and the delivery means 18.

[0036] At the beginning of a pressing cycle, with the male punches 4 still spaced so as to allow the loading of the powdered ceramic material C into the receptacle 3 (Figures 1 and 4), the electronic unit keeps the first electric valve and the second electric valve, respectively 7 and 8, closed.

[0037] Subsequently, with the male punches 4 mutu-

ally closer so as to close the receptacle 3 (Figure 2), the electronic unit activates the opening of the first electric valve 7, keeping the second electric valve 8 closed, so as to achieve the suction of the air trapped among the powders simultaneously with the compaction of such powders.

[0038] Once the forming of the article M has been completed, the upper male punch 4 starts to rise together with the corresponding beam of the press P to allow the extraction of the article M from the receptacle 3 (Figure 3). During this step the electronic unit can keep the electric valves 7 and 8 closed, or open one valve or the other for a few moments so as to facilitate the release of the article M from the lower male punch 4. In particular, if the male punch 4 provided with holes 5 is the upper one (Figures 1-3), the first electric valve 7 is kept open in the initial step of spacing the male punches 4 so that the upper one tends to entrain the article M; if however the male punch 4 provided with holes 5 is the lower one (Figure 4), a temporary opening of the second electric valve 8 is activated so as to slightly raise the article M from such male punch.

[0039] For achieving the self-cleaning of the mold 1, the electronic unit activates the opening of the second electric valve 8 and preferably the simultaneous opening of the first electric valve 7 as well, optionally delayed a few moments with respect to the previous one, so that at the same time a blowing action is performed by the delivery means 18 and a drawing action is performed by the suction means 17.

[0040] Each hole 5 is connected to a chamber 9, which has larger transverse dimensions than such hole, so as to avoid blockages in case of suction of powder granules, and leads into at least one connecting channel 10, which is common to the holes 5 of each male punch 4; the holes 5, the chambers 9 and the connecting channel 10 are provided inside the male punch itself.

[0041] Advantageously, the first electric valve and the second electric valve, respectively, 7 and 8 are external to the male punch 4 provided with holes 5 and are associated with such holes through the connecting channel 10. In particular, the connecting channel 10 may have a linear or ramified extension and is associated at one end with the first electric valve 7 and at the opposite end with the second electric valve 8. In this manner, it is possible during the self-cleaning step to obtain the passage of pressurized fluid along the entire length of the holes 5, of the corresponding chambers 9 and of the connecting channel 10 of each male punch 4 to achieve a complete "cleaning" of the internal parts of the male punch 4.

[0042] Moreover, there are at least one first duct and one second duct, respectively, 11 and 12 for connecting the ends of the connecting channel 10 to the respective electric valves 7 and 8.

[0043] In the embodiment shown in Figures 7 and 8, each male punch 4 provided with holes 5 has a single connecting channel 10 with a ramified extension so as to define a sort of grid inside such male punch which is

connected to the various chambers 9. The connecting channel 10 is connected, outside the male punch 4, at one end to two first ducts 11 and at the other end to two second ducts 12.

[0044] As an alternative, the male punch 4 provided with holes 5 can have a plurality of connecting channels 10; in fact, the holes 5 of each male punch 4 can be grouped and the holes 5 of each group can be connected to a respective connecting channel 10. In this case, a first duct and a second duct, respectively 11 and 12, may be provided which are connected to each connecting channel 10, or a single first duct 11 and a single second duct 12 may be provided for the various connecting channels 10 of each male punch 4.

[0045] The first ducts 11 are therefore connected to a same first electric valve 7 by means of a first manifold 13, while the second ducts 12 are connected to a same second electric valve 8 by means of a second manifold 14.

[0046] In the case of a mold 1 provided with a plurality of receptacles, it is possible to provide a single first electric valve 7 and corresponding first manifold 13 and a single second electric valve 8 and corresponding second manifold 14 for all the receptacles, or a first electric valve 7 and corresponding first manifold 13 and a second electric valve 8 and corresponding second manifold 14 for each receptacle so as to make their operation independent.

[0047] Figure 7 exemplifies an embodiment of a multiple mold 1, the three male punches 4 of which, provided with holes 5, are each provided with a single connecting channel 10 of the type described above connected to two first ducts 11 and two second ducts 12; the first ducts 11 and the second ducts 12 associated with the three male punches 4 provided with holes 5 are connected, respectively, to a single first manifold 13 intercepted by the first electric valve 7 and to a single second manifold 14 intercepted by the second electric valve 8.

[0048] Finally, it is noted that the male punch 4 provided with holes 5 may be of the rigid type (Figure 5) or of the isostatic type (Figure 6).

[0049] In the latter case, the male punch 4 is usually provided with a structure 15 for supporting one or more elastic membranes 16 and the holes 5 are defined in the structure 15 at the peripheral region of such membranes.

[0050] In practice it has been found that the described invention achieves the intended aim and objects and in particular the fact is stressed that the mold according to the invention makes it possible to ensure suction of the air trapped inside the receptacle directly during forming, with a simple and flexible structure. Moreover, the mold according to the invention allows quick and complete cleaning of the parts affected by the suction from the powder in a fully automatic manner.

[0051] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0052] All the details may further be replaced with other

technically equivalent elements.

[0053] In practice, the materials used, as well as the contingent shapes and dimensions, may be any according to requirements without thereby abandoning the scope of protection of the appended claims.

[0054] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A mold (1) for the unidirectional pressing of ceramic articles, comprising a containment rim (2) that forms at least one receptacle (3) for forming a respective article (M) and at least one pair of mutually opposite male punches (4) for delimiting said receptacle (3), wherein at least one of said male punches is provided with a plurality of holes (5), each of the holes (5) having a first end (5a) in communication with said receptacle (3) and a second end (5b) opposite to the first end (5a) which are associated with air suction means (17) and with delivery means (18) for delivering a pressurized fluid through the corresponding second ends (5b), valve means (6) for selective flow control being further provided which are interposed between said plurality of holes (5) and said suction means (17) and said delivery means (18) and are operated by an electronic management and control unit that activates their opening and closure, **characterized in that** said valve means (6) comprising at least one first electric valve (7) interposed between said plurality of holes (5) and said suction means (17), and at least one second electric valve (8) interposed between said holes (5) and said delivery means (18), said management and control unit is configured to keep, once the forming of the Article (M) has been completed and the upper male punch (4) starts to rise, one between said at least one first electric valve (7) and said at least one second electric valve (8) for a few moments in the open configuration for the release of said article (M) from the lower male punch (4).
2. The mold (1) according to claim 1, **characterized in that** said management and control unit is configured, in the pressing step, to keep the first electric valve (7) in the open configuration and the second electric valve (8) in the closed configuration and, in the self-cleaning step, to open at least the second electric valve (8).
3. The mold (1) according to claim 2, **characterized in**

that in said self-cleaning step the management and control unit is configured to keep said first electric valve (7) in the open configuration.

4. The mold (1) according to one or more of the preceding claims, **characterized in that** said management and control unit is interfaced with means for detecting the mutual position of said male punches (4) for the actuation of the opening and closure of said valve means (6) as a function of the current condition of said mold.
5. The mold (1) according to one or more of the preceding claims, **characterized in that** each one of said holes (5) communicates with a respective chamber (9) having transverse dimensions larger than those of said hole and leading into at least one connecting channel (10), said chambers (9) and said connecting channel (10) being provided within said male punch (4) provided with said plurality of holes (5).
6. The mold (1) according to claim 5, **characterized in that** said plurality of holes (5) is associated with said first and second electric valves (7, 8) via said connecting channel (10), to achieve in said self-cleaning step the passage of fluid along the holes (5), the corresponding chambers (9) and said connecting channel.
7. The mold (1) according to one or more of the preceding claims, **characterized in that** said male punch (4) provided with said plurality of holes (5) is of the rigid type.
8. The mold according to one or more of claims 1 to 6, **characterized in that** said male punch (4) provided with said plurality of holes (5) is of the isostatic type and comprises a structure (15) for supporting at least one elastic membrane (16), the holes (5) being formed in said structure (15) at the periphery of said membrane (16).
9. The mold (1) according to one or more of the preceding claims, **characterized in that** said male punch (4) operates on the masonry side of the article (M) being formed.

Patentansprüche

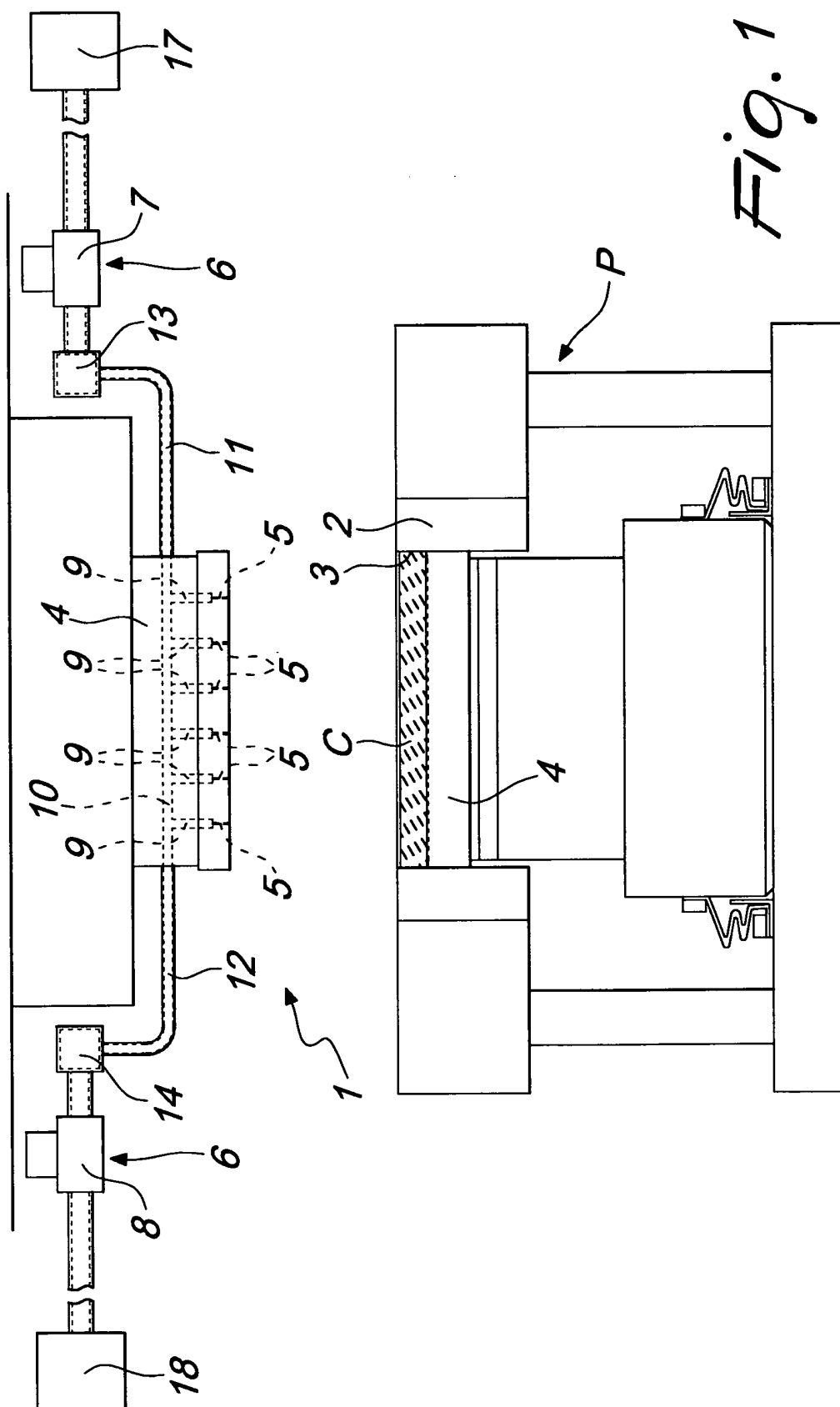
1. Eine Form (1) zum unidirektionalen Pressen von Keramik-Gegenständen, die einen Einfassungs-Rand (2) umfasst, der mindestens einen Behälter (3) zum Formen eines entsprechenden Gegenstands (M) bildet, und mindestens ein Paar von einander gegenüberliegenden männlichen Stempeln (4) zur Begrenzung des Behälters (3), wobei mindestens einer der

- männlichen Stempel mit einer Vielzahl von Löchern (5) versehen ist, wobei jedes der Löcher (5) ein erstes Ende (5a) in Verbindung mit dem Behälter (3) hat und ein zweites Ende (5b) gegenüber dem ersten Ende (5a) hat, die mit Luftsaugmitteln (17) und mit Abgabemitteln (18) zur Abgabe eines unter Druck gesetzten Fluids durch die entsprechenden zweiten Enden (5b) verknüpft sind, wobei weiter Ventilmittel (6) für die selektive Durchflussregelung bereitgestellt sind, die zwischen der Vielzahl von Löchern (5) und den Saugmitteln (17) und den Abgabemitteln (18) angeordnet sind und von einer elektronischen Verwaltungs- und Steuereinheit betätigt werden, die ihr Öffnen und Schließen aktiviert, **dadurch gekennzeichnet, dass** die Ventilmittel (6) mindestens ein erstes elektrisches Ventil (7) umfassen, das zwischen der Vielzahl von Löchern (5) und den Saugmitteln (17) angeordnet ist, und mindestens ein zweites elektrisches Ventil (8), das zwischen den Löchern (5) und den Abgabemitteln (18) angeordnet ist, wobei die Verwaltungs- und Steuereinheit konfiguriert ist, um, sobald das Formen des Gegenstands (M) abgeschlossen wurde und der obere männliche Stempel (4) sich zu heben beginnt, eines von dem mindestens einen ersten elektrischen Ventil (7) und dem mindestens einen zweiten elektrischen Ventil (8) zur Lösung des Gegenstands (M) aus dem unteren Stempel (4) für wenige Momente in der offenen Anordnung zu halten.
2. Die Form (1) gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Verwaltungs- und Steuereinheit ausgebildet ist, um im Pressschritt das erste elektrische Ventil (7) in der offenen Anordnung und das zweite elektrische Ventil (8) in der geschlossenen Anordnung zu halten und im Selbstreinigungsschritt mindestens das zweite elektrische Ventil (8) zu öffnen.
3. Die Form (1) gemäß Anspruch 2, **dadurch gekennzeichnet, dass** in dem Selbstreinigungsschritt die Verwaltungs- und Steuereinheit konfiguriert ist, um das erste elektrische Ventil (7) in der offenen Anordnung zu halten.
4. Die Form (1) gemäß einem oder mehreren der obigen Ansprüche, **dadurch gekennzeichnet, dass** die Verwaltungs- und Steuereinheit über eine Schnittstelle mit Mitteln zur Erfassung der Position der männlichen Stempel (4) verbunden ist, zur Aktivierung des Öffnens und Schließens der Ventilmittel (6) in Abhängigkeit vom aktuellen Zustand der Form.
5. Die Form (1) gemäß einem oder mehreren der obigen Ansprüche, **dadurch gekennzeichnet, dass** jedes der Löcher (5) mit einer entsprechenden Kammer (9) in Verbindung steht, die transversale Maße hat, welche größer als diejenigen des Lochs sind, und in mindestens einen Verbindungskanal (10) führt, wobei die Kammern (9) und der Verbindungskanal (10) innerhalb des männlichen Stempels (4) bereitgestellt sind, der mit der Vielzahl von Löchern (5) versehen ist.
6. Die Form (1) gemäß Anspruch 5, **dadurch gekennzeichnet, dass** die Vielzahl von Löchern (5) über den Verbindungskanal (10) mit dem ersten und dem zweiten elektrischen Ventil (7, 8) verknüpft ist, um in dem Selbstreinigungsschritt das Durchströmen von Fluid entlang den Löchern (5), den entsprechenden Kammern (9) und dem Verbindungskanal zu erzielen.
7. Die Form (1) gemäß einem oder mehreren der obigen Ansprüche, **dadurch gekennzeichnet, dass** der männliche Stempel (4), der mit der Vielzahl von Löchern (5) versehen ist, vom starren Typ ist.
8. Die Form gemäß einem oder mehreren der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** der männliche Stempel (4), der mit der Vielzahl von Löchern (5) versehen ist, vom isostatischen Typ ist und eine Struktur (15) zum Tragen mindestens einer elastischen Membran (16) umfasst, wobei die Löcher (5) in der Struktur (15) an der Peripherie der Membran (16) geformt sind.
9. Die Form (1) gemäß einem oder mehreren der obigen Ansprüche, **dadurch gekennzeichnet, dass** der männliche Stempel (4) auf der Mauerseite des geformten Gegenstands (M) arbeitet.

Revendications

1. Moule (1) servant au pressage unidirectionnel d'articles en céramique comprenant un rebord de confinement (2) qui forme au moins un récipient (3) servant à former un article respectif (M) et au moins une paire de poinçons mâles opposés l'un à l'autre (4) pour délimiter ledit récipient (3), au moins un desdits poinçons mâles étant muni d'une pluralité de trous (5), chacun des trous (5) ayant une première extrémité (5a), qui communique avec ledit récipient (3), et une seconde extrémité (5b), opposée à la première extrémité (5a), extrémités, qui sont associées à des moyens d'aspiration d'air (17) et à des moyens d'alimentation (18) servant à l'alimentation en fluide pressurisé à travers les secondes extrémités correspondantes (5b), des systèmes de valves (6) servant à la commande sélective du débit étant prévus, en outre, systèmes de valves, qui sont disposés entre ladite pluralité de trous (5) et lesdits moyens d'aspiration d'air (17) et lesdits moyens d'alimentation (18) et actionnés par une unité de gestion et de comman-

- de électronique qui active l'ouverture et la fermeture des valves, **caractérisé en ce que** lesdits systèmes de valves (6) comprennent au moins une première valve électrique (7), disposée entre ladite pluralité de trous (5) et lesdits moyens d'aspiration (17), et au moins une seconde valve électrique (8), disposée entre lesdits trous (5) et lesdits moyens d'alimentation (18), ladite unité de gestion et de commande étant configurée de façon à conserver, une fois que le formage de l'article (M) est terminé et le poinçon mâle supérieur (4) commence à monter, pendant quelques moments en configuration ouverte une parmi ladite au moins une valve électrique (7) et ladite au moins une seconde valve électrique (8) afin de dégager ledit article (M) du poinçon mâle inférieur (4).
2. Moule (1) suivant la revendication 1, **caractérisé en ce qu'**à l'étape de pressage, ladite unité de gestion et de commande est configurée de façon à conserver la première valve électrique (7) en état ouvert et la seconde valve électrique (8) en état fermé et, de façon à ouvrir au moins la seconde valve électrique (8) à l'étape d'auto-nettoyage.
3. Moule (1) suivant la revendication 2, **caractérisé en ce qu'**à ladite étape d'auto-nettoyage, l'unité de gestion et de commande est configurée de façon à conserver ladite première valve électrique (7) en état ouvert.
4. Moule (1) suivant une ou plusieurs des revendications précédentes, **caractérisé en ce que** ladite unité de gestion et de commande est interfacée avec des moyens de détection de la position réciproque des poinçons mâles (4) pour l'actionnement de l'ouverture et de la fermeture desdits systèmes de valve (6) en fonction de l'état actuel dudit moule.
5. Moule (1) suivant une ou plusieurs des revendications précédentes, **caractérisé en ce que** chacun desdits trous (5) communique avec une chambre respective (9) ayant des dimensions transversales supérieures à celles dudit trou et aboutissant dans un canal de liaison (10), lesdites chambres (9) et ledit canal de liaison (10) étant prévus à l'intérieur dudit poinçon mâle (4) pourvu de ladite pluralité de trous (5).
6. Moule (1) suivant la revendication 5, **caractérisé en ce que** ladite pluralité de trous (5) est associée à ladite première et à ladite seconde valve électrique (7, 8) via ledit canal de liaison (10) afin de permettre l'écoulement de fluide le long des trous (5), des chambres correspondantes (9) et dudit canal de liaison à l'étape d'auto-nettoyage.
7. Moule (1) suivant une ou plusieurs des revendica-
- tions précédentes, **caractérisé en ce que** ledit poinçon mâle (4) pourvu de ladite pluralité de trous (5) est de type rigide.
8. Moule suivant une ou plusieurs des revendications 1 à 6, **caractérisé en ce que** ledit poinçon mâle (4) pourvu de ladite pluralité de trous (5) est de type isostatique et comprend une structure (15) servant de support à au moins une membrane élastique (16), les trous (5) étant formés dans ladite structure (15), à la périphérie de ladite membrane (16).
9. Moule (1) suivant une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit poinçon mâle (4) fonctionne sur le côté externe de l'article (M) en cours de formage.



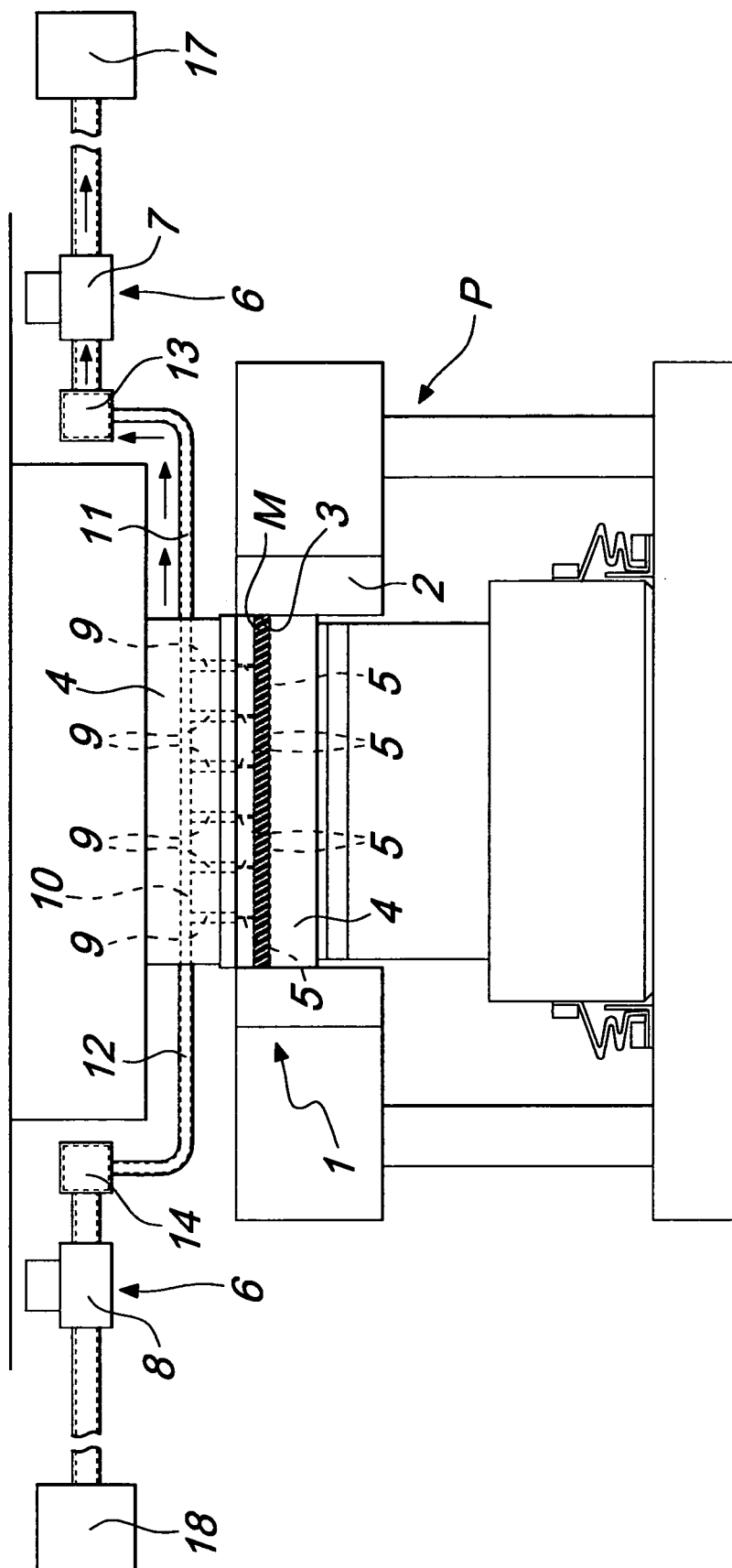
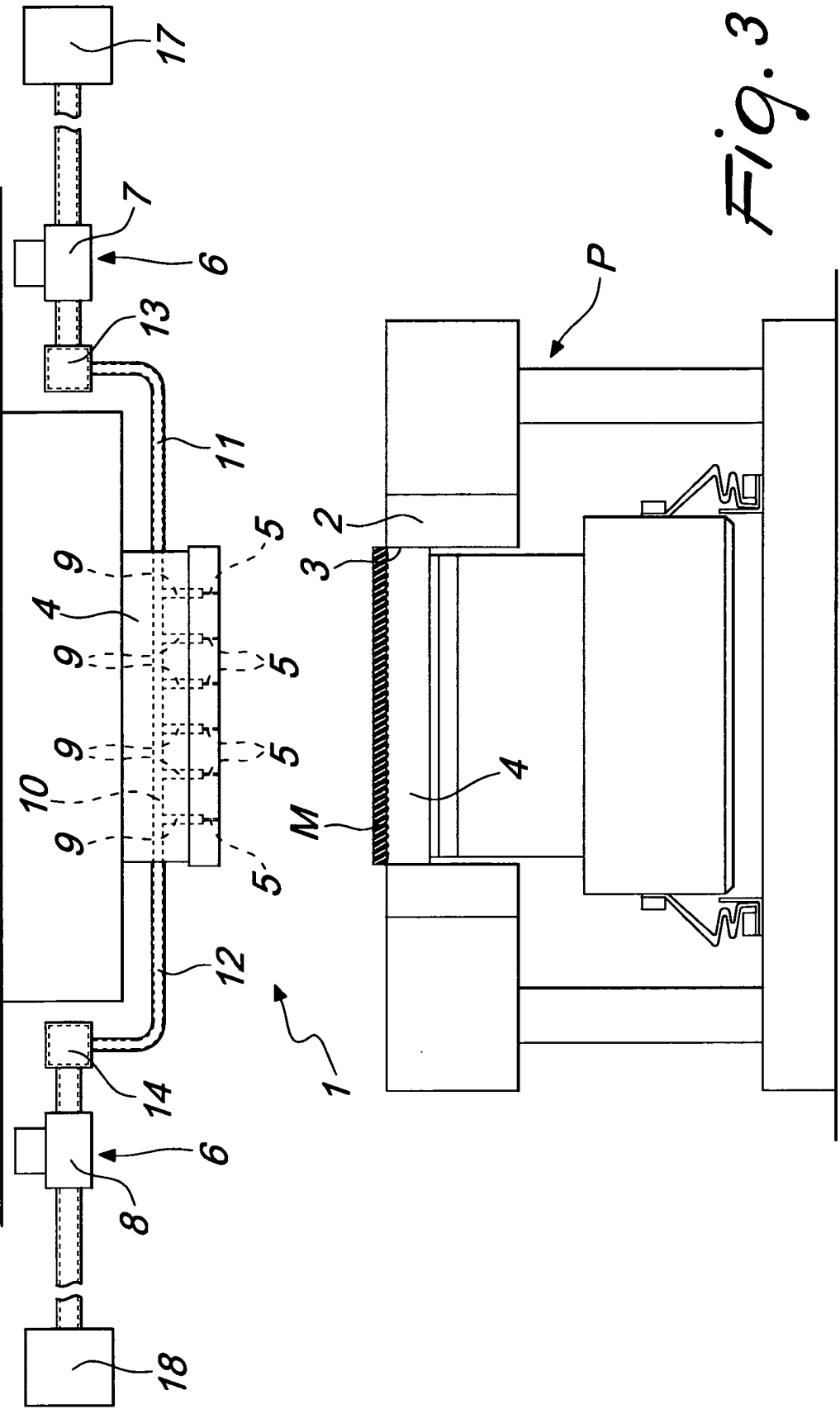
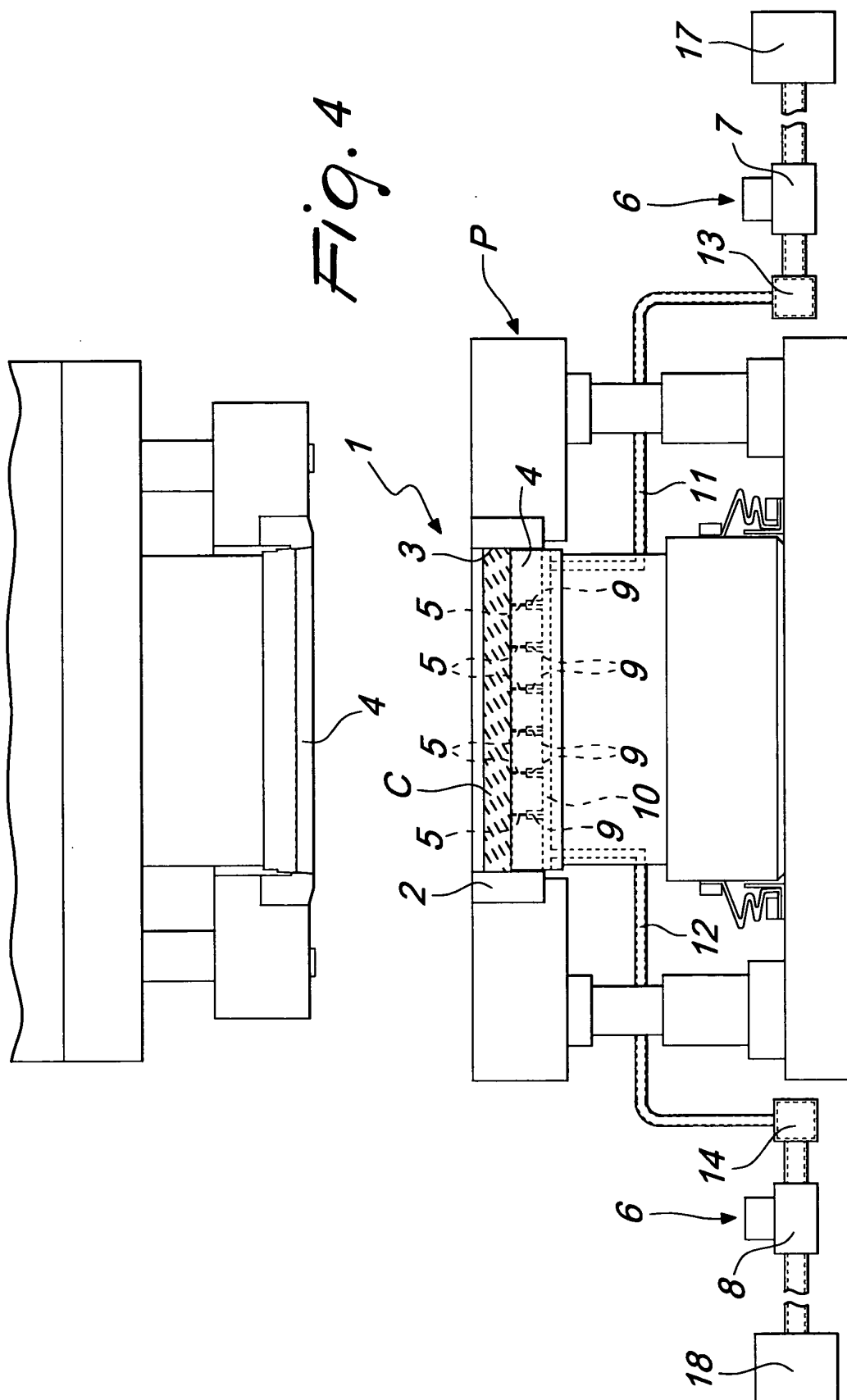


Fig. 2





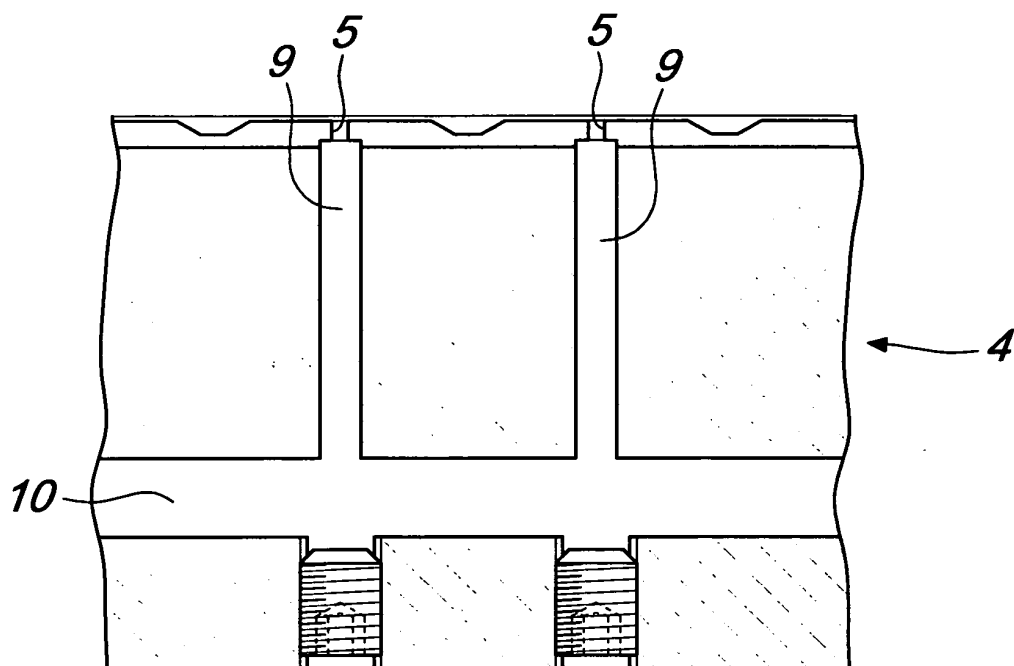


Fig. 5

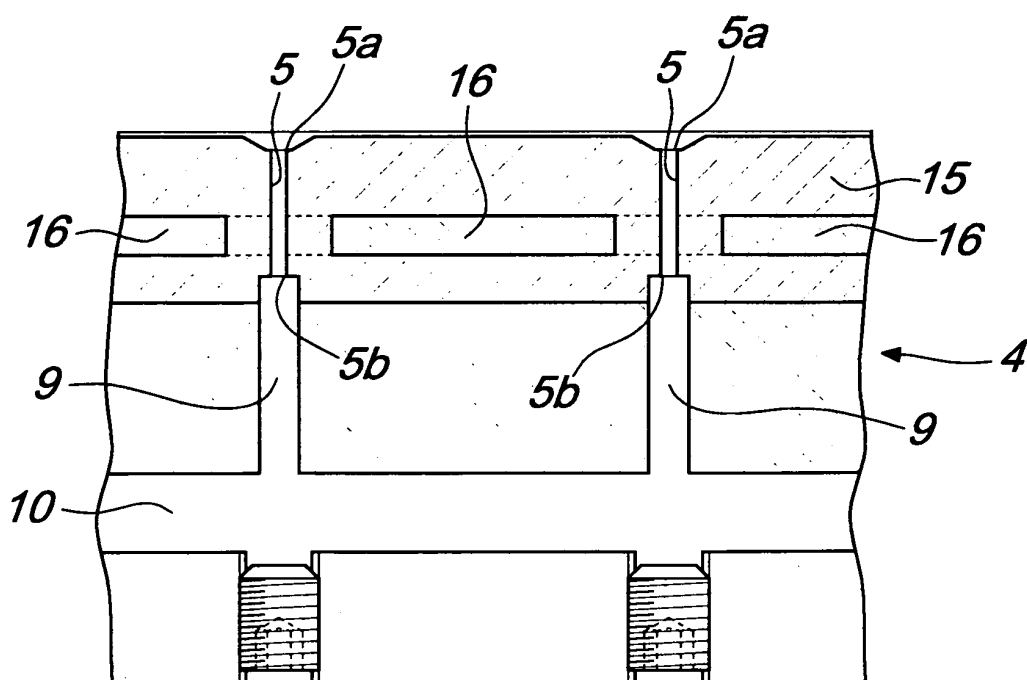


Fig. 6

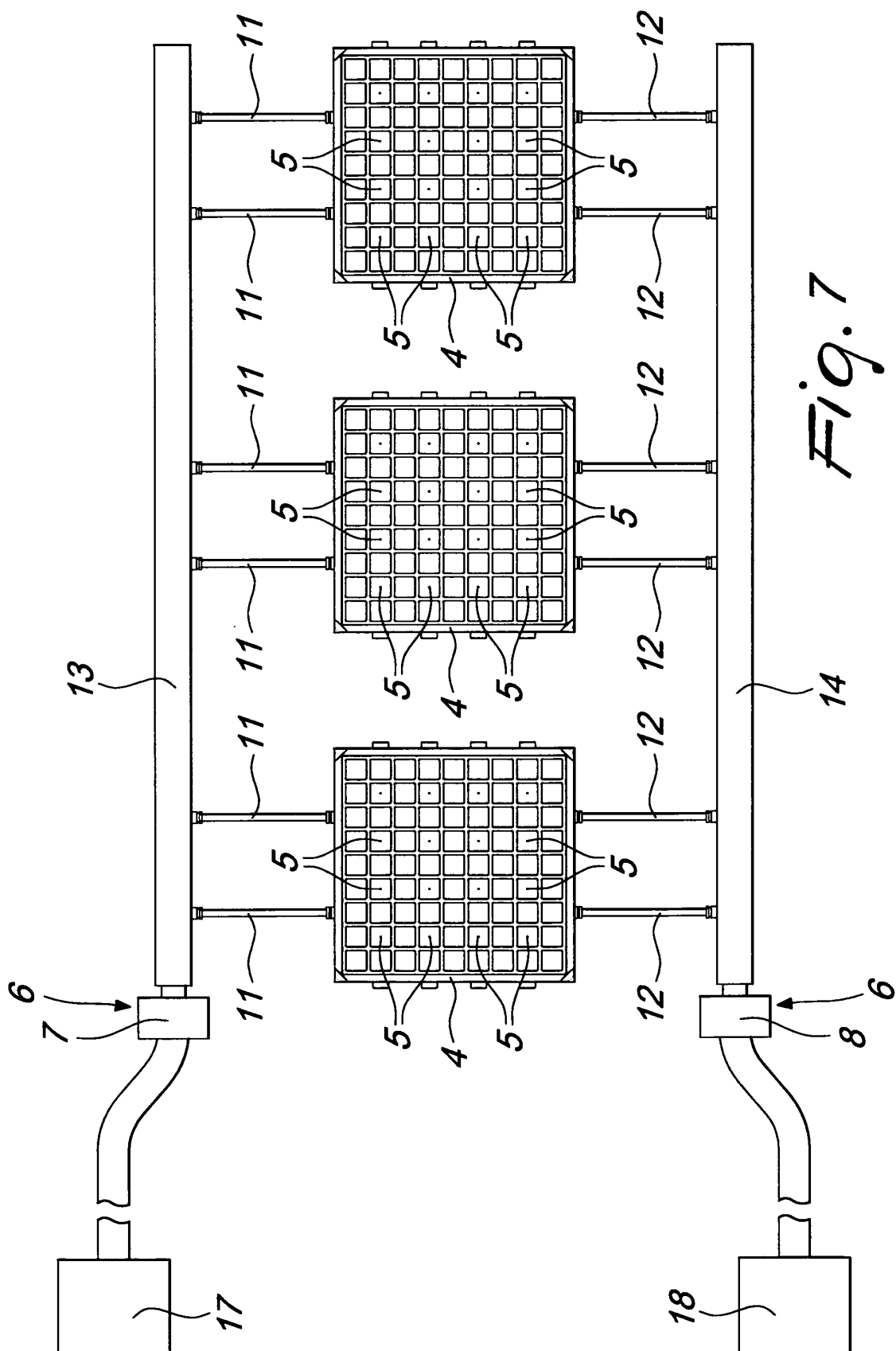


Fig. 7

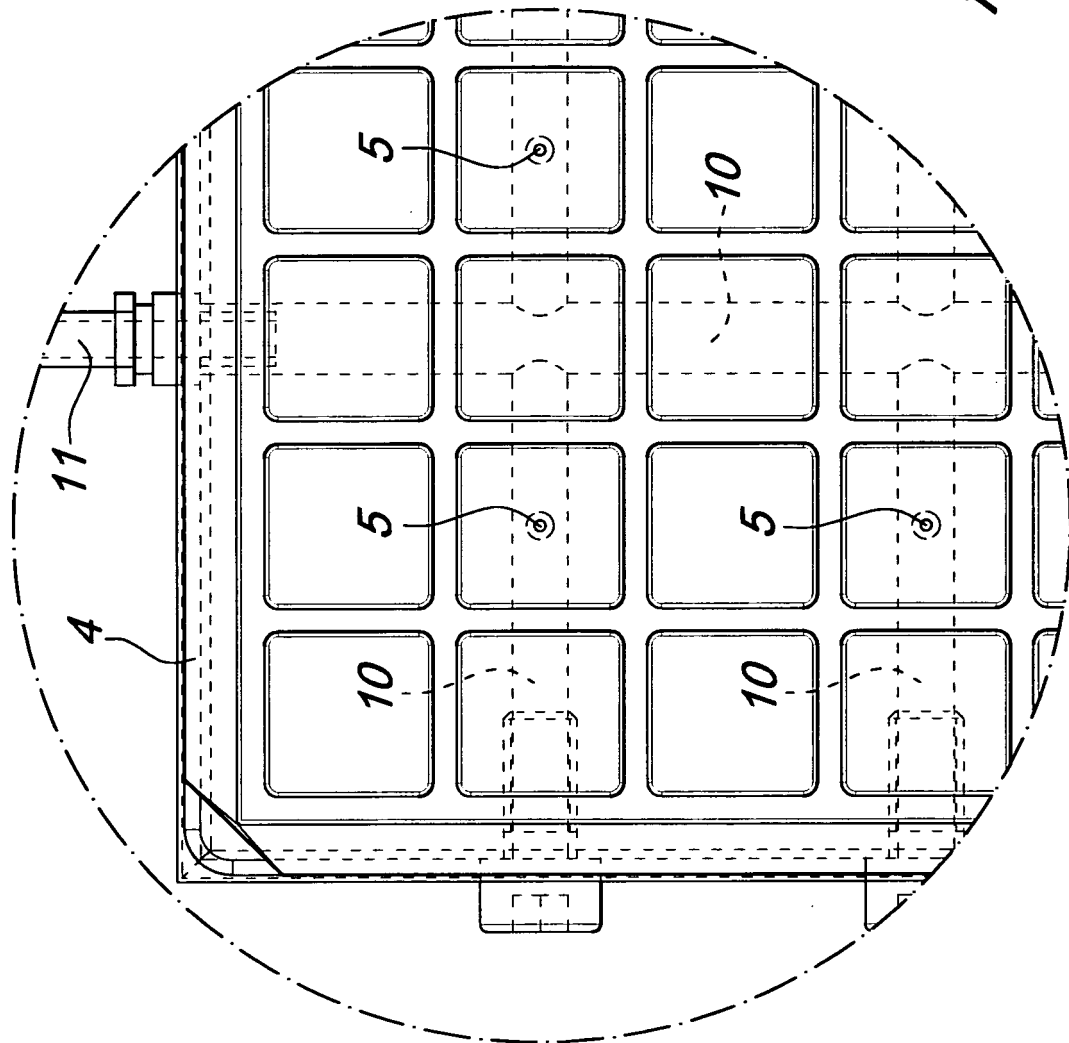


Fig. 8

REFERENCES CITED IN THE DESCRIPTION

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