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(54) **BEVERAGE CAPSULE MANUFACTURE**

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FABRICATION DE CAPSULE DE BOISSON

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(73) Proprietors:
- **Gort-Barten, Alex**
  Crawley, West Sussex RH11 7ST (GB)
- **Gort-Barten, Leslie**
  Crawley, West Sussex RH11 7ST (GB)

(72) Inventors:
- **Gort-Barten, Alex**
  Crawley, West Sussex RH11 7ST (GB)
- **Gort-Barten, Leslie**
  Crawley, West Sussex RH11 7ST (GB)

(74) Representative: **JENSEN & SON**
366-368 Old Street
London EC1V 9LT (GB)

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Description

[0001] The invention relates to a beverage capsule for an espresso machine, in particular for making espresso under high pressure.

[0002] Powered espresso machines are well known. The conventional espresso machine comprises a water chamber, a heating element adapted to heat the water to around 95-98 C, which is then pumped under high pressure of 15 to 19 bar to a filter holder or portafilter. Lower pressure systems also exist. The filter holder typically comprises a handle portion and a holder portion provided with two or three lugs that are adapted to engage in the installed position with the machine brewhead to where the water is pumped. The holder portion is adapted to receive a filter, which is usually a metal bowl with a number of perforations through its bottom. In use, the filter is filled with finely ground coffee and the water is forced through the coffee at the high pressure generated by the pump to produce the espresso coffee which is collected in a cup placed under the filter holder.

[0003] The classic coffee machine suffers from two potential drawbacks. The first drawback is that ground coffee starts to lose its freshness and flavour after a few days and so for the optimum espresso, the user will also need to have a coffee grinder. The other drawback is that the used espresso coffee has to be removed from the filter, which can lead to mess as the grinds are fine.

[0004] This led to the development of ESE coffee pods, which can be used in many espresso machines. Coffee pods are generally individually wrapped to maintain freshness and consist of a small pod made of a perforated filter paper which contains the coffee. The pod is placed in the filter holder and then disposed of after use. Coffee pods are convenient but have to fit the filter holder and be placed correctly otherwise water can leak around the edge.

[0005] This in turn lead to the development of capsule machines. The coffee capsules for these machines are completely sealed. The capsule machines do not use the conventional filter holder. A capsule machine typically has a two part mechanism. The first part receives the capsule and is provided with an extraction surface upon which the capsule rests. The second part is provided with a locking lever which is used to make the first and second parts integral. In use, the second part cuts the upper surface of the capsule to allow water to enter the capsule and percolate down through the capsule, where it exits through the lower surface of the capsule at multiple locations determined by the geometry of the extraction surface. An example of such a machine is disclosed in EP0870457 or WO2005/004683. Capsules in the known capsule coffee machines are, in use, inserted into a capsule cage of the machine which holds the capsule in position so that it may be cut by a cutting member.

[0006] Capsule machines have proved to be commercially very successful as they are very convenient to use and produce a consistent product. However, each manufacturer's coffee machines and capsules are designed to work with the manufacturers own brand. The most popular brand of capsule is Nespresso®, which uses a sealed capsule made of aluminium. In use, the capsule is clamped into position in the machine with a capsule cage part holding the capsule so that it can be cut by typically three prongs to enable water under pressure to enter the coffee capsule. Aluminium has the considerable advantage that it is oxygen and water impermeable, which means that the coffee in the capsules has a long shelf life. Aluminium however also suffers from several major drawbacks in that the aluminium is easily deformed during the filling and packing stage and it is difficult and expensive to produce a reliable seal on the capsule rim. The only known seal on the market that works is a silicone elastomer disclosed in EP1654966 despite significant research effort. In these capsules the edge of the aluminium rim is rolled over where the front foil seal is attached. The known solutions such as EP 2 730 523 A1, US2018/215120 and

[0007] WO2013/029184 to these problems further require an extremely high capital investment beyond most companies.

[0008] The present invention therefore seeks to provide an improved apparatus and method of manufacture of a coffee capsule according to claims 1 and 9.

[0009] Preferably, the apparatus further comprises capsule filling means, capsule sealing means for applying a foil to close a filled capsule, wherein manipulation means then invert the capsule, the inverted capsule then being moved through the machine to the gasket application means Preferably the aluminium capsule is preformed.

[0010] Further advantageous aspects of the invention can be found in the sub-claims.

[0011] The apparatus advantageously provides a good seal on the capsule which is more easily recycled than the known silicone seals.

[0012] Exemplary embodiments of the invention will now be described with reference to the drawings, in which:

Fig. 1 shows a capsule filling machine.

[0013] Figure 1 shows a capsule filling machine comprising stations 1 to 16. In stations 1-6, the empty capsule is fed in from a stack 1, the coffee is ground 2 and then the capsule filled by a doser 3 and then passed to the foil application station 5 to seal the capsule.

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[0014] The capsule rim has a 12-degree angle applied during the lid foil application at head shaper 6. This angle tightens the lid foil after application, for cosmetic reasons. It also prevents a tangent leading edge, which helps reduce foil peel when capsule pressurises due to coffee degassing.

[0015] The foil seal is cut from the reel at station 4 and the seal is then applied to close the capsule. In an alternative embodiment for producing empty capsules to be filled elsewhere, the gasket is applied to an empty cap-

sule in which case Stations 1 to 6 are not required.

[0016] At capsule rotator station, the capsule is rotated on the main conveyor belt from a lid foil facing up orientation to a lid foil facing down orientation to allow access to the gasket application area.

[0017] At station 9 the gasket material is fed from a reel of material into a die cutter 10, which cuts the gasket material from the material. In a first step a circle is punched from the reel of the material to form the inner circumference of the gasket. The circle of material is then removed using a vacuum tool. The outer diameter is then punched from the material to form the annular gasket. The annular gasket is then pushed downwards onto the capsule rim using compressed air jets 14 to speed up the movement of the gasket into the desired position.

[0018] At station 10 the gasket is applied to the capsule and at station 11 optical presence sensors are used to detect if the capsule has a gasket applied. If any capsule is detected not to have a gasket, that capsule is rejected as without the gasket, the capsule will leak in most capsule coffee machines.

[0019] To ensure the capsule always has a gasket fitted is technically challenging in particular where the gasket is colour matched to the colour of the capsule body.

[0020] There are a number of presence sensors on the market but differentiation of the gasket from the capsule is difficult. A fluorescent compound is included in the gasket material so that a UV light shone upon the capsule will light up differently on the gasket material from the capsule material. In a preferred approach, the fluorescence detector is provided with a sensor that provides a digital reading in response to the fluorescence detected. If the detected fluorescence is above a certain level, the detector will determine that there is a capsule with a seal there. If the reading is below that level the detector determines that there is no gasket and the capsule is rejected by not picking it off the conveyor belt and is directed into a waste bin, without the machine stopping.

[0021] In a further embodiment depending on the reflectiveness / absorption of the material different types of sensors, such as lasers can be used. If the ink used on the gasket does not have the fluorescent component required for detection, a laser could be used to measure the height from the rim and thereby deduce if a gasket is present or not.

[0022] Capsules are lifted from the transport belt so that they can be independently aligned to the station above or below. This eliminates any position errors on the transport belt that might arise from wear within the machine / inertia / coffee residue etc.

[0023] At station 12 upper and lower heat sealers are located. Heat and pressure is applied to the gasket so it adheres to the capsules using special angled sealing head to match the shape of the capsule and which, to accommodate the 12 degree angle, the gasket sealing heads are also angled to 12 degrees.

[0024] Depending on the gasket material, an adhesive may be required or alternatively pressure and/or heat alone may negate the need for an adhesive. From the perspective of recyclability, this is preferable. In a particularly preferred embodiment, as the pressure and the heat is applied the gasket swages out and tightens around the internal diameter, creating a tight fit over the capsule. The outer diameter also increases, pushing the gasket under the rim of the capsule. Using no adhesive has advantages of being cheaper, easier to apply, store and to comply with food safety. Heat is applied to both sides of the seal.

[0025] In this station the top sealer drops over the aligned gasket and capsule to bond them together. Typically the system runs with a top sealing temperature of between 240-300°C, a bottom temperature of between 180-210°C with a dwell time of 350-450ms. Application of heat from both sides significantly reduces the dwell time in the machine so increasing its capacity and also reduces the likelihood of any heat damage to the seal caused by the direct application of heat from the top side due to the longer dwell time which would otherwise be required. The use of the lower temperature on the bottom sealing side does not cause any damage to the foil.

[0026] If an alternative embodiment in which the gasket is applied to an empty capsule, the heat from the bottom may be in the range from no applied heat up to 170°C in particular in the case where the capsule interior is provided with a food safe coating such as PVC. In the first embodiment heat to seal the gasket is applied from the top and the bottom when the lid foil is already applied to the capsule, so the lower sealer does not come into contact with the PVC liner and stick to it. When the gasket is applied to an empty capsule, the lid is not in place and the lower heater may stick to the PVC liner.

[0027] The force applied to the sealing heads is controlled by a pressure dial on the machine. This pressure is excreted onto a 50.0mm diameter piston. The pressure typically used is in the range of 1 to 6, preferably 2-3 bar.

[0028] The pressure applied may be adjusted depending on the type of adhesive / gasket material used.

[0029] The table below shows the range of pressures found on the sealing head at the various inlet pressure settings.

Top Piston Pressure (bar)

[0030]

bar	MPa		psi
1	9	0.9	130
2	18	1.8	261
3	27	2.7	391
4	36	3.6	521
5	45	4.5	651
6	55	5.4	782

[0031] At station 13 the capsule is picked and placed onto an outlet conveyor belt connected to a cartoning machine so that the capsule can be packed.

Claims

1. Apparatus for manufacturing a capsule with a sealable opening for use in a coffee machine, comprising a capsule having a generally frusto-conical form with an upper surface and a lower surface, an annular flange being provided at the lower surface, wherein an annular seal is provided on the annular flange, the annular seal comprising a cellulose material such as paper that deforms in use, wherein the apparatus comprises gasket application means (10), which applies a gasket to the capsule on the flange, **characterised in that** the apparatus further comprises gasket detection means (11) for detecting the presence of a gasket on the capsule, capsule selection means being provided to enable capsules without a gasket to be rejected and capsules with a gasket detected to be packed.

2. Apparatus according to Claim 1, wherein the gasket comprises a fluorescent material, the apparatus further comprising illumination means for illuminating the gasket and the detection means comprises a fluorescence detector to detect fluorescence from the gasket.

3. Apparatus according to Claim 1 or Claim 2, wherein the apparatus further comprises capsule filling means, capsule sealing means for applying a foil to close a filled capsule, wherein manipulation means then invert the capsule, the inverted capsule then being moved through the machine to the gasket application means.

4. Apparatus according to any one of Claims 1 to 3, wherein the capsule rim has a 12-degree angle applied during the lid foil application.

5. Apparatus according to any one of Claims 1 to 4, wherein heat is applied to both sides of the foil seal to close the filled capsule.

6. Apparatus according to Claim 5, wherein the apparatus comprises a top sealer adapted to apply a top sealing temperature of between 240-300°C.

7. Apparatus according to Claim 5 or Claim 6, wherein a bottom sealer is provided, which provides a bottom sealing temperature of between 180-210°C

8. Apparatus according to any one of Claims 5 to 7, wherein the capsule has a dwell time of approximately 350-450 ms during the application of heat by the top and/or bottom sealers.

9. A method of manufacturing a capsule with a sealable opening for use in a coffee machine, which capsule has a generally frusto-conical form with an upper surface and a lower surface, an annular flange being provided at the lower surface, wherein an annular seal is provided on the annular flange, the annular seal comprising a cellulose material such as paper that deforms in use, wherein gasket application means (10) apply a gasket to the capsule on the flange, **characterised in that** gasket detection means (11) then detect the presence of a gasket on the capsule, capsule selection means then rejecting capsules without a gasket and capsules with a gasket the capsule are placed onto an outlet conveyor belt connected to a cartoning machine.

10. A method according to Claim 9, wherein a foil seal is applied and heat is applied to both sides of the foil seal to close the filled capsule.

11. A method according to Claim 9 or Claim 10, a top sealer applies a top sealing temperature of between 240-300°C.

12. A method according to any one of Claims 9 to 11, wherein a bottom sealer provides a bottom sealing temperature of between 180-210°C.

13. A method according to any one of Claims 9 to 12, wherein the capsule has a dwell time of approximately 350-450 ms during the application of heat by the top and/or bottom sealers.

Patentansprüche

1. Vorrichtung zur Herstellung einer Kapsel mit einer verschließbaren Öffnung zur Verwendung in einer Kaffeemaschine, umfassend eine allgemein kegelstumpfförmige Kapsel mit einer Oberseite und einer Unterseite und einem ringförmigen Flansch an der Unterseite, wobei sich auf dem ringförmigen Flansch eine ringförmige Dichtung befindet, die aus einem Zellstoff wie Papier besteht, der sich im Gebrauch verformt, und wobei die Vorrichtung ein Mittel zur Anbringung einer Dichtung (10) umfasst, das eine Dichtung auf dem Flansch der Kapsel anbringt, **dadurch gekennzeichnet, dass** die Vorrichtung weiter ein Mittel zur Dichtungserkennung (11) umfasst, das das Vorliegen einer Dichtung auf der Kapsel erkennt, und ein Mittel zur Kapselselektion, das es ermöglicht, Kapseln ohne Dichtung zurückzuweisen und Kapseln mit erkannter Dichtung zu verpacken.

2. Vorrichtung nach Anspruch 1, wobei die Dichtung ein fluoreszierendes Material umfasst und wobei die

Vorrichtung weiter ein Beleuchtungsmittel zur Beleuchtung der Dichtung umfasst und das Erkennungsmittel einen Fluoreszenzdetektor zur Erkennung von Fluoreszenz von der Dichtung umfasst.

3. Vorrichtung nach Anspruch 1 oder Anspruch 2, wobei die Vorrichtung weiter ein Kapselbefüllungsmittel sowie ein Kapselverschlussmittel zum Anbringen einer Folie zum Verschließen einer befüllten Kapsel umfasst, und wobei ein Manipulationsmittel dann die Kapsel invertiert und die invertierte Kapsel dann durch die Maschine zu dem Mittel zur Anbringung einer Dichtung bewegt wird.

4. Vorrichtung nach einem der Ansprüche 1 bis 3, wobei der Kapselrand während des Anbringens des Foliendeckels mit einer 12-Grad-Neigung versehen wird.

5. Vorrichtung nach einem der Ansprüche 1 bis 4, wobei beiden Seiten der Foliendichtung Wärme zugeführt wird, um die befüllte Kapsel zu verschließen.

6. Vorrichtung nach Anspruch 5, wobei die Vorrichtung einen oberen Versiegler umfasst, der darauf ausgelegt ist, eine obere Versiegelungstemperatur zwischen 240°C und 300°C zuzuführen.

7. Vorrichtung nach Anspruch 5 oder 6, die einen unteren Versiegler umfasst, der eine untere Versiegelungstemperatur zwischen 180°C und 210°C zuführt.

8. Vorrichtung nach einem der Ansprüche 5 bis 7, wobei die Kapsel während der Zufuhr von Wärme durch den oberen und/oder unteren Versiegler eine Verweilzeit von ca. 350-450 ms hat.

9. Verfahren zur Herstellung einer Kapsel mit einer verschließbaren Öffnung zur Verwendung in einer Kaffeemaschine, wobei die Kapsel allgemein kegelstumpfförmig ist mit einer Oberseite und einer Unterseite und einem ringförmigen Flansch an der Unterseite und wobei sich auf dem ringförmigen Flansch eine ringförmige Dichtung befindet, die aus einem Zellstoff wie Papier besteht, der sich im Gebrauch verformt, und wobei ein Mittel zur Anbringung einer Dichtung (10) eine Dichtung auf dem Flansch der Kapsel anbringt, **dadurch gekennzeichnet, dass** das Mittel zur Dichtungserkennung (11) dann das Vorliegen einer Dichtung auf der Kapsel erkennt, ein Mittel zur Kapselselektion dann Kapseln ohne Dichtung zurückweist und dass Kapseln mit Dichtung auf einem Auslassförderband platziert werden, dass mit einer Kartoniermaschine verbunden ist.

10. Ein Verfahren nach Anspruch 9, wobei eine Foliendichtung aufgebracht wird und beiden Seiten der Foliendichtung Wärme zugeführt wird, um die befüllte Kapsel zu verschließen.

11. Ein Verfahren nach Anspruch 9 oder Anspruch 10, wobei der obere Versiegler eine obere Versiegelungstemperatur zwischen 240°C und 300°C zuführt.

12. Ein Verfahren nach einem der Ansprüche 9 bis 11, wobei ein unterer Versiegler eine untere Versiegelungstemperatur zwischen 180°C und 210°C zuführt.

13. Ein Verfahren nach einem der Ansprüche 9 bis 12, wobei die Kapsel während der Zufuhr von Wärme durch den oberen und/oder unteren Versiegler eine Verweilzeit von ca. 350-450 ms hat.

Revendications

1. Appareil de fabrication d'une capsule pourvue d'une ouverture scellable destinée à être utilisée dans une machine à café, comprenant une capsule prenant globalement une forme tronconique avec une surface supérieure et une surface inférieure, un bord annulaire étant pourvu au niveau de la surface inférieure, dans lequel un joint d'étanchéité annulaire est disposé sur le bord annulaire, le joint d'étanchéité annulaire comprenant un matériau cellulosique tel que le papier qui se déforme à l'usage, l'appareil comprenant un moyen d'application de joint d'étanchéité (10), qui applique un joint d'étanchéité sur le bord de la capsule, **caractérisé en ce que** l'appareil comprend en outre un moyen de détection de joint d'étanchéité (11) destiné à détecter la présence d'un joint d'étanchéité sur la capsule, un moyen de sélection de capsule servant à permettre rejeter les capsules dépourvues de joint d'étanchéité et à emballer les capsules pourvues d'un joint d'étanchéité.

2. Appareil selon la revendication 1, dans lequel le joint d'étanchéité comprend un matériau fluorescent, l'appareil comprenant en outre un moyen d'éclairage destiné à éclairer le joint d'étanchéité et le moyen de détection comprend un détecteur de fluorescence pour détecter la fluorescence émise par le joint d'étanchéité.

3. Appareil selon la revendication 1 ou 2, dans lequel l'appareil comprend en outre un moyen de remplissage de capsule, un moyen de scellage de capsule destiné à appliquer un opercule servant à fermer une capsule remplie, dans lequel un moyen de manipulation retourne ensuite la capsule, la capsule retournée étant ensuite déplacée dans la machine vers le moyen d'application de joint d'étanchéité.

4. Appareil selon l'une quelconque des revendications 1 à 3, dans lequel l'angle du rebord de capsule, appliqué pendant l'application de l'opercule, est de 12 degrés.

5. Appareil selon l'une quelconque des revendications 1 à 4, dans lequel la chaleur est appliquée de chaque côté de l'opercule alu pour fermer la capsule remplie.

6. Appareil selon la revendication 5, dans lequel l'appareil comprend une scelleuse supérieure conçue pour appliquer une température de scellage supérieur comprise entre 240 et 300 °C.

7. Appareil selon la revendication 5 ou la revendication 6, dans lequel une scelleuse de fond sert à assurer une température de scellage de fond comprise entre 180 et 210 °C.

8. Appareil selon l'une quelconque des revendications 5 à 7, dans lequel la capsule a un temps de maintien comprise entre environ 350 et 450 ms pendant l'application de la chaleur par les scelleuse supérieure et/ou de fond.

9. Procédé de fabrication d'une capsule dotée d'une ouverture scellable destinée à être utilisée dans la machine à café, ladite capsule prenant globalement une forme tronconique avec une surface supérieure et une surface inférieure, un bord annulaire étant pourvu au niveau de la surface inférieure, dans lequel un joint d'étanchéité annulaire est disposé sur le bord annulaire, le joint d'étanchéité annulaire comprenant un matériau cellulosique tel que le papier qui se déforme à l'usage, dans lequel les moyens d'application de joint d'étanchéité (10) appliquent un joint d'étanchéité sur le bord de la capsule, **caractérisé en ce que** les moyens de détection de joint d'étanchéité (11) détectent ensuite la présente d'un joint d'étanchéité sur le capsule, le moyen de sélection de capsule rejetant ensuite les capsules dépourvues d'un joint d'étanchéité et les capsules pourvues d'un joint d'étanchéité, les capsules sont placées sur une bande transporteuse d'articles reliée à une machine d'encartonnage.

10. Procédé selon la revendication 9, dans lequel un opercule alu est appliqué et de la chaleur est appliquée de chaque côté de l'opercule alu pour fermer la capsule remplie.

11. Procédé selon la revendication 9 ou la revendication 10, une scelleuse supérieure applique une température de scellage supérieur comprise entre 240 et 300 °C.

12. Procédé selon l'une quelconque des revendications 9 à 11, dans lequel la scelleuse de fond fournit une température de scellage de fond comprise entre 180 et 210 °C.

13. Procédé selon l'une quelconque des revendications 9 à 12, dans lequel la capsule est soumise à un temps de séjour compris entre environ 350 et 450 ms pendant l'application de la chaleur par les scelleuses supérieure et/ou de fond.

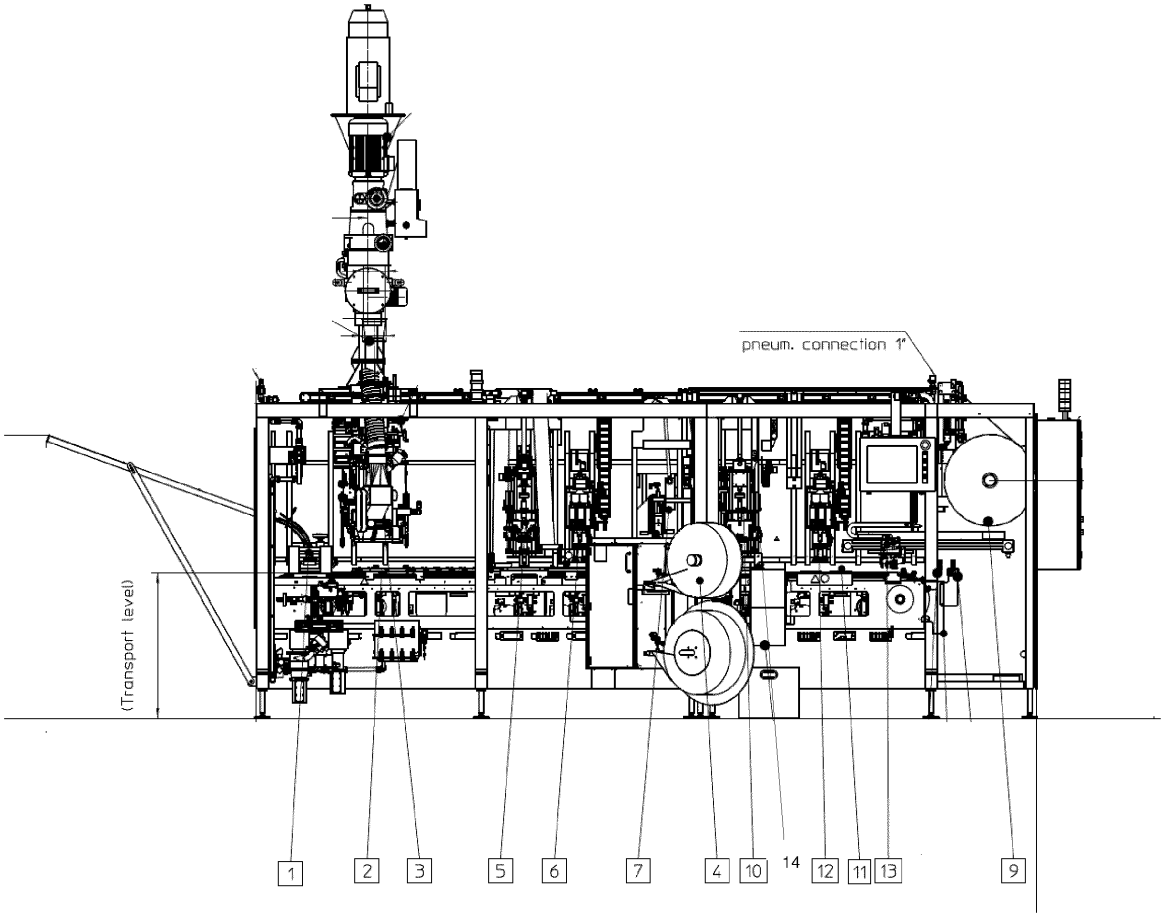

Fig. 1

REFERENCES CITED IN THE DESCRIPTION

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