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(54) Suction gripping unit

Sauggreifereinrichtung

Dispositif de préhension par aspiration

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Description

[0001] The present invention relates to a suction gripping unit.

[0002] In the following description, specific reference is made purely by way of example to the cigarette packing sector, and in particular to a suction gripping unit for supplying blanks on a cigarette packing machine.

[0003] Cigarette packing machines are known to employ a suction gripping unit for feeding blanks successively between a blank pickup station, located at a blank store, and a supply station where the blanks are transferred to respective seats on a packing wheel.

[0004] Known suction gripping units comprise a wheel supporting a number of suction heads, in each of which is defined a cavity communicating on one side with the outside atmosphere via a through hole controlled by a first valve, and connected on the other side to a discharge head suction pump by a conduit controlled by a second valve normally housed in the conduit at a given distance from the cavity. In known gripping units, the two valves are normally incorporated into a single slide valve.

[0005] To retain a blank on the suction head, the head is brought into contact with the blank, which closes the cavity to define, with the cavity, a suction chamber in which a vacuum (with respect to atmospheric pressure) is formed by closing the first valve and opening the second. To release the blank, atmospheric pressure is restored inside the suction chamber by opening the first valve and closing the second.

[0006] The response time of the gripping unit, i.e. the time taken to activate and deactivate the suction force, depends on the total volume of the suction chamber, the performance of the suction pump, and the size of said through hole; the total volume of the suction chamber being equal to the volume of the cavity plus the volume of the conduit portion between the cavity and the second valve.

[0007] The first valve is made necessary by using a discharge head suction pump, which is characterized by a relatively high discharge head and a relatively low flow rate, and could not operate correctly in the presence of high load losses such as those which would be induced by the through hole if this were not closed during suction by the first valve.

[0008] US4009876 discloses a unit for feeding blanks of corrugated cardboard into a printing and container forming machine. The feeding mechanism includes a perforated suction head for moving individual sheets from a stack of sheets into the machine; the suction head includes a perforated plate and plenum chamber mounted on a tubular member which is telescopically received over an open ended tubular support member, mounted on a hollow reciprocating shuttle. A valve is disposed at the shuttle end of the tubular support for connecting the shuttle to an evacuator supported with their forward ends at the shuttle and at their opposite

ends by a universally adjustable support which compensates for warped blanks. A dump valve for venting the shuttle to atmosphere is operable in timed relation to the vacuum valve by means of a linear cam located adjacent the shuttle.

[0009] Known units of the above type involve several drawbacks, foremost of which is the need for providing and controlling two separate valves or one relatively complicated slide valve for each suction head. Moreover, on account of the location of the second valve, the suction chamber has a relatively large volume, thus resulting in relatively slow response of the valve.

[0010] It is an object of the present invention to provide a suction gripping unit designed to eliminate the aforementioned drawbacks, and which in particular is cheap and easy to produce.

[0011] According to the present invention, there is provided a suction gripping unit as recited in Claim 1.

[0012] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a cross section, with parts removed for clarity, of a preferred embodiment of the unit according to the present invention;

figure 2 shows a larger-scale section along line II-II in Figure 1 of a Figure 1 detail in two different operating positions;

Figure 3 shows a section along line III-III in Figure 2; Figure 4 is similar to Figure 2 and shows a Figure 2 detail in a further operating position.

[0013] Number 1 in Figure 1 indicates as a whole a continuous packing machine comprising a powered packing wheel 2, which rotates continuously (anticlockwise in Figure 1) about a respective axis (not shown) perpendicular to the Figure 1 plane, and in turn comprises a number of hollow, equally spaced, peripheral seats 3 (only one shown) for successively receiving respective prefolded blanks 4 of cardboard or similar material. Machine 1 also comprises a store 5 for a stack 6 of blanks 4; and a suction gripping unit 7 interposed between a pickup station S1 at the open end 8 of store 5 and a supply station S2 at packing wheel 2, and for extracting blanks 4 from end 8 and feeding them successively to respective seats 3.

[0014] Gripping unit 7 comprises a powered roller 9 rotating continuously clockwise in Figure 1 about a respective fixed central axis 10 parallel to the axis (not shown) of wheel 2 and perpendicular to a longitudinal axis 11 of store 5. Roller 9 comprises an inner chamber 12 connected by a conduit 13 to a suction pump 14, a so-called "side-channel" pump, for creating in chamber 12 a vacuum with respect to the atmospheric pressure outside.

[0015] Roller 9 supports a number of pneumatic gripping heads 15 distributed about axis 10 and connected to roller 9 via the interposition of respective arms 16. As

shown more clearly in Figure 2, each head 15 is substantially in the form of a plate, which is connected on one side to respective arm 16, and is defined on the other side by a gripping surface 17 in which a cavity 18 is defined by an annular edge 19 and connected to chamber 12 by a respective conduit 20 formed along respective arm 16.

[0016] In the embodiment shown, gripping surface 17 is substantially defined by the top surface of edge 19.

[0017] At a joint 21 connecting conduit 20 to respective head 15, each conduit 20 houses a valve 22 for controlling conduit 20, i.e. for opening or closing conduit 20 to connect or disconnect it from respective cavity 18. A through hole 23 is formed in each head 15 so that respective cavity 18 communicates permanently with the outside atmosphere.

[0018] Each valve 22 is a known mechanical valve, and comprises a head 24; an annular seat 25 engaged by head 24 and formed at respective joint 21; and a control rod 26, which is fitted in axially-sliding manner to two perforated supporting walls 27 (Figure 3) housed inside conduit 20, and is moved axially, by an actuating device 28 and in a radial direction with respect to axis 10, between an open position (Figure 2a) in which cavity 18 is connected pneumatically to conduit 20 and therefore to chamber 12, and a closed position (Figure 2b) in which cavity 18 is isolated pneumatically from conduit 20 and therefore from chamber 12.

[0019] Actuating device 28 comprises a body 29, which is fitted to the end of respective rod 26 opposite the end connected to respective head 24, and is fitted to roller 9 so as to slide, together with rod 26, in a radial direction with respect to axis 10 and so move rod 26 between said open and closed positions. Actuating device 28 comprises a spring 30, which is located radially with respect to a wall 31 defining chamber 12 and coaxially with respect to respective rod 26, and is compressed between a respective wall 27 and body 29 to normally maintain rod 26 in said closed position.

[0020] Actuating device 28 also comprises a cylindrical rod 32, which is fitted to body 29 so as to slide longitudinally, with respect to body 29, along a respective axis 33 parallel to axis 10, and is fitted in rotary manner at one end with a tappet roller 34 cooperating with a fixed cam 35. Cam 35 is so formed that, as roller 9 rotates about axis 10, body 29, and therefore respective rod 26, of each head 15 is moved, in a radial direction with respect to axis 10, between said open position and said closed position.

[0021] The movement of rod 32 along axis 33 is controlled by an actuating device 36 for cutting off control of respective valve 22, and which moves rod 32 between a work position (Figure 2) in which roller 34 engages cam 35, and a rest position (Figure 4) in which roller 34 is detached from cam 35. Actuating device 36 comprises a known magnetic actuator 37 which, when energized, moves rod 32 along axis 33 from said work position to said rest position; and a spring 38 located coax-

ially with rod 32 between body 29 and roller 34 to normally maintain rod 32 in said work position.

[0022] As shown in Figure 1, each seat 3 is formed in an outer surface 39 of a respective head 40 opposite an inner portion of head 40 connected to wheel 2 so as to oscillate, with respect to wheel 2, about a respective axis 41 parallel to axis 10 under the control of a known cam-rocker arm control device not shown. Each seat 3 comprises two lateral surfaces 42 sloping towards each other and towards a bottom surface 43 through which are formed a number of holes 44 by which a known suction device (not shown) communicates externally.

[0023] The operation of one gripping head 15 will be described with reference to Figure 2.

[0024] To retain a blank 4 on gripping surface 17 of head 15, surface 17 is brought into substantial contact with blank 4, which closes respective cavity 18 to define, with cavity 18, a suction chamber in which a vacuum (with respect to atmospheric pressure) is formed by closing respective valve 22 and so connecting said suction chamber to chamber 12 in which pump 14 maintains a constant vacuum.

[0025] The load losses caused by through hole 23 connected permanently to the outside pose no serious problems, by pump 14 being capable of compensating even relatively high load losses, such as those induced by hole 23.

[0026] To release blank 4, atmospheric pressure is restored inside said suction chamber automatically, by virtue of hole 23, by simply closing valve 22.

[0027] The relatively small volume of the suction chamber provides for achieving extremely rapid response of gripping head 15, which at the same time is cheap and easy to produce by comprising only one valve 22.

[0028] Operation of gripping unit 7 will be described with reference to Figure 1, with reference to one gripping head 15, and as of the instant in which head 15, having released a blank 4 inside a respective seat 3 at supply station S2, is moved by the rotation of roller 9 towards pickup station S1 to withdraw another blank 4.

[0029] Between supply station S2 and pickup station S1, valve 22 of head 15 is maintained in said closed position.

[0030] As it is fed through station S1, gripping head 15 withdraws the blank 4 contacting end 8 of store 5 and retains it by suction on gripping surface 17. More specifically, at a given point in its movement, gripping head 15 is positioned with gripping surface 17 substantially contacting the blank 4 contacting end 8; and, just before said position is reached, actuating device 28 moves valve 22 into said open position to connect cavity 18 to chamber 12 and, via cavity 18, activate the suction force causing the blank 4 contacting end 8 to adhere to gripping surface 17.

[0031] As roller 9 rotates, head 15 leaves pickup station S1 in which blank 4 has been withdrawn, and is fed to supply station S2 where blank 4 is fed to a respective

seat 3 on a respective head 40.

[0032] At station S2, head 40 is oscillated in known manner about respective axis 41 by said known cam-rocker arm device (not shown) so as to remain a given length of time facing gripping surface 17 of head 15. During this time, head 15 is inserted inside seat 3 so that gripping surface 17 is positioned substantially contacting surface 43; and, just before said position is reached, actuating device 28 moves valve 22 into said closed position to cut off the suction through cavity 18, and the suction through holes 44 in surface 43 is activated to release blank 4 inside and adhering by suction to seat 3.

[0033] As shown in Figure 1, the insertion of head 15 inside respective seat 3 provides for folding blank 4 into a U along respective known preformed bend lines (not shown) as blank 4 is fed into seat 3.

[0034] The above operations are repeated cyclically.

[0035] To prevent a blank 4 from being fed into a seat 3, the respective head 15 must be prevented from withdrawing a blank 4 as it travels through station S1, which function is provided for by actuating device 36 of head 15. More specifically, throughout the passage of head 15 through station S1, respective magnetic actuator 37 is maintained energized to detach roller 34 from cam 35 and so prevent respective valve 22 from being opened, so that, in the absence of suction, gripping surface 17, as it travels through station S1, is brought into contact with, but fails to withdraw, the blank 4 at end 8.

[0036] In a further embodiment not shown, cavity 18 is divided into a number of elementary cavities separated and maintained pneumatically connected to one another by perforated sections; and surface 17 is defined by the top surface of edge 19 and by the top surfaces of said sections to provide a larger supporting surface for blank 4.

[0037] Further, not shown, the cavity 18 communicates permanently with the outside atmosphere via a number of small-diameter through holes 23.

Claims

1. A suction gripping unit comprising at least one suction head (15), at least one cavity (18) defined in said suction head (15) and suction means (13, 14, 20) for creating a vacuum inside said cavity (18); the suction means (13, 14, 20) comprising a conduit (20) communicating with said cavity (18), a pump (14) connected to said conduit (20), and a control valve (22) located along said conduit (20) between said pump (14) and said cavity (18); **characterized in that** said pump (14) is a side-channel suction pump having a low discharge head and a high flow rate, said valve (22) is located at a joint (21) connecting said conduit (20) to said suction head (15) so as to be in closed proximity to the cavity (18), and at least one through hole (23) is formed in said suction head (15) to connect said cavity (18) per-

manently with the outside atmosphere.

2. A unit as claimed in Claim 1, further comprising a powered roller (9) rotating about a fixed axis (10) and supporting said suction head (15).
3. A unit as claimed in Claim 1 or 2, wherein said valve (22) is a mechanical valve (22); the unit comprising mechanical control means (28) for controlling the position of said valve (22).
4. A unit as claimed in Claim 3, wherein said mechanical control means (28) comprise a cutoff device (36) for cutting off control of said valve (22).
5. A unit as claimed in Claim 4, wherein said cutoff device (36) comprises a magnetic actuator (37) for disengaging said tappet roller (34) from said cam (35).
6. A unit as claimed in Claim 3, 4 or 5, wherein said mechanical control means (28) comprise a rod (26) connected to said valve (22) and movable longitudinally to move the valve (22) between an open position and a closed position respectively opening and closing said conduit (20).
7. A unit as claimed in any Claim from 3 to 6, wherein said mechanical control means (28) also comprise a tappet roller (34) connected mechanically to said rod (26); and a fixed cam (35) engaged by said tappet roller (34) to move said rod (26) cyclically in an axial direction.
8. A device for supplying blanks (4) to a packing wheel (2) having a number of seats (3), each for receiving a respective said blank (4); the device comprising a pickup station (S1) at a store (5) for storing said blanks (4), and a supply station (S2) at said packing wheel (2), and being **characterized by** comprising a suction gripping unit (7) as claimed in Claim 2; said powered roller (9) feeding said suction head (15) through said pickup station (S1) to withdraw a respective said blank (4) from said store (5), and through said supply station (S2) to feed said blank (4) to a respective said seat (3).
9. A device as claimed in Claim 8, wherein said suction head (15) is so formed as to be inserted inside the respective said seat (3) at said supply station (S2) to fold said blank (4) into a U inside the seat (3).

Patentansprüche

1. Sauggreifereinrichtung bzw. -einheit, umfassend wenigstens einen Saugkopf (15), wenigstens einen Hohlraum (18), der in dem Saugkopf (15) definiert ist, und Saugmittel (13, 14, 20), um ein Vakuum im

Inneren des Hohlraums (18) auszubilden; wobei die Saugmittel (13, 14; 20) eine Leitung (20), die mit dem Hohlraum (18) kommuniziert bzw. in Verbindung steht, eine Pumpe (14), die mit der Leitung (20) verbunden ist, und ein Steuer- bzw. Regelventil (22) umfassen, das entlang der Leitung (20) zwischen der Pumpe (14) und dem Hohlraum (18) angeordnet ist; **dadurch gekennzeichnet, daß** die Pumpe (14) eine Seitenkanalsaugpumpe ist, die einen Kopf mit niedrigem bzw. geringem Austrag und eine hohe Flußgeschwindigkeit bzw. Strömungsrate besitzt, wobei das Ventil (22) an einer Verbindung (21), die die Leitung (20) mit dem Saugkopf (15) verbindet, so angeordnet ist, um sich in unmittelbarer Nachbarschaft zu dem Hohlraum (18) zu befinden, und wenigstens ein Durchgangsloch (23) in dem Saugkopf (15) ausgebildet ist, um den Hohlraum (18) permanent mit der Außenatmosphäre zu verbinden.

2. Einheit nach Anspruch 1, weiters umfassend eine angetriebene Walze (9), die um eine feststehende Achse (10) rotiert und den Saugkopf (15) trägt bzw. unterstützt.
3. Einheit nach Anspruch 1 oder 2, worin das Ventil (22) ein mechanisches Ventil (22) ist; wobei die Einheit mechanische Steuer- bzw. Regelmittel (28) zum Steuern bzw. Regeln der Position des Ventils (22) umfaßt.
4. Einheit nach Anspruch 3, worin die mechanischen Steuer- bzw. Regelmittel (28) eine Abschalt- bzw. Ausschalteinrichtung (36) umfassen, um die Steuerung bzw. Regelung des Ventils (22) abzuschalten.
5. Einheit nach Anspruch 4, worin die Abschalt- bzw. Ausschalteinrichtung (36) eine magnetische Betätigungseinrichtung (37) umfaßt, um die Stößelrolle (34) von dem Nocken (35) außer Eingriff zu bringen.
6. Einheit nach Anspruch 3, 4 oder 5, worin die mechanischen Steuer- bzw. Regelmittel (28) einen Stab (26) umfassen, der mit dem Ventil (22) verbunden ist und in Längsrichtung bewegbar ist, um das Ventil (22) zwischen einer Offenstellung und einer geschlossenen Stellung, die jeweils die Leitung (20) öffnet bzw. schließt, zu bewegen.
7. Einheit nach einem der Ansprüche 3 bis 6, worin die mechanischen Steuer- bzw. Regelmittel (28) auch eine Stößelrolle (34), die mechanisch mit der Stange (26) verbunden ist, und einen feststehenden Nocken (35) umfassen, der durch die Stößelrolle (34) ergriffen ist, um die Stange (26) zyklisch in einer axialen Richtung zu bewegen.
8. Vorrichtung zum Zuführen von Zuschnitten (4) zu

einem Packrad (2), das eine Anzahl von Sitzen (3) besitzt, jeweils um einen der entsprechenden Zuschnitte (4) aufzunehmen; wobei die Vorrichtung eine Aufnahmestation (S1) an einem Speicher (5) zum Speichern der Zuschnitte (4) und eine Zufuhrstation (S2) an dem Packrad (2) umfaßt, und welche **dadurch gekennzeichnet ist, daß** sie eine Sauggreifereinheit (7) umfaßt, wie sie in Anspruch 2 beansprucht ist; wobei die angetriebene Walze (9) den Saugkopf (15) durch die Aufnahmestation (S1), um einen entsprechenden Zuschnitt (4) von dem Speicher (5) zu entnehmen, und durch die Zufuhrstation (S2) zuführt, um den Zuschnitt (4) zu einem entsprechenden Sitz (3) zuzuführen.

9. Vorrichtung nach Anspruch 8, worin der Saugkopf (15) so ausgebildet ist, um im Inneren des entsprechenden Sitzes (3) an der Zufuhrstation (S2) eingesetzt zu sein, um den Zuschnitt (4) in ein U im Inneren des Sitzes (3) zu falten.

Revendications

1. Unité de préhension par aspiration comprenant au moins une hauteur d'aspiration (15), au moins une cavité (18) définie dans ladite hauteur d'aspiration (15) et des moyens d'aspiration (13, 14, 20) pour créer un vide à l'intérieur de ladite cavité (18) les moyens d'aspiration (13, 14, 20) comprenant un conduit (20) communicant avec ladite cavité (18), une pompe (14) reliée audit conduit (20), et une soupape de commande (22) située le long dudit conduit (20) entre ladite pompe (14) et ladite cavité (18) ; **caractérisé en ce que** ladite pompe (14) est une pompe d'aspiration à canal latéral ayant une hauteur de refoulement basse et une vitesse d'écoulement élevée, ladite soupape (22) est située au niveau d'un joint (21) reliant ledit conduit (20) à ladite hauteur d'aspiration (15) de manière à être très proche de la cavité (18), et au moins un trou débouchant (23) est formé dans ladite hauteur d'aspiration (15) pour relier ladite cavité (18) de manière permanente avec l'atmosphère extérieure.
2. Unité selon la revendication 1, comprenant en outre un rouleau motorisé (9) tournant autour d'un axe fixe (10) et soutenant ladite hauteur d'aspiration (15).
3. Unité selon la revendication 1 ou 2, dans lequel ladite soupape (22) est une soupape mécanique (22) ; l'unité comprenant des moyens de contrôle mécaniques (28) pour contrôler la position de ladite soupape (22).
4. Unité selon la revendication 3, dans lequel lesdits moyens de contrôle mécaniques (28) comprennent

un dispositif de coupure (36) pour couper le contrôle de ladite soupape (22).

5. Unité selon la revendication 4, dans lequel ledit dispositif de coupure (36) comprend un actionneur magnétique (37) pour mettre hors de prise ledit galet de poussoir (34) et ladite came (35). 5

6. Unité selon la revendication 3, 4 ou 5, dans lequel lesdits moyens de contrôle mécaniques (28) comprennent une tige (26) reliée à ladite soupape (22) et pouvant être déplacée longitudinalement pour déplacer la soupape (22) entre une position ouverte et une position fermée, ouvrant et fermant respectivement ledit conduit (20). 10
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7. Unité selon l'une quelconque des revendications 3 à 6, dans lequel lesdits moyens de contrôle mécaniques (28) comprennent aussi un galet de poussoir (34) relié mécaniquement à ladite tige (26) ; et une came fixe (35) en prise avec ledit galet de poussoir (34) pour déplacer ladite tige (26) cycliquement dans une direction axiale. 20

8. Dispositif pour fournir des pièces brutes (4) à une roue à garniture (2) ayant un certain nombre de logements (3), chacun destiné à recevoir une dite pièce brute respective (4) ; le dispositif comprenant une station d'enlèvement (S1) au niveau d'un magasin (5) destiné à stocker lesdites pièces brutes (4), et une station d'alimentation (S2) au niveau de ladite roue à garniture (2), et étant **caractérisé par le fait qu'il** comprend une unité de préhension par aspiration (7) selon la revendication 2 ; ledit rouleau motorisé (9) alimentant ladite hauteur d'aspiration (15) à travers ladite station d'enlèvement (S1) pour retirer une pièce brute respective (4) dudit magasin (5), et à travers ladite station d'alimentation (S2) pour amener ladite pièce brute (4) à un dit logement respectif (3). 25
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9. Dispositif selon la revendication 8, dans lequel ladite hauteur d'aspiration (15) est formée de manière à être insérée à l'intérieur dudit logement respectif (3) au niveau de ladite station d'alimentation (S2) pour plier en U ladite pièce brute (4) à l'intérieur du logement (3). 45

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