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(54) **DEVICE FOR SEPARATING SHEETS OF PAPER BY BLOWING AIR**

VORRICHTUNG ZUM TRENNEN VON PAPIERBÖGEN DURCH BLASEN VON LUFT

DISPOSITIF POUR SÉPARER DES FEUILLES DE PAPIER PAR INSUFFLATION D'AIR

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Description

[0001] The present invention relates to a sheet separating device for a vertical friction sorter, the vertical friction sorter comprising a plurality of stations arranged above each other, each one of which comprises a sheet separating device and a storage surface intended to contain a pile of sheets of paper lying on each other, individual sheets being intended to be picked from the stations in a predetermined way for further processing. The invention also relates to such a friction sorter.

[0002] There are essentially two types of sorters for use for after-treatment of sheets of paper in printing machines and copiers, viz. friction sorters and vacuum sorters. In friction sorters, individual sheets are picked from piles of sheets by the fact that a rotary feeding roll is abutted against and pulls the top sheet from the pile, wherein a subjacent friction block normally retains subjacent sheets of the pile. Friction sorters are robust and in general reliable in operation, but occasion- ally more than one sheet at a time may happen to be picked mistakenly. The feeding rolls may also leave marks in the sheets. In vacuum sorters, sheets are picked from piles by the fact that the top sheet of the pile is sucked against a conveyor belt for transportation of the sheet to subsequent further processing. The vacuum sorter has not the disadvantages mentioned above of the friction sorter, but the function thereof is more sensitive and a vacuum sorter is considerably more expensive than a friction sorter.

[0003] Another disadvantage of friction sorters is that when picking sheets, the top sheet is drawn against the closest subjacent sheet of the pile, the picked sheet being electrostatically charged, which often gives rise to problems in after-treat- ment steps. The sheets namely get a tendency to stick to each other as a consequence of the electrostatic charge, which hampers, e.g., putting together and adjustment of sheets into a sheaf having straight edges in a stapling and folding machine when stapling together the sheaf for the formation of a booklet. Since colour printing and colour copying have become more and more common, the described problem of electrostatic charging of the sheets has become even greater, since coloured paper has a greater tendency to be charged than paper with black-and-white print.

[0004] In large copiers and printing machines, it is previously known to separate sheets of paper in the paper magazines of the machines by blowing air from the side through the magazine. In doing so, air is supplied through central supply ducts to exhaust nozzles at the magazine or the magazines from a central fan unit situated at a distance from the magazine or the magazines.

[0005] US 2004/0178557 is a prior art document which describes a sheet feeding apparatus according to the preamble of claim 1 and which includes a sheet feeding roller that comes in contact with stacked sheets and feeds sheets one by one from the top, wherein an air outlet is provided so that air can be blown onto the upper part of the stacked sheets from the lateral side in the sheet feeding direction, and a floatation suppression member for suppressing floatation of the sheet is provided between the air outlet and the feeding roller and spaced apart from the uppermost surface of the stacked sheets.

[0006] US 5,499,806 is another prior art document which describes a collating machine which comprises a frame, a plurality of superposed trays in the frame in order to be loaded with stacks of paper. Each tray being fitted with an individual sheet ejection device and a transfer device, and a vertical conveyor adjacent to the transfer devices of the trays to receive, and sheets are ejected from their trays and to move the same to a collating station. The ejection device comprises several endless perforated tapes carried on two spaced bend rolls and a vacuum chamber surrounded by the tapes and having apertures, for the passage of air, distributed in its lower wall which is adjacent to the internal surface of the lower run of the tape. The opposite surface of the lower run of the tape is positioned opposite to the top sheet in the stack in parallelism to the latter and at a distance which is maintained essentially constant by a moving plate carrying the stack.

[0007] The object of the present invention is to solve the problem discussed above of electrostatic charging of sheets in friction sorters.

[0008] This object is attained by a device of the type indicated by way of introduction having the features defined in claim 1, and a vertical friction sorter according to claim 7.

[0009] Thus, by means of the present invention, a preseparation of the sheets in the stations is provided by blowing air, so that when the top sheet of a pile is to be picked, it does not abut against, but it is separated from the subjacent sheet by an air film. Thus, in the picking operation, the sheet will not be drawn over the subjacent sheet, whereby charging of the sheet is avoided. In addition, the risk of a plurality of sheets mistakenly being picked simultaneously is decreased. By arranging separate fans in each station of the sorter, the construction becomes considerably simpler than if the exhaust air would be supplied from a central fan unit to each station through central supply ducts having appurtenant, requisite valve or trap devices. In addition, with a central air supply, there would be problems to provide the same pressure and the same air flow at the different stations, since the air supply ducts would become relatively long in high friction sorters having many stations. Simple and inexpensive fans, without any valve or trap arrangements, can be used in the device according to the invention, which makes the construction as a whole simple and inexpensive. In this way, friction sorters equipped with the device according to the invention will also be useful within areas and for applications where one hitherto has been reduced to use the considerably more complicated and more expensive vacuum sorters. Thanks to the specially formed nozzle, an efficient separation is achieved no matter how high the stack of sheets is.

[0010] According to an advantageous embodiment of

the device according to the invention, in each station, two fans are arranged at opposite sides of the storage surface for the stack of sheets. In this way, a very efficient separation of the sheets is achieved.

[0011] According to another advantageous embodiment of the device according to the invention, the fans are mounted in lateral stops of the storage surface in each station. By mounting the fans directly in the lateral stops, a simple and efficient construction is obtained. According to yet another advantageous embodiment of the device according to the invention, the height of the exhaust opening of the nozzle exceeds the height of the outlet from the proper fan, and the exhaust opening of the nozzle widens in the upper part of the nozzle. By this design of the opening of the nozzle, an air curtain is obtained, the height of which exceeds the height of the outlet from the proper fan. Thus, by the fact that the exhaust opening of the nozzle has a restriction in the intermediate portion thereof, the exhaust air will also be directed outward toward the widened upper part of the opening that is above the height of the outlet from the proper fan. Furthermore, in fans of the type in question, in which air is sucked axially into the fan and is exhausted radially, the air flow tends to vary over the height of the exhausted air curtain. By forming the nozzle such as has been indicated, also a correction of this effect is achieved.

[0012] According to an additional advantageous embodiment of the device according to the invention, the exhaust opening of the nozzle widens in the lower part of the nozzle. A stronger air flow is namely required at the lower part of the stack of sheets in order to there bring about the initial separation of the sheets of the pile in an efficient way. In the upper part of the pile, there is only required that already separated sheets henceforth are kept separated by intermediate air films. To this end, a lower air flow is sufficient. According to yet another advantageous embodiment of the device according to the invention, the fans are individually controllable for each station. By making the fans individually controllable, suitably by providing each fan with its own electrical supply, the air flow can easily be adapted to, e.g., the weight of the sheets, which may vary from station to station if the stations contain sheets of different types. Such an individual control of the air flow to the individual stations would be very complicated in a construction having a central, constant air supply. Complicated, continuously controllable trap and valve arrangements would be required, not only for individually increasing and decreasing the air flow through the individual air gaps but also to compensate for the effect that, when the air flow through certain nozzles is restricted, the flow through other nozzles increases as a consequence of the central air supply being constant.

[0013] The invention also relates to a friction sorter according to the type indicated by way of introduction and comprising a device of the above-mentioned type for separating sheets of paper by blowing air. In order to explain the invention further, an embodiment of the device according to the invention chosen as example will now be described more in detail, reference being made to the appended drawings, in which Figures 1 and 2 show in a front view and in a side view, respectively, the principal structure of a vertical or standing friction sorter provided with the device according to the invention, Figure 3 principally illustrates feeding out or picking of sheets from a pile of sheets in a station in a sorter according to Figures 1 and 2, Figure 4 is a view from above of a station in the friction sorter, and Figure 5 is a detailed picture illustrating an example of the design of the exhaust nozzle in the device according to the invention.

[0014] Figures 1 and 2 show an embodiment of a vertical friction sorter from the front and in a side view, respectively, which is provided with a device according to the invention.

[0015] The machine comprises a plurality of stations 8 arranged above each other and resting on a control cubicle 10 containing the other equipment of the machine, see Figures 1 and 2. Each station 8 is intended to house a pile of sheets 1 of paper lying on each other, shown in the top station 8 in Figure 1. Each station 8 comprises a paper magazine having a storage surface 2 on which the pile of sheets rests, see also Figure 3. From the paper magazines, sheets 1 are fed out or are picked, one at a time, using feeding rolls 5 that are brought into frictional engagement with the top sheet 1 of the pile, such as shown in Figure 3.

[0016] In Figure 2, operating devices for the control of the machine are also shown, in the form of an LCD screen 11 for displaying miscellaneous information about the operation of the machine as well as a number of control buttons. In each station, two fans 3 are arranged at opposite sides of the storage surface 2 for the stack of sheets. The fans 3 are mounted directly in lateral stops 4 of the storage surface 2 of each station, see Figure 4.

[0017] Each fan 3 is provided with a nozzle having a slot-shaped exhaust opening 7 substantially vertical or orientated substantially perpendicularly to the storage surface, see Figure 5, for blowing a substantially vertical air curtain through the stack of sheets so as to separate the sheets 1 of the pile. This is illustrated in Figure 3. Then, the sheets 1 are spaced-apart by an air film. Thus, when the top sheet 1 of the stack of sheets is picked using the feeding roll 5, the sheet will not be drawn over the closest subjacent sheet, thereby avoiding that the sheet is charged electrostatically with the accompanying drawbacks discussed above.

[0018] The exhaust opening 7 of the nozzle, see Figure 5, is formed as a slot that is standing or orientated perpendicularly to the storage surface in order to generate a substantially vertical air curtain. The height of the air curtain considerably exceeds the maximum allowed height of an unblown stack of sheets resting on the storage surface of the station, since the height of the pile increases when air is blown toward the pile and the sheets 1 are separated.

[0019] Therefore, the height of the exhaust opening 7

of the nozzle exceeds the height of the outlet 6 from the proper fan, see Figure 5. The exhaust opening 7 is furthermore widened in the upper part thereof. In this way, the exhausted air will also be directed outward toward this part that is above the outlet 6 of the proper fan, since the flow resistance is lower in said widened part of the nozzle than in the central, narrower part. Thus, as a result, an air curtain is obtained, the height of which exceeds the height of the proper fan outlet 6.

[0020] Such a design of the nozzle opening 7 also gives another favourable effect. In the used type of fans, air is sucked into the fan axially and is exhausted radially. Such fans tend to generate an exhaust flow that varies over the height of the air curtain. By the described design of the nozzle opening 7, a certain correction of this effect is also obtained, so that an essentially equally strong flow is obtained along the entire height of the air curtain.

[0021] As is seen in Figure 5, the opening 7 of the nozzle is widened also in the lower part thereof. A greater air flow is namely desirable in the lower part in order to efficiently bring about the initial separation of the sheets in the lower part of the stack of sheets. In the upper part of the pile, an equally great flow is not needed to hold already separated sheets spaced-apart by air films.

[0022] The hourglass-like design of the nozzle opening 7 having a restriction in the intermediate part of the opening 7 is also seen from Figure 3.

[0023] Separate fans 3 are, as has been described above, arranged in each station 8 of the sorter. In this way, it is easier to maintain equally great air pressure and equally great air flow in each station 8 than in a construction having a central fan unit that feeds all stations via ducts provided with valves or traps, such as has been discussed above. By furthermore arranging the fans 3 individually controllable, suitably by providing each fan 3 with its own electrical supply, the air flow can easily be adapted to, e.g., the weight of the sheets in the individual stations. This is important, since the weight of the sheets may vary from station to station if the stations 8 contain sheets 1 of different types.

Claims

1. Sheet separating device for a vertical friction sorter, the vertical friction sorter comprising a plurality of stations (8) arranged above each other, each one of which comprises a sheet separating device and a storage surface (2) intended to contain a pile of sheets (1) of paper lying on each other, one sheet (1) at a time being intended to be picked from the stations (8) in a predetermined order for further processing, each sheet separating device comprises at least one fan (3) arranged beside the storage surface (2) for the pile of sheets (1) for blowing air essentially horizontally through the pile in order to separate sheets (1) of the pile, each fan (3) being provided with a nozzle having a slot-shaped exhaust opening (7), **characterized in that** the exhaust opening (7) is orientated substantially perpendicularly to the storage surface (2) for blowing a substantially vertical air curtain through a pile of sheets (1) lying on the storage surface (2), which exhaust opening (7) is formed to generate an air curtain, the height of which exceeds the maximum allowed height of the pile of sheets (1) lying on the storage surface (2).

2. Sheet separating device according to claim 1, **characterized in that**, in each station (8), two fans (3) are arranged at opposite sides of the storage surface (2) for the pile of sheets (1).

3. Sheet separating device according to claim 1 or 2, **characterized in that** the fans (3) are mounted in lateral stops of the storage surface (2) in each station (8).

4. Sheet separating device according to any one of claims 1-3, **characterized in that** the height of the exhaust opening (7) of the nozzle exceeds the height of the outlet from the proper fan (3), and that the exhaust opening (7) of the nozzle widens in the upper part of the nozzle.

5. Sheet separating device according to any one of claims 1-4, **characterized in that** the exhaust opening (7) of the nozzle widens in the lower part of the nozzle.

6. Sheet separating device according to any one of the preceding claims, **characterized in that** the fans (3) are individually controllable for each station (8).

7. Vertical friction sorter, comprising a plurality of stations (8) arranged above each other, each one of which is intended to contain a pile of sheets (1) of paper lying on each other, one sheet (1) at a time being intended to be picked from the stations (8) in a predetermined order for further processing, **characterized in that** the machine comprises a sheet separating device according to any one of the preceding claims.

Patentansprüche

1. Blattvereinzelungsvorrichtung für einen vertikalen Reibungssortierer, wobei der vertikale Reibungssortierer eine Mehrzahl von übereinander angeordneten Stationen (8) umfasst, von denen jede eine Blattvereinzelungsvorrichtung und eine Lagerfläche (2) umfasst, die dafür vorgesehen ist, einen Stapel von übereinanderliegenden Papierblättern (1) aufzunehmen, wobei jeweils immer ein Blatt (1) dazu vorgesehen ist, um von den Stationen (8) in einer vorbestimmten Reihenfolge zur weiteren Verarbeitung

aufgenommen zu werden, wobei jede Blattvereinzelungsvorrichtung wenigstens einen Lüfter (3) umfasst, der neben der Lagerfläche (2) für den Stapel von Blättern (1) angeordnet ist, um Luft im Wesentlichen horizontal durch den Stapel zu blasen, um die Blätter (1) des Stapels zu vereinzeln, wobei jeder Lüfter (3) mit einer Düse versehen ist, die eine schlitzförmige Auslassöffnung (7) aufweist, **dadurch gekennzeichnet, dass** die Auslassöffnung (7) im Wesentlichen rechtwinklig zu der Lagerfläche (2) orientiert ist, um einen im wesentlichen vertikalen Luftvorhang durch einen Stapel von Blättern (1) zu blasen, die auf der Lagerfläche (2) liegen, wobei die Auslassöffnung (7) so geformt ist, um einen Luftvorhang zu erzeugen, dessen Höhe die erlaubte maximale Höhe des auf der Lagerfläche (2) liegenden Stapels von Blättern (1) überschreitet.

2. Blattvereinzelungsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** in jeder Station (8) zwei Lüfter (3) auf einander gegenüberliegenden Seiten der Lagerfläche (2) für den Stapel von Blättern (1) angeordnet sind.

3. Blattvereinzelungsvorrichtung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Lüfter (3) in seitlichen Anschlägen der Lagerfläche (2) in jeder Station (8) montiert sind.

4. Blattvereinzelungsvorrichtung nach einem der Ansprüche 1-3, **dadurch gekennzeichnet, dass** die Höhe der Auslassöffnung (7) der Düse die Höhe des Auslasses des eigentlichen Lüfters (3) übersteigt, und dass sich die Auslassöffnung (7) der Düse in dem oberen Teil der Düse weitet.

5. Blattvereinzelungsvorrichtung nach einem der Ansprüche 1-4, **dadurch gekennzeichnet, dass** sich die Auslassöffnung (7) der Düse in dem unteren Teil der Düse weitet.

6. Blattvereinzelungsvorrichtung nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Lüfter (3) für jede Station (8) einzeln steuerbar sind.

7. Vertikalreibungssortierer, der eine Mehrzahl von übereinander angeordneten Stationen (8) umfasst, von denen jede dazu vorgesehen ist, einen Stapel von übereinanderliegenden Papierblättern (1) aufzunehmen, wobei jeweils immer ein Blatt (1) dazu vorgesehen ist, um von den Stationen (8) in einer vorbestimmten Reihenfolge zur weiteren Verarbeitung aufgenommen zu werden, **dadurch gekennzeichnet, dass** die Maschine eine Blattvereinzelungsvorrichtung nach einem der vorstehenden Ansprüche aufweist.

Revendications

1. Dispositif de séparation de feuilles pour un trieur à frottements vertical, le trieur à frottements vertical comprenant une pluralité de stations (8) disposées les unes au-dessus des autres, chacune d'entre elles comprenant un dispositif de séparation de feuille et une surface de stockage (2) destinée à contenir une pile de feuilles de papier (1) reposant les unes sur les autres,
une feuille (1) à la fois étant destinée à être prélevée depuis les stations (8) dans un ordre prédéterminé pour un traitement ultérieur, chaque dispositif de séparation de feuille comprend au moins un ventilateur (3) disposé à côté de la surface de stockage (2) pour la pile de feuilles (1) pour souffler de l'air essentiellement horizontalement à travers la pile de manière à séparer les feuilles (1) de la pile, chaque ventilateur (3) étant muni d'une buse ayant un orifice d'échappement en forme de fente (7), **caractérisé en ce que** l'orifice d'échappement (7) est orienté sensiblement perpendiculairement à la surface de stockage (2) pour souffler un rideau d'air sensiblement vertical à travers une pile de feuilles (1) couchées sur la surface de stockage (2), ledit orifice d'échappement (7) étant formé pour générer un rideau d'air, dont la hauteur est supérieure à la hauteur maximale autorisée pour la pile de feuilles (1) reposant se trouvant sur la surface de stockage (2).

2. Dispositif de séparation de feuilles selon la revendication 1, **caractérisé en ce que**, dans chaque station (8), deux ventilateurs (3) sont ménagés sur des côtés opposés de la surface de stockage (2) de la pile de feuilles (1).

3. Dispositif de séparation de feuilles selon la revendication 1 ou 2, **caractérisé en ce que** les ventilateurs (3) sont montés dans des butées latérales de la surface de stockage (2) dans chaque station (8).

4. Dispositif de séparation de feuilles selon l'une quelconque des revendications 1-3, **caractérisé en ce que** la hauteur de l'orifice d'échappement (7) de la buse est supérieure à la hauteur de la sortie du ventilateur associé (3), et **en ce que** l'orifice d'échappement (7) de la buse s'élargit dans la partie supérieure de la buse.

5. Dispositif de séparation de feuilles selon l'une quelconque des revendications 1-4, **caractérisé en ce que** l'orifice d'échappement (7) de la buse s'élargit dans la partie inférieure de la buse.

6. Dispositif de séparation de feuilles selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les ventilateurs (3) sont contrôlables individuellement pour chaque station (8).

7. Trieur vertical à frottements, comprenant une pluralité de stations (8) ménagées les unes au-dessus des autres, chacune d'entre elles étant destinée à contenir une pile de feuilles (1) de papier reposant les unes sur les autres, une feuille (1) à un moment donné étant destinée à être prélevée depuis les stations (8) dans un ordre prédéterminé pour un traitement ultérieur, **caractérisé en ce que** la machine comprend un dispositif de séparation de feuilles selon l'une quelconque des revendications précédentes.

Fig. 1

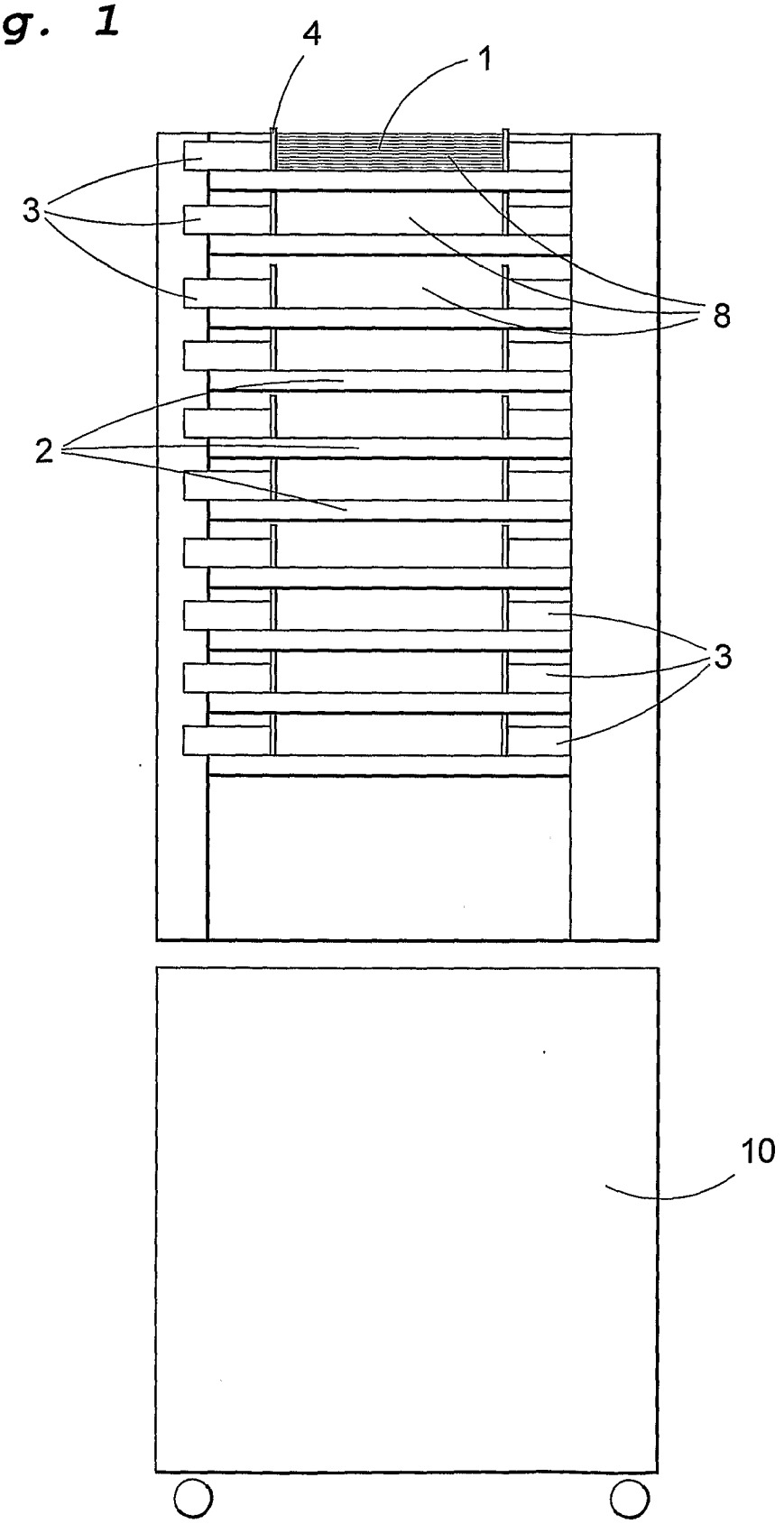


Fig. 2

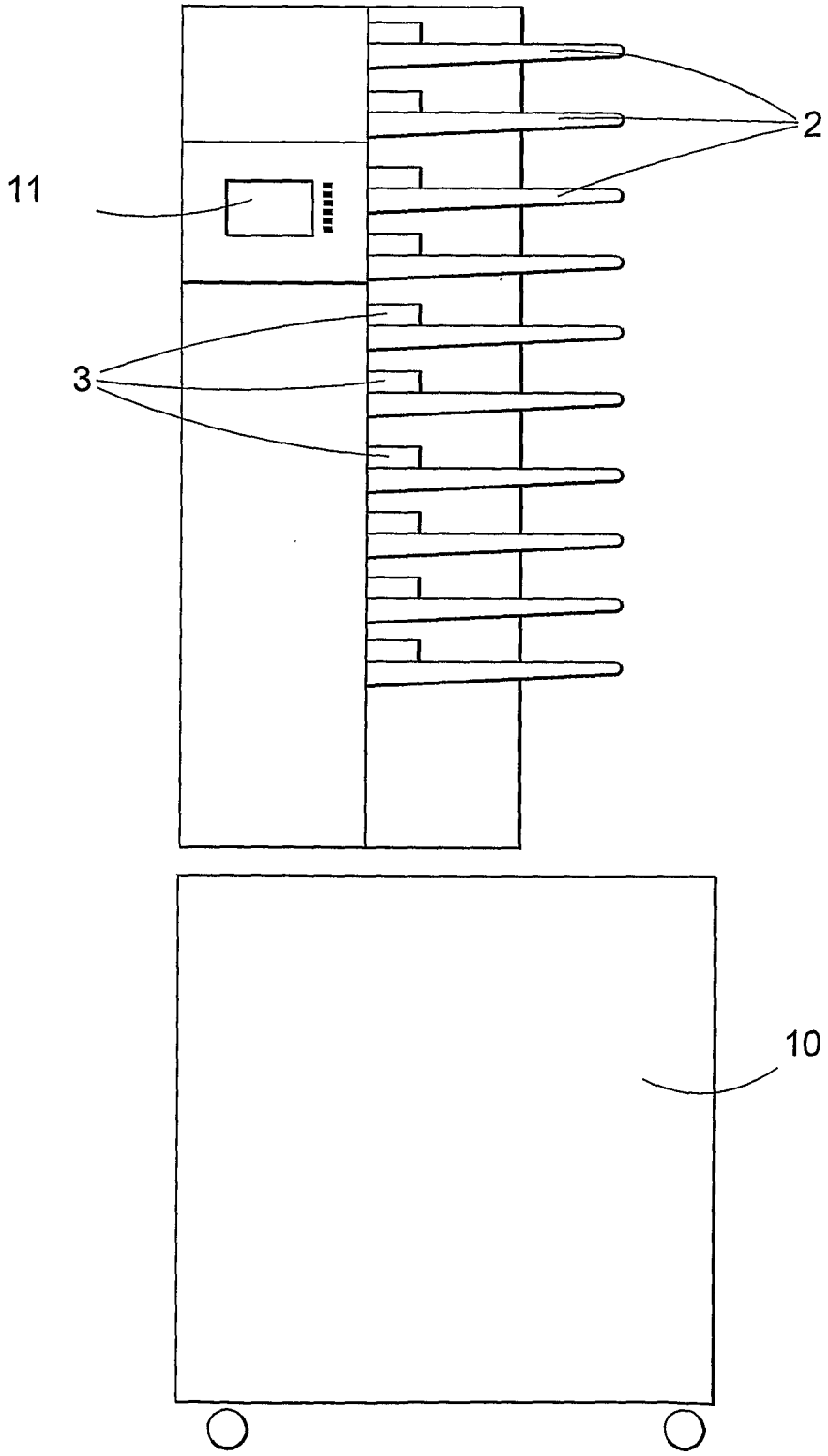


Fig. 3

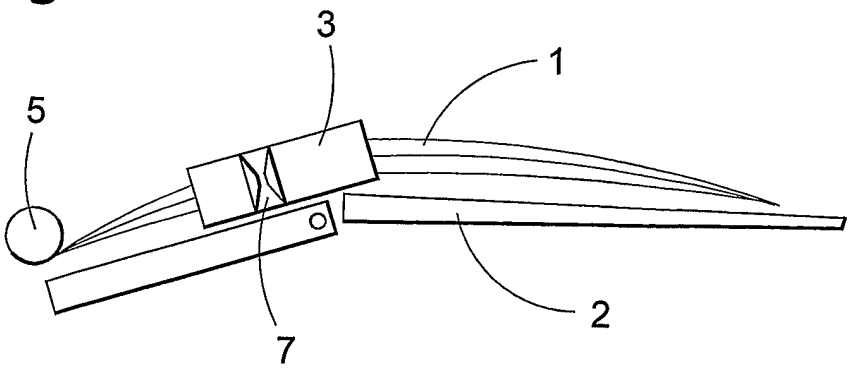


Fig. 4

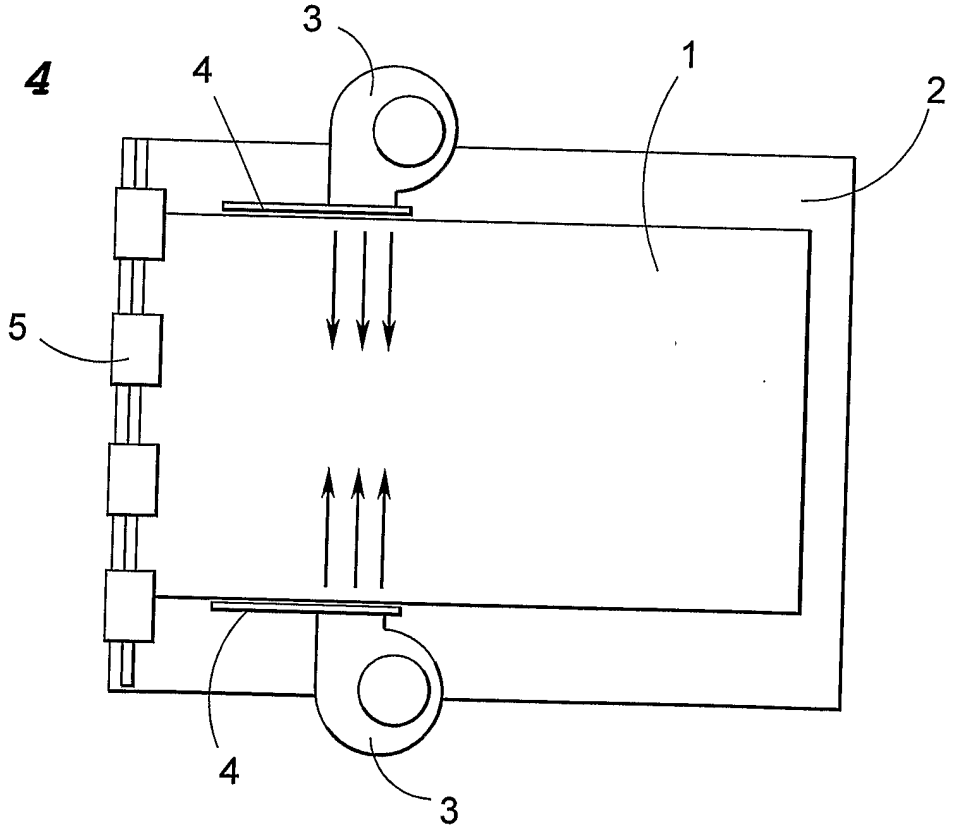
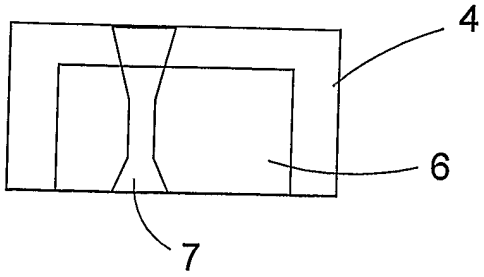


Fig. 5



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