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(54) **MACHINE FOR INSERTING GROUP OF SHEETS INTO ENVELOPES**

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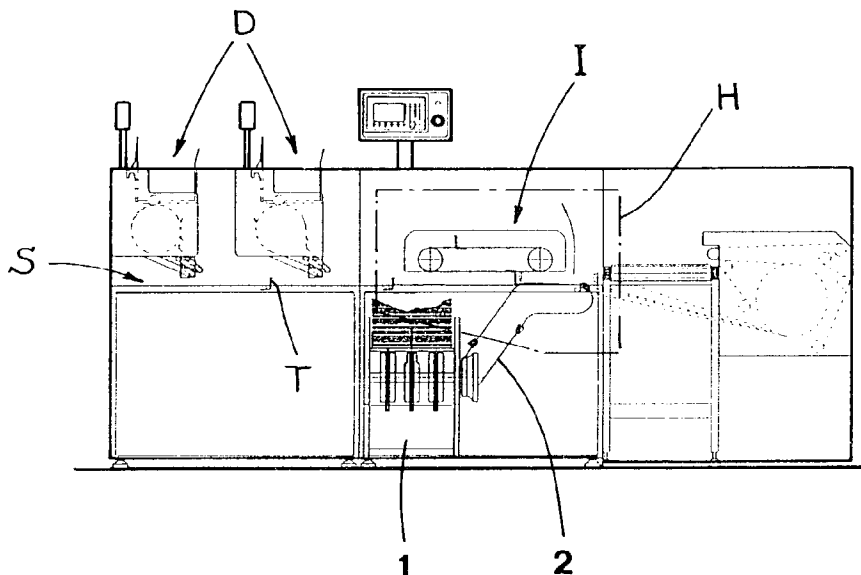
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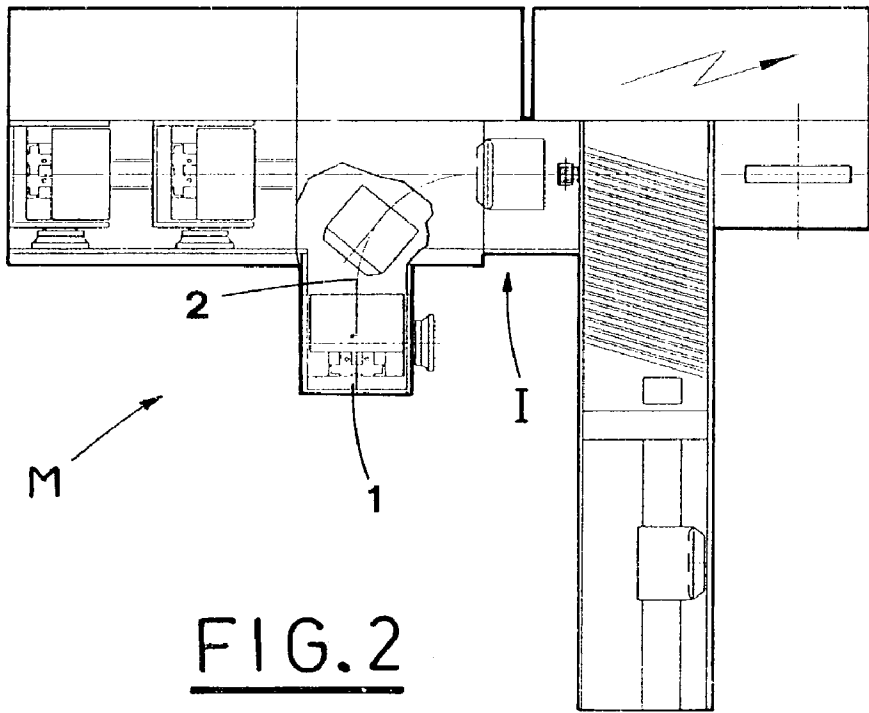
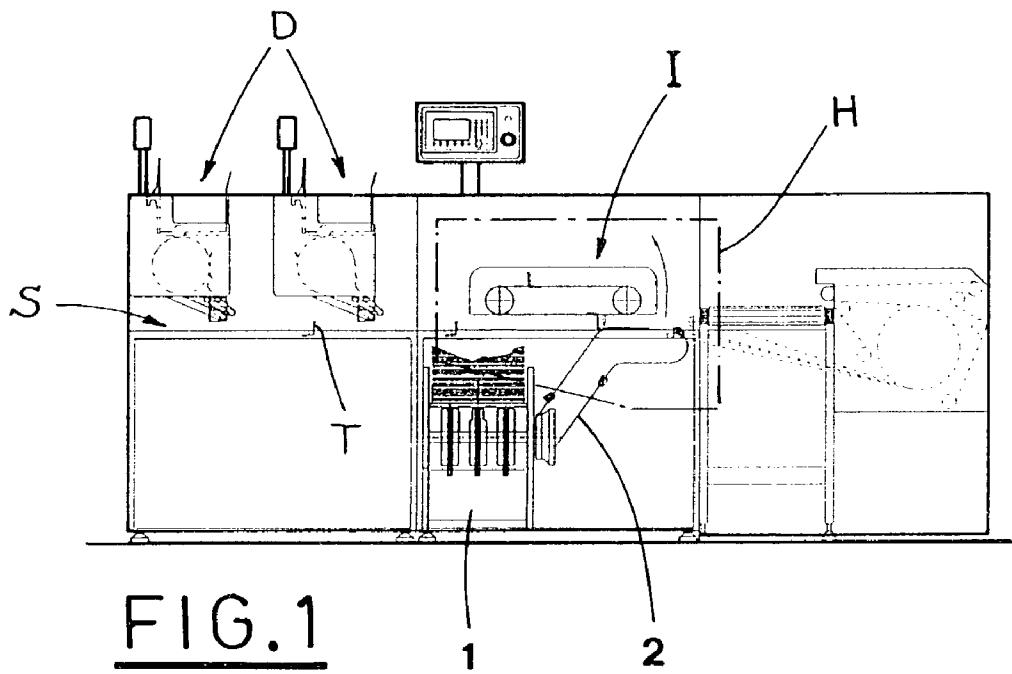
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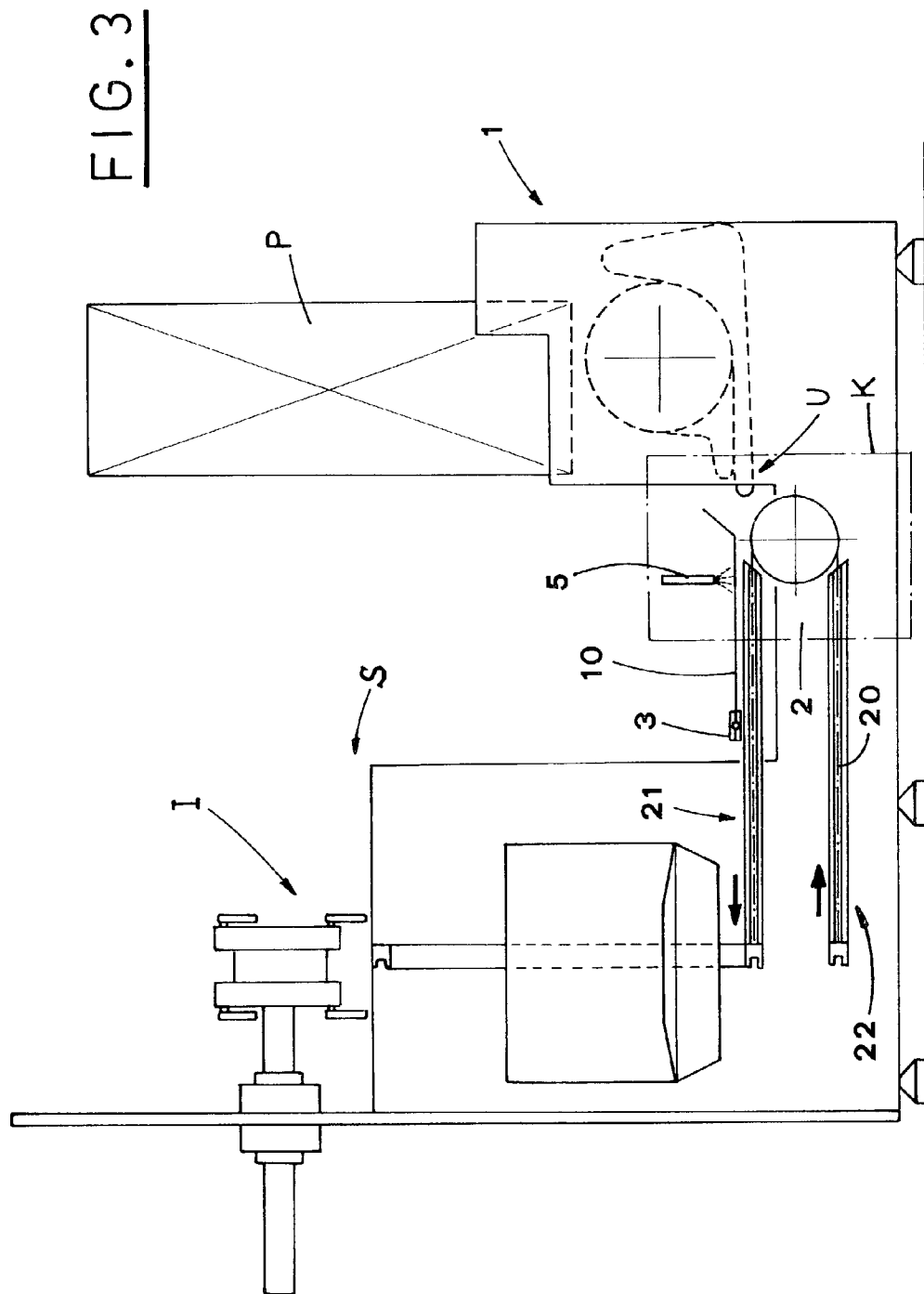
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(57) **ABSTRACT**

A machine for inserting sheets into envelopes, the machine includes sheets feeder means for delivering the sheets on an underlying sliding surface; lugging means disposed along said sliding surface and operated by a related endless conveying line to engage trailing edges of said sheets to move said sheets toward a sheet inserting station disposed along the sliding surface downstream of said conveying line, an envelope feeder enclosing a stack of envelopes, said envelopes feeder being situated beside said sliding surface and capable, of removing continuously single envelopes from the bottom of said stack and feeding each single envelope to the inlet of an additional conveying line, placing said single envelope arranged in such a way that the back wall of the envelope, to which the closing flap of the envelope is hinged, faces downwards, so that the opening for inserting the sheets faces upwards and backwards, with respect to the inlet of said additional conveying line, said additional conveying line extending between said envelope feeder and said sheet insertion station including gripping means, arranged stepwise and aimed at taking over each single envelope still arranged in the same way, and at transferring each single envelope to the sheet insertion station in suitable advance relation with respect to the arrival of the respective sheets,, while keeping the envelopes oriented in the same way, with the related back wall and closing flap turned downwards, so that the opening, through which the sheets are to be inserted, is turned upwards, crosswise to the sliding surface.







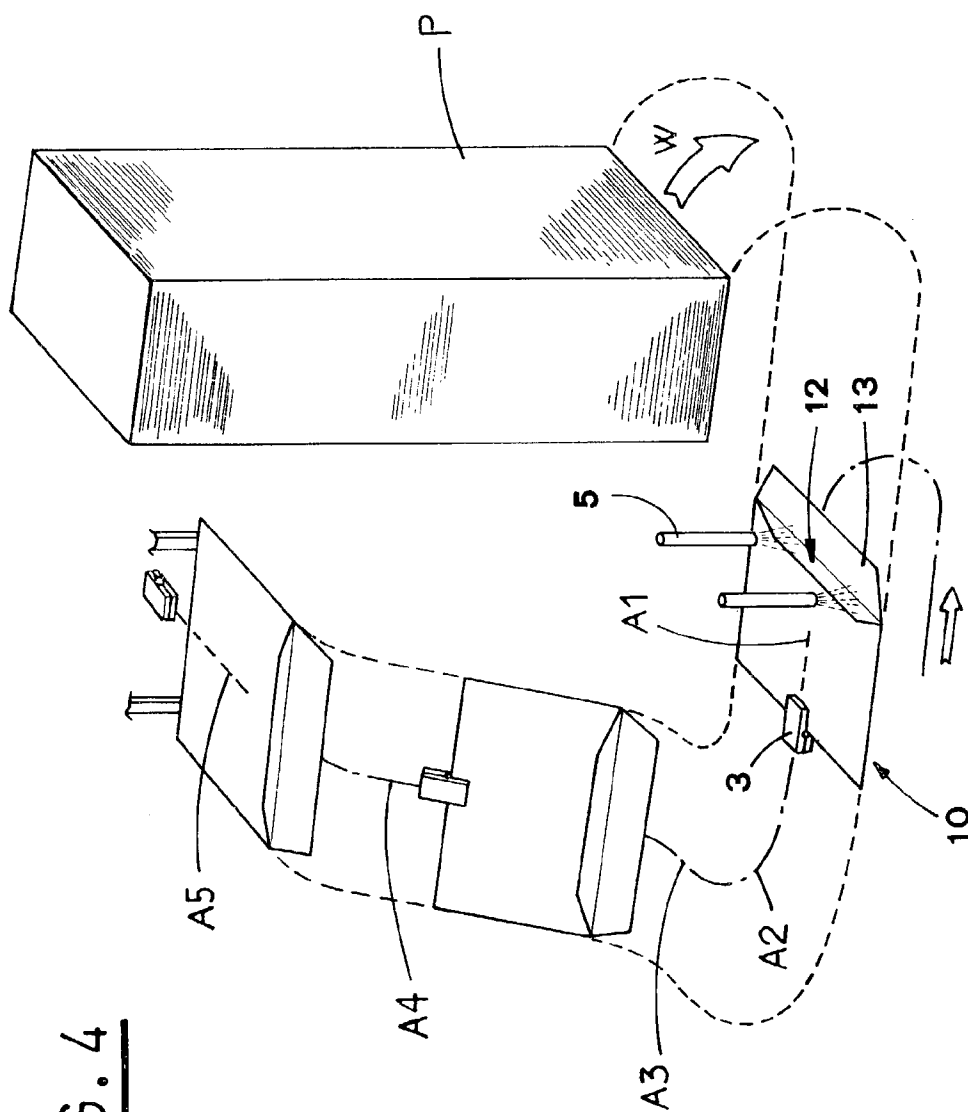
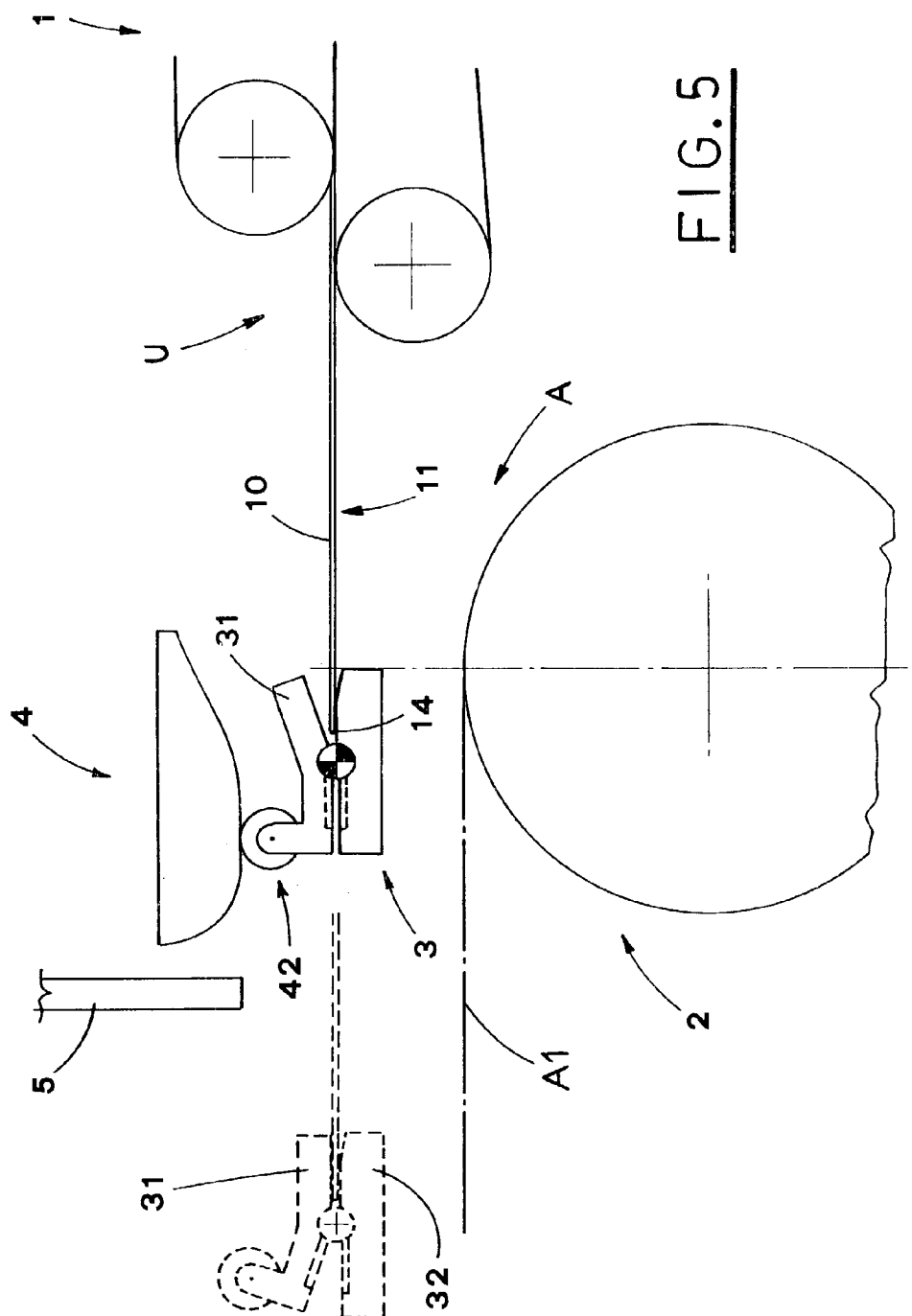


FIG. 4



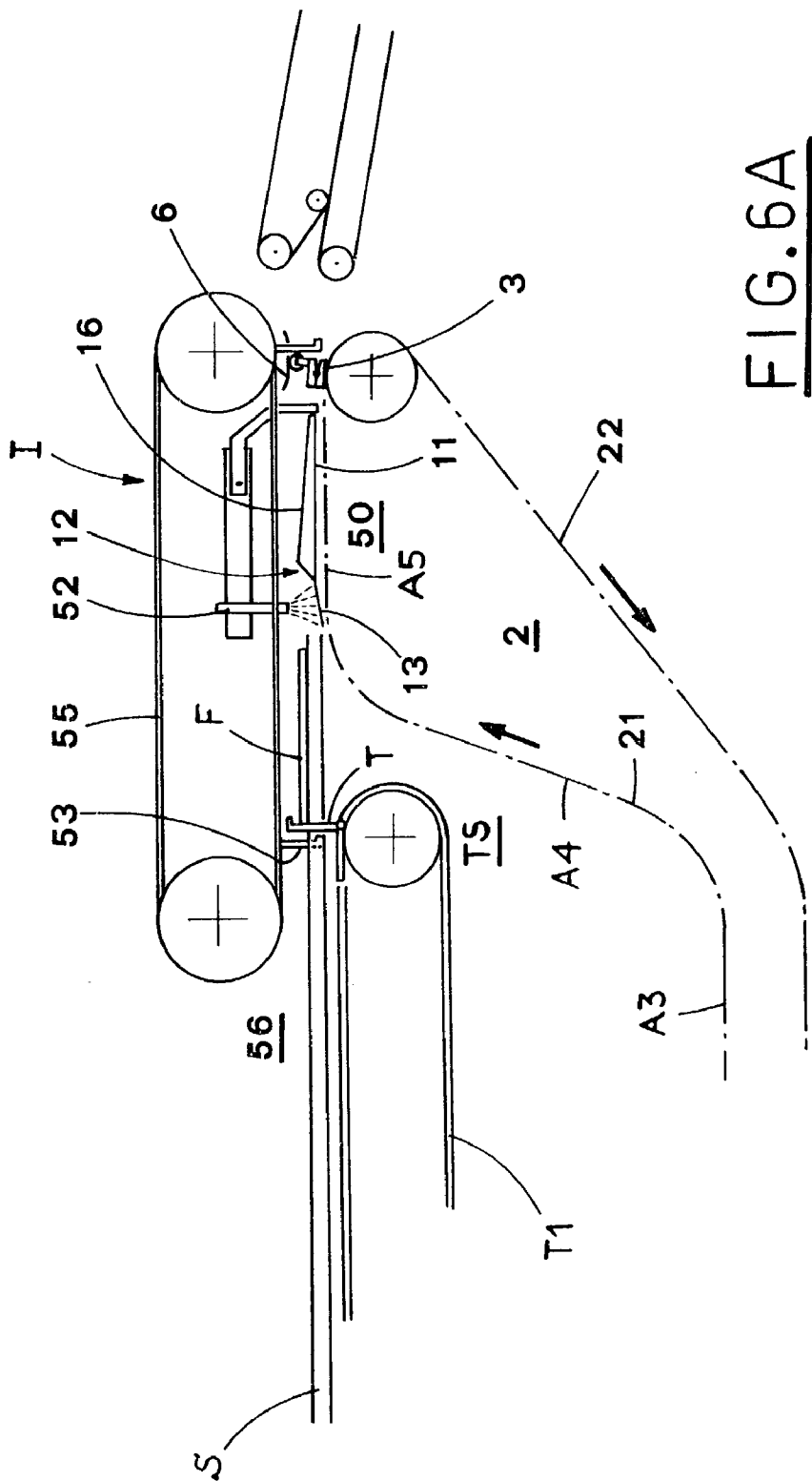


FIG. 6A

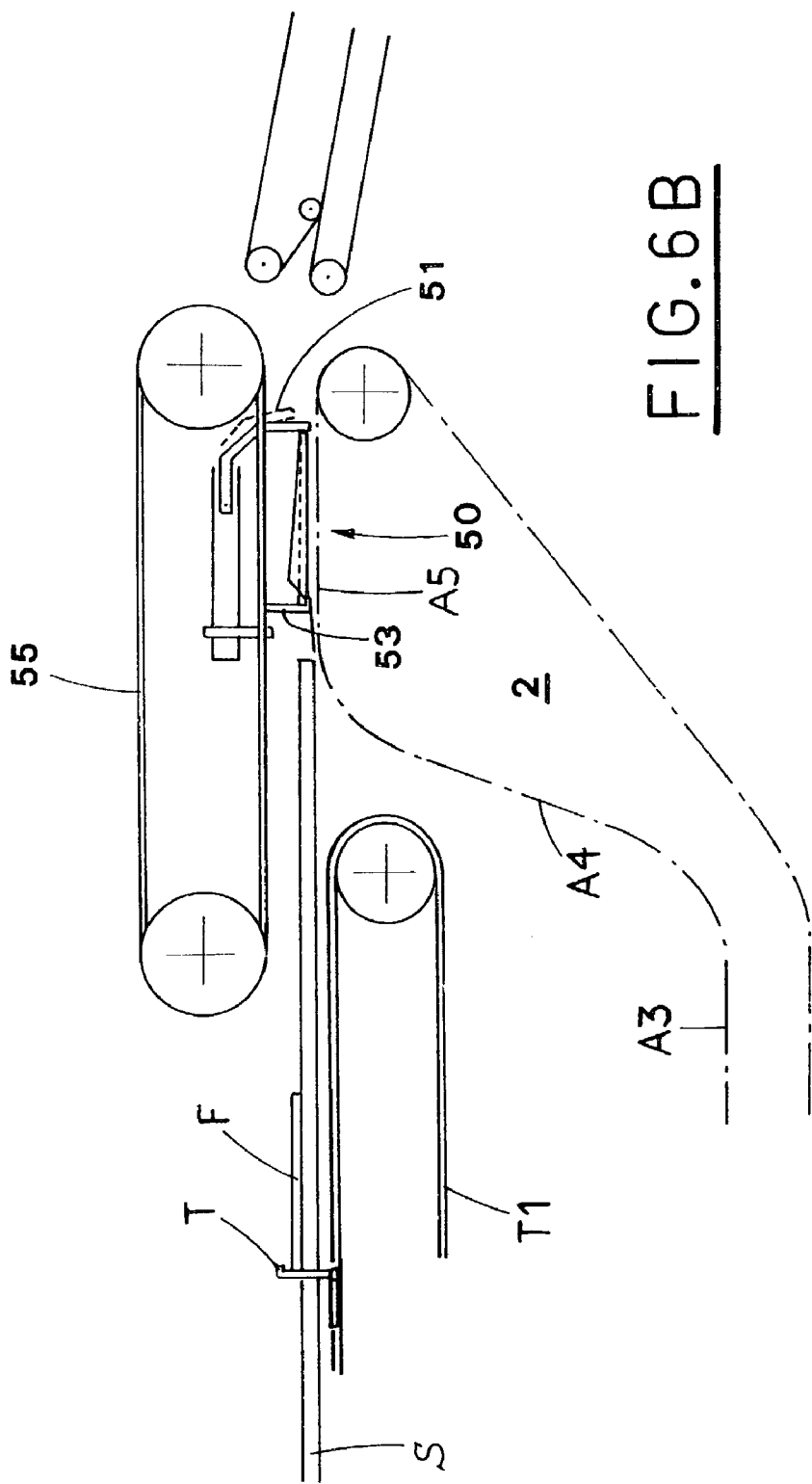


FIG. 6B

MACHINE FOR INSERTING GROUP OF SHEETS INTO ENVELOPES

BACKGROUND OF THE INVENTION

[0001] The present invention relates to automatic or semi-automatic machines for inserting stacked groups of sheets into envelopes.

[0002] In particular, the present invention relates to a machine for inserting sheets into envelope, which includes means for storing a stack of envelopes, means for sequentially removing the envelopes from the storing means, means for conveying the envelopes in a travel path, means for opening the envelopes, means for forming groups of stacked sheets, means for grouping and conveying the sheets to be inserted and means for inserting the groups of sheets into the envelopes.

[0003] Other means provides then for closing the envelopes and delivering them at the outlet of the machine.

DESCRIPTION OF THE PRIOR ART

[0004] Machine for inserting groups of sheets into envelopes are widely known.

[0005] In the known envelope filling machines, the possibility for the operator to see the opening of the envelope during operation of the machine, is very important.

[0006] Typically, the machines for inserting sheets into envelopes include a running plane, on which the sheets are dropped by sheet feeder devices, which are arranged above the running plane. Conveying means, disposed along the running plane, are operated, in step relation with the release of the sheets on the running plane, so as to transfer the group of stacked sheets to a sheet insertion station.

[0007] An envelope feeder is situated above the running plane close to the sheet insertion station, which feeds the envelopes to the running plane. Suitable opening means, such as air jet ejectors open the envelopes, in order to allow the insertion of the group of sheets moved by the conveying means.

[0008] Typically, the envelopes delivered by the envelope feeder to the running plane at the sheet insertion station have the back wall (address side), i.e. the wall to which the closing flap is hinged, turned upwards; consequently, the opening through which the sheets are inserted is turned downwards, thus, hidden by the closing flap.

[0009] Consequently, the operator cannot see envelopes with the sheets possibly introduced in a wrong way, even if the envelope filling machine is operated at low speed with respect to the usual operation at full rate.

[0010] Moreover, if the machine is stopped due to jamming during the introduction of the sheets into the envelopes, the operator must overturn the faulty envelope, reposition correctly the sheets, overturn again the envelope, and re-instate it into the forward travel path of the machine.

[0011] In the known enveloping machines, which have the envelope feeder situated above the running plane, continuous operation cannot last too long without stopping.

[0012] In fact, because the envelopes are thicker than the sheets to be inserted therein, the maximum number of

envelopes stacked inside the envelope feeder is lower than the sheets stacked in each sheet feeder. On the other hand, an higher stack of envelopes cannot be formed inside the envelope feeder because loading would be difficult for the operator, who should replenish the envelope feeder at too high level, above the running plane.

[0013] Therefore, the operator must replenish the envelope feeder more often than the sheet feeders.

SUMMARY OF THE INVENTION

[0014] The main object of the present invention is to propose a continuously operating machine for inserting sheets into envelopes, which inserts sheets into envelopes while allowing a direct sight of the insertion operation.

[0015] Another object of the present invention is to propose a machine for inserting sheets into envelopes, which is extremely reliable in relation to envelopes feeding operation, as well as in relation to the insertion of the sheets, and which can operate without feeder replenishment necessity for a longer time.

[0016] The above mentioned objects are obtained in accordance with the content of the claims, by a machine for inserting sheets into envelopes, the machine including:

[0017] a sliding surface along which the sheets are moved;

[0018] a sheet inserting station disposed along the sliding surface;

[0019] sheets feeder means for delivering the sheets onto the sliding surface;

[0020] lugging means disposed along said sliding surface and operated by a related endless conveying line to engage trailing edges of said sheets to move said sheets toward said sheet inserting station disposed downstream of said conveying line;

[0021] an envelope feeder enclosing a stack of envelopes, said envelope feeder being situated beside said sliding surface and capable of removing continuously single envelopes from the bottom of said stack and feeding each single envelope;

[0022] an additional conveying line for receiving single envelopes from said envelope feeder and arranging said single envelope in such a way that the back wall of the envelope, to which a closing flap is hinged, faces downwards, so that the envelope opening faces upwards and backwards, with respect to said additional conveying line, said additional conveying line extending between said envelope feeder and said sheet insertion station;

[0023] gripping means arranged along said additional conveying line for taking over each single envelope and transferring said single envelope to said sheet insertion station just before the respective sheets arrive, while keeping the envelopes oriented in the same way, with the related back wall and closing flap turned downwards, so that the envelope opening is turned upwards, crosswise to the sliding surface as well as turned towards the terminal section of said endless conveying line of the lugging means.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The characteristic features of the present invention will be pointed out in the following description of a preferred embodiment of an envelope filling machine, illustrated as an example with reference to the enclosed drawings, in which:

[0025] **FIG. 1** is a front schematic view of the whole envelope filling machine;

[0026] **FIG. 2** is a top schematic view of the envelope filling machine of **FIG. 1**;

[0027] **FIG. 3** is a lateral schematic view of a part of the machine;

[0028] **FIG. 4** shows, by means of a perspective schematic view, some working steps of the machine section shown in **FIG. 3**;

[0029] **FIG. 5** is an enlarged view of a particular indicated with K in **FIG. 3**;

[0030] **FIGS. 6a** and **6b** are enlarged views of a particular indicated with H in **FIG. 1**, as it appears in separate and subsequent steps of the envelope filling operation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] With reference to the enclosed drawings the reference sign M indicates the whole machine for inserting sheets into envelopes, proposed by the present invention.

[0032] The envelope filling machine M, operated continuously, includes (as shown for instance in **FIG. 1**) sheet feeder means D, which place the sheets F on a running plane S situated below. Driving means T are disposed and operated along the running plane S by a relative conveying line T1 situated therebelow and engage the trailing edge of the group of stacked sheets, in order to convey them to an sheet insertion station I, situated along the running plane S downstream of the conveying line T1.

[0033] A first characteristic of the proposed envelope filling machine M lies in the fact that, the envelope feeder 1, containing a stack of envelopes, is situated beside the running plane S.

[0034] In particular, the outlet section U of the envelope feeder 1 is situated at a level lower with respect to the running plane S and to the sheet insertion station I.

[0035] This allows the operator to work in wider operation space, so that he can introduce into the envelope feeder a stack of envelopes, which is higher than the stack of envelopes which he could introduce if the envelope feeder were situated above the running plane.

[0036] Consequently, the envelope filling machine proposed by the present invention can undoubtedly operate without necessity of replenishment of the envelope feeder for a time longer than the machines of prior art.

[0037] The envelope feeder 1 is aimed at removing continuously single envelopes from the base of the stack P and at feeding them to the inlet A of an additional conveying line 2, arranging the single envelopes 10 in such a way that their back wall 11 (address side), that is the wall to which the closing flap 13 is hinged, is turned downward. In this

condition, the envelope opening 12, for insertion of the sheets F, is turned upward and backward with respect to the inlet A of the additional conveying line 2 (**FIGS. 4 and 5**).

[0038] In particular, the envelope feeder 1 includes removing means (not shown and described in detail since they are of known type), which are aimed at removing continuously single envelopes from the base of the envelopes stack, and at turning them by 180° (arrow W in **FIG. 4**), in order to carry them toward the inlet station A of the additional conveying line 2 in the above described configuration.

[0039] The additional conveying line 2 extends between the envelope feeder 1 and the above mentioned sheet insertion station I and is equipped with gripping means 3, arranged spaced out according to a selected step and aimed at taking over single envelopes 10 and at transferring them, maintained in the above mentioned configuration and suitably earlier with respect to the arrival of respective sheets F, to the sheet insertion station I.

[0040] In particular, the additional conveying line 2 transfers the envelopes, placing them in the sheet insertion station I downstream of the running plane. The envelopes are released with their back wall (address side) 11 and their closing flap 13 turned downward, so that the opening 12 for inserting the sheets F is turned upwards and toward the terminal part TS of the conveying line T1 of the conveying means T, crosswise to the running plane S (**FIGS. 6a and 6b**).

[0041] For this purpose, the additional conveying line 2 can for instance include a first horizontal straight section A1 (**FIGS. 4 and 5**), which extends from the outlet portion U of the envelope feeder 1 toward the running plane S, below the latter, a second curved section A2, which arranges the envelopes, for instance by 90° rotation, substantially in alignment relation with the running plane S, a third horizontal straight section A3 (**FIG. 4 and FIGS. 6a and 6b**), which is parallel and situated below the running plane S, a fourth ascending section A4, downstream of the terminal part TS, and a final horizontal straight section A5, following the running plane S and adjoining the sheet insertion station I.

[0042] The additional conveying line 2, as shown for example in the enclosed figures, includes endless conveying means 20 (e.g. a chain), to which the above mentioned gripping means 3 are connected, with a working forward run 21 for transferring the envelopes and defining, one after another, the above described first A1, second A2, third A3, fourth A4 and fifth AS sections, and a return run 22, which completes the endless loop.

[0043] Thus, the additional conveying line 2 transfers and places the envelopes, previously removed from the envelope feeder, along the running plane S and in the sheet insertion station I in such a configuration that the opening of the envelopes are turned upwards. This allows advantageously an operator to verify the correct envelop filling operations, and to perform a direct visual check on the inlet section.

[0044] Each of the gripping means 3 of the additional conveying line 2 include a pair of gripping arms 31, 32, pivoted to each other and arranged normally in clamped configuration.

[0045] Suitable first wide apart means 4, situated near the inlet section A of the additional conveying line 2, are aimed

at engaging temporarily a first arm **31** of the gripping arms **31, 32** which is moving along the area of the section A, in order to open the first arm with respect to the second arm **32**.

[0046] This apart action allows introduction of the bottom edge **14**, opposite to the edge with the closing flap **13**, of an envelope **10** released by the outlet section U of the envelope feeder **1** between the arms **31, 32**. Then the edge remains gripped between the arms due to releasing of the first arm **31** by the first wide apart means **4**.

[0047] The first wide apart means **4** include for instance (as shown in detail in FIG. 5) stationary cam means **41**, suitably shaped and aimed at temporarily engaging a corresponding striking means **42**, connected to the first arm **31** of the gripping means **3**. Striking of the striking means **42** on the cam means **41** determines the temporary opening of the first arm **31** with respect to the second arm **32**.

[0048] The striking means **42** include, for instance (as shown in the same FIG. 5), an idle roller connected to the first arm **31** of each of the gripping means **3**.

[0049] First means **5** for opening the closing flap **13** of the envelopes **10**, are situated along the additional conveying line **2**, following the first wide apart means **4**, and are aimed at opening the flap **13** in suitable step relation with the passage of the single envelopes **10** dragged by the gripping means **3**.

[0050] The first opening means **5** include vertical nozzles, which are aimed at directing flows of air toward the envelopes passing below, so that one component of the flow of air acts on the flap **13** of the envelopes **10** in order to open it and consequently to widen the opening **12**.

[0051] The above mentioned sheet insertion station I includes (as shown in detail in FIGS. 6a and 6b): a filling place **50**, situated along the running plane S downstream of the terminal section TS of the conveying line T1 of the conveying means T.

[0052] The filling place receives single envelopes **10** to be filled from the additional conveying line **2** and means **51** retain the single envelopes **10** stopped dwelling in the above mentioned filling place **50** while inserting the sheets F.

[0053] Second means **52** open the closing flap **13** and keep the latter in open configuration. The second means also part the back wall **11** of the single envelopes **10** away from the front wall **16**, in order to increase the opening section during dwelling.

[0054] Transferring and inserting means **53**, situated and acting above the filling place **50**, take over the sheets F, in step relation with the release of the sheets F by the conveying means T in the region corresponding to the terminal section of the relative conveying line T1, by acting on the respective trailing edges.

[0055] Then, the transferring and inserting means **53** transfer the sheets F to said filling place **50** and insert the sheets F into the single dwelling envelopes **10**, up to a predetermined point, in which the trailing edges of the sheets F is located beyond the hinge line of the flap of the envelopes **10**.

[0056] The transferring and inserting means **53** are also aimed at transferring the envelopes **10**, after the sheets have been completely inserted therein, from the filling place **50**

toward subsequent working stations, in order to free the filling place **50** for further single envelopes to be filled.

[0057] The transferring and inserting means **53** are operated by an endless conveying device **55**, suitably situated above the running plane S, whose upstream section **56** is situated in the region corresponding to the terminal section TS of the conveying line T1 of the conveying means T.

[0058] Consequently, the transferring and inserting means **53** take over, in suitable step relation with the release of the sheets by the conveying means T, the sheets in order to transfer them to the filling place **50**, to introduce them into the envelopes dwelling therein and then, to transfer the envelopes together with the relative sheets toward subsequent working stations (not shown).

[0059] The above mentioned second opening means **52** include vertical nozzles, which direct flows of air toward the envelopes dwelling below, so that one component of the flow acts on the closing flap **13** in order to widen the single envelopes opening **12** and facilitate the insertion of the sheets F.

[0060] The retaining means **51** can include (as shown in the proposed Figures) arms kept in vertical configuration by relative contrast means, for instance counterweight, (not shown), to keep the envelopes **10** dwelling in the filling place **50** during the insertion of the sheets F; the arms are aimed at being partially raised, in order to free the single envelopes **10** due to the continuative pulling action of the transferring and inserting means **53**, so as to transfer the single envelopes **10** with the sheets F inserted therein toward subsequent working stations.

[0061] Second wide apart means **6** for opening the gripping arms **31, 32** of the additional conveying line **2** while passing by the filling place **50**, are situated in the sheet insertion station I in order to release the envelopes when it is positioned in the filling place **50**.

[0062] The second wide apart means **6** include stationary cam means, suitably shaped, aimed at temporarily engaging the idle rollers, connected to the first arm **31** of the gripping means **3**.

[0063] The run of the rollers on the cam means determines a temporary opening of the first arm **31** with respect to the second arm **32** and the release of the envelopes **10**.

[0064] It is obvious from the above description that the proposed machine for inserting sheets into envelopes, with simple and rapid manipulation operations, can direct and arrange the envelopes to be filled with sheets in such a way that the opening is turned upward, directly seen by the operator checking the machine correct operation.

[0065] Moreover, the proposed machine can work without replenishment for a time longer than the machines of the prior art, due to the advantageous positioning of the envelope feeder beside the sheets running plane, and the relative outlet section at a lower level with respect to the running plane.

[0066] This allows the operator a wider operation area range, because stack of envelopes to be filled can be arranged, which are considerably higher with respect to those of the prior art, where the envelope feeder is situated above the running plane.

[0067] The above mentioned advantages are obtained by a technique, which is extremely functional and reliable in any working step.

[0068] It is understood that what above, has been described as a pure, not limitative example, therefore, possible variants of the invention remain within the protective scope of the present technical solution, as described above and claimed hereinafter.

What is claimed is:

1. Machine for inserting sheets into envelopes, the machine including:

a sliding surface along which the sheets are moved;

a sheet inserting station disposed along the sliding surface;

sheets feeder means for delivering the sheets onto the sliding surface;

lugging means disposed along said sliding surface and operated by a related endless conveying line to engage trailing edges of said sheets to move said sheets toward said sheet inserting station disposed downstream of said conveying line;

an envelope feeder enclosing a stack of envelopes, said envelope feeder being situated beside said sliding surface and capable of removing continuously single envelopes from the bottom of said stack and feeding each single envelope;

an additional conveying line for receiving single envelopes from said envelope feeder and arranging said single envelope in such a way that the back wall of the envelope, to which a closing flap is hinged, faces downwards, so that the envelope opening faces upwards and backwards, with respect to said additional conveying line, said additional conveying line extending between said envelope feeder and said sheet insertion station;

gripping means arranged along said additional conveying line for taking over each single envelope and transferring said single envelope to said sheet insertion station just before the respective sheets arrive, while keeping the envelopes oriented in the same way, with the related back wall and closing flap turned downwards, so that the envelope opening is turned upwards, crosswise to the sliding surface as well as turned towards the terminal section of said endless conveying line of the lugging means.

2. A machine for inserting sheets into envelopes as in claim 1, wherein the outlet section of said envelope feeder is situated at a lower level with respect to said sliding surface and said sheet insertion station.

3. A machine for inserting sheets into envelopes as in claim 1, wherein said additional conveying line includes endless conveying means with an active forward run, operating to transfer the envelopes and including an upward extending section, and a non-active return run including a respective downward extending section, with said gripping means associated to said endless conveying means

4. A machine for inserting sheets into envelopes as in claim 3, wherein said gripping means include a series of a pairs of gripping arms pivoted to each other and normally set to a clamped configuration.

5. A machine for inserting sheets into envelopes according to claim 4, further including first wide apart means associated to said additional conveying line close to the inlet section thereof, said wide apart means being capable of temporarily engaging with a first arm of said gripping arms while moving along said section to open wide apart said first arm with respect to the second arm, so that the bottom edge of a corresponding envelope delivered by said envelope feeder can be introduced between said gripping arms and thus gripped therebetween, said bottom edge being opposite to the edge provided with a closing flap.

6. A machine for inserting sheets into envelopes according to claim 5, wherein said first wide apart means include stationary cam means which temporarily engage with striking means connected to said first arm of said gripping means, the engagement of said striking means with the cam means thus causing said first arm to temporarily part away from said second arm.

7. A machine for inserting sheets into envelopes according to claim 6, wherein said striking means include a roller rotatably connected to said first arm of each one of said gripping means.

8. A machine for inserting sheets into envelopes according to claim 5, further including includes first opening means acting on the closing flap of each envelope, said first opening means being disposed along said additional conveying line right after said first wide apart means and above said additional conveying line designed to open said closing flap when a single envelope occurs to pass thereunder, dragged by said gripping means.

9. A machine for inserting sheets into envelopes according to claim 8, wherein said first opening means include vertical nozzles fed with air flows directed to act on said envelopes while they pass thereunder, so as to make the related closing flap to open.

10. A machine for inserting sheets into envelopes according to 2, wherein said sheet insertion station includes:

a filling place, situated along the running plane downstream of the terminal section of the conveying line of the conveying means and aimed at receiving the single envelopes to be filled from the additional conveying line;

means for retaining stopped the single dwelling envelopes in the above mentioned filling place while inserting the sheets;

second means for opening the closing flap, aimed at keeping the latter in open configuration and at part the back wall of the single envelopes and the front wall away from each other, in order to increase the opening section during dwelling; transferring and inserting means, situated and acting above the filling place, aimed at taking over the sheets, in step relation with the release of the sheets by the conveying means in the region corresponding to the terminal section of the relative conveying line, by acting on the respective trailing edges, and at transferring the latter to said filling place and at inserting the sheets into the single dwelling envelopes, up to a predetermined point, in which the trailing edges of the sheets is located beyond the hinge line of the envelopes;

said transferring and inserting means being also aimed at transferring the envelopes, after the sheets had been

completely inserted therein, from the filling place toward subsequent working stations, in order to free the filling place for further single envelopes to be filled.

11. A machine for inserting sheets into envelopes according to claim 10, wherein the transferring and inserting means are operated by an endless conveying device, suitably situated above the running plane, whose upstream section is situated in the region corresponding to the terminal section of the conveying line of the conveying means.

12. A machine for inserting sheets into envelopes according to claim 10, wherein above mentioned second opening means include vertical nozzles, fed with flows of air so as to act on the envelopes dwelling therebelow, so that the closing flap is made to open and the opening is widened to facilitate the insertion of the sheets.

13. A machine for inserting sheets into envelopes according to claim 10, wherein the above mentioned retaining means include arms kept in vertical configuration by relative counterweight contrast means, so as to keep the envelopes dwelling in the filling place during the insertion of the sheets; the arms being aimed at being partially raised, in

order to free the single envelopes due to the continuative pulling action of the transferring and inserting means which makes them overcome the action of the contrast means, so as to transfer the single envelopes with the sheets inserted therein toward subsequent working stations.

14. A machine for inserting sheets into envelopes according to claim 10, further including second wide apart means situated in the sheet insertion station I and acting on a first arm of said gripping arms of the additional conveying line while passing by the filling place, in order to open them and release the envelopes dwelling against the retaining means.

15. A machine for inserting sheets into envelopes according to claim 14, wherein said second wide apart means include stationary cam means, aimed being temporarily engaged by idle rollers, connected to the first arm of the gripping means, the run of the rollers on the cam means determines the temporary opening of the first arm with respect to the second arm and the release of the envelopes.

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