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Wahle

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[54] **METHOD AND APPARATUS FOR FEEDING CIGARETTES OR ANALOGOUS ARTICLES TO PACKING MACHINES OR THE LIKE**

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[21] Appl. No.: **926,040**

[22] Filed: **Jul. 19, 1978**

Related U.S. Patent Documents

Reissue of:

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Issued: **Dec. 17, 1974**
Appl. No.: **245,409**
Filed: **Apr. 19, 1972**

U.S. Applications:

[63] Continuation of Ser. No. 748,927, Dec. 9, 1976.

[30] **Foreign Application Priority Data**

Apr. 21, 1971 [DE] Fed. Rep. of Germany 2119311

[51] **Int. Cl.**[4] **B65G 65/04**; B65B 69/00

[52] **U.S. Cl.** **414/416**; 198/425; 198/347; 414/786

[58] **Field of Search** ..... 214/301, 152, 302, 307, 214/17 CA; 198/425, 437, 626, 560, 523, 422, 347; 414/416, 786

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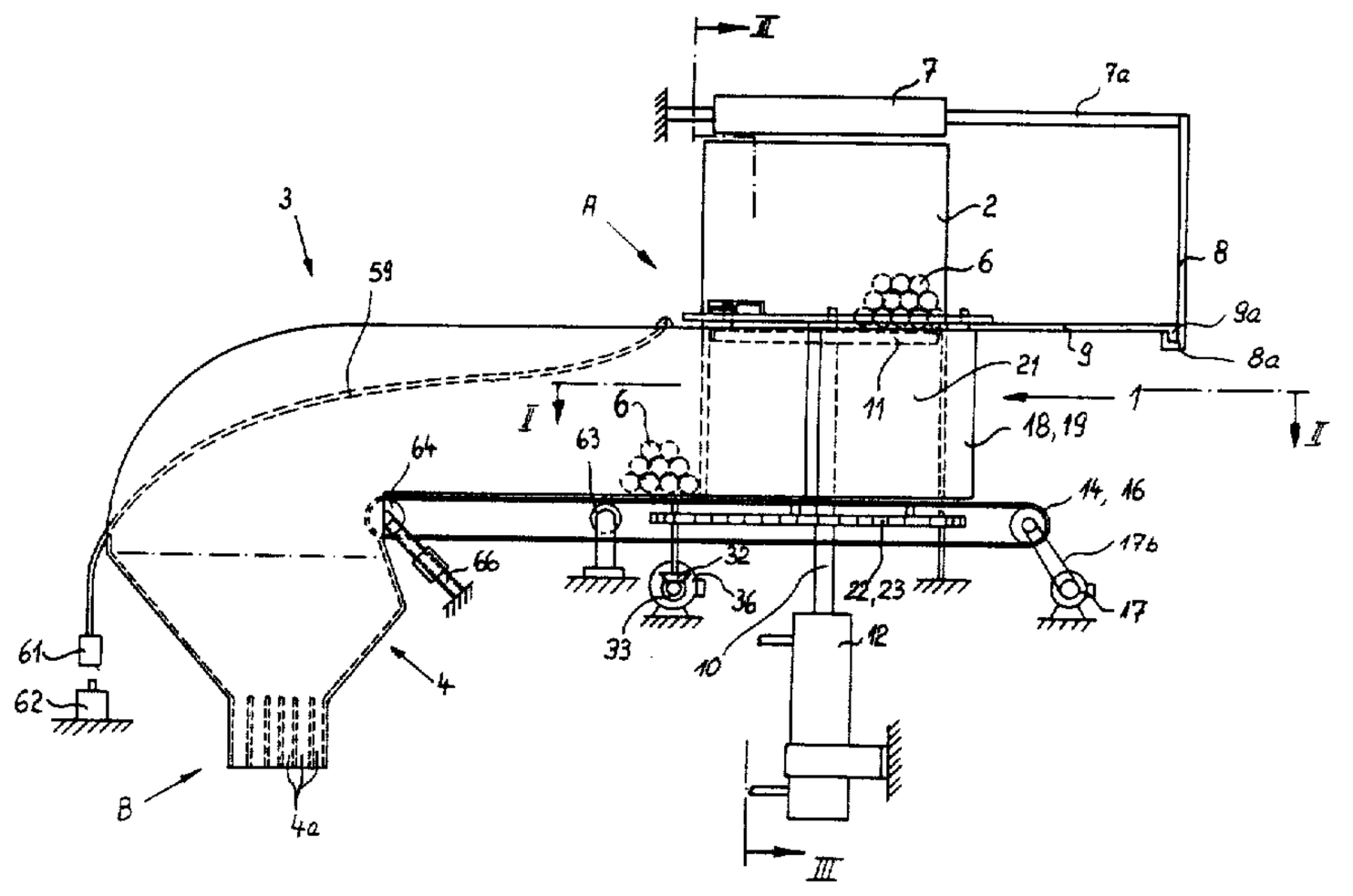
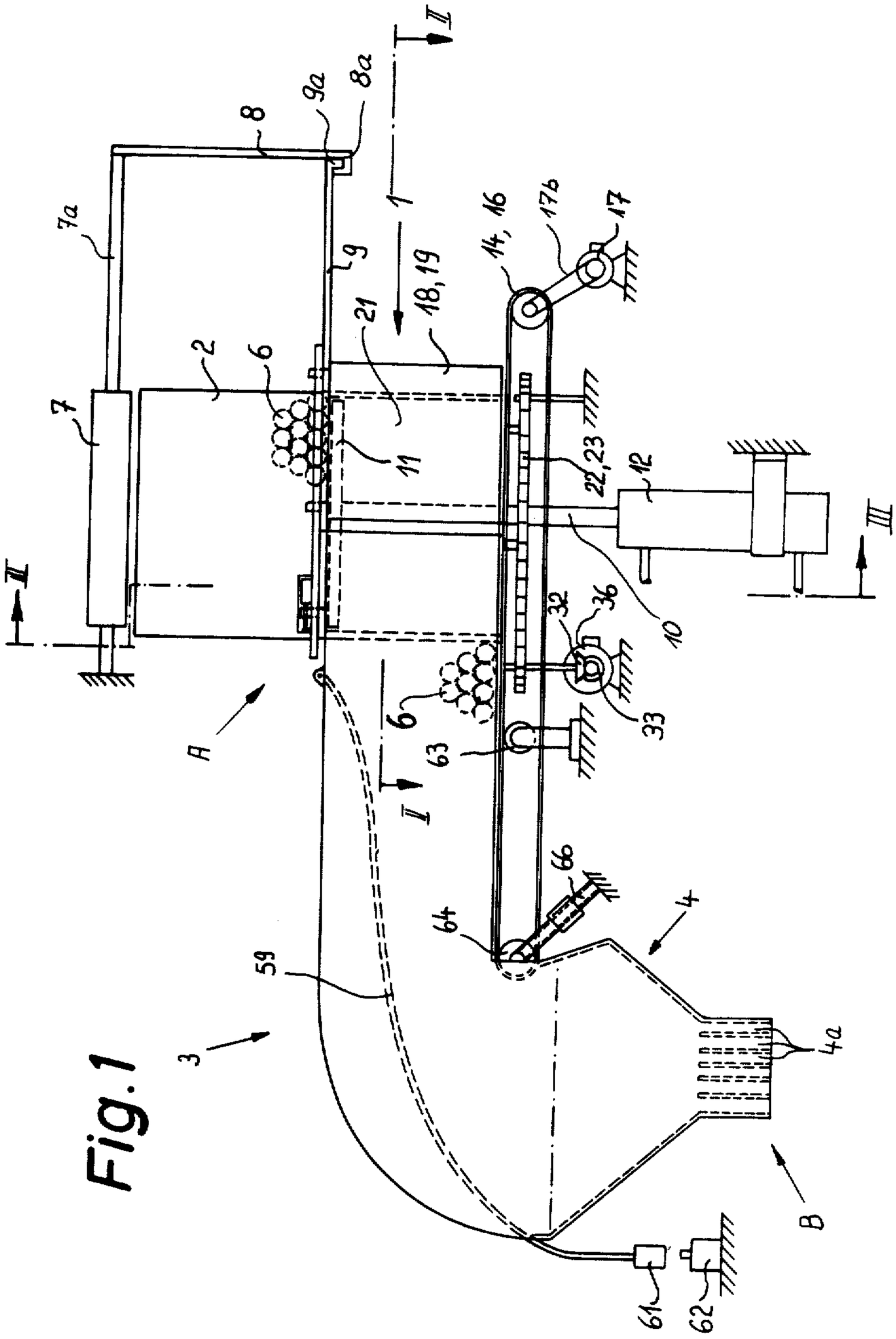
[57] **ABSTRACT**

Trays containing stacks of cigarettes are moved to an evacuating station above a vertically movable platform which descends as soon as the movable bottom of a filled tray is moved to its open position. The platform then lowers a stack of cigarettes from the interior of a filled tray onto the upper stretches of two intermittently driven endless belts in a magazine. The latter serves for temporary storage of such stacks prior to transport of cigarettes into a reservoir which feeds cigarettes into the hopper of a packing machine. The supply of cigarettes in the reservoir is monitored [,] and, when the supply is depleted to a certain minimum permissible value, a switch produces a signal which starts a motor for the belts so as to transfer a stack from the magazine into the reservoir. The stacks are confined during movement into and from the magazine so that the mutual positions of cigarettes in such stacks remain at least substantially unchanged during transport from a filled tray at the evacuating station and all the way into the reservoir.

27 Claims, 4 Drawing Figures

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9a
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17b
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18, 19
21
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11
22, 23
12
III
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32
36
33
63
A
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64
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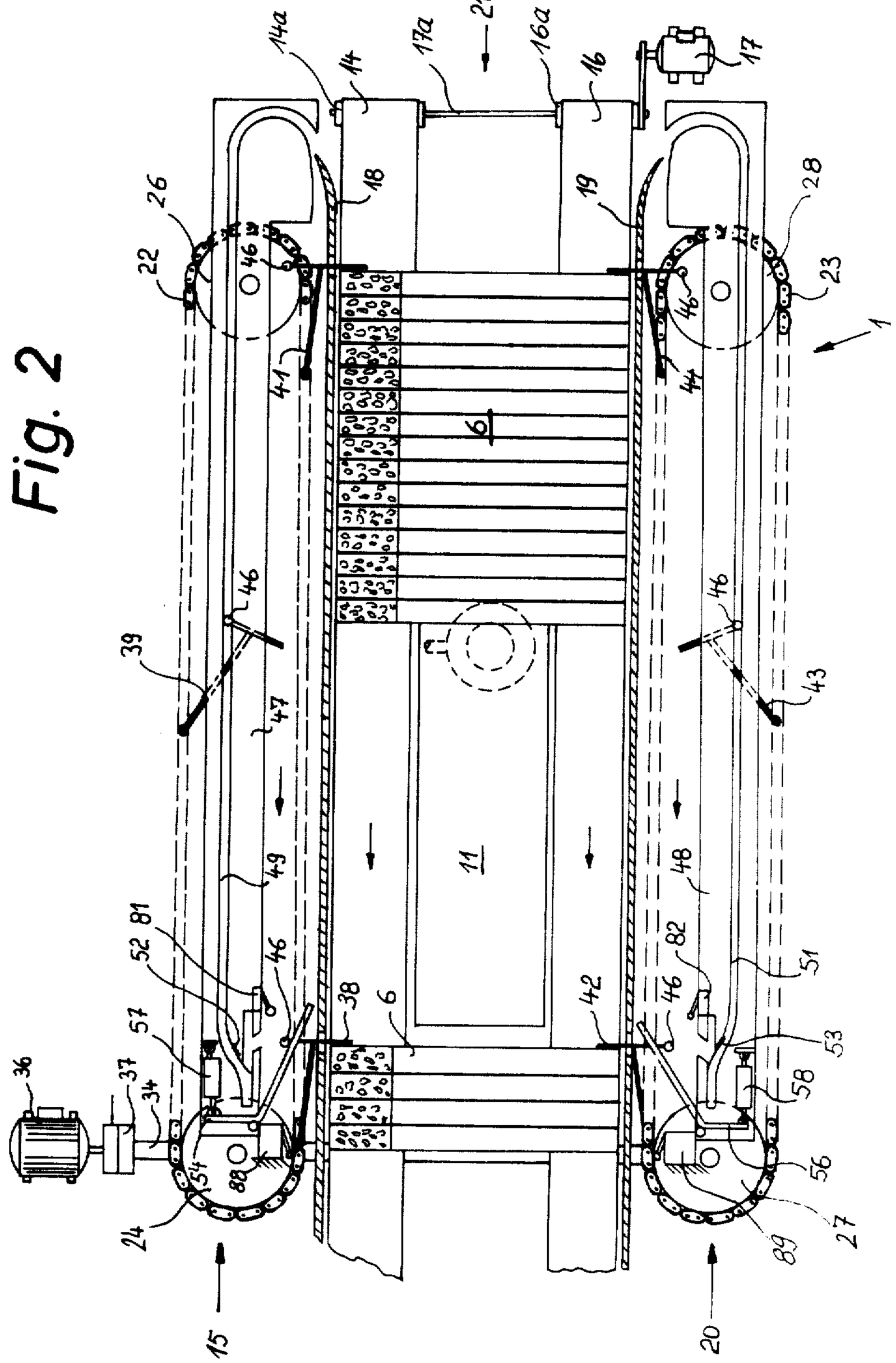
59
3
4a
B
61
62

Fig. 1

Fig. 2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14
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1
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47
43
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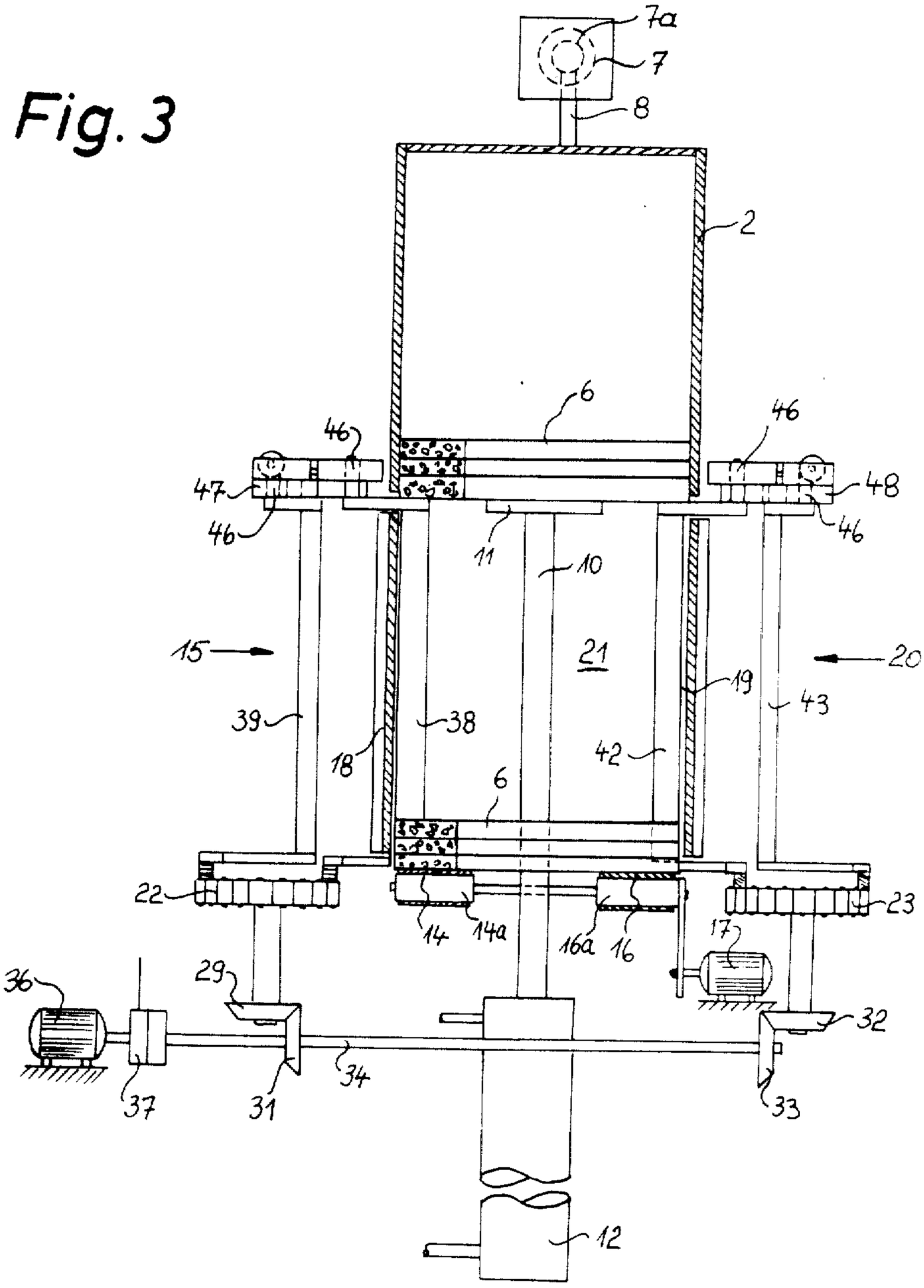
Fig. 3


7a
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16a
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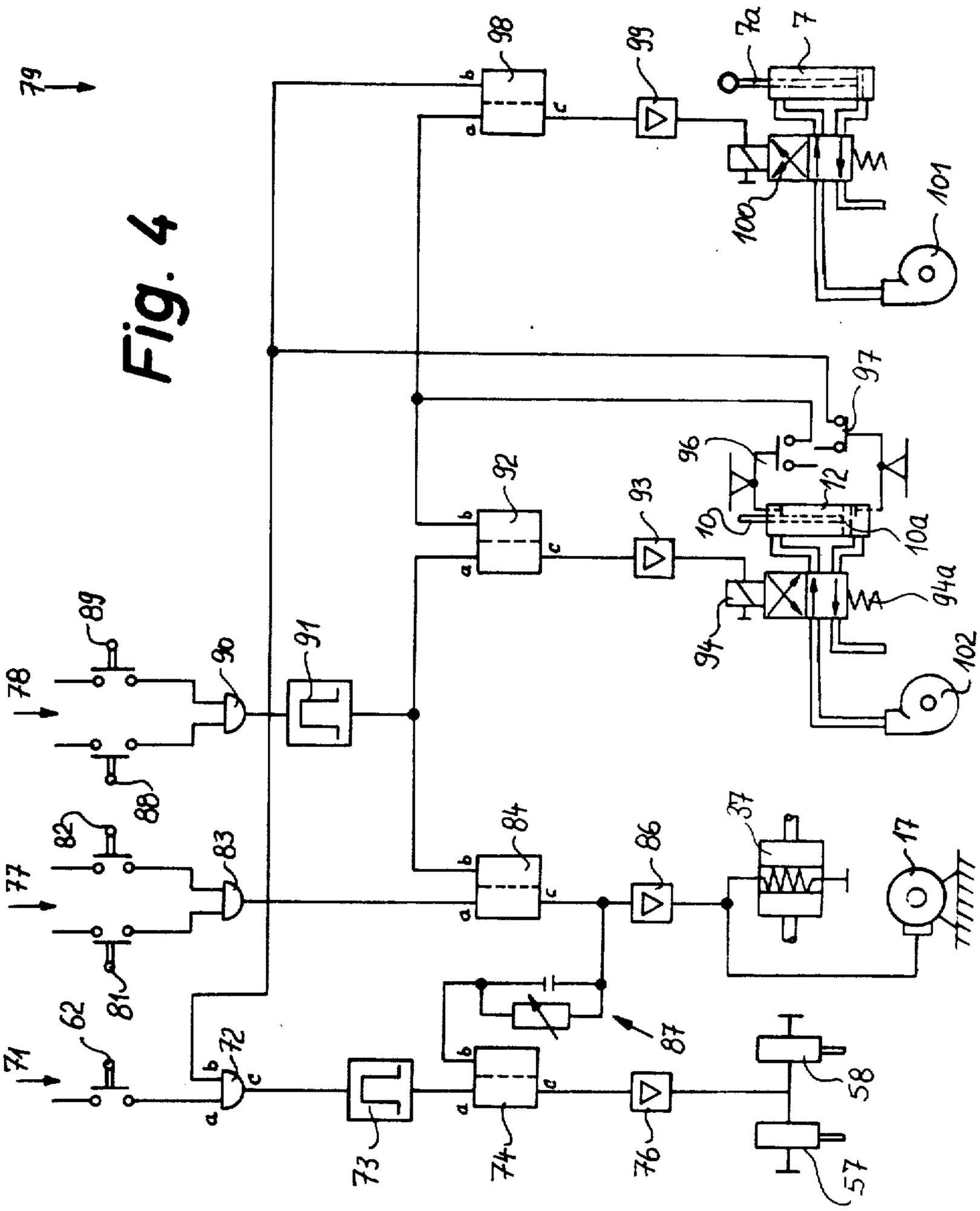
Fig. 4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92
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METHOD AND APPARATUS FOR FEEDING CIGARETTES OR ANALOGOUS ARTICLES TO PACKING MACHINES OR THE LIKE

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

Reference to Related Applications

This is a continuation of Ser. No. 748,927 filed Dec. 9, 1976, which is reissue of U.S. Pat. No. 3,854,611.

BACKGROUND OF THE INVENTION

The present invention relates to a method and apparatus for manipulating rod-shaped smokers' products including plain or filter-tipped cigars, cigarillos or cigarettes as well as sections of simple or composite filter rods. More particularly, the invention relates to a method and apparatus for manipulating rod-shaped articles which are temporarily stacked and confined in polygonal receptacles of the type known as chargers or trays and must be fed to a consuming station, for example, to a station accommodating one or more packing machines, one or more machines for pneumatically transporting cigarettes, filter stubs or the like to one or more filter tipping or packing machines and/or other types of consuming machines.

It is well known to introduce the output of one or more producing machines, such as machines for the making of plain or filter cigarettes or machines for the making of simple or multiplex filter rod sections, into receptacles known as trays or chargers and to transport the receptacles to one or more consuming machines. If the articles are plain or filter tipped cigarettes or the like, the receptacles will normally transport such articles to one or more packing machines. If the articles are sections of filter rods, they are normally transported to one or more machines for the making of filter tipped smokers' products.

Receptacles in the form of chargers or trays for stacks of confined rod-shaped articles are often utilized for transport of plain or filter cigarettes from one or more producing machines to one or more packing machines. A packing machine for cigarettes is normally provided with a hopper or a similar container for storage of a certain number of cigarettes which are withdrawn in the form of groups or blocks (e.g., blocks of twenty cigarettes each in the customary array including two outer layers of seven cigarettes each and a median layer of six cigarettes which are staggered with respect to the cigarettes of the outer layers). Furthermore, it is customary to provide for each packing machine a reservoir which supplies cigarettes to the hopper and serves to accommodate a major or main supply of cigarettes so as to insure that the packing machine need not be arrested in response to each (even short-lasting) stoppage of the associated producing machine or machines. In many instances, the transport of cigarettes from one or more producing machines to the reservoir for a packing machine is effected by a conveyor system which circulates filled and empty receptacles. Reference may be had to German printed publication No. 1,904,495 which describes an automatic transporting system for receptacles in the form of chargers or trays. A filled tray is delivered to an evacuating station and its reciprocable bottom wall is thereupon moved to an open position. A

plunger or pusher applies by gravity a requisite pressure to the top layer of cigarettes in the tray so as to expel the stack of cigarettes from the interior of the tray into an intermediate magazine. The main purpose of the plunger is to equalize the top layer of cigarettes during evacuation from the tray. The thus emptied tray is then replaced with a filled tray and the same procedure is repeated. Conveyor belts are employed to transfer cigarettes from the intermediate magazine into the reservoir for the packing machine. The transfer of fresh stacks of cigarettes from filled trays into the intermediate magazine takes place at spaced intervals so that the lowermost layer of cigarettes in a filled tray which occupies the evacuating station is often located well above the top layer of cigarettes in the intermediate magazine. Consequently, the cigarettes which are being expelled from a filled tray must cover a considerable distance by moving under the action of gravity so that at least some cigarettes are likely to change their orientation and to clog the intermediate magazine and/or the reservoir for the packing machine. Improper orientation of a single cigarette often necessitates lengthy interruptions in the operation of a packing machine with attendant losses in output and contamination of the respective reservoir and/or packing machine.

SUMMARY OF THE INVENTION

An object of the invention is to provide a novel and improved method and apparatus for manipulating rod-shaped articles, particularly rod-shaped articles which constitute or form part of smokers' products, in such a way that the articles are either prevented from changing or are highly unlikely to change their orientation during transport from filled receptacles to one or more consuming stations where the articles are subjected to further processing, such as packing, pneumatic transport or the like.

Another object of the invention is to provide a method and apparatus for the transport of cigarettes, filter stubs or analogous rod-shaped articles in such a way that the articles are manipulated gently, i.e., without excessive deformation, damage, losses of tobacco shreds and/or smudging, and that one or more consuming stations invariably receive and store a requisite minimum supply of such articles.

A further object of the invention is to provide a novel and improved method and apparatus for the transport of cigarettes or the like from successive filled receptacles of the type having pivotable, reciprocable or otherwise movable bottom walls to the hopper of a packing or analogous consuming machine.

An additional object of the invention is to provide a novel and improved control system for an apparatus which is used to remove stacks of rod-shaped articles from receptacles in the form of chargers or trays and feeds such articles to one or more packing or like machines at a rate corresponding to the rate of further processing of articles in such machine or machines.

One feature of the present invention resides in the provision of a method of feeding to a consuming station cigarettes or analogous rod-shaped articles for further processing, for example, for introducing groups of articles into envelopes which are produced in or fed to a [Packing] *packing* machine. More particularly, the invention relates to a method of feeding to a consuming station rod-shaped articles which are transported from at least one producing station (e.g., from one or more

machines for the making of plain or filter cigarettes) to an evacuating station in the form of stacks of confined parallel articles. The stacks may be confined in receptacles of the type commonly known as chargers or trays and having a wall (preferably a bottom wall) which is movable between open and closed positions.

The method comprises the steps of withdrawing successive stacks from the evacuating station by moving the stacks in a substantially vertical direction (this term is intended to denote any direction which has a vertical component and to embrace a movement from a lower level to a higher level or vice versa) while maintaining the articles of the respective stacks in at least substantially unchanged positions with respect to each other whereby each of the thus withdrawn stacks forms an intermediate supply of parallel articles, transporting batches of articles from the intermediate supply in a substantially horizontal direction (this definition is intended to embrace any movement which has a horizontal component) while maintaining the articles of the respective batches in at least substantially unchanged positions with respect to each other whereby the thus transported batches form a main supply of parallel articles, and transferring articles from the main supply to the consuming station at the rate at which the articles are being processed at the consuming station. The number of articles in each batch may equal the number of articles in a stack so that the intermediate supply of articles is exhausted upon completion of each transporting step.

The method may further comprise the steps of monitoring the main supply of articles and initiating the transporting step in response to depletion of the main supply to a predetermined minimum value. The transporting step preferably comprises moving the articles of the batches sideways, and the arrangement is preferably such that the completion of each transporting step triggers a next-following withdrawing step, i.e., that a fresh stack of rod-shaped articles is removed or withdrawn from the evacuating station in response to completed transport of a batch of articles into the main supply.

The method further preferably comprises the steps of blocking the withdrawal of stacks from the evacuating station and terminating the blocking step in response to completion of a withdrawing step. If the stacks of articles are confined in aforedescribed receptacles, the blocking step may include maintaining the wall of a filled receptacle at the evacuating station in its closed position until immediately prior to start of a withdrawing step, and returning the wall of the freshly emptied receptacle to its closed position in response to completion of such withdrawing step.

The transferring step preferably comprises moving the articles from the main supply to the consuming station at a speed which is at least slightly less than the speed of articles in the course of the transporting step.

The withdrawing step preferably comprises moving successive stacks from a higher level to a lower level, and the evacuating station is preferably (but not necessarily) located at a level above the consuming station.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved apparatus itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a diagrammatic side elevational view of an apparatus which embodies the invention and is used for the feeding of filter cigarettes to a packing machine;

FIG. **2** is an enlarged fragmentary horizontal sectional view as seen in the direction of arrows from the line II—II of FIG. **1**;

FIG. **3** is an enlarged transverse vertical sectional view substantially as seen in the direction of arrows from the line III—III of FIG. **1**; and

FIG. **4** is a circuit diagram of the control system for the apparatus or FIGS. **1** to **3**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. **1** to **3**, there is shown an apparatus **1** which is used to evacuate stacks of rod-shaped articles **6** which are confined in receptacles **2** in the form of so-called chargers or trays at an evacuating station A and to feed the thus evacuated articles to the hopper **4** or analogous storing means of a consuming machine located at a consuming or processing station B, e.g., a packing machine or a machine for pneumatically transporting filter stubs or analogous rod-shaped articles to one or more machines for the making of filter cigarettes, cigars or cigarillos. The articles **6** which are stored in receptacles **2** (hereinafter called trays for short) and in the hopper **4** of the consuming machine at the station B are assumed to be filter cigarettes (see particularly FIGS. **2** and **3**); however, it is evident that the apparatus **1** is equally suited for manipulation of other rod-shaped articles, such as plain cigarettes, plain or filter cigars, plain or filter cigarillos, simple filter stubs, composite filter stubs and/or others. The illustrated hopper **4** is assumed to form part of a packing machine wherein the cigarettes **6** are arrayed to form blocks or groups which are thereupon introduced into envelopes and sealed prior to introduction into cartons or the like. Each envelope may comprise one or more layers, for example, an innermost layer of tinfoil, a median layer of paper, and an outermost layer of transparent synthetic plastic material which can be provided with a customary tear strip. The lower portion of the hopper **4** is formed with several parallel vertical ducts **4**a into which the cigarettes **6** descend to form vertical rows and from which a pusher or a like transfer device expels blocks or groups of, for example, twenty cigarettes each.

The apparatus **1** comprises a withdrawing or removing mechanism which serves to transfer the stack of cigarettes **6** which are confined in a filled tray **2** at the station A into an intermediate magazine **21** (hereinafter called magazine), and a transporting mechanism which serves to move batches of parallel cigarettes from the magazine **21** into a main magazine or reservoir **3** (hereinafter called reservoir) which communicates with the upper portion of the hopper **4**.

The tray **2** which is shown in FIGS. **1** and **3** is one of a series of trays which are circulated along an endless path between one or more producing machines located at a producing station (such as one or more filter cigarette making machines of the type known as MAX and produced by Hauni-Werke, Körber & Co., K.G., of Hamburg-Bergedorf, Western Germany), and the evacuating station A which is located at a level above the

magazine **21** and consuming station B. The conveyor system which circulates the trays **2** between the station A and the station accommodating one or more producing machines is not shown in the drawing. Reference may be had to the aforementioned German printed publication which discloses a suitable conveyor system for trays. The arrangement is preferably such that a freshly emptied tray **2** is automatically removed from the evacuating station A to be replaced with a filled tray so that a filled tray is always held in a position of readiness for transfer of its contents into the magazine **21**. Each tray **2** has blocking means here shown as a slidable or otherwise movable bottom wall or gate **9** which can be moved between a closed or intercepting position in which it closes the lower end of the compartment in the respective tray and an open or extended position which is shown in FIG. **1** and in which the stack of cigarettes **6** can be evacuated by gravity from the compartment of the tray into the magazine **21**. It is assumed that the tray **2** has a bottom wall **9** which is reciprocable between its open and closed positions.

The apparatus **1** further comprises a mechanism which serves to move the bottom wall **9** of a filled tray **2** at the evacuating station A first to the open position of FIG. **1** and thereupon back to the closed or blocking position. Such mechanism is illustrated in FIG. **1** and it comprises a fluid-operated motor here shown as including a pneumatically operated double-acting cylinder and piston unit having a fixedly mounted cylinder **7** which is located above the evacuating station A and whose piston rod **7a** carries a downwardly extending motion transmitting arm or bar **8** having a hook-shaped lower end portion **8a** which can engage and entrain a suitably configurated complementary coupling portion **9a** of the bottom wall **9**. When a filled tray **2** is introduced into the evacuating station A (by moving in a direction at right angles to the plane of FIG. **1**), the piston rod **7a** is retracted and the coupling portion **9a** of the bottom wall **9** of such tray automatically engages the end portion **8a** of the arm **8** when the tray **2** comes to rest. Analogously, when the contents of the tray **2** at the station A are transferred into the magazine **21** and the tray is to be removed from the station A, it again moves in a direction at right angles to the plane of FIG. **1** so that the coupling portion **9a** of the bottom wall **9** (in the closed position of such bottom wall) can be automatically disengaged from the end portion **8a** which remains in the corresponding position so as to automatically engage the coupling portion **9a** on the closed bottom wall **9** of the next filled tray.

The withdrawing or removing mechanism for transferring the contents of a tray **2** at the evacuating station A into the magazine **21** without any appreciable changes in the relative positions of cigarettes **6** with respect to each other comprises a vertically movable support here shown as a platform **11** which is reciprocable by a second fluid-operated motor including a fixedly mounted double-acting pneumatic cylinder **12** having a piston rod **10** the upper end of which is affixed to the platform **11**. The bottom wall **9** of a filled tray **2** at the evacuating station A is moved to its open position immediately after the platform **11** reaches its upper end position so that it is closely adjacent to the lowermost layer of cigarettes **6** in such tray. The platform **11** thereupon descends with the entire contents of the tray **2** and deposits the lowermost layer of cigarettes **6** onto the elongated upper stretches of two endless conveyor belts **14**, **16** which are operated intermittently to thereby

transport batches of cigarettes **6** sideways along a substantially horizontal path for introduction into the reservoir **3**. The bottom wall **9** of a freshly emptied tray **2** at the evacuating station A is automatically returned to its closed position when the platform **11** reaches its lower end position so that the lowermost layer of cigarettes **6** which were evacuated from the tray already rests on the upper stretches of the belts **14** and **16**. As shown in FIG. **2**, the platform **11** is movable up and down in the space between the belts **14** and **16** and, when caused to assume its lower end position, the upper surface of the platform **11** is located at least slightly below the upper stretches of these belts.

The drive means for intermittently operating the conveyor belts **14**, **16** comprises an electric motor **17** which drives a common shaft **17a** for the [rest] *rear* rollers **14a**, **16a** of the belts through the intermediary of a belt or chain transmission **17b**. Two elongated side walls **18** and **19** flank the magazine **21**, the reservoir **3** and the hopper **4**. These side walls hold the cigarettes **6** in the magazine **21**, reservoir **3** and hopper **4** against axial or lengthwise movement to thus reduce the likelihood of jamming by preventing the cigarettes from leaving the positions in which they are parallel to each other and normal to the plane of FIG. **1**.

The belts **14** and **16** constitute two conveyors of the transporting system which is utilized to move batches of cigarettes **6** from the magazine **21** into the reservoir **3**. Such transporting system further comprises two lateral conveyors **15**, **20** which are located at the outer sides of the walls **18**, **19** and respectively comprise endless chains **22**, **23** mounted for travel in a common horizontal plane (see FIG. **3**). The chains **22**, **23** are respectively trained around sprocket wheels **24**, **26** and **27**, **28**. The drive means for intermittently operating the chains **22**, **23** comprises an electric motor **36** which is preferably driven continuously and can rotate a shaft **34** in response to energization of an electromagnetic clutch **37**. The shaft **34** drives two bevel gears **31**, **33** which respectively mesh with bevel gears **29**, **32**. The bevel gear **29** is mounted on a vertical shaft which drives the front sprocket wheel **24** for the chain **22**. The vertical shaft of the bevel gear **32** drives the front sprocket wheel **27** for the chain **23**.

The chain **22** is articulately connected with three upright panels or walls **38**, **39**, **41** which are equidistant from each other and each of which can serve to push a batch of cigarettes **6** from the magazine **21** into the reservoir **3** or to serve as a barrier or blocking means against movement of cigarettes **6** from the magazine **21** into the reservoir **3**. The chain **23** is articulately connected with three similar upright panels or walls **42**, **43** and **44**. In the positions of the chains **22**, **23** as shown in FIG. **2**, the panels **38**, **42** cooperate to block the movement of cigarettes **6** from the magazine **21** into the reservoir **3**, and the panels **41**, **44** are located behind a stack or batch of cigarettes **6** in the magazine **21** and are ready to transfer such batch into the reservoir **3** in response to starting of the chains **22**, **23**, i.e., in response to energization of the clutch **37** in the power train between the motor **36** and the sprocket wheels **24**, **27**. The panels **39**, **43** reach the positions occupied by the panels **41**, **44** when the panels **41**, **44** reach the positions occupied by the panels **38**, **42**, and the panels **38**, **42** then reach the positions occupied by the panels **39**, **43**. It is evident that each of the chains **22**, **23** can be articulately connected with only two or more than three panels. Each of the panels **38**, **39**, **41** and **42**, **43**, **44** is provided with a roller

follower **46**. The roller followers **46** of the panels **38**, **39**, **41** can be moved within or without a suitably configurated cam slot or groove **49** which is defined by a guide rail **47**. A similar guide rail **48** defines a second cam slot or groove **51** for the roller followers **46** of the panels **42**, **43**, **44**. The slots **49**, **51** guide the roller followers **46** during travel of the respective panels from the front sprocket wheels **24**, **27** toward the respective rear sprocket wheels **26**, **28** and also toward engagement of successive panels **38**, **39**, **41** and **42**, **43**, **44** with the suitably configurated (curved) rear end portions of the side walls **18**, **19** (see FIG. **2**). From there on, the panels are guided by the respective side walls during travel toward the front sprocket wheels **24**, **27**. As shown in FIG. **3**, the width of a panel can be only a small fraction of the length of a cigarette **6**.

The front portions of the slots **49**, **51** respectively accommodate switching devices in the form of leaf springs **52**, **53** which serve to insure proper guidance of successive roller followers **46** during entry into the respective slots. As shown in FIG. **2**, the switching devices **52**, **53** are adjacent to the front sprocket wheels **24**, **27**, i.e., adjacent to the regions where the panels **38**, **39**, **41** and **42**, **43**, **44** are respectively disengaged from the side walls **18**, **19** and begin to be guided by the rails **47**, **48** during travel back toward the rear end portions of the respective side walls.

The means for introducing successive roller followers **46** into the front end portions of the slots **49**, **51** comprises two pivotable shifting levers **54**, **55** which are respectively adjacent to the front sprocket wheels **24**, **27** and can be pivoted by electromagnets **57**, **58**. Referring to FIG. **2**, it will be seen that, when the electromagnet **57** is energized so as to pivot the lever **54** in a counterclockwise direction, the longer arm of the lever **54** engages the roller follower **46** of the panel **38** and pivots this panel with reference to the chain **22** until the roller follower **46** enters the front end of the slot **49** in the guide rail **48**. When the electromagnet **57** is thereupon de-energized, the lever **54** automatically reassumes the illustrated position under the action of a spring or other suitable biasing means. The mode of operation of the lever **56** for the roller followers **46** of the panels **42**, **43**, **44** is analogous. The electromagnets **57**, **58** are shown as being mounted on the guide rails **47**, **48**.

The reservoir **3** contains a flexible monitoring device or detector **59** which rests on the uppermost layer of cigarettes **6** and reduces the likelihood of undesirable changes in orientation of cigarettes in the reservoir. Furthermore, the detector **59** serves as a level indicator in that it carries a mass or weight **61** which can trip a detector in the form of a limit switch **62** when the supply of cigarettes **6** in the reservoir **3** is reduced to a predetermined minimum value which warrants the admission of a fresh batch of cigarettes from the magazine **21**.

FIG. **1** shows that the upper stretches of the belts **14**, **16** travel above a roll **63** which is parallel with the cigarettes **6** and is located substantially at the boundary between the magazine **21** and reservoir **3**. The front roll **64** for the belts **14**, **16** can be moved by a suitably inclined feed screw **66** or an analogous adjusting device to thereby flex the front portions of the upper stretches of belts **14**, **16** (in the reservoir **3**) relative to the rear portions (in the magazine **21**). This renders it possible to combine the apparatus **1** with existing consuming machines by insuring an optimum transport of cigarettes or analogous rod-shaped articles from the magazine into the reservoir and hopper or hoppers. By inclining the front portions of the upper stretches of the belts **14**, **16**, the operator can also promote the sidewise movement of cigarettes **6** toward the hopper **4** of the consuming machine. However, an equally important feature of such adjustability of the belts **14**, **16** is that the outlet of the apparatus **1** can be adjusted to insure satisfactory alignment with the hopper of and a reservoir for an existing consuming machine.

FIG. **4** illustrates the control system of the apparatus. This control system comprises four control units **71**, **77**, **78** and **79**. The control unit **71** includes the aforementioned limit switch **62** which can be actuated by the weight **61** of the monitoring means **59** in the reservoir **3**. The purpose of this control unit is to effect an energization of the electromagnets **57**, **58** for the shifting levers **54**, **55**. The control unit **77** serves to energize the electromagnetic clutch **37** in the power train between the motor **36** and the front sprocket wheels **24**, **27** for the chains **22**, **23** and to start the motor **17** which drives the belts **14** and **16**. The control unit **78** serves to deenergize the clutch **37** and to arrest the motor **17** as well as to control the operation of the double-acting cylinder **12** which moves the platform **11** toward and away from the evacuating station A. The purpose of the control unit **79** is to control the operation of the double-acting cylinder **7** which moves the bottom walls **9** of trays **2** at the station A.

The control unit **71** further comprises a logic circuit **72** of the type known as AND-gate. The input a of the AND-gate **72** receives a signal in response to actuation of the limit switch **62**. The output c of the AND-gate **72** is connected with the input a of a flip-flop circuit **74** by way of a pulse shaper **73**. The output c of the flip-flop **74** is connected with the windings of the electromagnets **57**, **58** by way of an amplifier **76**. The output c of the AND-gate transmits a signal for energization of electromagnets **57**, **58** when the input a receives a signal simultaneously with the input b.

The control circuit **77** comprises two detectors in the form of normally open limit switches **81**, **82** which are connected with the two inputs of an AND-gate **83**. The output of the AND-gate **83** is connected with the input a of a flip-flop **84** whose output c is connected with the motor **17** and electromagnetic clutch **37** by way of an amplifier **86**. The motor **17** is started and the clutch **37** is energized in response to simultaneous closing of the limit switches **81**, **82**. As shown in FIG. **2**, the limit switches **81**, **82** are respectively actuatable by the levers **54**, **55**, i.e., in response to energization of the electromagnets **57**, **58**. The output c of the flip-flop **84** in the control circuit **77** is further connected with the signal erasing input b of the flip-flop **74** in the control unit **71** by way of an adjustable R-C link **87** which constitutes a time delay device. When the input b of the flip-flop **74** receives a signal from the time delay device **87**, the signal at the output c is erased and the electromagnets **57**, **58** are de-energized.

The control unit **78** comprises two detectors in the form of normally open limit switches **88**, **89** which, as shown in FIG. **2**, are mounted adjacent to the front sprocket wheels **24**, **27** for the chains **22**, **23** and are respectively actuatable by successive panels **38**, **39**, **41** and **42**, **43**, **44**. The limit switches **88**, **89** are connected to the two inputs of an AND-gate **90** whose output is connected with a pulse shaper **91**. The output of the pulse shaper **91** is connected with a signal erasing input

b of the flip-flop **84** in the control unit **77** and with the input a of a flip-flop **92**. The output c of the flip-flop **92** is connected with the solenoid of an electropneumatic valve **94** by way of an amplifier **93**. The valve **94** controls the flow of pressurized fluid (preferably air) from a fluid source **102** to the chambers of the double-acting cylinder **12**. When the platform **11** is moved to its upper end position, the piston **10**a in the cylinder **12** closes a resetting switch **96** which is connected with the signal erasing input b of the flip-flop **92**. When the platform **11** reaches its lower end position, the piston **10**a actuates a further resetting switch **97** which is connected with the input b of the AND-gate **72** in the control unit **71**.

The control unit **79** comprises a flip-flop **98** whose first input a is connected with the resetting switch **96** for the flip-flop **92** and whose second (signal erasing) input b is connected with the resetting switch **97**. The output c of the flip-flop **98** is connected with the solenoid of an electropneumatic valve **100** by way of an amplifier **99**. The valve **100** controls the flow of a pressurized fluid (preferably air) from a fluid source **101** to the chambers of the double-acting cylinder 7. The cylinder 7 is caused to move the bottom wall **9** of a filled tray **2** at the evacuating station A to open position in response to closing of the switch **96**, and the bottom wall **9** is thereupon returned to its closed position in response to closing of the switch **97**.

The operation:

It is assumed that a filled tray **2**, with its bottom wall **9** in closed position, is located at the evacuating station A and that the reservoir **3** contains a relatively small main supply of cigarettes **6**. This means that the hopper **4** is still filled with cigarettes. When the supply of cigarettes in the reservoir **3** is depleted to a predetermined minimum value, the weight **61** of the monitoring means **59** actuates the switch **62** while the platform **11** dwells in its lower end position so that the switch **97** of the control unit **78** is closed. Thus, the input b of the AND-gate **72** in the control unit **71** receives a signal. When the input a of this AND-gate receives a signal in response to the closing of the switch **62**, the output c transmits a signal which energizes the electromagnets **57**, **58** by way of the flip-flop **74** and amplifier **76**. The energized electromagnets **57**, **58** respectively pivot the levers **54**, **55** which retract the blocking panels **38**, **42** and move the followers **46** of these panels into the respective slots **49**, **51**. The panels **38**, **42** are retracted through suitable openings in the side walls **18**, **19**.

The levers **54**, **56** respectively close the switches **81**, **82** of the control unit **77** whereby the AND-gate **83** transmits a signal which starts the motor **17** and energizes the electromagnetic clutch **37** by way of the flip-flop **84** and amplifier **86**. The clutch **37** connects the motor **36** with the shaft **34** so that the chains **22**, **23** of the lateral conveyors **15**, **20** are set in motion. The motor **17** drives the belts **14**, **16** so that the upper stretches of these belts transport the batch or stack of cigarettes **6** which was temporarily stored in the magazine **21** toward the reservoir **3**. The stack or batch remains at least substantially intact (i.e., the relative positions of cigarettes **6** which form such batch or stack remain substantially unchanged) because the chains **22**, **23** respectively drive the panels **41**, **44** which push the stack toward the reservoir **3** while the stack rests on the upper stretches of the moving belts **14** and **16**. The panels **38**, **42** are retracted so that they cannot block the entry of cigarettes **6** into the reservoir **3**.

The output signal from the flip-flop **84** of the control unit 77 is further transmitted to the time delay device **87** which produces a signal with a certain delay so that the signal at the output c of the flip-flop **74** disappears and the electromagnets **57**, **58** are de-energized to effect a return movement of the levers **54**, **56** to the positions shown in FIG. **2**. The chains **22**, **23** continue to transport the respective panels **38**, **39**, **41** and **42**, **43**, **44** whereby the roller followers **46** of the panels **38**, **39** and **43**, **43** respectively travel in the slots **49**, **51** of the guide rails **47**, **48**. The panels **41**, **44** are guided by the side walls **18**, **19** and effect a complete evacuation of cigarettes from the magazine **21** prior to actuating the switches **88**, **89** of the control unit **78**. The leaf springs **52**, **53** insure that the roller followers **46** of the panels **38**, **42** remain in the respective slots **49**, **51** after the levers **54**, **56** return to their starting positions. The belts **14**, **16** transport the cigarettes from the outlet of the reservoir **3** toward and cause such cigarettes to enter the hopper **4** of the consuming machine. The evacuation of cigarettes from the magazine **21** is carried out mainly by the panels **41** and **44** but the belts **14**, **16** assist these panels by moving the lower layer of the stack of cigarettes toward and into the reservoir **3**. Since the belts **14**, **16** move cigarettes from the reservoir **3** toward and into the hopper **4** only when the chains **22** and **23** are in motion, a wall of cigarettes is always present in front of the panels **38**, **42** or FIG. **2** (or in front of the panels **41**, **44** or **39**, **43** when these panels occupy the positions shown in FIG. **2** as being occupied by the panels **38** and **42**). This reduces the likelihood of a collapse of the stacks of cigarettes in front of and behind the panels **38**, **42** (as viewed in FIG. **2**) and hence the likelihood of improper orientation of cigarettes such as could cause jamming in the magazine **21**, reservoir **3** and/or hopper **4**.

The chains **22** and **23** are arrested when the panels **41**, **44** reach and actuate the switches **88**, **89** of the control unit **78**. The AND-gate **90** then produces a signal which is transmitted to the erasing input b of the flip-flop **84** by way of the pulse shaper **91**. Such signal erases the signal at the output c of the flip-flop **84** so that the motor **17** is arrested and the clutch **37** is de-energized. Thus, the chains **22**, **23** are arrested simultaneously with the belts **14** and **16**.

The pulse shaper **91** further transmits a signal to the input a of the flip-flop **92** which energizes the solenoid of the valve **94** by way of the amplifier **93**. The valve **94** connects the source **102** of pressurized fluid with the lower chamber of the double-acting cylinder **12** so that the piston rod **10** slowly lifts the platform **11** and the piston **10**a allows or causes the switch **97** to open. The switch **96** is closed when the platform **11** reaches its upper end position whereby the input b of the flip-flop **92** receives a signal which erases the signal at the output c so that the solenoid of the valve **94** is de-energized and the spring **94**a of this valve causes the valve member to assume a position in which the source **102** is connected with the upper chamber of the cylinder **12** so that the platform **11** descends and lowers a fresh stack of cigarettes **6** into the magazine **21**.

As mentioned above, the closing of the switch **96** by the piston **10**a results in transmission of a signal to the input a of the flip-flop **98** in the control unit **79**. The flip-flop **98** energizes the solenoid of the valve **100** by way of the amplifier **99** whereby the valve **100** connects the source **101** of the pressurized fluid with the double-acting cylinder 7 in such a way that the arm **8** of the

piston rod 7a moves the bottom wall **9** of the tray **2** at the evacuating station A to its open position. This takes place while the platform **11** dwells in its upper end position. The cylinder **12** thereupon moves the platform **11** downwardly (because the switch **96** was closed by the piston **10**a). When the platform **11** reaches its lower end position in which the stack of cigarettes **6** which were evacuated from the tray **2** at the station A rests on the upper stretches of the belts **14**, **16**, the piston **10**a actuates the switch **97** which transmits a signal to the erasing input b of the flip-flop **98** so that the valve **100** causes the cylinder **7** to retract its piston rod **7**a whereby the arm **8** returns the bottom wall **9** of the freshly emptied tray **2** to its closed position. At the same time, the closed switch **97** transmits a signal to the input b of the AND-gate **72** in the control unit **71** so that the electromagnets **57**, **58** can be energized again in the aforedescribed manner as soon as the weight **61** of the monitoring means **59** closes the limit switch **62**. The entire cycle is then repeated in the aforedescribed manner. It is assumed that the freshly emptied tray **2** is replaced with a filled tray before the supply of cigarettes **6** in the reservoir **3** is depleted to such an extent that the weight **61** can reach and actuate the limit switch **62**.

The monitoring means **59** in the reservoir **3** prevents overfilling of the reservoir during temporary or longer-lasting stoppage of the consuming machine. Thus, the monitoring means **59** insures that the floating main supply of cigarettes **6** always fluctuates between predetermined uppermost and lowermost levels. When the number of cigarettes **6** in the reservoir **3** is reduced to the lowermost permissible value or level, the switch **62** produces a signal which results in energization of electromagnets **57**, **58** and withdrawal of blocking panels (**38**, **42** in FIG. 2) from their blocking positions. The levers **54**, **56** then actuate the switches or detector means **81**, **82** which start the motor **17** and energize the clutch **37**. When the transport of a batch or stack of cigarettes **6** from the magazine **21** into the reservoir **3** is completed (i.e., when the supply of cigarettes in the reservoir **3** increases to the maximum permissible level), the movable panels **41**, **44** of FIG. 2 actuate the detector switches **88**, **89** which cause the platform **11** to rise and to initiate the movement of the bottom wall **9** of a filled tray **2** at the evacuating station A to its open position. The bottom wall **9** returns to its closed position when the platform **11** returns to its lower end position. In this way, the reservoir **3** receives a fresh batch or stack of cigarettes only at the rate at which the cigarettes are being further processed in the consuming machine including the hopper **4**. A stack of cigarettes **6** which can fill a tray **2** can constitute only a small portion of the main supply of cigarettes in the reservoir **3** so that the level of cigarettes in this reservoir changes only little during an interval beginning with introduction of a fresh batch and ending with actuation of the switch **62**.

The feature that the cigarettes **6** are transported sideways during withdrawal from filled trays **2** as well as during transport from the magazine **21** into the reservoir **3** reduces the likelihood that the cigarettes would lose tobacco particles at the free ends of their wrapped tobacco filler rod sections.

In the illustrated apparatus, the intermediate supply of cigarettes **6** in the magazine **21** is exhausted whenever the transporting means including the belts **14**, **16** and chains **22**, **23** is set in motion, i.e., the number of cigarettes in each batch which is being transported into the reservoir **3** equals the number of cigarettes in the stack which was transferred into the magazine during the preceding downward movement of the platform **11**. Such mode of operation is preferred at this time even though it is within the purview of the invention to transport into the reservoir **3** batches each of which contains a predetermined number of cigarettes whereby such number may be less than or exceeds the number of cigarettes in a filled tray.

The detector switches **88**, **89** insure that the magazine **21** receives a fresh stack of cigarettes **6** in response to completed transport of a batch of cigarettes from the magazine into the reservoir **3**. The switch **96** insures that the bottom wall **9** of a filled tray **2** at the evacuating station A cannot be moved to its open position before the platform **11** reaches its upper end position so that the stack of cigarettes which are freed for evacuation from the tray immediately reaches the upper surface of the platform **11**, without allowing the cigarettes to change their mutual positions during movement toward the platform as well as during movement with the platform onto the upper stretches of the belts **14** and **16**. As explained above, the belts **14**, **16** thereupon cooperate with the side walls **18**, **19** and with the rearmost and foremost pairs of panels on the chains **22**, **23** to insure that the mutual positions of cigarettes **6** do not change or change negligibly during storage in the magazine **21** as well as during transport into the reservoir **3**.

A fresh filled tray **2** is moved to the evacuating station A as soon as the evacuation of the contents of the preceding filled tray is completed. It is therefore important to close the bottom wall **9** of a freshly emptied tray as soon as possible, i.e., as soon as the uppermost layer of the stack on the descending platform **11** has been moved below the plane of the bottom wall **9**. This is achieved by the provision of the switch **97** which causes the control unit **79** to actuate the cylinder **7** so that the latter returns the bottom wall **9** of the freshly emptied tray **2** to it closed position as soon as the platform **11** reaches its lower end position. The tray **2** is then free to leave the station A to be immediately replaced with a filled tray.

In accordance with a further feature of the invention, the transport of cigarettes **6** from the reservoir **3** into the hopper **4** of the packing machine at the consuming station B is carried out at a speed which is less than the speed of evacuation of cigarettes from the magazine **21**. This insures that the cigarettes in the reservoir **3** form a wall or barrier which prevents excessive movements of freshly admitted cigarettes relative to each other and thus reduces the likelihood of improper orientation of one or more cigarettes in the main supply which is stored in the reservoir **3**. In other words, it is advisable to transport the cigarettes from the magazine **21** in such a way that the cigarettes cannot drop into the reservoir **3** because such mode of manipulating could lead to jamming in the reservoir and/or hopper **4**.

An important advantage of the improved apparatus is that it automatically replenishes the supply of cigarettes in the hopper **4** and also that the orientation of cigarettes is not only highly unlikely to but normally cannot change so that the possibility of jamming in the magazine **21**, reservoir **3** and/or hopper **4** is very remote. This is attributed to the fact that the cigarettes are always confined during movement from a filed tray **2** at the evacuating station A and all the way into the reservoir **3** and hopper **4** at the consuming station B. Thus, the platform **11** is sufficiently close to the station A

when the bottom wall **9** of a filled tray **2** at this station is moved to the open position to insure that the gravitational descent of cigarettes onto the upper surface of the platform is negligible. From there on, the cigarettes are confined between the side walls **18**, **19**, upper stretches of the belts **14**, **16** and two or four of the panels **38**, **39**, **41** and **42**, **43**, **44**.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of my contribution to the art and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. A method of feeding to a consuming station cigarettes or analogous rod-shaped articles which are transported on holders from at least one producing station to an evacuating station in the form of stacks of confined parallel articles and are further processed at the consuming station, each stack being made up only of the entire contents of one said holder, comprising the steps of withdrawing each successive stack from each successive holder at said evacuating station by moving the stack in a substantially vertical direction only—while maintaining the articles of the respective stack in at least substantially unchanged position with respect to each other—to an intermediate supply station where each of the thus withdrawn stacks forms an intermediate supply of articles; transporting each of said stacks of articles from said intermediate supply station in a substantially horizontal direction by moving the articles of said stack sideways and while maintaining the articles of the respective stacks in at least substantially unchanged position in which they have been during vertical movement from said evacuating station to said intermediate supply station whereby the thus successively transported stacks form a main supply of articles; and transferring articles from said main supply to the consuming station in at least substantially parallel position with respect to each other and at the rate at which the articles are being processed at said consuming station.

2. A method as defined in claim **1**, further comprising the steps of monitoring said main supply of articles and initiating said transporting step in response to depletion of said main supply to a predetermined value.

3. A method as defined in claim **1**, further comprising the step of starting a fresh withdrawing step in response to completion of each transporting step.

4. A method as defined in claim **3**, further comprising the steps of blocking the withdrawal of stacks of articles from said evacuating station and terminating said blocking step immediately prior to start of said withdrawing step.

5. A method as defined in claim **1**, wherein said transferring step comprises moving the articles from said main supply at a speed which is less than the speed of articles in the course of said transporting step.

6. A method as defined in claim **1**, wherein said withdrawing step comprises moving successive stacks from a higher level to a lower level.

7. A method as defined in claim **1**, wherein said evacuating station is located at a level above said consuming station.

8. Apparatus for feeding to a consuming station cigarettes or analogous rod-shaped articles which are transported in receptacles from at least one producing station to an evacuating station and wherein each filled receptacle contains a stack of parallel articles, comprising a reservoir arranged to store a floating supply of articles for delivery to said consuming station at the rate at which the articles are being processed at the consuming station; a magazine disposed between said evacuating station and said reservoir; withdrawing means operative to move stacks of articles in a substantially vertical direction from successive filled receptacles at said evacuating station into said magazine, said withdrawing means and said magazine comprising cooperating elements arranged to maintain the articles of said stacks in at least substantially unchanged positions with respect to each other; transporting means operative to move batches of articles from said magazine into said reservoir in a substantially horizontal direction, including means for maintaining the articles of such batches in at least substantially unchanged positions with respect to each other, said transporting means comprising at least one conveyor which includes a first portion arranged to withdraw articles from said magazine and a second portion arranged to move the thus withdrawn articles in said reservoir; and adjusting means for changing the position of one said conveyor portions with respect to the other conveyor portion.

9. Apparatus as defined in claim **8**, wherein said means for maintaining the articles of said batches, in at least substantially unchanged positions with respect to each other comprises at least one pair of mobile panels arranged to push the articles of said batches during transport into said reservoir.

10. Apparatus as defined in claim **8**, wherein said conveyor comprises at least one endless belt having an article-supporting upper stretch.

11. Apparatus for feeding to a consuming station cigarettes or analogous rod-shaped articles which are transported in receptacles from at least one producing station to an evacuating station, wherein each filled receptacle contains a stack of parallel articles, and wherein each receptacle comprises a wall which is movable between an open position in which it affords access to the stack of articles in such receptacle and a closed position, comprising a reservoir arranged to store a floating supply of articles for delivery to said consuming station at the rate at which the articles are being processed at the consuming station; a magazine disposed between said evacuating station and said reservoir; withdrawing means operative to move stacks of articles in a substantially vertical direction from successive filled receptacles at said evacuating station into said magazine, said withdrawing means and said magazine comprising cooperating elements arranged to maintain the articles of said stacks in at least substantially unchanged positions with respect to each other and said withdrawing means further comprising a support for stacks which is movable between a first end position adjacent to a filled receptacle at said evacuating station and a second end position which said support assumes upon completed transport of a stack of articles into said magazine; control means including means for moving the wall of a filled receptacle at said evacuating station to said open position in response to movement of said support to said first end position and for moving the wall of such receptacle back to said closed position in response to movement of said support to said second

end position; and transporting means operative to to move batches of articles from said magazine into said reservoir in a substantially horizontal direction, including means of maintaining the articles of such batches in at least substantially unchanged positions with respect to each other.

12. Apparatus as defined in claim **11**, wherein said transporting means comprises two endless conveyors and said means for maintaining the articles of said batches in at least substantially unchanged positions with respect to each other comprises confining panels mounted on said endless conveyors.

13. Apparatus as defined in claim **11**, wherein said withdrawing means comprises a vertically movable support and said magazine is disposed at a level below said evacuating station so that the stacks of articles on said support are moved downwardly during transport from said evacuating station.

14. Apparatus as defined in claim **11**, wherein the number of articles in each of said batches equals the number of articles in said stacks so that the supply of articles in said magazine is exhausted in response to each operation of said transporting means.

15. Apparatus as defined in claim **11**, wherein said walls are the bottom walls of receptacles at said evacuating station.

16. Apparatus as defined in claim **11**, wherein the receptacles are polygonal trays.

17. Apparatus as defined in claim **11**, further comprising means for monitoring the supply of articles in said reservoir and for producing signals in response to depletion of such supply to a predetermined minimum value, and further comprising blocking means movable to and from a blocking position in which said blocking means prevents the transport of articles from said magazine into said reservoir, and control means for moving said blocking means from said blocking position in response to said signals.

18. Apparatus as defined in claim **17**, wherein said control means includes electromagnet means which is energizable in response to said signals to thereby move said blocking means from said blocking position.

19. Apparatus as defined in claim **11**, further comprising blocking means movable to and from a blocking position in which said blocking means prevents the transport of articles from said magazine into said reservoir, and control means for operating said transporting means in response to movement of said blocking means from said blocking position.

20. Apparatus as defined in claim **19**, wherein said control means comprises detector means which is arranged to produce signals in response to movement of said blocking means from said blocking position and said transporting means comprises motor means which is started in response to said signals.

21. Apparatus as defined in claim **20**, wherein said transporting means comprises a plurality of endless conveyors and said blocking means comprises panels articulately connected with said conveyors.

22. A method of feeding to a consuming station cigarettes or analogous rod-shaped articles which are transported from at least one producing station to an evacuating station in the form of stacks of parallel articles confined in receptacles of the type having a wall movable between open and closed positions to allow for withdrawal of a stack from such receptacle in the open position of said wall and which articles are further processed at the consuming station, comprising the steps of moving the walls of successive filled receptacles at said evacuating station to open positions; withdrawing the stacks from the receptacles at said evacuating station immediately after movement of the respective walls to open positions by moving the respective stacks in a substantially vertical direction while maintaining the articles of the respective stacks in at least substantially unchanged positions with respect to each other whereby each of the thus withdrawn stacks forms an intermediate supply of articles; returning the walls of receptacles to closed positions in response to completion of the respective withdrawing steps; transporting batches of articles from said intermediate supply in a substantially horizontal direction while maintaining the articles of the respective batches in at least substantially unchanged positions with respect to each other whereby the thus transported batches form a main supply of articles; and transferring articles from said main supply to the consuming station at the rate at which the articles are being processed at said consuming station.

23. Apparatus for feeding to a consuming station cigarettes or analogous rod-shaped articles which are transported in receptacles from at least one producing station to an evacuating station and wherein each filled receptacle contains a stack of parallel articles, comprising a reservoir arranged to store a floating main supply of articles for delivery to said consuming station at the rate at which the articles are being processed at the consuming station; a magazine disposed between said evacuating station and said reservoir; withdrawing means operative to move stacks of articles in a substantially vertical direction from successive filled receptacles at said evacuating station into said magazine, said withdrawing means and said magazine comprising cooperating elements arranged to maintain the articles of said stacks in at least substantially unchanged positions with respect to each other; and transporting means operative to move batches of articles from said magazine into said reservoir in a substantially horizontal direction, including means for maintaining the articles of such batches in at least substantially unchanged positions with respect to each other, said last mentioned means comprising at least one pair of mobile panels which are disposed between said reservoir and said magazine during introduction of a stack of articles into said magazine to thus temporarily prevent the movement of articles from said magazine into said reservoir.

24. In a system for conveying cigarettes or other rod-like articles in containers, said system including an article delivery device and an article receiving device, means for inserting articles into containers, and means for conveying containers, apparatus for forming a stream of articles, comprising an unloading station; means for conveying through said unloading station a succession of containers containing batches of the articles; means for successively removing batches of articles from said containers; retaining means for receiving and confining batches of articles from said containers, said retaining means including spaced members arranged to confine each end of a batch; means for removing said spaced members from around said batch; and means for conveying away from said unloading station, as a continuous stream after said spaced members have been removed, batches of articles received by said retaining means.

25. Apparatus as claimed in claim 24 including means for intermittently driving said article conveying means and means for intermittently moving a container through said unloading station in synchronism with said conveying

means, said batch removing means being arranged to remove articles from said containers when said conveying means and said container moving means are stationary.

26. Apparatus as claimed in claim 25 wherein the article conveying means comprises an endless conveyor.

27. Apparatus as claimed in claim 26 wherein the spaced members include upstanding end plates associated with said conveyor, the spacing between adjacent end plates matching one dimension of a container.

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