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(54) **METHOD OF AND APPARATUS FOR ACCUMULATING AND MANIPULATING ARRAYS OF CIGARETTES AND THE LIKE**

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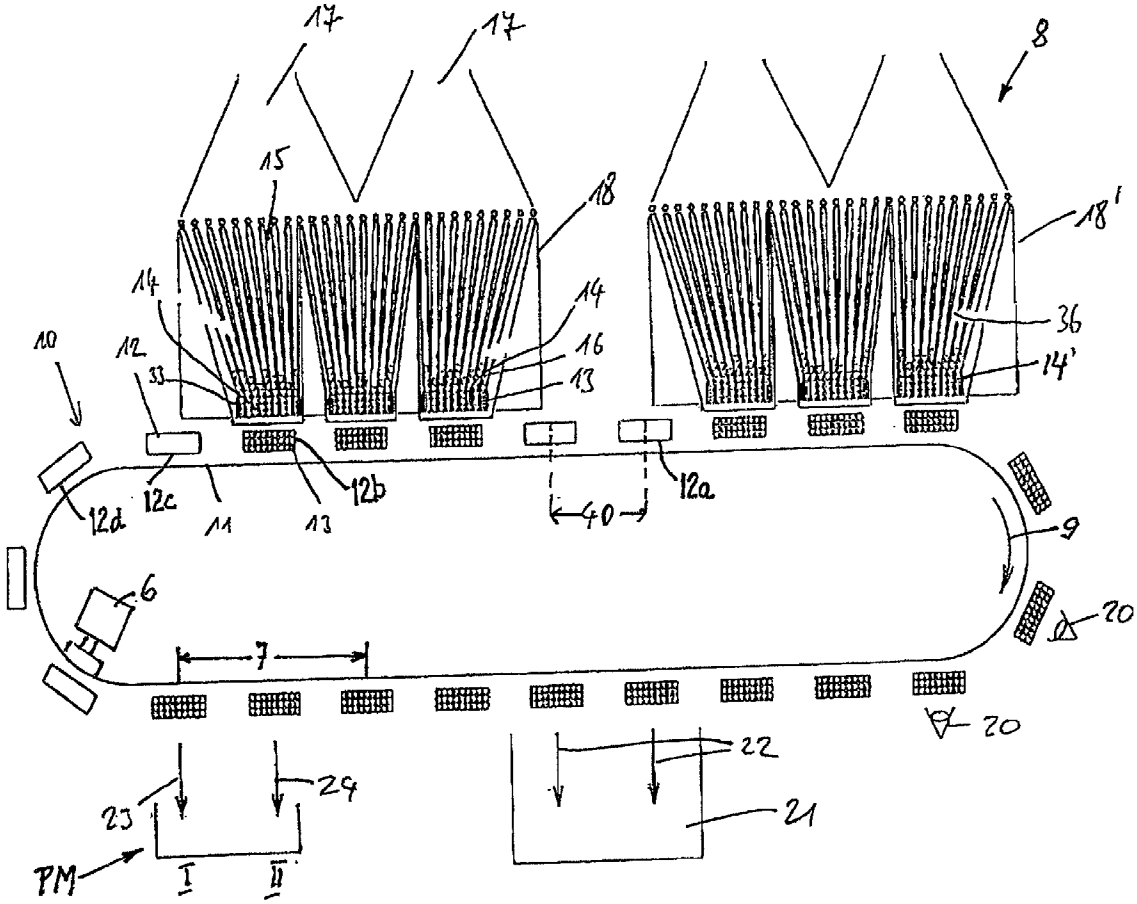
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(57) **ABSTRACT**

Blocks of plain or filter cigarettes are accumulated in at least two group building assemblies each of which comprises at least two block forming units receiving cigarettes by gravity flow by way of upright ducts. The assemblies are adjacent the path of a series of successive receptacles which serve to transport discrete blocks stepwise to a multiple-track packing machine. The units accumulate blocks of cigarettes during intervals which include the duration of at least one stepwise movement of the receptacles and that of at least one period of standstill of the receptacles. Such intervals suffice to ensure satisfactory gathering of cigarettes into blocks of required size and shape at a frequency which is required for full-speed operation of the multiple-track packing machine.



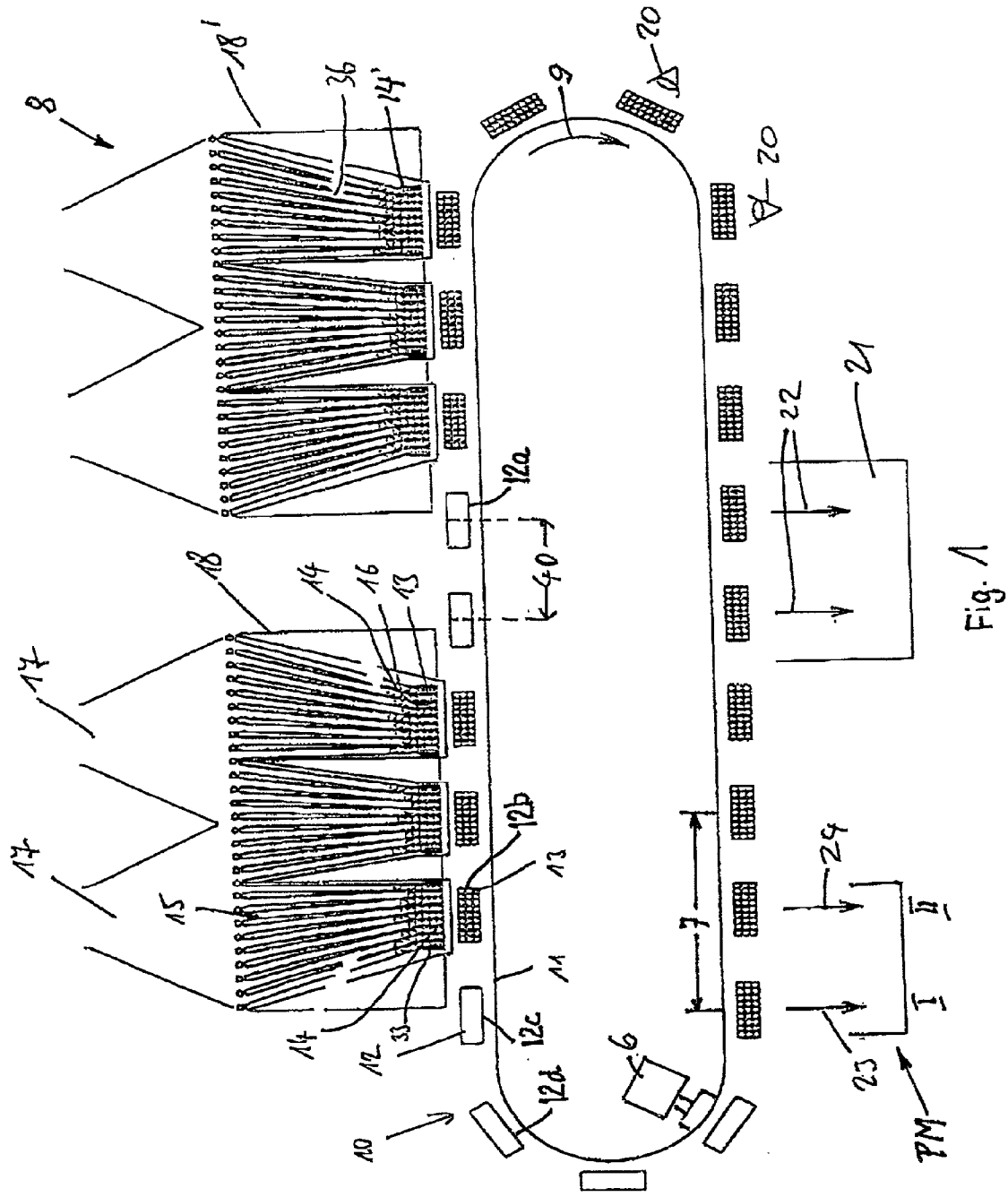

8
18'
36
14'
9
20
20
12a
40
18
14
16
13
17
17
15
12b
13
11
14
12
33
12c
12d
10
6
7
22
21
24
II
I
23
PM

Fig. 1

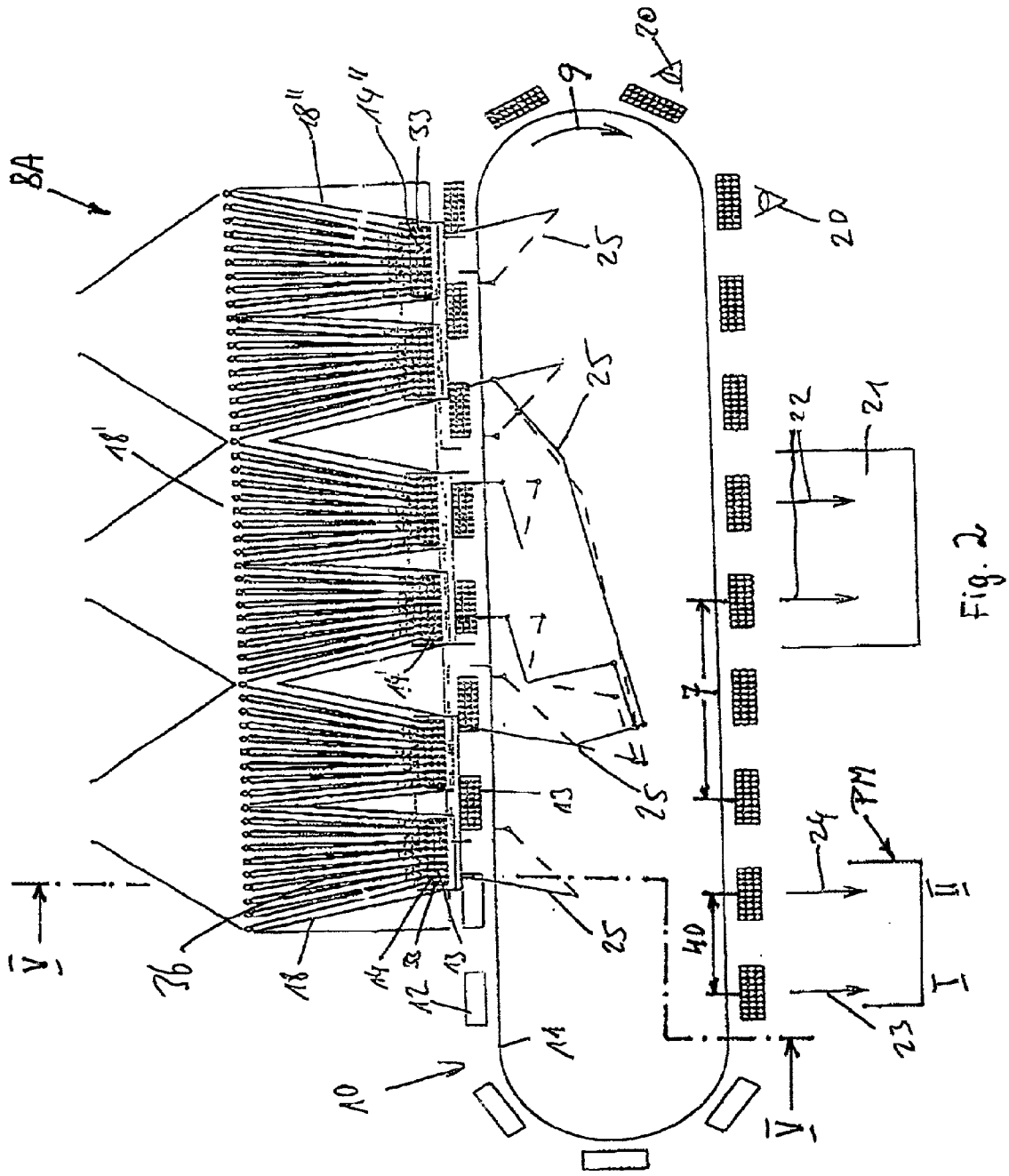


Fig. 2

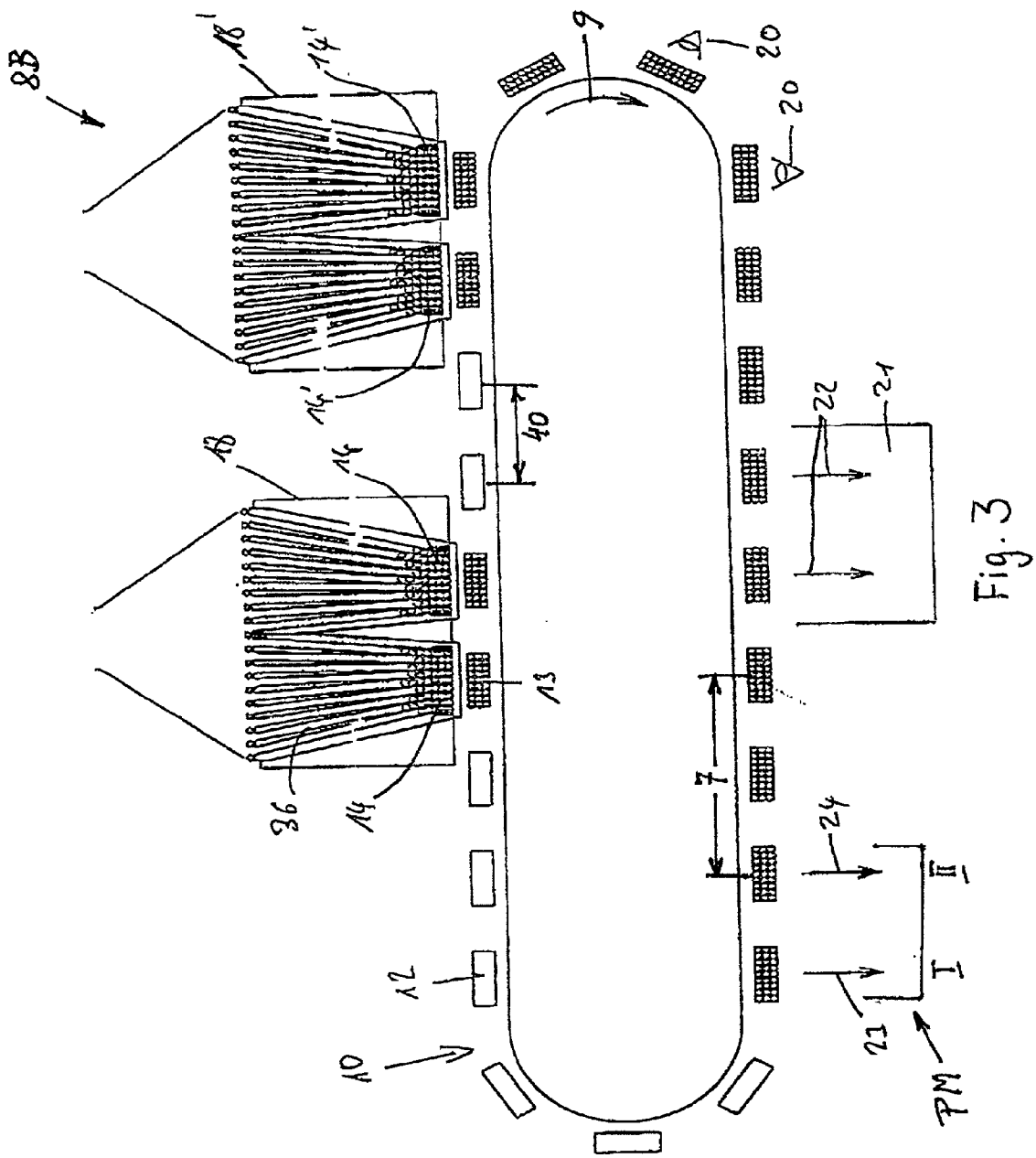


Fig. 3

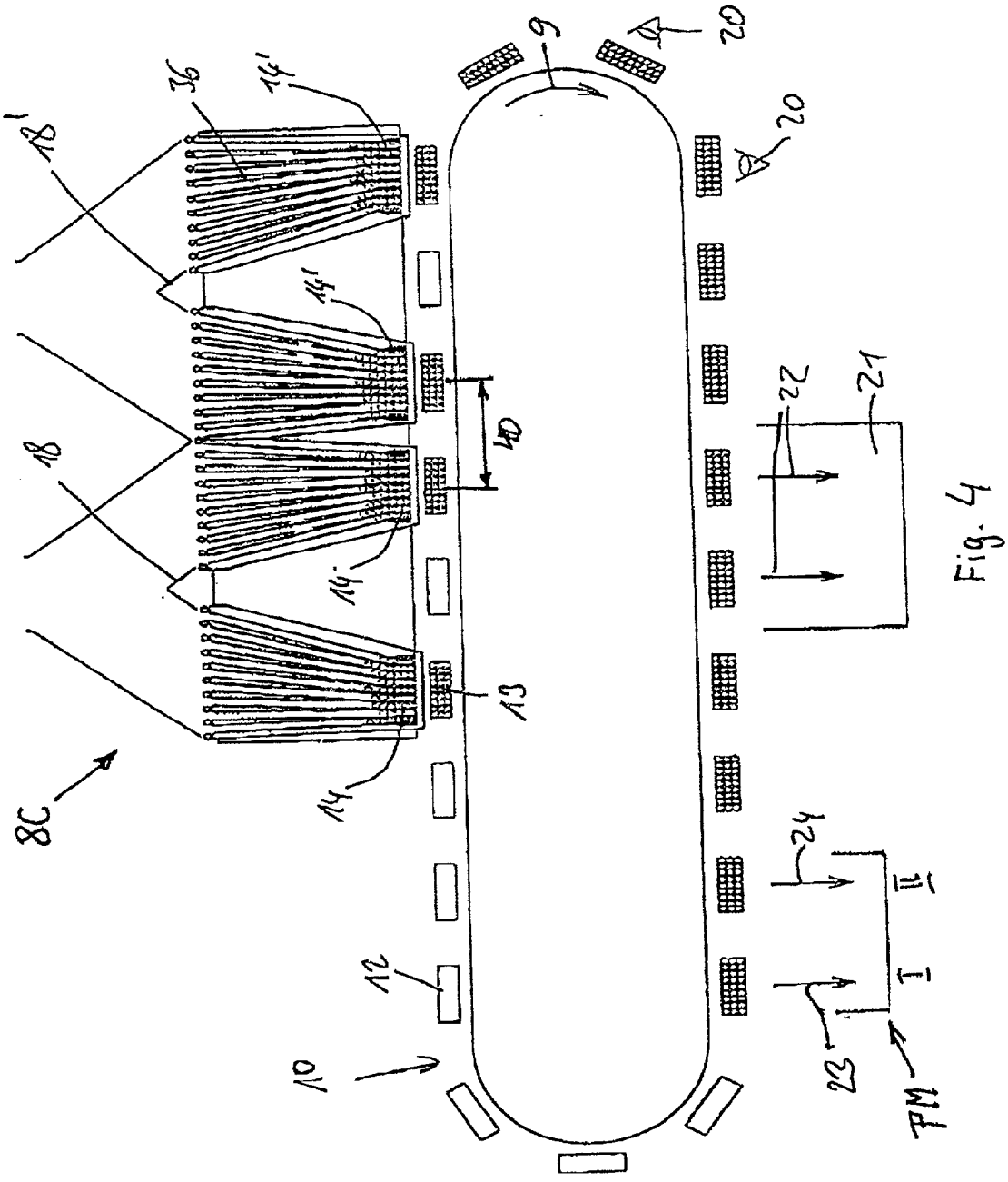
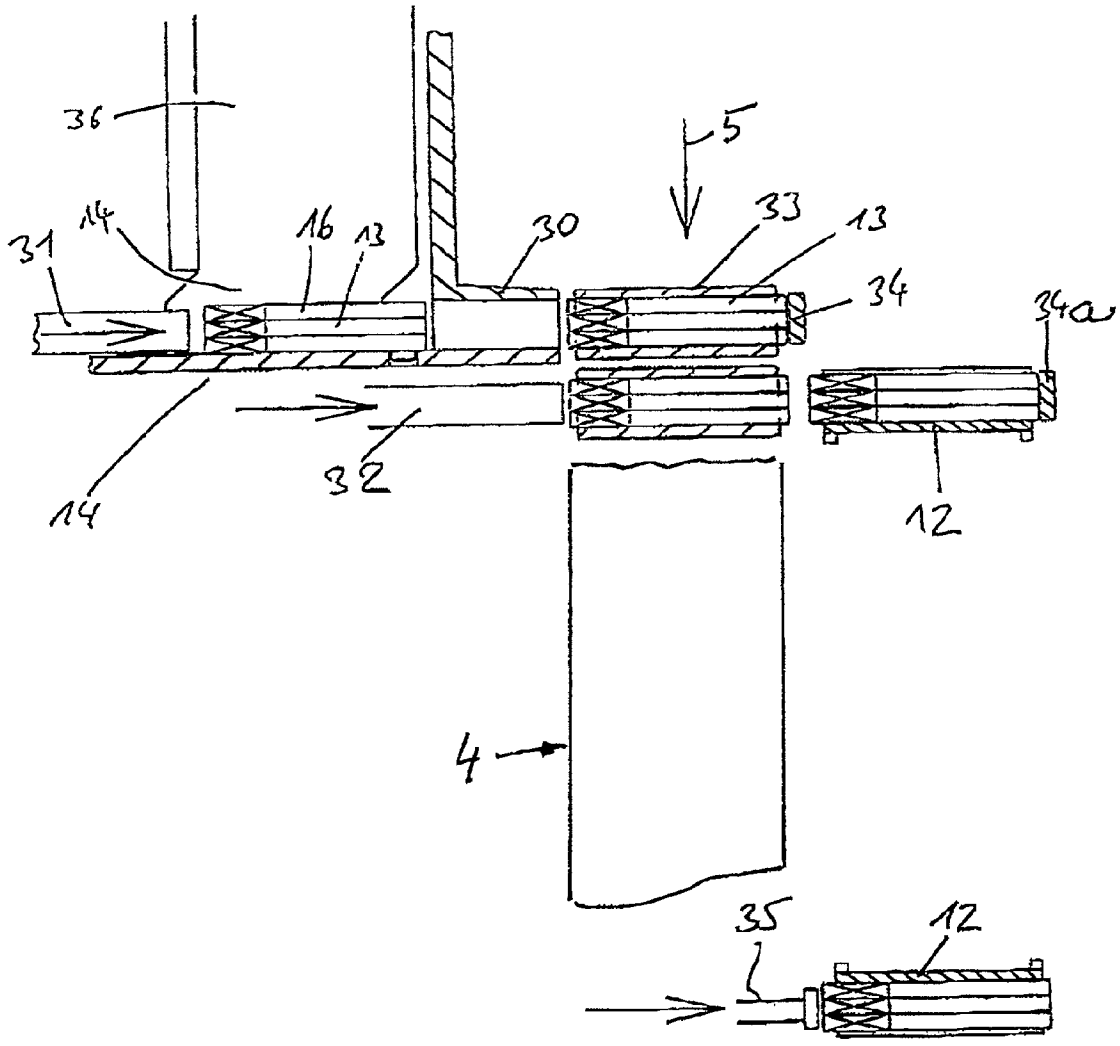


Fig. 4

Fig. 5



METHOD OF AND APPARATUS FOR ACCUMULATING AND MANIPULATING ARRAYS OF CIGARETTES AND THE LIKE

BACKGROUND OF THE INVENTION

[0001] The invention relates to improvements in methods of and in apparatus for gathering groups (e.g., blockshaped arrays) of commodities and for introducing the thus obtained groups into intermittently advancing receptacles. Examples of equipments which can be operated by resorting to the method and to the apparatus of the present invention are processing machines (such as packing machines) which are employed to mass produce packs of cigarettes or other rod-shaped commodities or products of the tobacco processing industry.

[0002] In a modern production line which is designed to turn out cigarette packs, groups or blocks or arrays of parallel rod-shaped articles (hereinafter referred to as cigarettes) are assembled in block forming units the contents of which are thereupon transferred into the receptacles of an intermittently advancing conveyor for delivery to the inlet of the packing machine wherein the groups are confined in envelopes (converted blanks) of metalic foil, paper, cardboard and/or plastic foil. As a rule, the thus obtained packs (e.g., those known as soft packs or hinged-lid packs) are thereupon confined in cartons each of which normally accommodates ten packs, and groups of thus filled cartons are confined in boxes each of which can accommodate, for example, twentyfive cartons and which are delivered to storage or shipped to the purchasers.

[0003] Numerous problems arise when the production lines employ plural packing machines or multiple-track packing machines. In either event, a modern packing machine of such character can process large numbers of arrays of properly grouped cigarettes. On the other hand, that part of a production line which gathers cigarettes into groups or arrays of, for example, twenty cigarettes each can turn out the groups at a rate having an upper limit. This is attributable in part to the force of gravity and in part to the presently known best mode of assembling discrete cigarettes into arrays; such mode involves causing cigarettes to descend by gravity sideways in upright or downwardly sloping ducts on their way into the group or block forming units where the cigarettes of an assembled group occupy predetermined positions relative to each other. It is not always advisable to propel the cigarettes sideways with a force exceeding the force of gravity because this could result in damage to (such as defacing of) the cigarettes so that the speed of sidewise downward movement of the cigarettes to the group or block forming units cannot exceed an upper limit. The speed of sidewise downward movement of cigarettes is also affected by friction between the wrappers of the cigarettes and the surfaces of walls which define the ducts. Therefore, a modern high-speed packing machine (especially a multi-track packing machine) cannot operate at full capacity because the group forming station of the production line cannot furnish arrays of cigarettes at the rate at which such arrays can be wrapped into envelopes by the packing machine.

[0004] French patent application Serial No. 2.012.136 (published Mar. 13, 1970) discloses an apparatus wherein two block forming units are installed next to each other and each of which can gather groups or arrays of twenty cigarettes each at a frequency which is dictated by the force of gravity and by friction between the wrappers of the cigarettes and the surfaces bounding the ducts wherein the cigarettes descend sideways into the respective block forming units. In other words, the frequency at which the receptacles of the intermittently advancing conveyors, which transport finished groups to the packing machine, receive groups or arrays of twenty cigarettes each is not determined by the maximum possible speed of the conveyor and/or by the capacity of the packing machine but rather solely by the ability of the block forming units to gather successive arrays. Thus, there exists an urgent need for an apparatus (such as a production line) which can be resorted to in order to ensure that the capacity of the packing machine determines the frequency at which groups or arrays of commodities can be wrapped into packets or multiple-layer envelopes of paper, cardboard, metallic foil, plastic foil and/or other suitable wrapping materials.

OBJECTS OF THE INVENTION

[0005] An object of the invention is to provide a novel and improved method of gathering groups or arrays or blocks of discrete commodities at a frequency which is determined by the requirements of the processing machine or machines rather than by the gathering or arraying equipment.

[0006] Another object of the invention is to provide a novel and improved method of meeting the requirements of modern high-speed (such as multiple-track) packing or other processing machines.

[0007] A further object of the invention is to provide a novel and improved method of supplying arrays of plain or filter cigarettes or other rod-shaped products of the tobacco processing industry to twin-track packing machines.

[0008] An additional object of the invention is to provide a novel and improved method of and a novel and improved mechanism or apparatus for filling the receptacles of an endless conveyor with arrays of commodities, such as blocks of plain or filter cigarettes, at a rate exceeding that which can be achieved in accordance with heretofore known proposals.

[0009] Still another object of the invention is to provide a method which renders it possible to increase the output of a high-speed cigarette packing machine.

[0010] A further object of the invention is to provide an apparatus which can supply to one or more consumers arrays of discrete commodities at a rate exceeding that achievable with presently known apparatus.

[0011] Another object of the invention is to provide a novel and improved production line for the making of packs containing arrays of discrete commodities, such as blockshaped arrays or groups of rod-shaped products of the tobacco processing industry.

[0012] An additional object of the invention is to provide a novel and improved group forming or arraying apparatus for use in conjunction with packing machines for rod-shaped articles of the tobacco processing industry.

[0013] Still another object of the present invention is to provide a novel and improved combination of a machine or

apparatus for gathering arrays or groups of discrete commodities with a machine which packs or otherwise processes such arrays.

[0014] A further object of the invention is to provide a novel and improved apparatus which can meet the requirements of multi-track machines for the processing of arrays of discrete commodities, such as rod-shaped articles of the tobacco processing industry in so-called quincunx and analogous formations.

[0015] An additional object of the instant invention is to provide an apparatus which constitutes an improvement over and a further development of those disclosed in the aforementioned published French patent application Serial No. 2.012.136.

SUMMARY OF THE INVENTION

[0016] One feature of the present invention resides in the provision of an apparatus for supplying groups or arrays of commodities to a processing machine. The improved apparatus comprises group building means having a plurality of assemblies each including a plurality of group forming units each of which is arranged to gather a succession of groups, and means for transporting groups of commodities from such units to the processing machine.

[0017] The processing machine can constitute a packing machine having at least two tracks which are spaced apart from each other by a first distance. The transporting means of such apparatus can comprise a conveyor having a plurality of neighboring receptacles spaced apart from each other by distances each of which at least approximates the first distance. Each such receptacle is arranged to accommodate a group of rod-shaped articles (e.g., plain or filter cigarettes or other rod-shaped aticles of the tobacco processing industry). The transporting means of such apparatus can further comprise means for intermittently moving the conveyor by increments each having a length of m+1 second distances (m is the number of tracks in the packing machine).

[0018] The group building means of the improved apparatus can include three assemblies, and each such assembly can include two group forming units.

[0019] Alternatively, the group building means can comprise two assemblies, and each such assembly can include three group forming units.

[0020] If the group building means employs two assemblies and each such assembly includes two group forming units, the units of each assembly are preferably spaced apart from each other by a first distance and the assemblies are spaced apart from each other by a second distance which is twice the first distance.

[0021] Each group forming unit can be provided with a fixed outlet (e.g., an outlet in the form of a mouthpiece) for groups of commodities.

[0022] The apparatus can further comprise an intermediate storage facility for each of the group forming units; each such facility is or can be movable between a first position for reception of a group of commodities from the respective unit and a second position for transfer of a group of commodities to the transporting means. At least one of the intermediate storage facilities can be installed in such a way that it is movable at least substantially vertically between its first and second positions. Alternatively, at least one of the intermediate storage facilities can be installed in such a way that it is movable at least substantially horizontally between its first and second positions.

[0023] If each of the group forming units is provided with a fixed outlet for successive groups of commodities, the improved apparatus can further comprise the aforementioned intermediate storage facility for each group forming unit and means for moving such facilities between first positions for reception of groups of commodities from the respective outlets and second positions best suited for transfer of groups or arrays or blocks of commodities to the transporting means. All of the aforementioned moving means are or can be at least substantially identical.

[0024] Another feature of the present invention resides in the provision of a method of supplying a processing machine with groups of commodities. The improved method comprises the steps of establishing a plurality of group building stations with at least two group forming units per station, repeatedly gathering groups of commodities in the group forming units of such group building stations, converting the groups which are assembled by the group forming units into a series of groups in a path leading to the processing machine, and stepwise transporting the groups of the series along such path to the processing machine.

[0025] The processing machine can constitute or include a multi-track packing machine for rod-shaped commodities of the tobacco processing industry. The tracks of such packing machine are or can be spaced apart from each other by a first distance, and the transporting step can include advancing the groups of the series through second distances m+1 times a first distance (m is the number of tracks in the packing machine).

[0026] The converting step can include simultaneously transferring into the path assembled groups of commodities from all of the group forming units of all of the group building stations.

[0027] Alternatively, the converting step can include simultaneously transferring, from one station at a time, into the path all of the groups assembled at the respective station.

[0028] Still further, the converting step can include simultaneously transferring all of the groups which are built at the group building stations.

[0029] It is also possible to select the converting step in such a way that it includes delivering to the path groups of commodities subsequent to completion of pairs of successive stepwise transports of groups along the path.

[0030] Still further, it is possible to select the converting step in such a way that it includes transferring groups of commodities from one station at a time in accordance with a predetermined pattern, e.g., first from one station, thereupon from another of two stations, thereupon from the one station, thereupon from the other station, and so forth.

[0031] The number of stations can equal two, and each station can comprise three group forming units.

[0032] Alternatively, the number of stations can equal three and each station can comprise two group forming units.

[0033] The converting step can include expelling groups of commodities through stationary mouthpieces of the group forming units into discrete mobile storage facilities, and thereupon transporting the storage facilities from the respective mouthpieces to the aforementioned path.

[0034] The packing machine can constitute an updated version of the packing machine known as COMPAS 500 packer.

[0035] 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 constriction and the modes of assembling and operating the same, together with numerous additional important and advantageous features and attributes thereof, will be best understood upon perusal of the following detailed description of certain presently preferred specific embodiments with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] **FIG. 1** is a schematic front elevational view of an apparatus which is designed to gather arrays of rod-shaped articles in accordance with a first embodiment of the invention and is set up to supply such arrays to a twin-track packing machine;

[0037] **FIG. 2** is a similar schematic front elevational view of an apparatus constituting a first modification of the apparatus which is shown in **FIG. 1**;

[0038] **FIG. 3** is a similar view of a third apparatus;

[0039] **FIG. 4** is a similar view of a fourth apparatus; and

[0040] **FIG. 5** is an enlarged fragmentary sectional view substantially as seen in the direction of arrows from the line V-V in **FIG. 2**.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0041] **FIG. 1** illustrates a portion of a production line which includes a multiple-track processing or packing machine PM and a novel apparatus which is designed to supply groups or blocks or arrays **13** of discrete commodities **16** to the two tracks (wrapping lines) of the packing machine. The commodities **16** are rod-shaped products (such as plain or filter cigarettes) of the tobacco processing industry, and each group or array or block **13** (hereinafter called group) contains three superimposed layers of nine discrete rod-shaped products (hereinafter called cigarettes) each.

[0042] The improved apparatus comprises a transporting unit **10** including an endless belt or chain conveyor **11** which carries a series of equidistant receptacles or pockets **12**, and each such pocket is dimensioned to temporarily receive and confine a group of twentyseven cigarettes **16**. The conveyor **11** is arranged to advance, stepwise, in the direction indicated by arrow **9** so that successive pockets **12** advance first toward, past and beyond a group forming location **8** (located at a level above the conveyor **11**, as viewed in **FIG. 1**), thereupon toward, past and beyond an ejecting or expelling station **21** (wherein defective groups **13** are expelled from their pockets **12** in the direction indicated by arrows **22**), and thereupon toward, past and beyond the inlet of the packing machine PM.

[0043] The conveyor **11** is driven stepwise by a suitable motor **6** so that it advances by increments **7** each having a length twice the distance **40** between the centers of two neighboring pockets **12**. This ensures that each incremental advance of the conveyor **11** results in a movement of two foremost filled pockets **12** to positions of alignment with the inlets of the tracks I, II of the packing machine PM. Such foremost groups are thereupon transferred into the respective tracks I, II in directions indicated by the arrows **23**, **24** by implements or robots or other suitable devices not forming part of the present invention. For example, such devices can include one or more pushers of the type shown (at **35**) in the lower part of **FIG. 5**.

[0044] The illustrated location **8** provides room for two group building stations which respectively accommodate two assemblies **18**, **18'** of three preferably identical group forming units **14** and **14'**, respectively. Each of these units is designed to build or form or assemble a group **13** of twentyseven cigarettes **16** in a manner similar or analogous to that disclosed, for example, in commonly owned U.S. Pat. No. 4,471,866 granted Sep. 18, 1984 to Erdmann et al. for "APPARATUS FOR ASSEMBLING ARRAYS OF CIGARETTES IN PACKING MACHINES". A packing machine which embodies a structure of the type disclosed in the '866 patent to Erdmann et al. is known as COMPAS 500 and is distributed by the assignee of the present application.

[0045] Each of the group forming units **14**, **14'** comprises nine upright or nearly upright ducts **15** for sidewise gravitational descent of cigarettes **16** from one or more magazines **17** (**FIG. 1** shows that each of the assemblies **18**, **18'** comprises two magazines **17** and that each of these magazines supplies cigarettes **16** to one of the outer group forming units **14** or **14'** and to a portion of the median group forming unit **14** or **14'**). It is also possible to employ a single magazine for each of the assemblies **18**, **18'** (such arrangement is resorted to in or with many types of the COMPAS 500 packing machines) The magazines **17** can receive cigarettes **16** from suitable makers. For example, each such magazine can receive plain cigarettes from a maker known as PROTOS (distributed by the assignee of the present application) and similar or analogous to that described in U.S. Pat. No. 4,281,670 granted Aug. 4, 1981 to Heitmann et al. for "APPARATUS FOR INCREASING THE PERMEABILITY OF WRAPPING MATERIAL FOR ROD-SHAPED SMOKERS' PRODUCTS". Alternatively, the magazines **17** can receive filter cigarettes from a maker (also called tipping machine) known as MAX which is distributed by the assignee of the present application and is described, for example, in commonly owned U.S. Pat. No. 5,135,008 granted Aug. 4, 1992 to Oesterling et al. for "METHOD OF AND APPARATUS FOR MAKING FILTER CIGARETTES". The MAX machine can receive plain cigarettes from a PROTOS machine.

[0046] Cigarettes **16** descend by gravity from the magazines **17** in the ducts **15** along vertical or substantially vertical (downwardly sloping) paths **36** into the respective group forming units **14** and **14'** to gather into groups **13** which are ready for direct admission into the then registering empty pockets **12** of the conveyor **11** or into intermediate storage facilities **33**. The storage facilities **33** can constitute or include containers which are movable between an upper level for reception of arrays **13** from the respective group forming units **14** or **14'** and a lower level at which they are

in optimum positions for the transfer of their contents (groups **13**) into the then registering empty pockets **12**.

[**0047**] **FIG. 1** further shows two sensors **20** which monitor the contents of successive filled (or presumably filled) pockets **12** downstream of the second assembly **18'** and upstream of the ejecting station **21** to ascertain one or more characteristics of the adjacent groups **13** during the intervals between successive intermittent advancements of the conveyor **11** in the direction of arrow **9**. For example, the sensors **20** can ascertain the number of cigarettes **16** in the adjacent groups **13** as well as the extent to which the cigarettes of the adjacent groups are filled with tobacco particles. Signals from the sensors **20** serve to initiate expulsion of defective groups **13** at the ejecting station **21** (in the direction indicated by the arrows **22**). The ejected cigarettes **16** can be opened up to recover the tobacco particles which are returned into the hopper of the cigarette maker. An apparatus which can test plain or filter cigarettes for the presence of one or more defects is disclosed, for example, in commonly owned U.S. Pat. No. 4,901,860 granted Feb. 20, 1990 to Wahle et al. for "APPARATUS FOR TESTING AND CLASSIFYING CIGARETTES OR THE LIKE".

[**0048**] Apparatus which deliver plain or filter cigarettes to the magazines **17** can be of the type disclosed in U.S. Pat. No. 4,339,026 granted Jul. 13, 1982 to Base et al. for "APPARATUS FOR DELIVERING CIGARETTES OR THE LIKE FROM A MAKER TO A CONSUMING MACHINE", or in commonly owned U.S. Pat. No. 5,472,078 granted Dec. 5, 1995 to Hoffmann et al. for "METHOD OF AND APPARATUS FOR CONVERTING A SINGLE LAYER OF ROD-SHAPED ARTICLES INTO A MASS FLOW".

[**0049**] Satisfactory groups **13** are permitted to advance beyond the ejecting station **21** and to reach the packing machine PM. The two tracks I and II of the machine PM can receive satisfactory groups **13** simultaneously or seriatim. The directions of transfer of satisfactory groups **13** into the tracks I and II are respectively indicated by the arrows **23, 24**. The thus emptied pockets **12** are thereupon advanced back toward the first assembly **18**. The motor **6** for moving the conveyor **11** stepwise, always through increments equaling two distances **40**, can comprise or constitute a suitable stepping motor. The distance **40** between the centers of any two neighboring pockets **12** matches the distance between the centers of the tracks I and II in the packing machine PM.

[**0050**] The mode of operation of the production line including the packing machine PM, the transporting unit **10** and the assemblies **18, 18'** is as follows:

[**0051**] It is assumed that the conveyor **11** of the transporting unit **10** is idle and that the pockets **12** of the conveyor **11** are empty. The magazines **17** of the two assemblies **18, 18'** are assumed to contain supplies of parallel cigarettes **16** (extending at right angles to the plane of **FIG. 1**) and each of the group forming units **14, 14'** is assumed to contain a group or array or block **13** of twentyseven cigarettes **16** in three superimposed layers or strata of nine cigarettes each.

[**0052**] The first step involves the (direct or indirect (via intermediate storage facilities **33**)) transfer of three groups **13** from the group forming units **14** of the assembly **18** into the adjacent (then stationary) pockets **12**. The motor **6** is thereupon caused to advance the conveyor **11** by an increment **7** so that the foremost one of the three freshly filled pockets **12** occupies the position occupied in **FIG. 1** by the empty pocket **12***a*. The units **14** of the assembly **18** can begin to gather three fresh groups **13** (above the filled pocket **12***b* and the immediately following empty pockets **12***c*, **12***d*) as soon as the emptying of the units **14** is completed, and such filling can continue during the following evacuation of the contents of the three units **14'** of the assembly **18'** into the pockets **12** therebelow. Thus, six consecutive pockets **12** of the conveyor **11** are then filled with groups **13** of cigarettes **16**.

[**0053**] The next step involves advancement of the conveyor **11** by an increment **7** and the immediately following step involves a transfer of three groups **13** from the units **14** into the adjacent empty pockets **12** so that the thus filled pockets are separated from the preceding filled pockets by three empty pockets. A further step by another increment **7** results in the placing of three empty pockets **14** beneath the three units **14**, and the contents of such three units **14** are transferred into the empty pockets **12** below them, and so forth.

[**0054**] It will be seen that the intervals which are available for the simultaneous gathering of three groups **13** each in the units **14** of the assembly **18** as well as in the units **14'** of the assembly **18'** are much longer than in the apparatus of the aforediscussed published French patent application Serial No. 2.012.136 because each such interval includes at least one period of dwell and at least one period of advancement of the conveyor **11**. This greatly increases the likelihood that each of the groups **13** will contain a prescribed number of cigarettes **16** as well as that each such group will contain the requisite number of cigarettes in optimum positions relative to each other. Therefore, the number of rejects which must be evacuated at the ejecting station **21** is much lower than in conventional production lines even though the output of the devices at the group forming location **8** is highly satisfactory. All this is attributable to the provision of plural block building assemblies (**18, 18'**), to the provision of the distance (2×40) between these assemblies, the provision of several units (**14, 14'**) per assembly, and the feature that the transfer of three groups **13** from the unit **14** of the assembly **18** need not take place simultaneously with the transfer of three groups **13** from the units **14'** of the assembly **18'** into the adjacent empty pockets **12**.

[**0055**] Otherwise stated, the improved method and apparatus render it possible to operate the multiple-track packing machine PM at full capacity because, even though the intervals for the assembling or building of the groups **13** are long, this does not necessitate a slowing down of the delivery of pairs of freshly assembled groups **13** to the tracks I and II of the packing machine PM.

[**0056**] **FIG. 2** illustrates certain relevant parts, units and assemblies of a modified production line. All such constituents of this production line which are identical with or clearly analogous to the corresponding constituents of the production line of **FIG. 1** are denoted by similar reference characters. This also applies for the embodiments which are illustrated in **FIGS. 3 and 4**.

[**0057**] The group forming location **8**A of **FIG. 2** comprises a series of three successive equidistant neighboring group building assemblies **18, 18', 18"** each of which com-

prises only two group forming units **14**, **14'**, **14"**, respectively. The production line of **FIG. 2** further employs transfer units **25** which are designed to move groups **13** of cigarettes **16** from the group forming units **14**, **14'**, **14"** into the then adjacent or registering or properly positioned empty receptacles or pockets **12** of the conveyor **11**. Each transfer unit **25** includes an intermediate storage facility **33** which can assume a first position for reception of groups **13** from the fixed mouthpieces or outlets **30** (see **FIG. 5**) of the respective units **14**, **14'**, **14"** and a second position (shown in the lower part of **FIG. 5**) for the transfer of such groups into the adjacent empty pockets **12**.

[**0058**] The details of one of the transfer units **25** are shown in **FIG. 5**. The group forming unit **14** of **FIG. 5** has the aforementioned fixed outlet or mouthpiece **30** which serves to guide the cigarettes **16** of an assembled or formed group **13** which is being expelled from the respective unit **14** by a first pusher **31**. Such group **13** enters the respective intermediate storage facility **33** which is adjacent an abutment or stop **34** serving as a means for properly aligning the cigarettes **16** of the freshly transferred group **13**. The facility **33** is movable (e.g., vertically in and counter to the direction indicated by the arrow **5**) between the (upper) level of the outlet **30** of the respective unit **14** and the (lower) level of the adjacent empty pocket **12**. A second pusher **32** is provided to transfer the array **13** from the (lowered) storage facility **33** into the adjacent empty pocket **12** against a second stop **32***a*. The pusher **35** which is shown in the lower right-hand portion of **FIG. 5** is provided at the inlet of the packing machine PM to expel groups **13** from their pockets **12** into the track I or II.

[**0059**] The transfer units **25** are employed when the space which is available at the group forming location **8**A is such that the individual group forming units **14**, **14'**, **14"** cannot be installed directly above the path for the pockets **12** being borne by the upper reach or stretch of the conveyor **11**.

[**0060**] In **FIG. 2**, the positions of the intermediate storage facilities **33** at the (upper) levels of the respective outlets **30** are indicated by solid lines and the positions of such storage facilities at the (lower) levels of the pockets **12** are denoted by broken lines. When in their lower end positions, the storage facilities **33** can be located in front of or behind the adjacent pockets **12**, depending upon the nature of the space which is available for such storage facilities and for the pushers **31**, **32** at the group forming units **14**, **14'** and/or **14"**.

[**0061**] The mode of operation of the production line including the structures shown in **FIGS. 2 and 5** is as follows:

[**0062**] It is again assumed that the pockets **12** of the conveyor **11** are empty and that each of the group forming units **14**, **14'**, **14"** contains a fully grown or a growing (incipient) group **13**. The motor **6** (not shown in **FIG. 2**) for the conveyor **11** is set to advance the conveyor **11** through increments **7** matching the distances between the centers of the first, third, fifth, etc. pockets **12**, i.e., the same as in **FIG. 1**. Each such increment **7** equals twice the distance **40** between the centers of the tracks I, II of the packing machine PM.

[**0063**] The first step involves simultaneous transfer of pairs of groups **13** from each of the three assemblies **18**, **18'**, **18"** into the adjacent or allocated pockets **12** by way of the respective transfer units **25**. This results in simultaneous filling of six neighboring pockets **12**. The next steps involve three successive stepwise advances of the conveyor **11** in the direction of arrow **9** to thus move successive foremost pairs of groups **13** into positions for transfer into the tracks I and II of the packing machine PM. In the meantime, the group forming units **14**, **14'**, **14"** jointly (simultaneously) accumulate six fresh groups **13** which are thereupon transferred into the six empty pockets **12** immediately following the six filled pockets of the conveyor **11**. It will be seen that the production line including the structure of **FIGS. 2 and 5** establishes even longer intervals of time for the gathering of fresh groups **13** so that the likelihood of the formation of unsatisfactory groups (due to the influence of gravity and/or friction between the wrappers of the cigarettes **16** and the surfaces bounding the ducts **15**) is even more remote.

[**0064**] **FIG. 5** shows that the improved apparatus including the structure at the group forming location **8**A and the transporting unit **10** has means **31**, **32**, **35** for moving groups **13** horizontally between first and second positions, as well as means (note the schematically indicated elevator **4**) for moving groups **13** vertically or substantially vertically between upper and lower levels, i.e., between the outlets **30** of the group forming units **14**, **14'**, **14"** and the level of the properly positioned empty pockets **12**.

[**0065**] The pushers **31**, **32**, **35**, the outlets **30**, the storage facilities **33** and/or the pockets **12** can further serve as a means for at least slightly compressing or compacting and thus shaping the groups **13** of cigarettes **16**.

[**0066**] In **FIG. 1**, the length of successive advances of pockets **12** between successive deliveries of groups **13** thereto equals m wherein m is a whole number matching the number of tracks I, II of the packing machine PM.

[**0067**] The total number of units **13** in the apparatus of the present invention can equal m×n wherein each of m and n is a whole number equal to or greater than two. In **FIG. 2, m** (i.e., the number of assemblies **18**, **18'**, **18"**) equals three, and n (i.e., the number of group forming units **14**, **14'**, **14"** in each assembly) equals two. In **FIG. 1, m** equals two and n equals three.

[**0068**] An advantage of the apparatus of **FIG. 2** is that, since all of the six simultaneously assembled groups **13** can be expelled from the respective units **14**, **14'**, **14"** in a single step, and all of the thus simultaneously expelled groups **13** can be introduced into the then aligned empty pockets **12** in a single step, the number of pushers **31**, **32**, **35** can be reduced to a minimum (i.e., one pusher **31**, one pusher **32** and one pusher **35**).

[**0069**] Furthermore, and as already mentioned above, the apparatus of **FIG. 2** provides for very long intervals of time which are available for the simultaneous building or assembling of six groups **13** in the three pairs of group forming units **14**, **14'**, **14"**. The three steps of forward movement of the conveyor **11** between successive transfers of freshly gathered groups **13** into empty pockets **12** can be carried out as rapidly as is permissible for the transfer of pairs of groups **13** into the packing machine PM during each interval of dwell of the conveyor **11**.

[**0070**] The production line including the structure of **FIG. 3** comprises a group forming location **8**B for two array or block or group forming assemblies **18**, **18'** each of which

includes two group forming units **14**, **14'**. In this embodiment, the building or assembling of groups **13** can take place during intervals each of which includes one stepwise advancement of the conveyor **11** along its endless path. The distance between the right-hand group forming unit **14** and the left-hand group forming unit **14'** equals three distances **40**, and the length of incremental advances **(7)** is the same as in the embodiments of **FIGS. 1 and 2**. The units **14**, **14'** discharge their contents (i.e., freshly formed groups **13**) simultaneously after each second incremental advance of the pockets **12**. However, it is equally possible to operate the structure of **FIG. 3** in such a way that the units **14** discharge the freshly formed groups **13** after a first step, the units **14'** discharge after the next-following second step, the units **14** discharge after the next-following third step, the units **14'** discharge after the next-following fourth step, and so forth.

[0071] The distance between the tracks I and II of the packing machine PM again equals the distance **40**, i.e., the distance between neighboring group forming units **14** or **14'**. In all other respects, the production line embodying the structure of **FIG. 3** can be constructed and operated in a manner as described with reference to **FIG. 1** or **2**, i.e., the units **14**, **14'** shown in **FIG. 3** can discharge freshly formed groups **13** directly into the then adjacent empty pockets **12** or into intermediate storage facilities **33** (not shown in **FIG. 3**).

[0072] The group forming location **8**C in the production line including the structure shown in **FIG. 4** accommodates two array or block or group building assemblies **18**, **18'** which are constructed and assembled in such a way that the two group forming units **14**, as well as the two group forming units **14'**, are spaced apart from each other by distances 2×40 but that the right-hand unit **14** and the left-hand unit **14'** are spaced from each other by a distance **40**. The distance **40** equals that between the centers of the tracks I and II of the packing machine PM.

[0073] The operation of the production line including the structure shown in **FIG. 4** is such that the group forming units **14** discharge their contents (groups **13**) after the conveyor **11** completes a first step, the units **14'** discharge their contents (groups **13**) after the conveyor **11** completes the next (second) step, that the units **14** discharge their contents after the conveyor **11** completes the third step, and so on. Thus, the assembling of the groups **13** can take up relatively long periods of time because each such period covers an interval of dwell and two periods of advancement of the conveyor **11**. The transfer of groups **13** from the group forming units **14**, **14'** into the (then) adjacent empty pockets **12** can take place directly (as described with reference to **FIG. 1**) or indirectly (e.g., by way of intermediate storage facilities **33** and transfer units **25** as described with reference to **FIGS. 2 and 5**).

[0074] It is also possible to operate the production line including the structure of **FIG. 4** in such a way that the group forming units **14**, **14'** discharge freshly assembled groups **13** simultaneously after each second stepwise advance of the conveyor **11**.

[0075] As a rule, or at least in many instances, the term "array" or "block" or "group" (as utilized in this specification and in the appended claims) is intended to denote an assembly of cigarettes or other types of commodities which are caused to assume predetermined positions relative to each other. For example, in lieu of the aforementioned formations each of which includes three layers of nine cigarettes each, it is equally possible to assemble plain or filter cigarettes or other types of rod-shaped articles in so-called quincunx formations wherein two outer layers of, for example, seven articles each flank a median layer of six articles which are staggered relative to the articles of the outer layers. Still further, the articles need not necessarily be rods because the method and the apparatus of the present invention can be put to use, with equal or similar advantage, in connection with the conveying and/or other processing or treatments which necessitate retention of articles or other commodities in receptacles corresponding to those of the units **14**, **14'** and/or **14"** for intervals of time at least slightly longer than the shortest possible interval of gathering a certain number or quantity (e.g., by weight) of commodities in a receptacle or the like.

[0076] An advantage of each embodiment of the improved method and apparatus is that the number of groups **13** which are delivered to the conveyor **11** per unit of time is greater than in heretofore known apparatus, and this is achieved without unduly shortening the intervals which are taken up for the gathering of groups **13**. The reason is that the gathering of groups **13** takes place in at least two assemblies (such as **18**, **18'**, **18"**) each of which comprises at least two group forming units (such as **14**, **14'**, **14"**).

[0077] Stated differently, the frequency of transfers of groups **13** to the conveyor **11** is higher than the frequency or time of gathering of successive groups **13** in the units **14**, **14'** or **14**, **14'**, **14"**.

[0078] The lengths of successive steps carried out by the conveyor **11** are or can be m+1 (wherein m is a whole number matching the number of tracks (I, II) in the packing machine PM.

[0079] U.S. Pat. No. 5,718,102 (granted Feb. 17, 1998 to Draghetti for "METHOD AND DEVICE FOR FORMING AND TRANSFERRING GROUPS OF CIGARETTES ON A PACKING MACHINE WITH MULTIPLE WRAPPING LINES") discloses an apparatus which is designed to gather pairs of groups or arrays of twenty cigarettes each in the pockets of an intermittently advancing endless conveyor serving to deliver successive pairs of fully grown arrays to two tracks (called wrapping lines) of a packing machine. A drawback of such proposal is that the layers of cigarettes of each array must be repeatedly shifted relative to each other with attendant pronounced likelihood of defacing of and/or other damage to the cigarettes. Moreover, the mechanism which serves to transfer discrete layers of cigarettes into the pockets of the intermittently advancing conveyor is complex and bulky; in fact, such mechanism can take up more space than the mechanism which gathers layers of cigarettes next to one side of the path for the pockets of the intermittently advancing conveyor.

[0080] Additional apparatus which are designed to gather cigarettes or the like into arrays ready for admission into a packing machine are disclosed in U.S. Pat. No. 3,278,077 (granted Oct. 11, 1966 to Schmermund for "DEVICE FOR HANDLING ELONGATED ARTICLES"), U.S. Pat. No. 4,735,032 (granted Apr. 5, 1988 to Focke for "APPARATUS FOR CONVEYING CIGARETTE GROUPS"), and U.S. Pat. No. 5,617,943 (granted Apr. 8, 1997 to Belvederi et al. for "GROUP FORMING DEVICE FOR CIGARETTE PACKING MACHINES".

[0081] 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 that, from the standpoint of prior art, fairly constitute essential characteristics of the generic and specific aspects of the above outlined contribution to the art of packing cigarettes and the like and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the appended claims.

What is claimed is:

1. Apparatus for supplying groups of commodities to a processing machine, comprising:

group building means having a plurality of assemblies each including a plurality of group forming units each arranged to gather a succession of groups; and

means for transporting groups from said units to the processing machine.

2. The apparatus of claim 1, wherein the processing machine is a packing machine having at least two tracks spaced apart from each other by a first distance, said transporting means comprising a conveyor having a plurality of neighboring receptacles spaced apart from each other by identical second distances each of which at least approximates said first distance, each of said receptacles being arranged to accommodate a group of rod-shaped articles.

3. The apparatus of claim 2, wherein said transporting means further comprises means for intermittently moving said conveyor by increments each having a length of m+1 second distances, m being the number of tracks in the packing machine.

4. The apparatus of claim 1, wherein said group building means has three assemblies and each of said assemblies includes two group forming units.

5. The apparatus of claim 1, wherein said group building means has two assemblies and each of said assemblies includes three group forming units.

6. The apparatus of claim 1, wherein said group building means has two assemblies and each of said assemblies includes two group forming units, the units of each assembly being spaced apart from each other by a first distance and said assemblies being spaced apart from each other by a second distance twice said first distance.

7. The apparatus of claim 1, wherein each of said units has a fixed outlet for groups of commodities.

8. The apparatus of claim 1, further comprising an intermediate storage facility for each of said units, each of said facilities being movable between a first position for reception of a group of commodities from the respective unit and a second position for transfer of a group to said transporting means.

9. The apparatus of claim 8, wherein at least one of said intermediate storage facilities is movable at least substantially vertically between said first and second positions thereof.

10. The apparatus of claim 8, wherein at least one of said intermediate storage facilities is movable at least substantially horizontally between said first and second positions thereof.

11. The apparatus of claim 1, wherein each of said units has a fixed outlet for discrete groups of commodities, and further comprising an intermediate storage facility for each of said units and means for moving the facilities between a first position for reception of a group from the respective outlet and a second position for transfer of a group to said transporting means.

12. The apparatus of claim 11, wherein all of said moving means are at least substantially identical.

13. A method of providing a processing machine with groups of commodities, comprising the steps of:

establishing a plurality of group building stations with at least two group forming units per station;

repeatedly gathering groups of commodities in the group forming units of the group building stations;

converting the groups assembled by the group forming units into a series of groups in a path leading to the processing machine; and

stepwise transporting the groups of the series along the path to the processing machine.

14. The method of claim 13, wherein the processing machine is a multiple-track packing machine for rod-shaped commodities of the tobacco processing industry.

15. The method of claim 14, wherein the tracks of the packing machine are spaced apart from each other by a first distance and said transporting step includes advancing the groups of the series through second distances m+1 times a first distance wherein m is the number of tracks in the packing machine.

16. The method of claim 13, wherein said converting step includes simultaneously transferring into the path assembled groups of commodities from all of the units of all of the group building stations.

17. The method of claim 13, wherein said converting step includes simultaneously transferring, from one station at a time, into said path all of the groups assembled at the respective station.

18. The method of claim 13, wherein said converting step includes simultaneously transferring all of the groups built at the group building stations.

19. The method of claim 13, wherein said converting step includes delivering to the path groups of commodities subsequent to completion of pairs of successive stepwise transports of groups along the path.

20. The method of claim 13, wherein said converting step includes transferring groups of commodities from one station at a time in accordance with a predetermined pattern.

21. The method of claim 13, wherein the number of stations equals two and each station comprises three group forming units.

22. The method of claim 13, wherein the number of stations equals three and each station comprises two group forming units.

23. The method of claim 13, wherein said converting step includes expelling groups of commodities through stationary mouthpieces of the group forming units into discrete mobile storage facilities and thereupon transporting the storage facilities from the respective mouthpieces to the path.

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