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Giatti

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[54] **STORING AND FEEDING DEVICE FOR CIGARETTES**

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[52] **U.S. Cl.** ..... **198/22 R,** 198/25

[51] **Int. Cl.** **B65g 47/61**

[58] **Field of Search** ..... 198/22 R, 22 B, 25, 198/103, 211; 131/25

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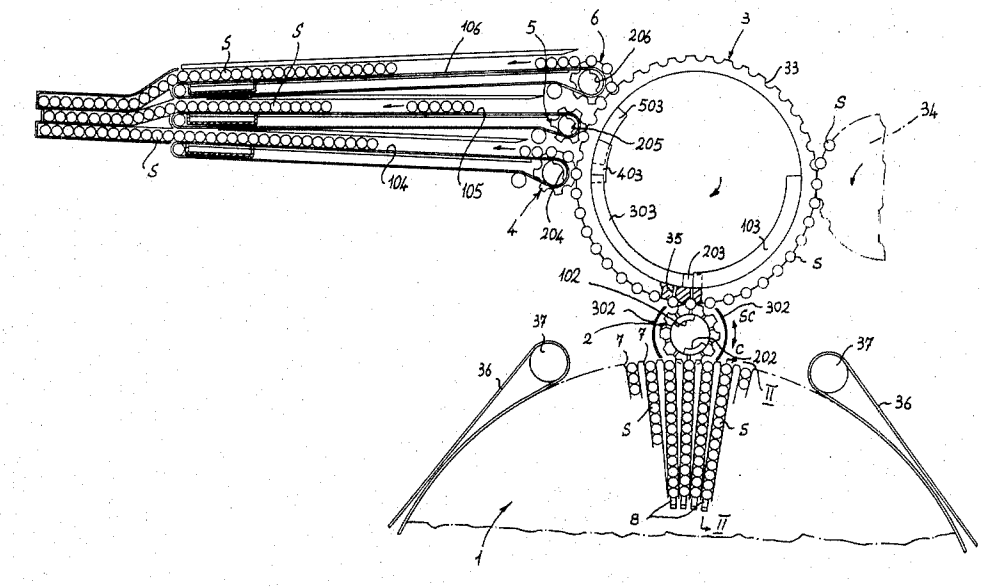
Primary Examiner—Edward A. Sroka

Attorney—George W. Price et al.

[57] **ABSTRACT**

Apparatus for storing and feeding cigarettes, which comprises a conveyor for advancing cigarettes from the output of a cigarette manufacturing unit, means for receiving cigarettes from the conveyor and transporting them to the input of a cigarette packer, a cylindrical storage unit having a plurality of cigarette receiving slots open to the periphery thereof mounted adjacent the conveyor between the output of the cigarette manufacturing unit and the input of the cigarette packer, and means responsive to operating conditions in the packer for transferring cigarettes between the conveyor and the slots in the storage unit.

19 Claims, 3 Drawing Figures



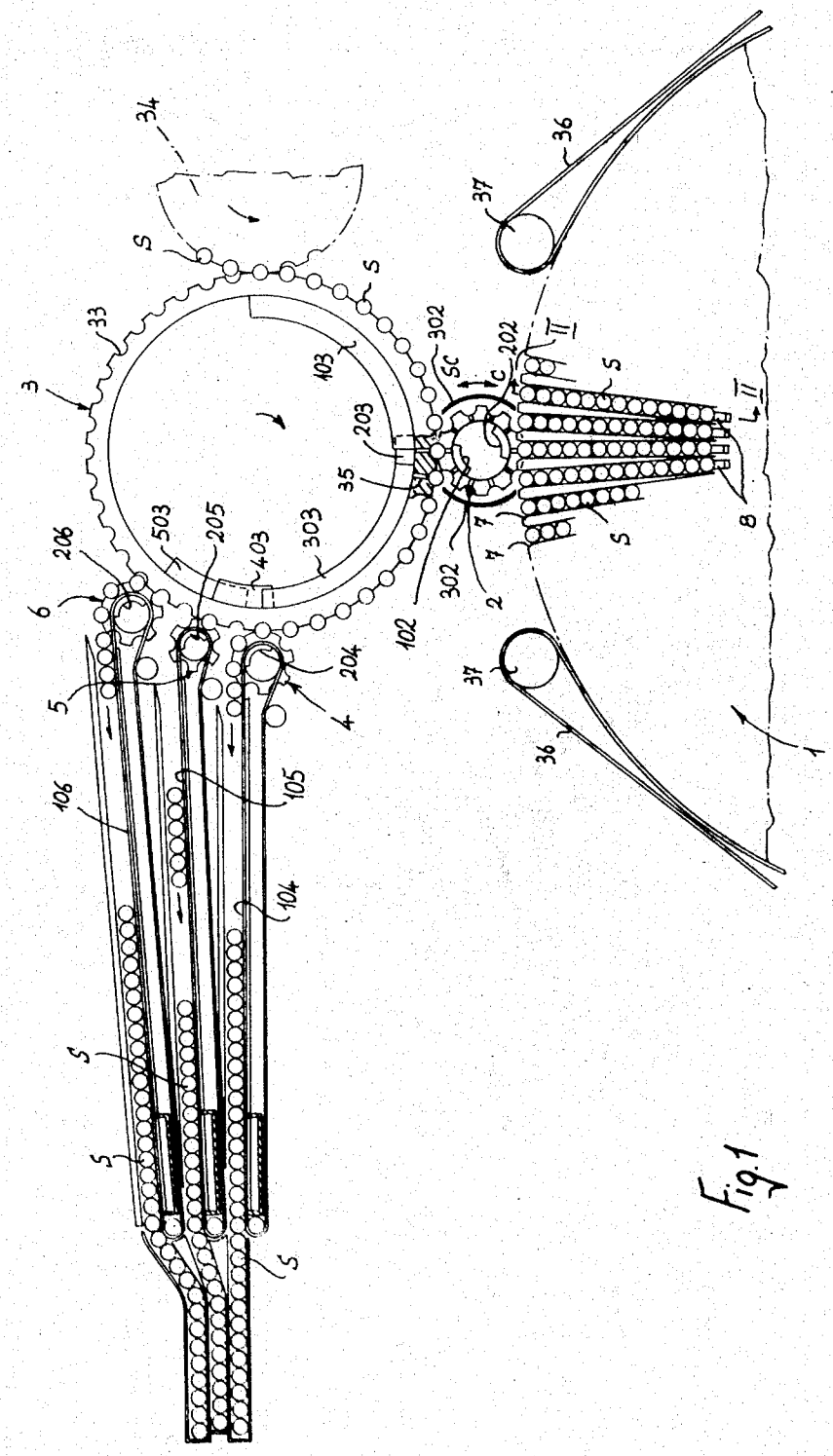

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Fig 1

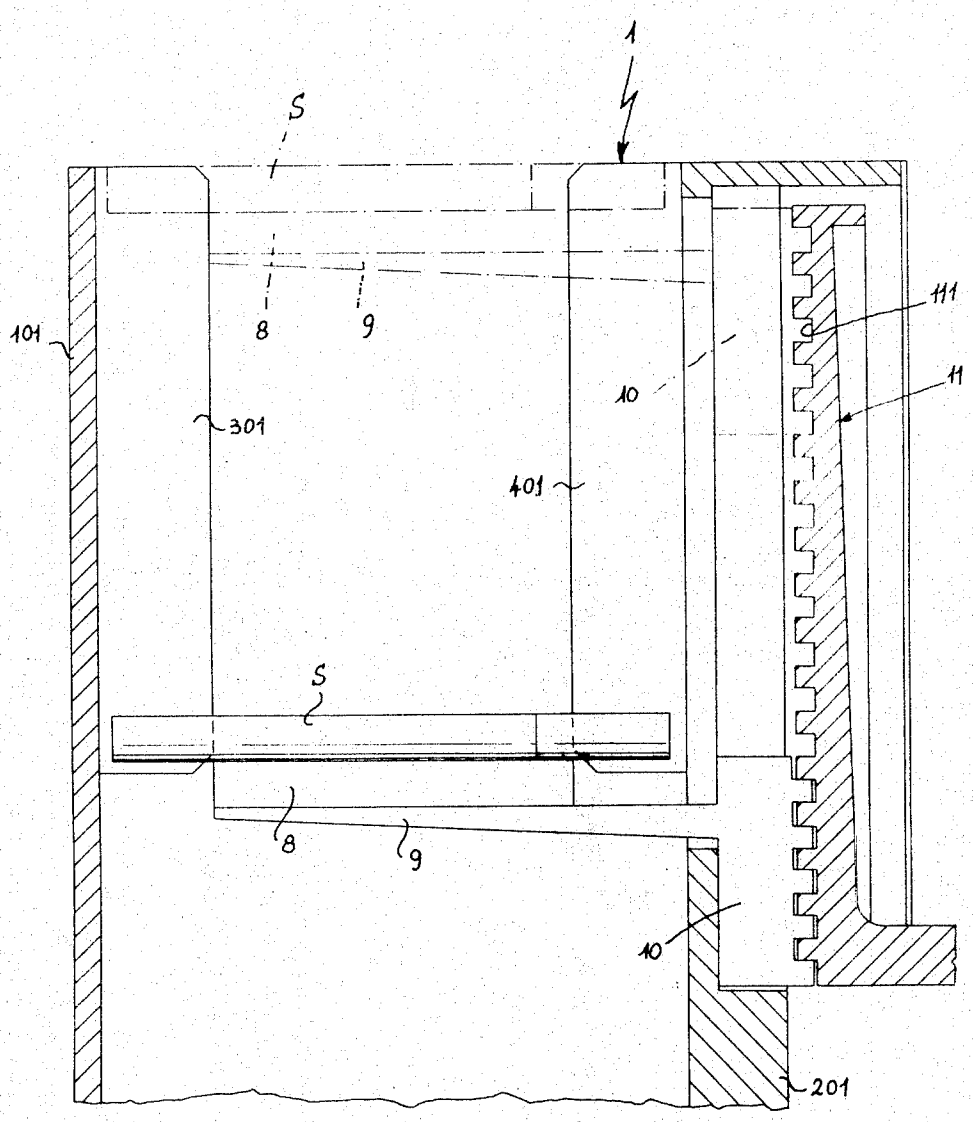

Fig. 2

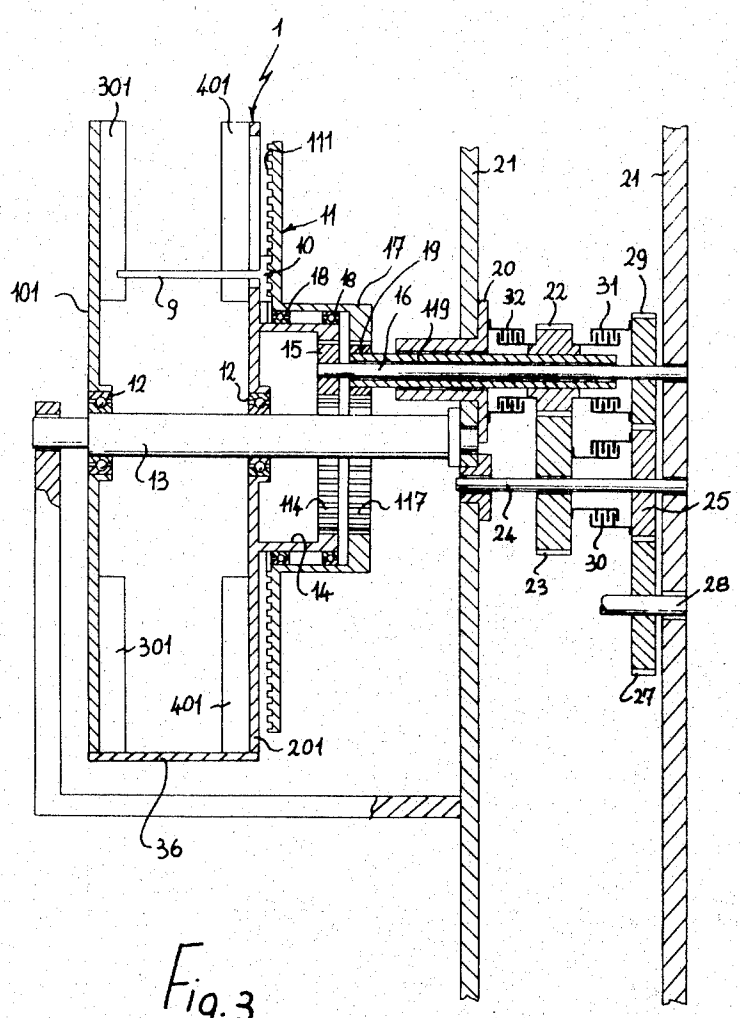
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Fig. 3

STORING AND FEEDING DEVICE FOR CIGARETTES

BACKGROUND

This invention relates to the handling of rod like articles such as cigarettes and more particularly to a storing and feeding device interposed between a cigarette making machine and a cigarette packing machine.

The development of the cigarette industry has long been dominated by the joint themes of automating and accelerating the production process. As a result, cigarette making machine output has been recently raised to 4,000 per minute by a new generation of machines and the output of cigarette packing machines has been increased by a corresponding amount.

This increase in maker and packer outputs has strained the current mode of connecting the two machines. This mode has involved attaching a tray filler to the maker output, incorporating a tray stacker into the line and the taking of stacks of trays to the packer where a tray feeding and inverting mechanism is associated with the infeed of the packer. This arrangement not only constitutes a substantial expense in capital outlay and manual labor, but also incorporates additional apparatus and interfaces between apparatus into the system, increasing the possibilities for malfunctions.

SUMMARY

It is, therefore, an object of this invention to provide an improved apparatus connecting a cigarette maker and a cigarette packer.

It is a further object of this invention to provide apparatus directly connecting a cigarette maker and a cigarette packer with a cigarette storage and delivery unit therebetween.

It is another object of this invention to provide apparatus for receiving cigarettes from a conveyor thereof and for storing the same for subsequent delivery back to the conveyor.

It is a more specific object of this invention to provide a cigarette storage drum for receiving cigarettes from a conveyor and storing them for delivery back to the conveyor, the drum having a plurality of radial slots of variable depth and means for driving the slots past the conveyor for receiving a single cigarette and means for adjusting the depth of the slots so they may receive additional cigarettes.

In accordance with these and other objects, apparatus according to the invention comprises a conveyor for advancing rod-like articles from a first location to a second location, a storage unit having a plurality of rod-like articles receiving slots mounted adjacent the conveyor, means for driving the slots of the storage unit into spaced relationship with the rod-like article conveyor and means for transferring rod-like articles between the conveyor and the slots in the storage unit.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front schematic view, partially broken away, of a preferred embodiment of apparatus according to the invention.

FIG. 2 is a partial section, in a greater scale, taken on lines II—II of FIG. 1.

FIG. 3 is a sectional view taken on a plane analogous to the one identified by lines II—II.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the drawings, particularly FIG. 1, apparatus according to the invention generally comprises a cigarette storage drum 1 mounted adjacent a fluted cigarette conveying drum 3, which receives cigarettes S from the outfeed drum 34 of a cigarette maker or filter tip attachment and transports them to three fluted counting drums, 4, 5 and 6, each of which is operable to remove cigarettes from the conveying drum 3 and deliver them to a respective transfer tape 104, 105 and 106 which convey the cigarettes to the infeed of a cigarette packer. Cigarettes are transported between the storage drum 1 and the conveying drum 3 by a fluted transfer wheel 2.

More specifically, the storage drum 1 comprises two co-axial disks 101 and 201, which are mounted in parallel spaced relationship to each other on a fixed shaft 13 by respective bearings 12. The disks are spaced apart a distance that is adjustable in accordance with the length of the cigarettes which are to be stored in the drum.

A plurality of ribs, designated 301 and 401, extend inwardly a short distance from the opposed faces of disks 101 and 201, respectively. The ribs extend radially from the periphery of the disks towards the common axis thereof and are equispaced angularly around said axis in facing parts so as to form a plurality of radial slots 7 therebetween. The slots 7 are open towards the periphery of drum 1 so that the cigarettes S can be received and stacked therein.

As seen most clearly in FIG. 2, the bottom of each slot 7 is formed by a slide 8 which is fastened to a bracket 9 cantilevered from one face of a sliding block 10. A spiral thread 110 is formed on the other side of block 10 and meshes with a corresponding spiral thread 111 formed on a face of a disk 11 rotatably mounted coaxially with disks 101 and 201. With this arrangement, the slides 8 are movable radially as disk 11 rotates to vary the effective depth of the slots.

The disks 101 and 201 are mounted for rotation with respect to shaft 13 on the bearings 12. Disk 201, and by dint of the connection formed by brackets 9, disk 101, are rotated by a pinion and gear assembly that commences with a hollow cylinder 14 formed integrally to disk 201 and mounted coaxially with shaft 13. An inner portion of disk 2 forms one of the bases of the cylinder 14, the other base being open and being provided with an inner ring gear 114. A pinion 15, keyed to the end of a drive shaft 16, meshes with the ring gear 114.

A hollow cylinder 17 is formed integrally with disk 11 and is mounted outwardly of and coaxially with cylinder 14. Cylinder 17 is rotatably mounted with respect to cylinder 14 on bearings 18. One end of cylinder 17 is open and is provided with a ring gear 117, which is coaxial to shaft 13.

A pinion 19 is fastened to the end of a hollow shaft 119 through which shaft 16 passes. The hollow shaft 119 is supported in a bushing 20 formed integrally with the machine fixed frame 21. A toothed wheel 22 is keyed to hollow shaft 119 and meshes with a wheel 23 which is rotatably mounted on a spindle 24 rotatably supported in frame 21. A toothed wheel 25 is keyed on spindle 24 and meshes with a drive wheel 27, which is rotatable around pivot 28, and a toothed wheel 29 keyed to shaft 16.

Wheels 23 and 25 can be kinematically coupled through a clutch 30, actuated by a solenoid through a suitable control. An analogous clutch 31 allows the coupling of wheels 22 and 29, while another similar clutch 32 acts as a brake, which locks wheel 22 when both clutches 30 and 31 are disengaged.

The chain of toothed wheels 27, 25, 29 achieves a unitary drive ratio between wheels 27 and 29, while the pair 22, 23 doubles the revolving speed of wheel 22 in relation to wheel 27.

The pairs constituted, respectively, by pinion 15 and ring gear 114, and by pinion 19 and ring gear 117 have the same drive ratio. Pair 15, 114 rotates disks 101 and 201 of drum 1. Pair 19, 117 rotates disk 11, causing spiral screw thread 111 to effect the radial displacement of brackets 9 towards and away from the axis of shaft 13 by a length substantially equal to the diameter of a cigarette at each rotation of the drum 1 in relation to disk 11.

During the inoperative mode of the storage drum clutch 31 is engaged and clutch 30 and brake 32 are disengaged. With this arrangement drum 1 and disk 11 rotate at the same speed, whereby no radial displacement of the brackets 9 (and thus slides 8) occurs. Thus, drum 1 rotates without the capability of either receiving or delivering cigarettes.

In the cigarette receiving mode of the storage drum, clutch 30 is engaged and clutch 31 and brake 32 are disengaged and thus both shaft 16 and hollow shaft 119 are rotated. However, the angular velocity of the hollow shaft 119 is twice as high as that of shaft 16. This will rotate spiral gear 111 of disk 11 twice as fast as the drum 1 and the brackets 9 will be driven radially inwardly with respect to the geometrical axis of shaft 13, whereby the cigarettes can be received in flutes 7 at the rate of one cigarette per flute every time drum 1 makes one revolution.

When it is desired to return cigarettes from the storage drum to the conveyor drum brake 32 is actuated and clutches 30 and 31 are disengaged. With this arrangement, disk 11 is stationary, while drum 1 rotates, whereby there exists relative rotation between the disk 11 and the drum that is opposite in direction to that described hereinabove in connection with the cigarette receiving mode. This relative rotation motion causes the brackets 9 to be radially displaced outwardly in relation to the geometrical axis of shaft 13, and thus the slides 8 discharge cigarettes from the slots 7 at the rate of one cigarette per slot every time drum 1 makes one revolution.

The fluted conveyor drum 3 includes a hollow drum type body having a plurality of longitudinal grooves 33 angularly equispaced in the periphery thereof, each suitable to receive a cigarette S from a cigarette maker or filter tip attachment through an intermediate infeed drum 34.

Each groove 33 includes a row of longitudinally interspaced radial holes 35 located at the bottom thereof which, due to the rotation of drum 3, communicate periodically and sequentially with a plurality of suction chambers 103, 203, 303, 403 and 503 arranged in series inside of drum 3 so as to follow said drum along the arc included between the line of coordination between drums 3 and 34 and the line of coordination between drum 3 and the last of the fluted counting drums 6.

The suction chambers can be selectively set to communicate with a suitable suction source (that is, a chamber in which air pressure is constantly maintained at a value lower than that of the environmental atmospheric pressure) so as to generate through holes 35 a pneumatic suction as required to retain the cigarettes in the grooves of distributing drum 3. The communication between each chamber and said source occurs through shutoff valves, the opening and closing of which is automatically controlled by suitable means in accordance with the operative sequences which will be described hereinbelow.

The fluted counting drums 4, 5 and 6 have a structure similar to that of drum 3 and include respective suction chambers 204, 205, 206 so arranged as to hold the cigarettes on the drums until delivered to the associated tapes 104, 105 and 106. These suction chambers also communicate with the suction source through respective automatically operated shutoff valves, controlled in accordance with the above mentioned operative sequence. The tapes 104, 105 and 106 are perforated and suitable suctions means are coupled thereto to retain the cigarettes thereon. The perforated tapes convey the rows of cigarettes picked up by counting drums to the packer compressor pockets (not shown).

The transfer drum 2 also has a structure similar to drum 3 with two suction chambers 102 and 202 and two side curved guides 302, arranged on opposite sides thereof to retain the cigarettes in the grooves of said drum during their transfer to and from storing drum 1. Obviously, drum 2 is operatively coordinated with drums 1 and 3. Suction chambers 102 and 202 are connected to the suction source through automatically operated shutoff valves to apply vacuum to one or the other chamber according to the desired operation of the device.

More particularly, vacuum is applied to chamber 102 when the cigarettes coming from the cigarette maker through intermediate drum 34 and distributing drum 3 must be stacked in the slots 7 of storage drum 1, while vacuum is applied to chamber 202 when the maker is inoperative and cigarettes must be transferred from the slots of drum 1 to the packer.

An endless tape 36, guided on return rollers 37 accompanies drum 1, except in the area of drum 2, so as to prevent the cigarettes from falling from flutes 7 as a consequence of the rotation of drum 1.

The various drums of the device according to the invention are operatively connected in an interdependent manner and the drive (not shown) for rotating the drums is preferably taken off the filter tip attachment through a clutch which maintains a timing correlation between the two devices, or from the packer through a clutch which does not require the maintenance of said timing correlation.

During normal operation of the maker-filter tip attachment-packer system, when the cigarettes are directly transferred from drum 34 to counting drums 4, 5 and 6 through conveyor drum 3, and during the loading phase of storing drum 1, when the cigarettes are transferred from drum 34 to drum 1 through conveyor drum 3 and transferring unit 2, the drive is derived from the filter tip attachment, while, when the production unit is stationary, the drive is taken off the packer to transfer the cigarettes from storing drum 1 to counting drums 4, 5 and 6 through transferring unit 2 and distributor 3.

In operation, when cigarettes are being delivered directly from the maker or filter tip attachment to the

packer, the storage drum is in its inoperative mode and neither receives cigarettes from conveyor drum **3**, nor delivers cigarettes thereto. A certain reserve of cigarettes will generally exist in the slots **7** in this mode.

A vacuum is always maintained in chambers **103, 203** and **303**, while in chambers **403** and **503** vacuum will be applied first in one chamber and then in both chambers, in accordance with controls responsive to the counting of drums **4** and **5** respectively so as to form the desired row of cigarettes subsequently on tapes **104, 105** and **106**. The rows of cigarettes can consist, for instance, of seven cigarettes on tapes **104** and **106** and six on tape **105**. It is evident that the vacuum drop and restoration in the various suction chambers will be effected automatically by actuating and interrupting the above mentioned remote controlled shutoff valves interposed between each chamber and the suction source.

More particularly, with vacuum in chamber **204** and atmospheric pressure in chamber **403** and **503** for the length of time equivalent to the transit of seven consecutive grooves of conveyor drum **3** in the area of the line of coordination with drum **4**, the latter picks up a row of seven cigarettes and transfers them to tape **104**.

Then, vacuum drops in chamber **204**, while the vacuum in drum **3** is extended to chamber **403** and at the same time vacuum is applied in chamber **205** for the length of time equivalent to the transit of six consecutive grooves of distributing drum **3** in the area of the line of coordination with counting drum **5**, whereby the latter picks up a row of six cigarettes from drum **3** and transfers it to the associated tape **105**.

Finally, vacuum drops in **205** while it is applied in chamber **503**, vacuum being still maintained in chamber **403** and constantly maintained in chamber **206**. Thus, a row of seven cigarettes is formed on tape **106** in a manner similar to the row on tape **104**. However, as soon as the last cigarette of this latter row has passed beyond the line of coordination of drum **4**, vacuum stops in **403** while it is reset in **204**, thus initiating the next cigarette row forming cycle.

To provide for start-up, a photocell type is mounted to start the packer only after a predetermined number of cigarettes has been collected on tapes **104, 105** and **106**, for example, enough cigarettes to fill about one third of the conveying length of the tapes.

If the packer becomes inoperative, the rows of cigarettes on tapes **104, 105** and **106** become longer since the infeed to the packer compressor pockets is blocked. When the length of the rows on the tapes is about to exceed a pre-set limit, corresponding, for instance, to two thirds of the active section of the tape, a device, for example, of the photocell type, detects this excess length and generates a control signal. The control signal drops the vacuum in chamber **203** of the conveyor drum **3**, while it applies vacuum in chamber **102** of transfer drum **2**, thus diverting the cigarettes towards the storage drum **1**.

In the meantime, drum **1** is changed by the same signal from the inoperative mode to the receiving mode by disengaging clutch **31** and brake **32** and by engaging clutch **30**. The cigarette maker output rate is also reduced to a lower rate appropriate to the capacity of the drum **1** to receive cigarettes. If the packer stoppage is for a duration sufficient to completely fill the storage drum **1**, the cigarette maker is stopped by a suitable detection and control circuit.

If the packer is re-started before the storage drum is filled, the excess of cigarettes on tapes **104, 105** and **106** which has actuated the cigarette receiving mode of the storage drum decreases until the photocell induced control signal is countermanded, restoring the vacuum in chamber **203**, dropping the vacuum in chamber **102** and disengaging clutch **30** and disengaging clutch **31** and brake **32**. This returns storage drum **1** to its inoperative mode and the cigarettes coming from the maker or from the filter tip attachment are once again conveyed directly to the counting drums and the packer.

If the cigarette maker or the filter tip attachment is stopped, either as a consequence of a forced packer stoppage as previously described or due to a malfunction therein, a control signal is generated which automatically disengages conveyor drum **3** from the filter tip attachment drive and transfers the drive of said drum to an output from the packer. At the same time, vacuum is applied to chamber **202**, brake **32** is actuated and clutches **30** and **31** are disengaged, whereby the cigarettes are delivered from the storage drum **1** to the packer via transfer drum **2**, conveyor drum **3** and the counting drums and the tapes, within the limits allowed by the cigarette reserve existing in it.

While this invention has been described in connection with the handling of cigarettes, it should be understood that any similar rod-like article can be handled by the method and apparatus disclosed.

Having now fully set forth both structure and operation of preferred embodiments of the concept underlying the present invention, it may be that various other embodiments as well as certain variations and modifications of the embodiments herein shown and described will occur to those skilled in the art upon becoming familiar with said underlying concept. All such embodiments, variations, and modifications as incorporate the spirit of the invention and depend upon its underlying concept are consequently to be considered as within the scope of the claims appended herebelow, unless the claims by their language expressly state otherwise.

I claim:

1. Apparatus for storing and feeding rod-like articles, which comprises:

a conveyor for advancing rod-like articles from a first location to a second location,

a storage unit having a plurality of rod-like article receiving slots therein mounted adjacent the conveyor,

means for varying the depth of the slots in the storage unit,

means for driving the rod-like article receiving slots of the storage unit into spaced relationship with the rod-like article conveyor, and

means for transferring rod-like articles between the conveyor and the slots in the storage unit.

2. Apparatus according to claim **1**, wherein the means for transferring the rod-like articles between the conveyor and the slots in the storage unit comprises:

a wheel having a diameter approximately equal to the distance between the conveyor and the storage unit, the wheel having flutes provided in the periphery thereof, and

a source of vacuum selectively coupled to the bottoms of the flutes.

3. Apparatus according to claim 1, wherein the storage unit is a cylindrical member including a plurality of slots provided in the periphery thereof.

4. Apparatus for storing and feeding rod-like articles, which comprises:

a conveyor for advancing cigarettes from a first location to a second location,

a cylindrical storage unit mounted adjacent the conveyor having a plurality of cigarette receiving slots provided in the periphery thereof,

means for rotating the cylindrical storage unit to drive the slots therein into spaced relationship with the cigarette conveyor,

means for transferring cigarettes between the conveyor and the slots in the cylindrical storage unit, and

means selectively coupled to the means for rotating the cylindrical storage unit for varying the depth of slots in the storage unit as the storage unit rotates.

5. Apparatus according to claim 4, wherein:

the cigarette conveyor comprises a fluted drum, the first location is the output of an apparatus for producing cigarettes and the second location is the input area of a cigarette packer.

6. Apparatus according to claim 4, wherein the means for transferring cigarettes between the conveyor and the slots in the cylindrical storage unit is a fluted wheel.

7. Apparatus according to claim 4, wherein the storage drum includes:

a pair of spaced disks rotatably mounted on a central shaft, and

a plurality of ribs protruding from the inner walls of the disks in opposed pairs, the ribs on each disk being spaced around the peripheries thereof a distance from each other equal to the approximate width of a cigarette.

8. Apparatus according to claim 4, wherein the means for varying the depth of the slots in the storage units includes a slide mounted for radial movement in each of the slots.

9. Apparatus according to claim 4, wherein the means for varying the depth of the slots in the storage units includes:

a slide mounted for radial movement in each of the slots,

a gear mounted coaxially with the storage unit for driving the slides radially with respect to the slots, and

means for causing relative rotation between the gear and the storage unit.

10. Apparatus for storing and feeding cigarettes, which comprises:

a conveyor for advancing cigarettes from the output of a cigarette manufacturing unit,

means for receiving cigarettes from the conveyor and transporting them to the input of a cigarette packer,

a cylindrical storage unit having a plurality of cigarette receiving slots open to the periphery thereof mounted adjacent the conveyor between the output of the cigarette manufacturing unit and the input of the cigarette packer, and

means responsive to operating conditions in the packer for transferring cigarettes between the conveyor and the slots in the storage unit.

11. Apparatus according to claim 10, further comprising:

means for increasing the depth of the slots in the storage unit as cigarettes are delivered thereto.

12. Apparatus according to claim 10, wherein:

the cigarette conveyor is a fluted drum,

the means for receiving cigarettes from the conveyor for transport to the packer is at least one tape conveyor, and

a fluted wheel is mounted adjacent the cigarette conveyor operable to remove cigarettes from the conveyor and transfer them to a tape conveyor.

13. Apparatus according to claim 11, wherein the cylindrical storage unit is mounted for rotation, and drive means are connected thereto to drive the slots of the drum sequentially into spaced relationship with the conveyor, and the means for increasing the depth of the slots as cigarettes are delivered to the storage unit includes a slide mounted for radial movement in each slot, gear means coupled to the slides for moving them radially, and means connected to the storage unit drive means for causing relative rotation between the storage unit and the gear.

14. Apparatus according to claim 10, further comprising:

means for decreasing the depth of the slots in the storage unit wherein cigarettes are transferred from the storage unit to the cigarette conveyor.

15. Apparatus according to claim 13, further comprising:

means for modifying the connection between the storage unit drive means and the gear means for causing relative rotation between the storage unit and the gear means that is the reverse of said last named relative rotation to decrease the depth of the slots in the storage unit.

16. Apparatus according to claim 15, wherein,

the means for transferring cigarettes between the storage unit and the conveyor includes a fluted wheel mounted therebetween, said fluted wheel being operable to receive cigarettes from the slots of the storage unit as they decrease in depth and transfer them to the conveyor.

17. Apparatus according to claim 15, wherein:

the storage unit includes a pair of spaced disks rotatably mounted on a central shaft and a plurality of ribs protruding from the inner walls of the disks in opposed pairs, the ribs on each disk being spaced apart around the peripheries thereof a distance equal to the approximate width of a cigarette, the disks being rotatable in unison by the slides, which are mounted between the ribs of the disks, and

the means for rotating the storage unit includes means for rotating one of the disks.

18. Apparatus according to claim 17, wherein the gear means is mounted in spaced relationship with said one of the disks, and the means for varying the depth of the slots includes means for rotating the gear and the disk with respect to each other.

19. Apparatus according to claim 10, further comprising:

means for modifying the connection between the storage unit drive means and the gear means for causing relative rotation between the storage unit and the gear means that is the reverse of said last named relative rotation to decrease the depth of the slots in the storage unit.

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