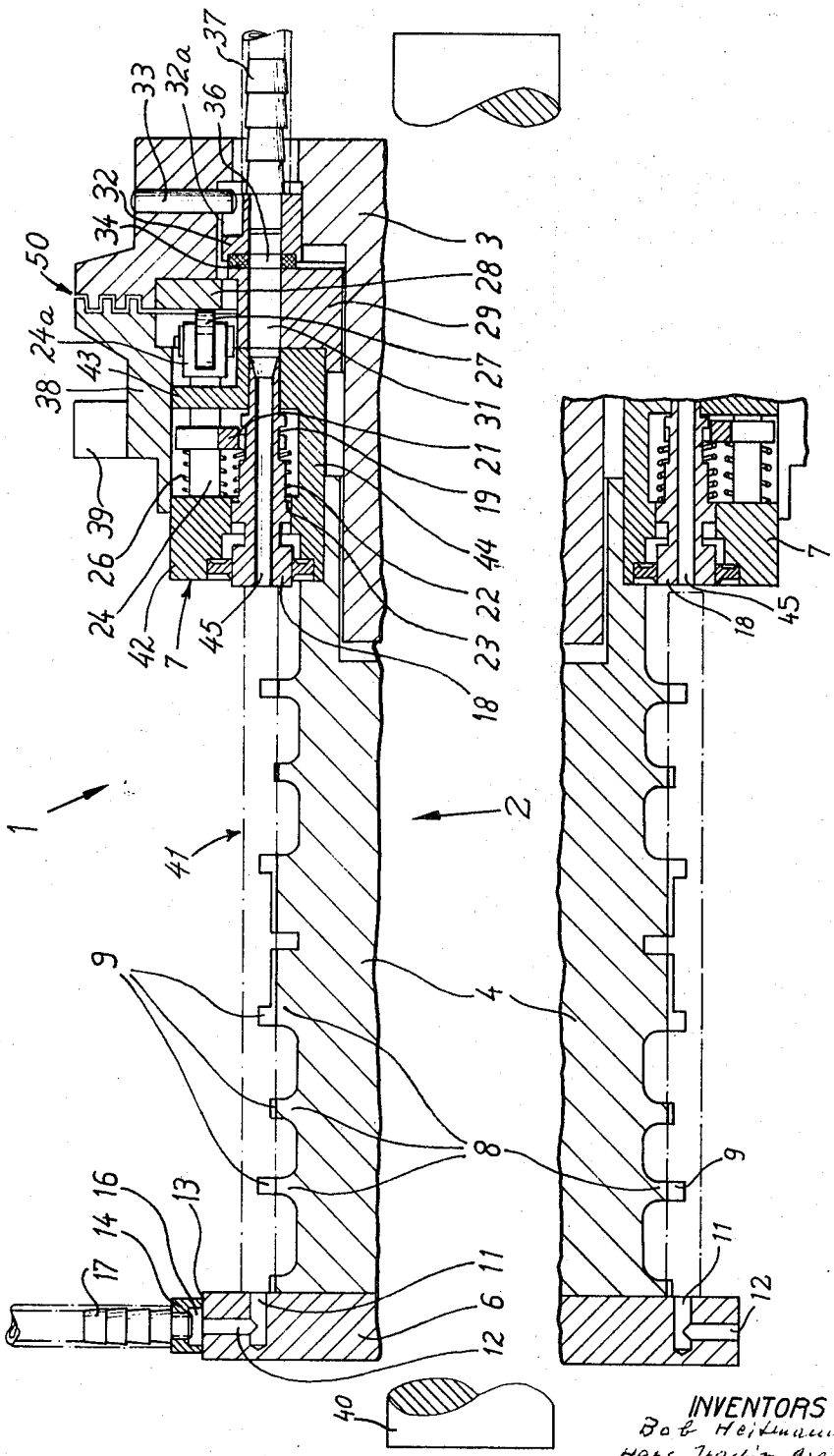
Dec. 1, 1970 B. HEITMANN ET AL 3,543,564

CONVEYOR FOR CIGARETTES OR THE LIKE

Filed Jan. 17, 1968



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United States Patent Office 3,543,564 Patented Dec. 1, 1970

3,543,564

CONVEYOR FOR CIGARETTES OR THE LIKE

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Filed Jan. 17, 1968, Ser. No. 698,521
Claims priority, application Great Britain, Feb. 10, 1967, 6,405/67
Int. Cl. G01m 3/02
U.S. Cl. 73—41 11 Claims

ABSTRACT OF THE DISCLOSURE

A conveyor including a rotary drum which transports cigarettes or like rod-shaped articles sideways past a testing station where the articles are tested by air or another suitable gas which is admitted into one or both ends of articles. The articles are accommodated in flutes which extend in parallelism with the axis of the drum and one end of each article can be moved into abutment with a flange which rotates with the drum. The latter also supports nozzles which convey testing fluid and are movable axially of the drum toward and away from the other end of each article. The nozzles are biased by springs which cause them to move the articles into abutment with the flange. Shifting forks are controlled by a stationary cam and serve to disengage the nozzles from the respective articles during travel past an ejecting station where the defective articles are expelled from their flutes by compressed air, and thereupon past a transfer station where the satisfactory articles are removed for delivery to a stacking, packing or other processing machine.

The springs compensate for eventual differences in the length of articles in that they bias the nozzles against the articles and cause each article to move axially into abutment with the flange. Testing air passes through the nozzles and through bores provided in the flange. The characteristics of such air are examined to determine the condition of articles. Signals produced in response to detection of a defective article are used to expel such article at the ejecting station.

CROSS-REFERENCE TO RELATED APPLICATION

The conveyor of the present invention is identical with the conveyor in the apparatus which is disclosed in our copending application Ser. No. 698,522 filed Jan. 17, 1968 and assigned to the same assignee.

BACKGROUND OF THE INVENTION

The present invention relates to conveyors for cigarettes or like rod-shaped articles wherein an open-ended tubular wrapper surrounds a permeable filler of tobacco and/or filter material. More particularly, the invention relates to improvements in conveyors which can be utilized to transport rod-shaped articles seriatim past one or more testing stations where the components of articles are tested for the presence or absence of defects, for example, for the presence of leaks in their wrappers, for the presence of defective seams between the overlapping edges of wrappers, for the absence of fillers and/or other defects. Still more particularly, the invention relates to improvements in conveyors which can be utilized to transport cigarettes or similar rod-shaped articles sideways past a station where the articles are tested by air which is admitted at one end and issues at the other end of a satisfactory wrapper.

SUMMARY OF THE INVENTION

It is an object of our invention to provide a conveyor which can properly transport and hold articles of slightly

different length and which can automatically compensate for eventual differences in the length of articles.

Another object of the invention is to provide a conveyor of the just outlined character wherein the ends of articles can be coupled to and retained on a travelling support in a novel and improved way so as to prevent misalignment of articles during travel past a testing station.

A further object of the invention is to provide the conveyor with a coupling or clamping assembly which prevents uncontrolled escape of testing fluid from satisfactory articles or uncontrolled penetration of outside air into satisfactory articles.

An additional object of the invention is to provide a conveyor wherein the articles are properly and securely clamped regardless of slight deviations from an optimum length and without the danger of deforming and/or damaging the wrappers and/or fillers of such articles.

Still another object of the invention is to provide a conveyor which can be used in combination with available testing apparatus and occupies little room in a cigarette machine, filter machine, filter cigarette machine or an analogous producer of rod-shaped articles which must be tested prior to transfer into storage or to another destination.

The improved conveyor is particularly suited for transportation of cigarettes or like rod-shaped articles past one or more testing stations. It comprises a support which can constitute a drum and is movable in a predetermined direction (for example, about the axis of a fixed shaft or the like), fluted article holding means provided on the support and extending transversely of the direction of movement of the support to advance the articles sideways, and novel coupling means carried by the support and flanking the holding means. The coupling means includes a nozzle provided on the support at one end of each holding means and being movable with reference to the support toward and away from the one end of the respective holding means into and from engagement with one end of an article carried by such holding means, and biasing means urging the nozzles toward the respective holding means.

In accordance with another feature of our invention, the conveyor further comprises shifting means for moving the nozzles with reference to the support by way of the biasing means. The latter preferably includes prestressed helical springs operating between an external shoulder of each nozzle and a fork of the shifting means. The shifting means may further include a roller follower connected with each fork and a stationary cam adjacent to the path of movement of the nozzles and forks to control the position of successive forks in response to movement of the support.

The coupling means further includes back support means, e.g., an annular flange at one axial end of a cylindrical support adjacent to the other end of each holding means. Such back support means is fixed to the support and serves to arrest the articles during movement of nozzles toward the respective holding means so that each article can be clamped between the back support means and the respective nozzle during travel along a certain portion of the path defined by the support for the articles thereon.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved conveyor 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 a specific embodiment with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

The single figure is a fragmentary axial sectional view of a rotary conveyor which embodies our invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The improved conveyor **1** comprises a cylindrical support **2** (hereinafter called drum) which is rotatable about the axis of a stationary shaft **40**. The drum **2** rotates with reference to a stationary annular carrier **3** which is affixed to the shaft **40** or to a frame member of the testing apparatus which embodies the conveyor **1**. A cylindrical portion or cylinder **4** of the drum **2** is provided with groups of axially parallel article holding means **8** (hereinafter called holders for short) having aligned grooves or flutes **9** which accommodate articles during travel toward, past and beyond a testing station. The left-hand end of the cylinder **4** is rigid with a flange **6** which constitutes a back support of a coupling assembly serving to clamp the articles **41** during travel with the holders **8**. The right-hand end portion of the cylinder **4** is rigid with a ring **7** which carries a set of reciprocable nozzles **18**, one for each set of holders **8** and each reciprocable with reference to the ring **7** in the longitudinal direction of the respective grooves **9**. Each nozzle has a shoulder **23** which is biased by a helical spring **22** to urge the respective nozzle toward the adjoining set of holders **8**. The nozzles **18** also form part of the aforementioned coupling assembly.

The flange or back support **6** is provided with axially parallel blind bores **11** each of which registers with one set of grooves **9** and communicates with one of several radial bores **12** which extend outwardly to the smooth cylindrical peripheral surface **13** of the flange **6**. A stationary shoe **14** is biased against the peripheral surface **13** of the flange **6** by suitable springs (not shown) and is provided with an elongated slot or chamber **16** which communicates with a conduit **17** for testing fluid, normally air. The length of the chamber **16** (as considered in the circumferential direction of the flange **6**) determines the length of the aforementioned testing station. As the flange **6** rotates, successive bores **12** come into registry with and travel along the open side of the chamber **16** to convey testing fluid from the conduit **17** to the respective blind bores **11** or vice versa.

The ring **7** is of U-shaped cross section and comprises two ring-shaped arms **42, 43** which are axially spaced from each other. These arms extend radially beyond the nozzles **18**. The nozzles **18** are reciprocable in axially parallel bores machined into the base or web **44** of the ring **7** and each thereof has an axial orifice **45** which can convey testing fluid to or from the adjoining end of the respective cigarette **41**. Each nozzle **18** has a circumferential groove **19** which is located in the space between the arms **42, 43** and is straddled by a shifting fork **21** affixed to a shifting pin **24** which is reciprocable in parallelism with the axis of the shaft **40**. A prestressed helical spring **26** surrounds the shifting pin **24** between the fork **21** and arm **42** to bias the pin in a direction to the right, as viewed in the drawing, and to thereby urge a roller follower **27** against a shifting cam **28** which latter is mounted in the stationary carrier **3**. The shifting pin **24** extends through a bore in the arm **43** and carries a bifurcated bearing **24***a* for the follower **27**. The right-hand end face of the ring **7** is adjacent to a further ring **29** provided with axially parallel bores **31** each of which registers with the orifice **45** of a nozzle **18**. The ring **29** rotates with the drum **2** and ring **7**. A control ring or valve ring **32** is mounted in the carrier **3** and its left-hand end face carries a slide ring or washer **34**. The ring **32** is biased in a direction toward the ring **29** by one or more helical springs (not shown) operating between its right-hand end face and an internal annular shoulder of the carrier **3**. Thus, such springs bias the slide ring **34** against the right-hand

end face of the ring **29**. The rings **32, 34** have registering testing slots **36** which communicate with the interior of a conduit **37** mounted in the carrier **3** or directly in the valve ring **32**. A radial pin **33** of the carrier **3** extends into an axially parallel slot **32***a* of the valve ring **32** to hold the latter against rotation with the ring **29** but to permit axial movements of parts **32, 34** toward and away from the ring **7**. The length of the slot **36** corresponds to that of the chamber **16** in the shoe **14**. The bores **31** travel seriatim past the slots **36** of rings **32, 34** when the ring **29** rotates with the drum **2**.

A synchronizing cam **38** surrounds the ring **7** and rotates therewith. This car carries a set of radially outwardly extending equidistant projections or lobes **39**, one for each set of holders **8**. The synchronizing cam **38** serves as a means for cooperating with a contactless initiator or signal generator to produce synchronizing impulses which are transmitted to a testing unit to determine the exact moment when a defective article is ejected from its flutes **9** by blasts of compressed fluid in a manner as disclosed in our aforementioned copending application. Furthermore, the cam **38** covers the space between the arms **42, 43** of the ring **7**. Still further, the right-hand portion of the cam **38** if grooved or ribbed to form with the adjoining portion of the carrier **3** a labyrinth seal **50** which prevents entry of tobacco dust or other foreign matter into the range of the shifting means including the forks **21**, pins **24**, springs **26**, followers **27** and fixed cam **28**.

The operation is as follows:

Cigarettes **41** (for example filter cigarettes of double unit length each of which contains a centrally located filter mouthpiece of double unit length between two wrapped tobacco rods of unit length) are fed into successive sets of flutes **9** at a receiving station which is located upstream of the testing station (chamber **16** and slots **36**) as considered in the direction in which the drum **2** rotates. The shifting cam **28** is configurated in such a way that, when a nozzle **18** travels past the receiving station, the corresponding spring **26** is free to expand and to push the associated pin **24** in a direction to the right, as viewed in the drawing, so that the fork **21** moves in the same direction and entrains the nozzle **18** away from the registering holders **8** to thus provide room for convenient introduction of a cigarette **41** into the flutes **9**. For example, the fork **21** can shift the nozzle **18** to such an extent that the left-hand end face of the nozzle is then flush with the left-and end face of the ring **7**. As the follower **27** continues to roll along the left-hand end face of the cam **28**, the latter causes the pin **24** to move in a direction to the left and to displace the fork **21** so that the fork shifts the nozzle **18** by way of the spring **22** and causes its left-hand end face to bear against the adjoining end of the cigarette **41**. This takes place before the cigarette **41** reaches the testing station. The left-hand end of the cigarette **41** then bears against the right-hand end face of the flange or back support **6** and overlies the open end of the associated blind bore **11**. In other words, the spring **22** then causes the nozzle **18** to bear against one end and the flange **6** to bear against the other end of the cigarette **41** without, however, causing any undesirable deformation of the wrapper. The fork **21** can move further to the left; this merely causes the spring **22** to store additional energy and to produce a stronger clamping action upon the cigarette **41**. The resistance of the cigarette to shortening in response to engagement with the left-hand end face of the nozzle **18** is greater than the bias of the spring **22** so that the wrapper of the cigarette remains intact. The bias of the spring **22** determines the magnitude of the clamping force. The main purpose of the spring **22** is to compensate for eventual minor differences in the length of cigarettes **41** and to thus insure that each end of the cigarette is in proper sealing engagement with the adjoining part of the clamping assembly (i.e., with the flange **6** and nozzle **18**).

During travel past the testing station, the filler and

wrapper of the cigarette **41** are tested by fluid which is admitted via conduit **17** or **37** and flows through the chamber **16**, bores **12**, **11**, the filler, orifice **45**, bore **31**, and slots **36**, or vice versa. If the wrapper has a leak, the pressure of testing air drops and the aforementioned testing unit detects such drop in pressure in a manner as disclosed in our copending application to produce a signal which is utilized to eject the defective cigarette from its flutes **9** by one or more blasts of compressed air which is admitted into radial orifices (not shown) machined into the cylinder **4**. The exact moment of ejection of a defective cigarette is determined by the synchronizing cam **38** whose lobes **39** cooperate with the aforementioned signal generator to produce a succession of signals which are transmitted to the testing unit. When the latter receives a signal from the signal generator and produces a signal which is indicative of a defective cigarette, the ejecting device is energized to eject the defective cigarette at an ejecting station located downstream of the testing station. The configuration of the cam **28** is such that it allows the springs **26** to move the nozzles **18** in a direction to the right to release the cigarettes **41** during travel past the ejecting station so that relatively weak blasts of air suffice to dislodge defective cigarettes from their flutes **9**. Satisfactory cigarettes can be held by suction and preferably advance past the ejecting station to be transferred onto a further conveyor for delivery to storage or to another processing device.

The manner in which the cigarettes can be held mechanically and/or by suction during travel with the drum **2** is fully disclosed in our aforementioned copending application.

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 our contribution to the art.

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

1. A conveyor, particularly for transporting cigarettes or like rod-shaped articles past a testing station, comprising a support movable in a predetermined direction; a plurality of article holding means provided on said support and extending transversely of said direction to move a succession of articles sideways; coupling means including a nozzle mounted on said support at one end of each holding means for movement toward and away from the respective holding means, each nozzle comprising a first portion having an article-engaging surface, a second portion, and deformable motion transmitting means between said portions; and shifting means for moving said second portions toward the respective holding means whereby said motion transmitting means undergo deformation when said first portions engage articles in the respective holding means while the corresponding second portions continue to move toward such holding means, said shifting means comprising cam means and a plurality of follower means each bearing against said cam means and each rigid with one of said second portions.

2. A conveyor as defined in claim **1**, wherein said coupling means further includes back support means adjacent to the other ends of said holding means and carried by said support to arrest the articles during movement of said nozzles toward the respective holding means.

3. A conveyor as defined in claim **1**, wherein said support comprises a cylinder and said holding means are provided on the periphery of and extend in parallelism with the axis of said cylinder.

4. A conveyor as defined in claim **3**, further comprising a ring rotatable with and located at one end of said cylinder, the first portions of said nozzles being reciprocable in bores provided in said ring.

5. A conveyor as defined in claim **4**, wherein said coupling means further comprises an annular flange adjacent to the other end of said cylinder and rotatable therewith, said flange providing a back support for articles in said holding means in response to displacement of a nozzle toward the one end of the associated holding means

6. A conveyor as defined in claim **1**, wherein each of said holding means defines at least one groove for articles.

7. A conveyor as defined in claim **1**, wherein the first portions of said nozzles are provided with axial orifices arranged to convey testing fluid to or from the adjoining ends of articles during travel along a predetermined portion of the path defined by said support.

8. A conveyor as defined in claim **1**, wherein each of said motion transmitting means comprises a spring.

9. A conveyor as defined in claim **1**, wherein said shifting means comprises cam means and a plurality of follower means each bearing against said cam means and each operatively connected with one of said nozzles.

10. A conveyor, particularly for transporting cigarettes or like rod-shaped articles past a testing station, comprising a support including a cylinder rotatable in a predetermined direction; a plurality of article holding means provided on the periphery of and extending in parallelism with the axis of said cylinder to move a succession of articles sideways; coupling means carried by said support and flanking said holding means, said coupling means including a nozzle provided at one end of each holding means and movable with reference to said support toward and away from said one end of the respective holding means into and from engagement with one end of an article in such holding means, and biasing means for urging said nozzles toward the respective holding means; and shifting means for moving said nozzles with reference to said cylinder by way of said biasing means, said shifting means comprising a stationary cam adjacent to one end of said cylinder and to said nozzles, followers arranged to track said cam, pins reciprocable in parallelism with the axis of and rotatable with said cylinder, springs for biasing said followers against said cam, and forks provided on said pins and straddling portions of said nozzles, said biasing means comprising springs operating between said forks and the respective nozzles.

11. A conveyor as defined in claim **10**, further comprising a ring rotatable with said cylinder and supporting said pins and said nozzles.

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