ABSTRACT: This invention is concerned with feeding a continuous stream of cigarettes or other rodlike articles from a hopper which receives successive batches of articles lying parallel and side by side. Apparatus according to this invention includes a pressure member arranged to extend between sidewalls of the hopper and to move through the hopper, in the direction of the sidewalls, so as to apply continuous pressure to the articles in the hopper while being constrained against tilting during movement through the hopper.
PRODUCTION OF STREAMS OF ARTICLES

This invention is concerned with methods and apparatus for receiving successive batches of cigarettes or other rodlike articles lying parallel to one another and side by side, and for feeding the articles transversely to their lengths.

This invention is related to the invention described in U.S. Ser. No. 702,981.

Apparatus according to this invention comprises a hopper having sidewalls which are parallel to the articles and extend in the direction of feed of the articles through the hopper, and a pressure member arranged to extend between sidewalls of the hopper and to move through the hopper, in the direction of the sidewalls, so as to apply continuous pressure to the articles in the hopper while being constrained against tilting during movement through the hopper.

This invention is particularly concerned with the case of a hopper with vertical sidewalls, and where the stream of articles is moved downwards through the hopper. In this case the pressure member, which is conveniently in the form of a straight pressure plate, preferably applies pressure to the articles by moving downwards through the hopper under gravity.

We have found that the pressure member according to this invention is a useful means of maintaining the upper surface of the articles in the hopper (as an example in the preferred case of a downward feed) substantially level so as to be parallel to the bottom surface of a subsequent batch of articles. This invention is particularly concerned with arrangements in which the articles are fed from a vertical hopper horizontally past one sidewall of the hopper, for example on a band conveyor.

In the absence of the pressure member according to this invention, the level of the articles in the hopper tends to rise in the direction of the sidewall past which the articles are fed, so that the apex of the articles remaining in the hopper may have to be removed to make room for the next batch of articles; that is, unless a considerable vertical clearance is allowed, which is undesirable as it can, for example, result in the articles becoming disorientated as they drop onto the remains of the previous batch.

Each batch of articles is preferably carried to a fixed hopper part in a tray which remains in position while the articles are being fed from the hopper, except for the removal of a bottom wall, and has sidewalls which function as vertical extensions of the sidewalls of the fixed hopper part.

An apparatus according to this invention can be arranged to supply a fast well-controlled stream of cigarettes to a high-speed packing machine.

An example of apparatus for feeding cigarettes according to this invention is shown in the accompanying drawings. In these drawings:

FIG. 1 is an elevation (partly sectional) of the apparatus, viewed endwise of the cigarettes, showing a tray full of cigarettes;

FIG. 2 is similar to FIG. 1 but shows the tray partly emptied; and

FIG. 3 is a fragmentary section on the line III—III in FIG. 2.

Referring to the drawings, the apparatus comprises a fixed framework 1 which is arranged to receive in its lower part a tray having sidewalls 2, and to support in its upper part a raising and lowering mechanism for a pressure plate 3 which is used to control the movement of cigarettes out of the tray and which is movable up and down within the tray and has the same shape as the cross section of the tray (see FIG. 3). The tray is open at the top and has a backwall 2a and an open front. When the tray is in the hopper, its open front lies against a transparent wall (not shown in FIGS. 1 and 2) which is fixed to the hopper.

The tray has a bottom wall 4 which passes through a slot in one of the sidewalls 2 and is horizontally slideable out of the tray to enable cigarettes to be removed downwards from the tray. The tray is supported to rest upon a ledge 5 which surrounds the inlet to a fixed hopper part 6 which is positioned directly beneath the tray and has sidewalls 6a and 6b. Across the bottom of the part 6 there run two endless band conveyors 7 and 8 which remove cigarettes in a stream 9 from the hopper through an opening 10. A flexible guide 11 controls the egress of the cigarettes from the hopper. To facilitate good removal of the cigarettes from the hopper the conveyor 7 is run at a slower speed than the conveyor 8 and is positioned at a slightly higher level, the gap being bridged by a bridge plate 12. The speed ratio of the bands may, for example, be approximately 2:7:1.

The mechanism for raising and lowering the pressure plate 3 includes a pair of vertical guides 13 which carry the plate 3 across their lower ends and run through guide holes 14 in the framework 1; the guides keep the plate 3 horizontal. A crosspiece 14 is secured between the guides 13 and is formed with a central aperture 15 through which an operating rod 17 of a vertically acting jack 16 extends. The jack is mounted on the upper part of the framework 1, and its rod 17 is formed at its lower end with a boss 18 which is too large to pass through the aperture 15, so that the pressure plate 3 can be raised by retracting the jack 16. A switch 19 is positioned on a crossbar 20 of the framework 1 and is operated by downward movement of the crosspiece 14 when the pressure plate 3 reaches the bottom of the tray.

The apparatus is operated to function in the following manner. Each tray is moved into position in the direction of the cigarettes until it reaches the wall 2b. During delivery of the tray the jack 16 holds the pressure plate 3 at the top of its travel so that the tray can be moved in beneath it. Once the tray is in position, the bottom wall 4 of the tray is withdrawn, allowing cigarettes to move under gravity out of the tray and into the hopper part 6 where they rest on cigarettes already in the hopper. At the same time the jack 16 is extended to its maximum, thereby transferring the weight of the pressure plate 3 and its guides 13 to the cigarettes. The cigarettes are thus subject to constraint to have a flat upper surface which is horizontal as the pressure plate 3 is maintained in a horizontal position by the guides 13. The conveyors 7 and 8 run continuously to remove a continuous stream of cigarettes 9 from the hopper, and so the level of the cigarettes in the tray 2 drops steadily, as is shown in FIG. 2. When the tray is empty, the crosspiece 14 operates the switch 19 and causes the jack 16 to be retracted to raise the pressure plate 3 to its uppermost position (FIG. 1). The bottom 4 of the tray is then pushed back into position and the tray 2 is removed by being moved initially in the direction from which it was delivered, and another full tray is brought into position for the purpose to be repeated.

This way of handling the trays is such that the exchange of a full tray for an empty one can be carried out very quickly so that the level of the cigarettes in the fixed hopper part 6 does not therefore drop very much. This is important as the cigarettes coming out of a new tray have only a small distance to travel before resting on those already in the hopper part 6. It also has the advantage that the hopper part 6 can be relatively small. The stream of cigarettes 9 is carried away on the conveyor 8 for packing and can be conveyed directly to a packing machine.

Various modifications are possible. In one, for example, the side and front walls of the fixed hopper part 6 are extended upwards to the height of the crosspiece 20. The trays are then positioned in turn alongside (i.e. behind) the hopper with the bottom wall 4 of the tray positioned at the level of the ledges 5. Thus, instead of each tray forming part of the hopper, the backwalls 2a of the trays are omitted (or made removable) to enable the cigarette contents of each tray in turn to be passed in the direction of the cigarettes through the open front of the tray into the upper part of the hopper. The bottom walls 4 of the trays would in this case be fixed to the side walls 2, and each tray may also include a fixed top wall.

What we claim as our invention and desire to secure by Letters Patent is:
1. Apparatus for receiving successive batches of cigarettes or other rodlike articles lying parallel and side by side, and for feeding the articles transversely to their lengths, each batch comprising a substantially rectangular having dimensions such as to accommodate a plurality of rod diameters in each direction, the apparatus comprising a hopper having substantially vertical sidewalls which are parallel to the articles and extend in the direction of feed of the articles in the hopper, the upper part of the hopper formed successively by each of a number of trays including vertical sidewalls and delivering articles to the hopper, the vertical sidewalls of said hopper cooperating with the vertical sidewalls of each tray in turn to form a hopper through which the articles move in a downward direction, a pressure member arranged to extend between the sidewalls of the hopper and to move downwards through the hopper under gravity so as to apply continuous pressure to the articles in the hopper, means to prevent the pressure member from tilting during movement through the hopper, and means to feed the articles horizontally from the hopper, past one of the sidewalls, said feed means comprising a first conveyor band which extends part of the way across the bottom of the hopper, and a second conveyor band which extends over the remainder of the bottom of the hopper and feeds the articles out of the hopper, said second band being at a lower level than the first band and arranged to move at a higher speed than the first band, each tray in turn including a removable bottom wall which initially supports the articles in the tray and is subsequently removed to allow the articles to pass downwards through the tray when the tray forms part of the said hopper.

2. Apparatus for receiving successive batches of cigarettes or similar cylindrical rodlike articles lying parallel and side by side in trays which are rectangular in shape and have dimensions in each direction such as to accommodate a large number of cigarette diameters, comprising means for delivering successive trays to a discharge position, means for initially supporting the batch of cigarettes from each new tray at a position above the upper surface of the cigarettes remaining from the previous tray, means for dropping the contents of each new tray on to the upper surface of the cigarettes remaining from the previous tray, means for feeding the contents of the new tray downwards whereby the upper surface of the cigarettes in the tray tends to depart progressively from a flat, level contour as a result of relative rolling of the cigarettes, a horizontal pressure member arranged to rest on the upper surface of each batch of cigarettes in turn and having a width measured transversely to the cigarettes such as to extend from one vertical sidewall of the tray to the other vertical sidewall, whereby the pressure member moves downwards through the tray while applying continuous pressure through gravity on the upper surface of the cigarettes in the tray and thus maintains the upper surface substantially flat and horizontal, and including means for lifting the pressure member, after it has moved downwards through one tray, to prepare it for contacting the upper surface of the cigarettes in the next full tray, the said lifting means being releasable from the pressure member to allow the pressure member to move downwards under gravity in contact with the upper surface of the cigarettes and at a speed determined by the rate at which cigarettes are withdrawn from the bottom of the tray.

3. Apparatus according to claim 2, in which the pressure member is carried by at least two vertical guides which are vertically slidable.

4. Apparatus according to claim 2, in which the lifting means comprises a fluid-powered jack having an operating member which is movable vertically upwards to lift the pressure member and is movable downwards to release the pressure member and thus allow it to move downwards under gravity.

5. Apparatus according to claim 2, in which the cigarettes are fed horizontally from each tray on a conveyor band moving past and below one of the vertical sidewalls of the tray.

6. Apparatus according to claim 5, in which the conveyor band extends only part of the way across the bottom of each tray, and including a second band which extends over the remainder of the width of the tray and moves at a lower speed than the first band.

7. Apparatus according to claim 6, in which the slower band is at a higher level than the faster band.

8. A method of feeding batches of cigarettes from trays in which the cigarettes are parallel and side by side, the trays being substantially rectangular in shape and having dimensions such as to accommodate a large number of cigarette diameters in each direction, the method comprising feeding the cigarettes downwards through each tray in turn at a discharge position, whereby the surface of the batch of cigarettes tends to assume an uneven contour as a result of relative rolling of the cigarettes, and controlling the upper surface of the cigarettes by applying to the top surface of the cigarettes in each tray in turn a gravity-loaded pressure member to maintain the surface substantially flat and horizontal, whereby each new batch of cigarettes is dropped on to the upper surface of the cigarettes at the discharge position through a gap of substantially uniform height to minimize any tendency for the cigarettes to become skew as a result of the drop.