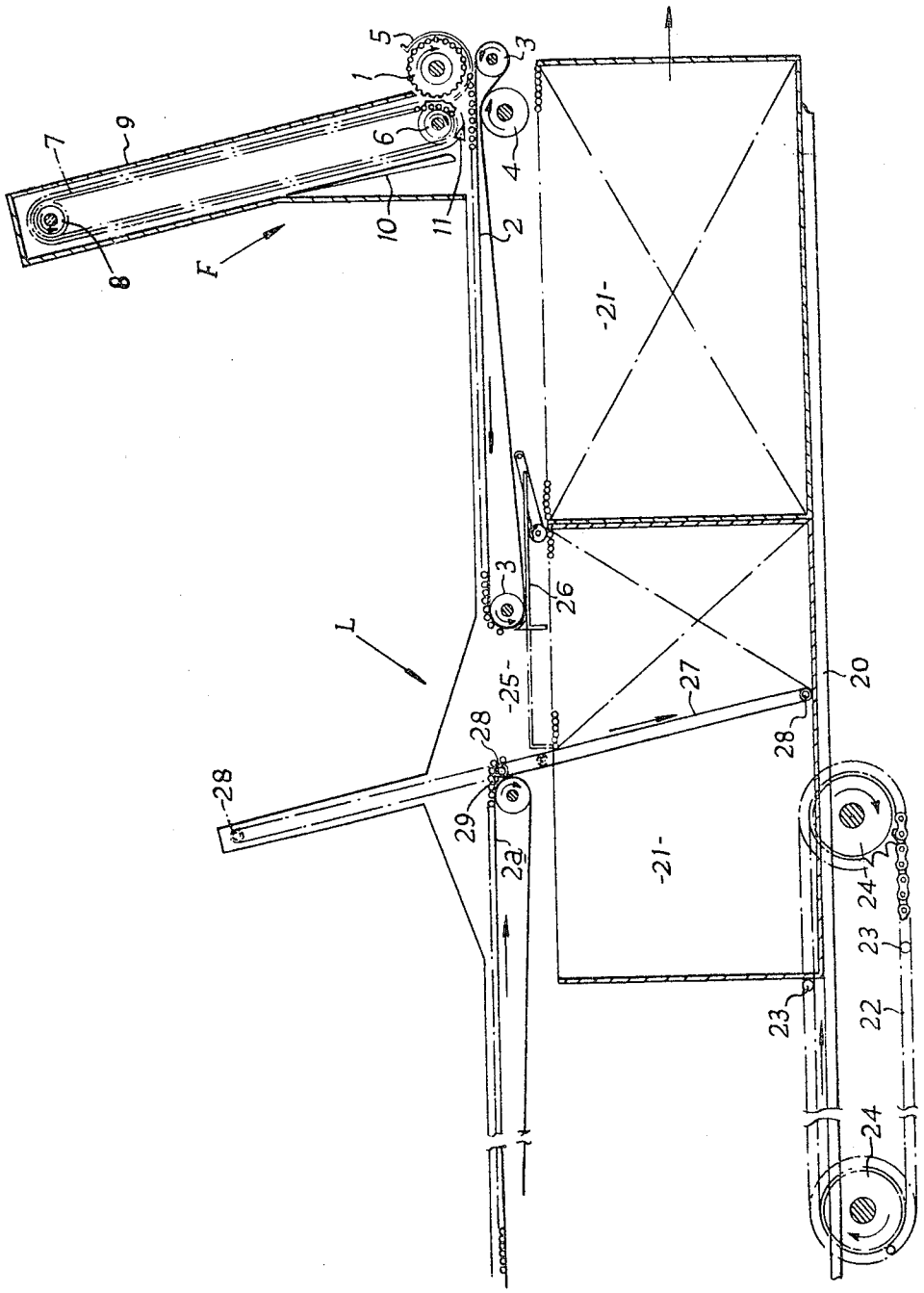
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APPARATUS FOR FILLING BOXES, TRAYS OR THE LIKE

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APPARATUS FOR FILLING BOXES, TRAYS OR THE LIKE

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This invention relates to apparatus for filling boxes, trays or the like with relatively small articles. A convenient and typical example is the filling of boxes or trays with cigarettes or multiple filter plugs for cigarettes (the latter being of similar dimension to cigarettes in all respects here relevant).

It is of course simple to arrange a box or tray to be filled below a chute or other guide means and allow articles such as cigarettes to descend into the box or tray until the latter is full. Moreover, it can be, and commonly is, arranged that boxes or trays are caused to pass under the chute or guide means in continuous succession at such speed that each box or tray fills adequately as it passes, this arrangement producing a distribution of the articles along the length of the box or tray which might be expected to be adaquately uniform.

However, in practice such simple filling apparatus is inefficient as the articles on arrival in the box or tray tend to bunch in ways which leave substantial random gaps, hence the load in the box or tray may be found to be unevenly spread and the total number of articles packed in any one box or tray is materially less than an be achieved with uniform close packing.

Various forms of apparatus have been devised for filling boxes or trays more efficiently; as one example reference may be made to the specification of British Patent No. 549,876. In the said specification, there is described an apparatus in which an inclined guide extends into the box or tray during filling to improve the distribution of articles therein; a part at least of said guide being movable upwardly to clear obstacles at the ends of or between successive boxes or trays.

It is an object of the present invention to provide an improved apparatus for filling boxes, trays or the like with relatively small articles, with which more uniform packing may be obtained than with prior arrangements.

According to the invention, there is provided apparatus for filling boxes, trays or the like with relatively small articles, comprising means for feeding articles to a position above a box, tray or the like to be filled and permitting said articles to fall therein, a guide arranged in operation to extend into said box, tray or the like substantially the whole depth thereof, and means for producing relative motion betwen said box, tray or the like and said guide so that an article engaging face of said guide and an end wall of the box, tray or the like together define an article-receiving space whose length increases from a minimum to a maximum during the filling operation, in which said guide includes an endless belt, chain or the like providing the article-engaging face of the guide, said belt, chain or the like being arranged to be driven during the filling operation.

While the said endless belt, chain or the like may be driven in either direction with beneficial results, due to the disturbance of the articles produced by the moving belt, chain or the like which opposes bunching, we prefer with articles such as cigarettes to drive said belt, chain or the like so that the part of it which engages the articles is moving downwards i.e. into the box, tray or the like.

The relative motion between the box, tray or the like and the guide may be produced by movement of the guide but we prefer to produce it by movement of the box, tray or the like as it is most convenient to provide a conveyor e.g., a movable belt arranged to propel a succession of boxes, trays or the like past a filling position at which the guide is located. When as is common the boxes, trays or the like have solid ends the guide is conveniently arranged to be raised as the trailing end of each box, tray or the like approaches it and to be lowered as soon as the leading end of the next box, tray or the like has passed under it. With boxes, trays or the like which pass in end-to-end abutted relationship and have no external protuberances e.g. handles, it is possible to feed articles continuously but when as is more usual the presence of handles or the like at the ends of each box, tray or the like produces unavoidable gaps then means may be provided to interrupt the flow of articles as each gap passes the filling position.

In order that the invention may be well understood, a preferred embodiment thereof will now be described, referring to the accompanying drawing which is an elevation of a machine embodying the invention and designed to fill boxes or trays with multiple filter plugs for cigarettes (which are cylindrical objects of dimensions generally similar to those of a cigarette).

The machine shown forms part of an assembly or complex of machines comprising a pair of filter plug making machines, which are not shown but would be placed to the left and right of the assembly illustrated so as to deliver the plugs they make towards and into a pair of feeding systems placed on either side of the filling machine embodying the invention. The said feeding systems, one of which is shown in full and the other shown in part only, serve to carry the plugs from the plug making machines to the filling machine and such systems are the subject of a separate application filed concurrently herewith.

The drawing shows one of the feeding systems, generally indicated at F, and the box or tray loader generally indicated at L.

Starting at the right of the figure, filter plugs from one of the filter plug making machines (not shown) are delivered by a fluted roller **1** at the one end of a conveyor belt **2** carried on support rollers **3** and having a tensioning roller **4**. Around part of the circumference of the fluted roller **1** is a guide plate **5** which is normally in the position shown in full lines but is movable to an alternative position shown in chain-dotted lines. In either position part of the plate **5** serves to prevent plugs dropping out of the flutes of the roller **1** while said flutes are in downwardly-facing positions. With the plate **5** in its normal (full-line) position, the plate **5** terminates just past the lowermost point of roller **1**, and the plugs carried by roller **1** are therefore permitted to drop on to the belt **2** and are carried on said belt to the left, and ultimately discharged to the loader L as the belt **2** passes over its left-hand support roller **3**.

Closely adjacent to the fluted roller **1**, and to its left, is a support roller **6** carrying a fluted endless conveyor belt **7** which extends upwardly and to the left to a second support roller **8**, the belt **7** being driven in an anticlockwise direction at the same linear speed as the belt **2** which in turn travels anticlockwise at the same linear speed as the periphery of the fluted roller **1**. The belt **7** is enclosed in a casing **9** which surrounds the belt **7** so closely that plugs resting in the flutes of the belt **7** are retained therein and must therefore travel with the belt **7**. The lower part of the left-hand wall of the casing **9** is flared outwardly to increase the rigidity of said casing but a guide plate **10** provided within the flared portion

of said casing is arranged in close relation to the adjoining (descending) run of the belt **7** so that the plugs in the flute of this part of belt **7** are maintained therein.

At the bottom of the descending run of the belt **7**, stationary plates **11** are mounted, one at each edge of said belt; the width of the belt **7** (measured at right-angles to the plane of the drawing) is somewhat less than the length of the plugs to be carried thereby and the plugs therefore project at each edge of the belt and their projecting portions are engaged by the deflector plates **11** as the plugs reach the bottom of the descending run of the belt **7** and are compelled to leave the flutes of belt **7** and fall on to belt **2**.

When the plate **5** is moved to its alternative position, it will be seen that it terminates just clear of the belt **7**, as the latter passes round the roller **6** to commence its ascending run. Furthermore, the right hand wall of casing **9** terminates, at its lower end, just clear of the fluted roller **1**.

In operation, with the guide plate **5** in its normal (full-line) position, plugs arriving at the top of fluted roller **1** are received in the flutes of said roller and travel with it within the guide plate **5** until the lower end of the latter is reached; here the plugs drop on to belt **2** and are carried to the left until they are discharged to the loader L, this path being the normal or main path provided by the system. However, the plugs can be prevented from traversing that part of this main path extending from the lower end of guide plate **5** (in its normal position) to the far (left) edge of deflector plates **11**, simply by moving the guide plate **5** to its alternative (chain-dotted) position. When this is done, the plugs travel along a longer subsidiary path to reach the far (left) edge of deflector plates **11**, as they are restrained by plate **5** from leaving the fluted roller **1** until they reach a position where they are embraced by a flute of the fluted roller and a flute of the belt **7** simultaneously. While so embraced, each plug is lifted a short distance and then, as the flutes holding it separate, encounters the lower edge of the right-hand wall of casing **9** and is constrained to remain in the flute of belt **7** and travel with said belt; this situation lasts while each plug travels the whole length of the ascending run of the belt **7**, with the belt **7** over roller **8** and then down the descending run of belt **7**, although in the lower part of the descending run it will be appreciated that the plate **10** serves, in place of the casing **9**, to keep the plugs in the flutes of the belt.

If the plate **5** is kept in its alternative position until after the first plug diverted along the subsidiary path, i.e. to belt **7**, reaches the belt **2**, then there will be a maximum pause in the delivery of plugs to the loader L which lasts for a time equal to the time taken by a plug to traverse the subsidiary path (from plate **5** to plates **11**) minus the time taken to travel directly (on belt **2**) between the same points. Should the plate **5** be returned to its normal position before the first diverted plug reaches the belt **2**, then the pause will be equal to the time the plate **5** is allowed to remain in its alternative position. The number of plugs which would normally have been delivered during the pause will be temporarily stored on the belt **7**.

Whenever the plate **5** is restored to its normal position, for a period equal in duration to the pause created in the discharge to loader L there will be a doubled loading of belt **2**, as plugs will still be discharging from the belt **7** as well as plugs arriving on belt **2** direct from the fluted roller **1**. As both the roller **1** and belt **2** are fluted, but the belt **2** is plain-surfaced, the latter should accommodate the temporarily enhanced flow of plugs without difficulty but if it is desired to ensure there is no piling of plugs on the belt **2**, said belt may be driven at a greater linear speed than belt **7** and roller **1**.

While the position of the plate **5** may be controlled by any desired means, it is noted that where the system is to

be used to provide interruptions in the supply of plugs to the loader L which are so timed that each separate batch of plugs delivered contains a predetermined number of plugs, a sensing device such as a photo-electric cell and lamp may be fitted at a convenient point around the fluted roller **1** and connected to a counter which is arranged to cause operation of the plate **5** whenever a selected number of plugs has passed the sensing device.

Turning now to the loader L, this has a support **20** along which boxes **21** can slide. An endless horizontally-extending chain **22** provided with spaced projecting pushers **23** is carried on sprockets **24** alongside the support **20**, the spacing of successive pushers **23** along the chain being slightly greater than the length of a box **21** and the whole length of chain **22** is a whole-number multiple of said spacing. The chain **22** is driven in a clockwise direction by one or both of the sprockets **24**, its upper run being above and its lower run below the support **20**. It is readily seen that whenever a box is loaded on to the left-hand end of the support **20** so that its rear, i.e. left-hand, end is past the point at which the upper run of the chain **22** commences the next pusher **23** to appear on the upper run of the chain will engage the said rear end of the box and push it to the right for the whole length of said upper run; thereafter the box stops as the pusher disengages from it as the pusher is carried round the right-hand sprocket **24** and remains stationary until a further box is pushed along by one of the pushers **23**, at which time the leading or front end wall of the second box engages the rear end wall of the first box and pushes the latter further along the support **20**; a third box will engage the second box later and push both the second and first boxes and so on until each box in turn reaches the right-hand end of support **20** (not shown) and is removed by any convenient means, irrelevant in this description.

Substantially at the centre of the drawing, there is an opening **25** between the belt **2**, previously mentioned, and a similar belt **2***a* (of which part only is shown) which occupies the place of the belt **2** the second feeding system which is identical with the system F already described, save that it feeds from left to right. A slidable horizontal closure plate **26** normally occupies a position (shown in full lines) under the left-hand end of the belt **2**, but may slide horizontally to the position shown in chain-dotted lines so as to close the gap **25**.

A distributor member in the form of an endless belt **27** carried on rollers **28** has a normal position shown in full lines and an alternative position shown in chain-dotted lines. The belt **27** always has its two straight runs between the rollers **28** lying in parallel planes slightly inclined (e.g. at 5°) to the vertical (its upper end being further to the left than its lower end) and its width extending at right-angles to the direction of travel of the boxes **21** and the belts **2**, **2***a*. In the normal position of the belt **27**, its lowermost part, around the lower roller **28**, barely clears the bottom of a box **21** below the gap **25**, while its uppermost part, around the upper roller **28**, is closely adjacent to and at the same level as the discharge (right-hand) end of the belt **2***a*, a fixed bridge-piece **29** of approximately triangular-section bar serving to fill the gap between the adjoining curved portions of the belts **27**, **2***a* so that plugs fed to the right may readily pass over said bridge-piece **29** and over the top of the belt **27** to drop through the gap **25** on or near the surface of the belt **27**.

When in its alternative position, the lowermost portion of the belt **27** is slightly above the level of the upper edges of boxes **21** but below the level of the belt **2***a* and bridge-piece **29**. Means (not shown) are provided to drive the belt **27** in a clockwise direction.

Considering the operation of the loader, the drawing shows the parts in the positions they occupy when a box is nearly half filled. Plugs are being fed along belt **2** and falling through the gap **25** into the box; plugs are

also feeding along belt 2*a*, over bridge-piece 29 and the top belt 27, and falling along or near belt 27 through gap 25 into the box. The belt 27 is travelling-clockwise, therefore as it is the part of the box to the right of the belt 27 which receives the falling plugs, the right-hand run of the belt 27 tends to pack the fallen plugs more closely in the box as in that run the belt 27 is descending and movement of the belt 27 continually pushes the plugs downwards, thus tending to prevent bunching which would otherwise occur, giving rise to uneven packing; the belt 27 does not however propel the plugs positively, but only by frictional engagement and therefore damage to the plugs, e.g. squashing, is avoided.

As the plugs are falling and the belt 27 packing them compactly, the box 21 being filled is moving to the right at a suitable speed to give a desired level of plugs in the box. Shortly before the rear end of box 21 becomes disengaged from the pusher 23 which is advancing it, the upper edge of the rear end of the box is about to engage the left (ascending) run of belt 27. Drive means (not shown) therefore commences to raise the belt 27 to its alternative position, the speed of raising being such that a minimum clearance is maintained between the upper edge of the rear wall of the box and the ascending run of belt 27. As belt 27 is raised, it continues to travel clockwise on its support rollers 28, and plugs continue to fall from belt 2, but the belt 27 as it rises stops feed of any plugs which may still be travelling on belt 2*a*. However, no great number of plugs (or none at all, if timing is absolutely correct) collects at the end of belt 2*a*, and on the bridge-piece 29, because at the time the belt 27 starts to rise, or a little earlier, the guide plate 5 of the left-hand feeding system (not shown) has been moved to its alternative position, giving rise to a pause in the delivery of plugs along belt 2*a* in the manner previously explained. The feed of plugs from belt 2 continues however until the belt 27 has reached its alternative position, or even a little longer, to ensure complete filling of the box; at a suitable time the guide plate 5 of the right-hand feeding system is moved to its alternative position, giving rise to a pause in delivery of plugs by the belt 2 as explained, and the closure plate 26 is also moved to its alternative position when the belt 27 ceases to rise, or a little later.

Correct relative timing of the various movements may be obtained in a variety of ways; it has already been explained that a sensing device and counter may be included in the feeding system to control movement of the plate 5, and the other movable parts, i.e. belt 27, plate 26, and belt 22, may also be connected to this counter; with two feeding systems as described, it will be understood that if separate counters are used to control the two plates 5 then the two counters will need to be interconnected if they are to control the other parts specified. However, direct control of the said other parts is not essential, but an indirect control may be obtained by providing further sensing devices, such as photo-electric cells, at the discharge ends of belts 2, 2*a*. Such further sensing device may be arranged to detect the pauses in

supply of plugs which are created by operation of plate 5 and to operate the said parts, 22, 26, 27 at suitable times in relation to such pauses. With such an arrangement, it is of course necessary to provide some measure of synchronisation between the two feeding systems and the machines supplying them to ensure that the pauses in discharge from belts 2, 2*a* overlap sufficiently for the proper operation of the parts 22, 26, 27 to bring a fresh box below the gap 25.

Whatever control arrangements are made, with a twin installation such as that described it is of advantage to provide for combined operation at times when one or other of the machines supplying plugs is inoperative, thus where two counters are used it is desirable that they should be settable to allow delivery of twice the normal number of plugs in each batch.

I claim:

1. Apparatus for filling open-topped containers such as trays with relatively small articles, comprising article feeding means for feeding articles to a position over a container to be filled and permitting said articles to fall therein, a guide member arranged in operation to extend into said container substantially the whole depth thereof, an endless flexible band forming part of said guide, means for producing relative motion between said container and said guide, an article-engaging face of said guide being provided by said band and cooperating with an end wall of said container to provide an article-receiving space whose length increases from a minimum to a maximum during the filling operation by virtue of said relative motion, and means to drive said band during the filling operation.

2. Apparatus as claimed in claim 1, in which the drive means for the band is so arranged that part of said band which engages the articles is moving downwards.

3. Apparatus as claimed in claim 1, in which the means for producing relative motion comprises a conveyor arranged to propel a succession of containers past a filling position, the guide being located at said filling position.

4. Apparatus as claimed in claim 1, in which said guide is arranged to be raised and lowered to permit the passage of ends of containers thereunder.

5. Apparatus as claimed in claim 1, including means to interrupt the flow of articles as gaps between successive containers pass below the position at which the articles are permitted to fall.

6. Apparatus as claimed in claim 5, in which said means to interrupt the flow of articles comprises a horizonally-slidable plate.

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