

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements relating to apparatus for the Pneumatic Conveyance of Cigarettes

5 We, BRITISH-AMERICAN TOBACCO COMPANY LIMITED, of Westminster House, 7, Millbank, London, S.W.1, a Company incorporated under the laws of Great Britain, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention concerns improvements relating to the pneumatic conveyance of cigarettes. Due to the vulnerable nature of cigarettes and the high speed and complexity of modern cigarette-making and cigarette-handling apparatus, the conveyance of cigarettes for considerable distances in such apparatus and between units of such apparatus presents serious and specialised problems for which it is increasingly difficult to find solutions with mechanical conveying means.

20 In accordance with the present invention, a cigarette-conveying arrangement for the transport of cigarettes between separated parts or units of cigarette-making and/or cigarette-handling apparatus comprises a pneumatic conveyor tube or duct extending between the said parts, means for feeding the cigarettes to the tube or duct, a rotatable air-lock device with chambers for receiving the cigarettes from the feeding means and introducing them into the airstream flowing through the tube or duct, and means for removing the cigarettes from the said air stream at the destination point. The conveyance of the cigarettes through the tube or duct may be either continuous or intermittent.

30 The feeding means may comprise a hopper provided with refusal means, such as is well known in the cigarette-making art, from which the cigarettes emerge in predetermined, ordered, fashion into the air-lock device. Alternatively use may be made of other known cigarette-feeding means, mechanical or pneumatic, employed in cigarette making, handling and packing machinery. The feeding means may comprise part of a cigarette-making, processing, handling or like machine, provided that the cigarettes are discharged or delivered thereby with sufficient force and/or in appropriate manner for reception by the means for introducing them into the air stream in the pneumatic conveyor tube.

45 The air-lock device may comprise a rotatable cylinder with groove-shaped chambers, each capable of receiving a cigarette from the feeding means, from which chambers the cigarettes are entrained by the air stream in the tube or duct.

50 One embodiment of the invention by way of example will now be more fully described with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a cigarette-conveying apparatus,

Figure 2 an exploded perspective view of components at the feeding end of the apparatus, to a larger scale, and

Figure 3 a view, similar to Figure 2, of components at the delivery end of the apparatus.

70 For this example, it is assumed that the cigarettes to be conveyed are fed to the pneumatic conveying tube 1 from a hopper 2. The hopper is arranged with its discharge opening above an opening 3 in the upper part of a stationary hollow cylinder 4 formed with end flanges 5. Disposed in the cylinder 4 and rotatably mounted by a shaft 6 in end plates 7, 8 is a separating cylinder 9 provided with longitudinal grooves 10. The said grooves are of a size to receive one cigarette each from the hopper 2 as the cylinder 9 rotates. A ribbed refusal roller 11 is arranged in well-known manner to ensure that only the one cigarette per groove is taken. The directions of rotation of the cylinder 9 and roller 11 are indicated by arrows in Figure 2. The cylinder 9 is driven continuously from an electric motor



air stream



refuser

[Price 4s. 6d.]

12 through reduction gearing 13 and a chain drive 14. The roller 11 is similarly driven from a motor 15.

A tube 16 communicating with a compressor or other supply of compressed air is connected at 17 to the lower part of the end plate 7. The pneumatic conveying tube 1 is connected to the end plate 8 at a point 18 axially opposite to the point 17. The cylinder 9 forms a rotatable air-lock device into whose chambers 10 the cigarettes fall singly and successively from the hopper 2. During the continued rotation of the cylinder 9 each chamber 10 in turn, after receiving a cigarette, comes opposite to the connections 17, 18 with the compressed-air supply tube 16 and the conveying tube 1 respectively. The cigarette in the chamber is thereupon entrained by the compressed air and forced into the tube 1.

The tube 1 may be made of metallic or non-metallic material, for example a plastic material. The tubing will generally be of circular (as shown) or other rounded cross section, but non-round cross sections may be employed. The size of bore must be such that the cigarettes can be satisfactorily conveyed at a desired velocity without detriment and that necessary bends in the tubing can be negotiated by the cigarettes without risk of damage or blockage. For cigarettes 72 mm. long and 25 mm. in circumference, it has been found advantageous to use nylon tubing of $\frac{3}{8}$ inch diameter. The air pressure and velocity used will depend upon the weight of the cigarettes and the distance for which they are to be conveyed. For the cigarettes and tubing just referred to, an air pressure of 15—20 pounds per sq. inch gauge has been found to be sufficient for conveying the cigarettes for 100 ft. horizontally or 25 ft. vertically. Provision may, if desired, be made for adjusting or controlling the pressure and velocity of the air.

Tubing of the above-mentioned size will allow the cigarettes to be conveyed in directions other than a straight line. Bends of up to 360°, with a minimum radius of 2 ft., can readily be tolerated.

When the cigarettes are approaching the delivery point, it is necessary to reduce their speed and withdraw them from the conveying system without allowing them to be damaged. For this purpose, as shown in Figure 1, the cigarettes are allowed to emerge from the tube 1 into a narrow open-topped trough or chute 19, by which they are slowed down, and then onto the top of a rotating suction drum 20, where they are brought to rest against a cushion or spring buffer 21. The drum 20, which has lines of fine suction holes 22 distributed over its cylindrical surface is mounted around a stationary cylinder 23 with a slot 24 in the upper part of its surface (Figure 3). The cylinder 23 is connected at 25 to a source of suction, for example a vacuum pump. The shaft 26 of the drum 21 is driven from a

motor 27 through reduction gearing 28 and a V-belt drive 29.

The drum 20 and the cylinder 23 inside it together form a suction chamber closed at the ends by the end walls 30 and 31. Under the effect of the suction exerted on the cigarettes from the said chamber through the slot 24, the cigarette arrested by the cushion 21 adheres temporarily to the rotating drum 20 and is carried along by it in a direction at right angles to its direction of delivery from the tube 1 and chute 19. In this it is assisted in *per se* known manner by a rotating take-off roller 32 disposed parallel to the drum 20 and spaced therefrom. The roller 32 is driven by a motor 33. The directions of rotation of the drum 20 and roller 32 are indicated in Figure 1. Each cigarette may, for example, be deposited upon a slow band conveyor extending under the drum 20 and at right angles to its axis, the cigarettes being then placed side by side on the said conveyor where they lie parallel to the direction of delivery from the tube 1, but move at right angles to that direction.

The compressed air introduced at 16 may be at ambient or other temperature, depending upon the condition of the cigarettes as they enter the conveying system and upon the condition required of the cigarettes as they leave the system. Thus it is conceivable that the cigarettes may have been subjected to heat before they entered the conveying tube 1. In this case, compressed air at slightly below the ambient temperature may be used, so that by the time the cigarettes emerge from the conveying system, they will be restored to ambient temperature.

During the time of conveyance or dwell in the tube 1, the cigarettes may be otherwise subjected to heating, cooling and/or other processing conditions. For instance, they may be exposed to heat for drying purposes.

The air flow in the tube 1 may alternatively be produced or assisted by suction, i.e. by a vacuum pump, or by a vacuum pump as well as a compressor, acting on the tube 1.

In an alternative for the plain tube 1, air may be forced into a central conveying tube through bleed holes from an annular tube surrounding the central tube, such air being additional to air forced or drawn along the latter tube. With this arrangement, the bled air would tend to hold the cigarette in an air cushion while it was conveyed by the other air along the central tube in the required direction.

In place of the arrangement illustrated on the left hand side of Figure 1 and in Figure 3, use may be made of other means known for bringing cigarettes to rest from a substantial speed, or for transferring them to some other conveying or manipulating means.

WHAT WE CLAIM IS:—

1. A cigarette-conveying arrangement for the transport of cigarettes between separated



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20 The tube 1 may be made of metallic or non-metallic material, for example a plastic material. The tubing will generally be of circular (as shown) or other rounded cross section, but non-round cross sections may be employed. The size of bore must be such that the cigarettes can be satisfactorily conveyed at a desired velocity without detriment and that necessary bends in the tubing can be negotiated by the cigarettes without risk of damage or blockage. For cigarettes 72 mm. long and 25 mm. in circumference, it has been found advantageous to use nylon tubing of $\frac{3}{8}$ inch diameter. The air pressure and velocity used will depend upon the weight of the cigarettes and the distance for which they are to be conveyed. For the cigarettes and tubing just referred to, an air pressure of 15—20 pounds per sq. inch gauge has been found to be sufficient for conveying the cigarettes for 100ft. horizontally or 25 ft. vertically. Provision may, if desired, be made for adjusting or controlling the pressure and velocity of the air.

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The compressed air introduced at 16 may be at ambient or other temperature, depending upon the condition of the cigarettes as they enter the conveying system and upon the condition required of the cigarettes as they leave the system. Thus it is conceivable that the cigarettes may have been subjected to heat before they entered the conveying tube 1. In this case, compressed air at slightly below the ambient temperature may be used, so that by the time the cigarettes emerge from the conveying system, they will be restored to ambient temperature.

During the time of conveyance or dwell in the tube 1, the cigarettes may be otherwise subjected to heating, cooling and/or other processing conditions. For instance, they may be exposed to heat for drying purposes.

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In place of the arrangement illustrated on the left hand side of Figure 1 and in Figure 3, use may be made of other means known for bringing cigarettes to rest from a substantial speed, or for transferring them to some other conveying or manipulating means.

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- parts or units of cigarette-making and/or cigarette-handling apparatus, comprising a pneumatic conveyor tube or duct extending between the said parts, means for feeding the cigarettes to the tube or duct, a rotatable air-lock device with chambers for receiving the cigarettes from the feeding means and introducing them into the air stream flowing through the tube or duct, and means for removing the cigarettes from the said air stream at a destination point.
- 5 2. An arrangement as claimed in claim 1, wherein the feeding means comprises a hopper provided with refusal means allowing one cigarette at a time to pass from the hopper into the air-lock device.
- 10 3. An arrangement as claimed in claim 1 or 2, wherein the air-lock device comprises a rotatable cylinder with groove-shaped chambers, each capable of receiving a cigarette from the feeding means, from which chambers the cigarettes are entrained by the air stream in the tube or duct.
- 15 4. An arrangement as claimed in any one of claims 1 to 3, wherein the means for removing the cigarettes from the air stream comprises an open-topped trough or chute on to which each cigarette is allowed to emerge from the tube or duct.
- 20 5. An arrangement as claimed in claim 4, wherein a cushion or spring buffer is provided for assisting in bringing each cigarette to rest after it has emerged from the tube or duct.
- 30 6. An arrangement as claimed in claim 4 or 5, wherein the cigarettes are brought to rest on the surface of a rotating suction drum adapted for depositing the arrested cigarettes underneath the said drum.
- 35 7. An arrangement as claimed in claim 6, wherein a rotary take-off roller is disposed adjacent to the drum which assists in the depositing of the cigarettes.
- 40 8. An arrangement as claimed in any one of claims 1 to 3, wherein the means for removing the cigarettes from the air stream comprises an open-topped trough or chute over which each cigarette passes after emerging from the tube or duct and from which it passes over a device which exerts suction on it, so that it is gently retarded before being finally stopped by a cushion or spring buffer.
- 45 9. A cigarette-conveying arrangement substantially as hereinbefore described with reference to the accompanying drawings.
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