Transfer device for cigarettes or similar objects fed as a continuous stream along a rectilinear feeding path having a given set direction and designed to transfer them in succession to a receiving means at a receiving point at which said receiving means has a velocity in a direction substantially perpendicular to said feeding path, comprising prehensory members for objects on their feeding path, means for driving said prehensory members on a closed path intersecting said feeding path and passing through said receiving point and imparting to said members at the meeting point with said feeding path, a velocity having a direction different from that of said path but having a component on that path at least equal to the velocity of said objects on their feeding path.

3 Claims, 3 Drawing Figures
TRANSFER DEVICE FOR CIGARETTES AND SIMILAR OBJECTS

In modern machines for making cigarettes, the speed reached by the latter at the exit of a cutting station which cuts the continuous slab into individual components has become quite substantial, i.e., of the order of 5 meters per second. This exit speed, parallel to the longitudinal axis of the cigarettes, must be rapidly absorbed, since, immediately after, whether the purpose is to collect them or to provide them with a filter tip, they are driven perpendicularly to this longitudinal axis.

In machines in operation up to now, the method used has consisted in blocking or, subsequently, restraining the cigarettes before or during the change in their direction. This procedure leads to shocks or decelerations which are all the more abrupt as the speed of the continuous slab reaches a high value: for a given stopping distance, and, in the favourable case of a uniform deceleration, the latter is a function of the square of the initial velocity. Under the same conditions, an increase in the stopping distance makes it possible to reduce the required deceleration in order to absorb a given speed only in direct proportion with the increase in the distance travelled. Very cumbersome devices are therefore quickly obtained which do not, however, eliminate the tendency of the cigarettes to lose tobacco through their front end. Furthermore, the known braking devices lack precision and the cigarettes must then be realigned using any particular device.

Devices have been suggested more recently which are designed to progressively convert the translational motion of the cigarettes along their axis into a translational motion perpendicular to this axis by making each cigarette integral (or even two successive cigarettes simultaneously) with a support (also termed below “prehensory component”) which while remaining parallel with itself follows a closed curve contained in a plane passing through the axis of motion of the cigarettes. The curve described by the supports, which are regularly spaced, is defined by rotating members which rotate in synchronism with the manufacturing machine and more particularly with the cutting station. A cigarette is made integral with its support by suction through that part of the latter which comes into contact with the cigarette’s envelope. This suction is then stopped at the point at which the velocity of the support, on the closed curve which it describes, becomes perpendicular to the axis of the cigarettes. A conventional cellular drum, rotating around an axis parallel to that of the cigarettes (which axis maintains the same orientation throughout the entire transfer) and whose peripheral velocity is equal to that of the support, may then take up again the successive slab sections.

A common characteristic to all devices of this type is certainly detrimental to their efficiency: the closed curves described by each active point of a support (by this is meant the point that comes into contact with the envelope) are only tangent to the external part of the slab cut into cigarettes. As the support subsequently rapidly departs from this path, it is not certain that the support is integral (through suction) with the cigarette, particularly since the velocity vector of the one and initial velocity vector of the other, although substantially equal at the moment at which gripping takes place, and more and more divergent.

The present invention is the result of efforts made in order to provide a transfer device, of the above type, in which the supports may be made integral with the cigarettes in an absolutely certain manner. This has been achieved by providing, at the moment at which gripping occurs, that the velocity vector of the support has a component perpendicular to the velocity vector of the cigarette. In other words, each support then crosses, during an interval of time which is not negligible, the path of the slab divided into cigarette components which allows it to apply itself on the latter and ensures that the one is integral with the other, through suction, for example, before the cigarette component is subjected to a substantial deceleration.

Another drawback common to known devices already mentioned resides in the fact that since the absolute peripheral speed of the support is parallel to the axis of the slab of split cigarettes at the exact moment at which gripping occurs, its component in that direction is then obviously at a maximum. Thus, it is not possible to use the device in order to provide, between the successive cigarette components, the interval required for their differentiation, except as regards giving to this peripheral velocity a value in magnitude which is definitely greater than that of the velocity of the slab of cigarettes. The observed defect is then seen again with the various devices for the longitudinal separation of cigarettes which are grouped under the name “accelerating cam”; this defect results from the application of an abrupt pulse in order to increase the velocity of the first cigarette by acting substantially on its envelope, i.e. on the paper itself more than on the tobacco. It can be understood that this way of proceeding starts the emptying out of the cigarette through its end, which emptying out will have a tendency to continue under the influence of other stresses. The relative sliding of the cigarette and of its support at the moment of contact can also lead, as for the accelerating cams, to a lack of precision as far as the exact location of a cigarette at a given instant is concerned.

The object of the device according to the invention is also to palliate these defects. To this effect, provision is made so that the cigarette supports are first driven with a velocity component which is increasing with respect to the initial velocity of the cigarette that has just been gripped. The first cigarette (or group of cigarettes) is thus rather progressively “loosened” from the next one (or next ones) without any jerks and without any excessive acceleration.

This result, as well as the preceding one, are obtained simultaneously by anticipating the moment of contact between the support and the cigarette with respect to the one at which the support passes at the high point (or at the low point) of its stroke, in the most current case in which the initial path of the slab of cigarettes is horizontal and in the case in which the supports rotate around horizontal axes. This notion of the high point (or low point) might naturally appear in other configurations, but it is possible, however, in each case, to determine a “leading gripping angle” with respect to the point at which the velocity of the slab and absolute peripheral velocity of the support are rigorously parallel. The duration of forced application of the support on the cigarette (crosswise sweeping effect) and the extent of initial increase in velocity with respect to that of the slab (longitudinal separation effect of the various
slub sections) will both depend on the value of this lead gripping angle.

It will be noted that in almost all previous patents, the support takes up the cigarettes (or groups of cigarettes) while passing at the low point of their path. As a result, the suction effect which makes supports and cigarettes integral with one another occurs against the influence of gravity. In order to palliate this drawback, the regulator of such a machine will always have a tendency to cause the downward movement of each support to a small extent below the upper nominal level of the cigarette to be gripped, which leads to a slight crushing of the latter on its transport guide. In a preferred embodiment of this invention, this detrimental precaution is rendered absolutely useless by choosing the direction of rotation so that the lead gripping angle starts from the high point of the closed path followed by the support. In this way, suction and gravity act in the same direction while the cigarettes are raised without any damage from their transport guide.

Other pertinent disadvantage may also be noted regarding the devices described in the known devices: in particular, they do not provide, because of the bulkiness of the prehensory components and their driving mechanism, for a crosswise guide of the slub sections (perpendicularly to this latter’s axis) in the zone in which they are taken up again by the transfer device (designated below as “feeding zone”). In the device according to the invention, this guiding is perfectly well provided for by incorporating two lateral slideways which extend into the feeding zone and which provide, between them a slit whose width is smaller than the diameter of the cigarettes. The prehensory components themselves are shaped as a blade, pass through this slit and come into contact with the successive sections of the slub, raising them from this support and once the high point of the supports is crossed, cause them to move again downwards beyond the overhanging end of the slideways. The lateral guiding is therefore excellent until a firm grip is provided by the suction exerted across the supports. A large height of the prehensory blade (perpendicularly to the axis of the slub) provides a large lead gripping angle without any risk of shock with the guide strips.

Another drawback, finally, can be ascribed to the known devices, which is inherent in the part chosen for the gripping of the low point or high point of the path of the prehensory components. The peripheral velocity of the latter and the velocity of the slub must indeed be in a substantially constant ratio, in general, slightly greater than unity. The maximum permissible speed of the slub is a construction characteristic of the cigarette making machine, however, in order to maintain the above defined ratio at a constant value, it might be suitable, using a given device operating in accordance with the principle of the devices mentioned, to increase or decrease the speed of the slub depending on whether the cigarettes to be made are longer or shorter. Indeed, in a given interval of time, an increase in the number of sections obtained for a constant slub speed would require the rotation, a greater number of times, of the prehensory component in order to discharge the articles produced which would require an increase in their peripheral velocity. This would therefore require a decrease in the speed of the slub in order to maintain the number of sections made per unit time at a substantially constant value. But the difference between the speed of the slub and the peripheral velocity would reappear since the peripheral velocity of the support would remain equal to the initial velocity. This shows that the devices made according to the previous principles correspond actually only to a length of cigarette, which is determined by the geometric dimensions of these devices.

On the other hand, the devices according to the invention can comprise all usual cigarette lengths while maintaining for the production machine a slub speed which is close to the maximum permissible and a difference which is substantially constant between the speed of the slub and the horizontal component of the speed of the prehensory components at the moment of transfer (this applying to a horizontal path of the slub as it is usually found). This difference characterizes the tendency to the relative sliding of the cigarettes and their supports at the moment at which gripping takes place. It will be seen in the example given that this result is easily obtained by varying the lead gripping angle from a minimum corresponding to the longest cigarettes to be made to a maximum suitable for the shortest cigarettes.

The invention therefore also relates to a process for using transfer mechanisms of the type defined below in which the production machine is always operated close to its maximum slub motion speed and for which the lead gripping angle is modified according to the lengths of cigarettes to be made, so that the relative sliding of the cigarettes and prehensory components at the moment at which gripping occurs remains within very permissible limits.

In all that precedes and follows, it should be understood that the term “cigarette” is used to designate any similar rod-shaped object whatever its length, nature or finishing stage may be. A cigarette of simple, double or triple length, small sticks in which the cigarette filters are cut, cigars or rough shapes (poupees) not made for the latter’s production, etc. may be involved indifferently. Similarly, the particularities of the invention are applicable to non cylindrical objects such as regular packages whenever the output velocity of the latter is sufficiently great and stable to be included within the scope of the invention.

One example of an embodiment of the invention for receiving the cigarettes at the exit of the cutting station of the machine which makes them will now be given with reference to the appended drawing in which:

FIG. 1 is a partial front view of the device according to the invention, along line 1—1 of FIG. 2;

FIG. 2 is detailed sectional view along line II—II of FIG. 1; and

FIG. 3 is a diagram of the theoretical operation of the device.

Double length cigarettes C leave the cutting station of the machine, which shows at 10 an extension of the frame, with a speed substantially equal to that of the continuous slub made by this machine. This speed is represented in magnitude and direction by the horizontal vector V_{h} (FIG. 3). They then slide on a perfectly smooth support which ends with two guide strips in a console 11 and 11'. These guide strips provide between them, in their low part, a slit 12 whose width is definitely smaller than the diameter of the cigarettes. Above, this slit widens progressively so as to form a support and guide which brings the cigarettes in the zone in which they are taken up again, i.e., the feeding
zone of the transfer device without practically slowing them down and while maintaining them in a perfectly well defined orientation.

This transfer device itself comprises in this embodiment four prehensory components or supports 21, 22, 23, 24, whose dimensions are suited for cigarettes of a double length. These components consist of a high hollow part shaped as a blade 25 and of a base having a reinforced section 26. The upper part 27 of the blade comprises a perforated cradle on which the median part of the double cigarettes rests and the width of the blade is smaller than that of slit 12 between guide strips 11 and 11'. Supports 21 to 24 are driven into rotation while remaining parallel with themselves (their upper part 27 remaining parallel with the axis of the cigarettes) through two rotating members 30 and 40. Members 30 and 40 are connected to the bases 26 of the prehensory components respectively through solid axes 31, 32, 33, 34 and hollow axes 41, 42, 43 turning in rings such as 35 or bearings 45. The rotary member 30 is provided with four branches, shaped as a cross radiating around a central hub 36, wedged onto a shaft driving 37. Member 40 shaped as a disk is wedged onto the shaft driving 47. Shafts 37 and 47 are driven at the same velocity along the curvilinear arrows of FIG. 1, from the general members of the cigarette making machine, so as to carry out a rotation on themselves whenever four double length cigarettes are sectioned by the cutting station.

The disk 40 remains intimately applied against a stationary bracket 50 throughout its entire rotation while pressing lubricated air-tight linings such as 51. Bracket 50 is provided with a curvilinear groove 52 with which hollow axes 41 to 44 connecting 40 and prehensory components 21 to 24 can communicate during part of their travel. In addition, bracket 50 is provided with two borings 53 and 54. The first one communicates with an oblong opening 61, pierced in a flap 60, used in suspending bracket 50. A large channel 62 in flap 60 communicates with a vacuum pump (not shown). Boring 54, through nozzle 55, communicates with the atmosphere (or optionally, a source of slightly compressed air) in order to break the vacuum existing in tube 42, and blade 25 arriving at the position at which the double cigarette 24 is to be transferred to the receiving device 70. Bolts 63 and 64 provide for the maintenance of bracket 50 on flap 60 while providing for the slight displacement of the latter around the axis of shaft 47 in order to set as best as possible the release of the cigarette at position 24, as will be explained subsequently.

The cigarette receiving device 70 is a conventional suction device which comprises, as disk 30, four arms (71, 72, 73, 74). The end of these arms (75) rotates at the same peripheral velocity (in the direction of the curvilinear arrow of FIG. 2) as the upper part 27 of blades 21 to 24, which provides for a transfer, without any difficulty, to device 70 which feeds a discharge carpet or a filter assembly device. The double length cigarettes are of course cut again in the double sections, which does not give rise to any difficulty since they are already perfectly well aligned longitudinally immediately upon their transfer.

The operation of the transfer device itself results immediately from the preceding points. The prehensory components 21 to 24 rotate in synchronism with the cutting station of the production machine. Their radius of gyration is determined, by construction, so that when the components pass between guide strips 11 and 11', the horizontal component of their velocity (Vx) is of the same order of magnitude (but preferably slightly greater) as the cigarette stubs' own velocity (V2).

Once the compatibility of velocities V2 and Vx has been obtained, the transfer mechanism operates without any problem, since the phasing of the latter and the cutting station comprises a conventional setting on this type of machine. Cradles 27 will come into contact with a cigarette such as C3, which is perfectly centered axially and transversely. They carry it up to position C4 and the depression which exists in the channels of the hollow shafts (such as 43) and channels 52 - 53 - 61 - 62 (the suction according to dashed arrows of FIG. 2) applies it strongly on cradle 27 of the prehensory component (23). During the following quarter of a turn of this component 23 which corresponds to the damping phase of the longitudinal (axial) motion of the stub section and its conversion into a crosswise motion of the same velocity, the double cigarette will be integral with the support up to the moment at which the suction will be stopped as a result of the fact that the hollow axis 42 stops communicating with channel 52 connecting it to the vacuum in order to communicate with channel 54 connecting it to the atmosphere. The setting into communication of tube 42 with the atmosphere through boring 54 will make it possible for the cigarette at C3 to be gripped by the sucking component of arm 72, because of the depression existing inside member 70.

The continuous transfer of the successive cigarette components is thus carried out by progressively absorbing their axial velocity without any excessively sharp deceleration which might lead to the emptying out of these components through their forward end.

Whatever the length of the sections desired may be, at least within the conventional production range, a rate of motion can be maintained in the machine which is very close to the maximum authorized by the manufacturer, by varying lead gripping angle A. The peripheral velocity Vr of cradles 27 is indeed directly proportional to the number of double cigarettes produced per unit of time (therefore, for a given sub velocity Vx, which is inversely proportional to the length of the sections made). But the horizontal component Vx and Vr is equal to Vrcos A. If an average lead gripping angle A corresponds to a cigarette of average length and, when switching to the manufacture of longer cigarettes, it becomes necessary to slow down the peripheral velocity of the prehensory components, the entire mechanism 20 can be displaced downwards and in the direction of the production machine. Angle A will thus be decreased and cos A will thus be increased so that Vx = Vrcos A reaches again a value close to the sub velocity Vx. Conversely, the manufacture of shorter cigarettes will require, as an adjustment, only the raising with respect to guide strips 11 - 11', and bringing away further with respect to the machine, of device 20 as a whole. Angle A will thus be increased (cos A). In spite of the greater peripheral velocity Vr, the gap between the horizontal velocity upon gripping Vr and the unchanged sub velocity Vx will be kept constant.

This adjustment, of course, which in general is not very frequent, can be facilitated, when necessary, by guiding members which are easy to define, since there remains a constant relationship between the size of the
cigarettes to be made and the relative position between device 20 and the production machine. It should be noted that by changing angle A from 20° to 60°, it is possible to use, in practice, a variation of the length of the cigarettes which can be doubled and which, taking into account the possibilities for repeated subsequent cutting, distinctly exceeds manufacturing constraints.

Numerous modifications can of course be introduced into the apparatus described above without departing from the scope of the invention. It is thus possible to simultaneously transfer several cigarettes which are already cut and by acting on the point at which the suction ceases through their prehensory component, divide them into two different streams, one of which is taken up at the upper level of component 22 (FIG. 1) and the other one of which is taken up in a symmetrical position on component 24. Application to items other than cigarettes would not involve any more difficulties.

I claim:

1. A device for transferring objects which are moving in succession on a linear feeding path, from a first zone on said path, through a plane in which said feeding path lies to a second zone in said plane which comprises central hub means mounted for rotation about an axis perpendicular to said plane and a plurality of like gripping means pivotably disposed on said hub means about an axis parallel to the axis of rotation of said hub means, each of said gripping means having an outer gripping cradle lying within said plane operable to grip an object upon engagement thereof in said first zone, said gripping means being linked to said hub so that said cradle maintains a parallel relationship with said linear feeding path at all times during conveyance of a gripped object from said first zone to said second zone, the axis of rotation of said hub being disposed from said feeding path at a distance less than the radius of the circular motion of said cradles so that each of said cradles defines an arc moving through said first zone, away from said path and then towards and through the line of said feeding path to said second zone.

2. A device according to claim 1 including means for adjusting the distance at which the axis of rotation is disposed away from the feeding path so as to change said arc and thereby change the velocity of the linear component of cradles' motion in moving through said first zone.

3. A device according to claim 1 wherein said feeding zone comprises a pair of parallel slideways, each of said slideways being disposed equidistant on either side of the feeding path at a distance from one another less than the width of the objects being transferred but greater than the width of the gripping cradle.

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