June 19, 1962 G. DEARSLEY 3,039,606

CIGARETTE CATCHER

Filed March 2, 1960 3 Sheets-Sheet 1

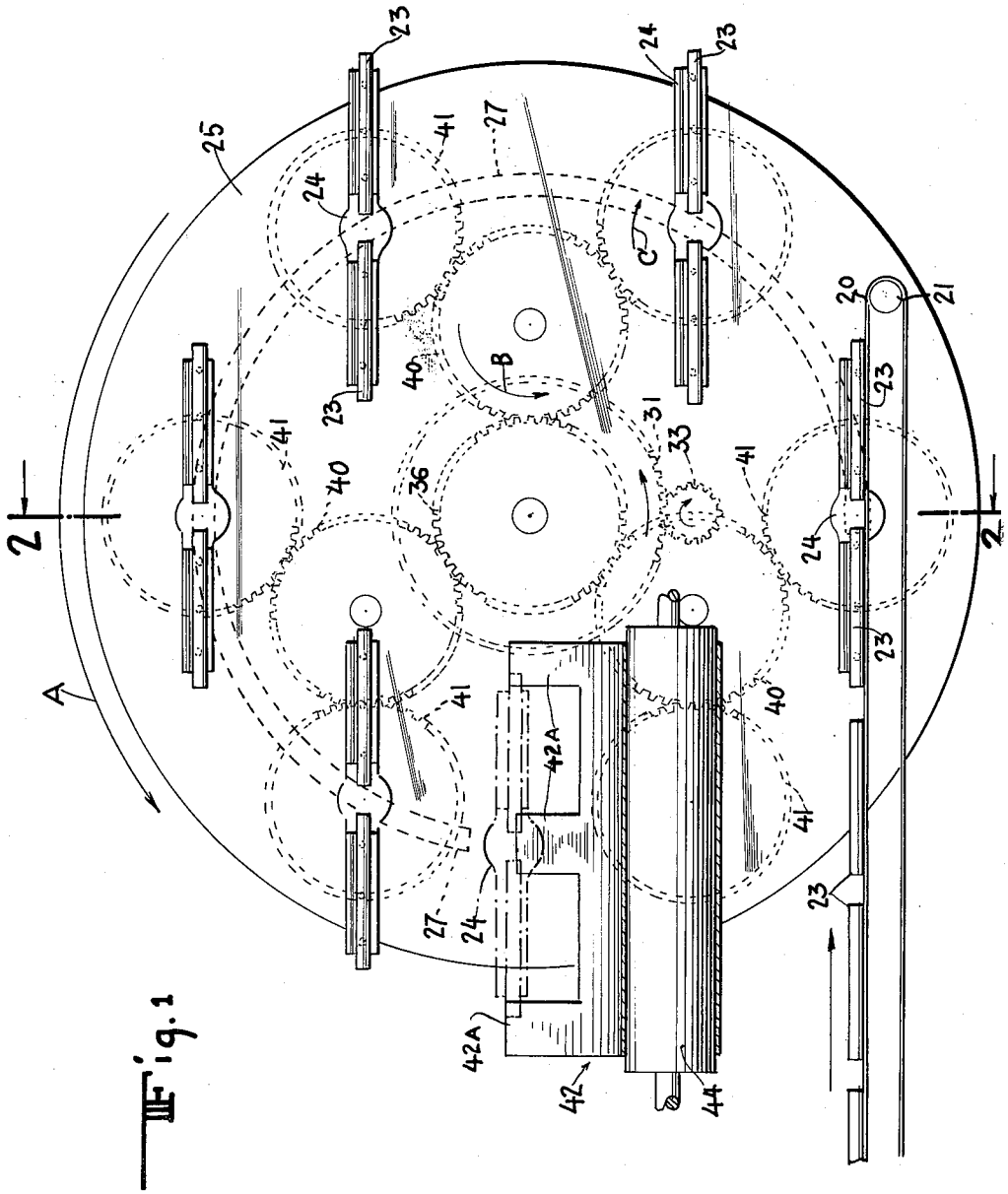

Fig. 1

INVENTOR
GEORGE DEARSLEY
BY
Tenner & Eustad
ATTORNEY

June 19, 1962 G. DEARSLEY 3,039,606

CIGARETTE CATCHER

Filed March 2, 1960 3 Sheets-Sheet 2

Fig. 3

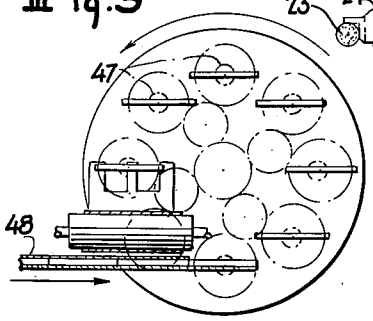

Fig. 2

Fig. 4

INVENTOR
GEORGE DEARSLEY
BY
ATTORNEY

June 19, 1962 G. DEARSLEY 3,039,606

CIGARETTE CATCHER

Filed March 2, 1960 3 Sheets-Sheet 3

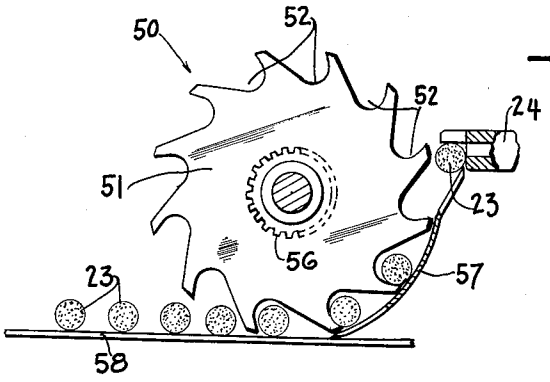

Fig. 5

Fig. 6

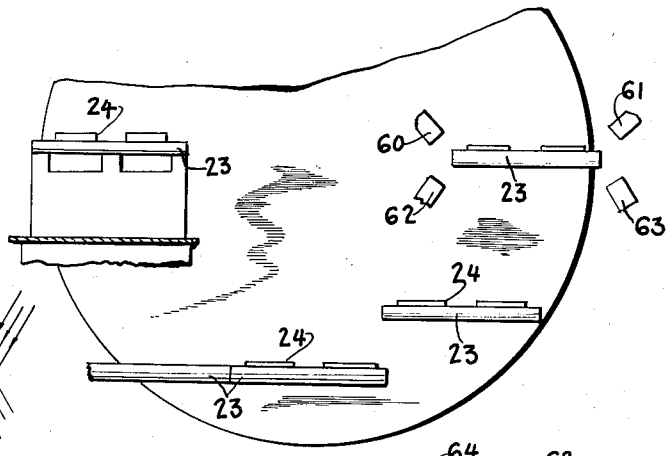

Fig. 7

Fig. 8

Fig. 9

Fig. 10

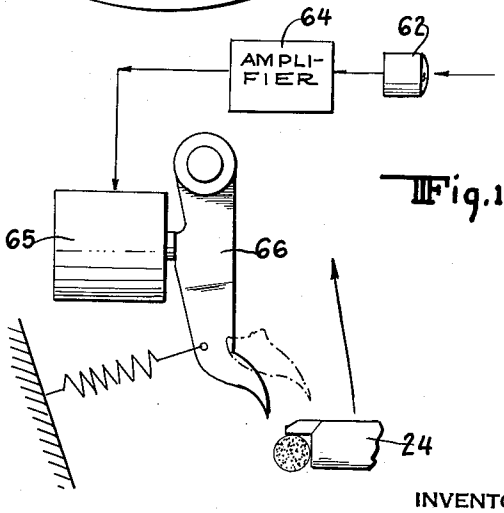

Fig. 11

INVENTOR
GEORGE DEARSLEY
BY
ATTORNEY

United States Patent Office 3,039,606 Patented June 19, 1962

3,039,606

CIGARETTE CATCHER

George Dearsley, London, England

Filed Mar. 2, 1960, Ser. No. 12,350
Claims priority, application Great Britain Jan. 1, 1960
23 Claims. (Cl. 209—111.5)

The present invention relates to a collector and transfer mechanism for cigarettes or the like, and in particular to such a mechanism to be used for collecting cigarettes from a high-speed cigarette making machine, and for inspecting such cigarettes as they are collected.

Modern high-speed cigarette making machines discharge cigarettes at such speeds that the subsequent collection presents a problem. In conventional machines the axial speed of the completed cigarette is suddenly stopped and the cigarette deflected sidewise, i.e., its normal axial speed is suddenly converted into a motion normal to its axis. This frequently results in objectionable damage to the cigarette. The cigarette ends are liable to be deformed and the even distribution of the tobacco throughout the cigarette may be interfered with and tobacco may dribble out of the cigarette ends at this time.

The present invention replaces this sudden deflection or change in direction by a gradual change in direction. This is accomplished by guiding the cigarette along the arc of a circle subtending an angle equal to an odd multiple of 90° while maintaining its orientation in space, the circular arc being tangent to the initial cigarette path at the beginning and the two linear velocities being close. Hence any shock in picking up the cigarettes is avoided.

According to a further feature of the present invention, the cigarette is lifted from the linear path by suction and held by suction during its progress through the circular arc.

In prior art automatic inspection of cigarettes leaving the cigarette making machine at high speeds, it has been necessary to use a memory device between the defect detection signal and the cigarette ejection signal. Another object of the present invention is to dispense with the necessity of a memory device and to have the ejection performed at the location of the defect detection.

It is an object of the present invention to provide a collector and transfer mechanism for cigarettes or the like which is simple in structure and efficient in operation.

Another object of this invention is to avoid any sudden acceleration or deceleration or any sudden change in direction of progress equivalent to such a change in speed.

Another object of this invention is to avoid damage to the transported cigarette.

A further object of the present invention is to provide such a mechanism with a simple and effective sorting device for discarding defective cigarettes.

It is a still further object of the present invention to provide such a sorting device which does not require a memory device.

Further objects and advantages of the present invention will become apparent from the following specification and the appended drawings, in which:

FIG. 1 is a front view of the cigarette collecting and transfer mechanism according to the present invention;

FIG. 2 is a vertical cross-section through the mechanism shown in FIG. 1;

FIGS. 3 and 4 are views similar to FIG. 3 illustrating different embodiments of the invention;

FIG. 5 is a front view of a detail of the present invention;

FIG. 6 is a view similar to FIG. 3 illustrating a cigarette-inspection device according to the present invention;

FIGS. 7, 8, 9 and 10 are side views showing the light-reflecting properties of different type cigarette ends; and

FIG. 11 is a schematic view of a cigarette-sorting device cooperating with the cigarette-inspection device shown in FIG. 6.

Referring now to FIGS. 1 and 2 of the drawings, cigarettes are discharged from a cigarette making machine into a high-speed conveyor 20 which travels over roller 21. Cigarettes 23 are transported by the belt 20 to a deflector having suction heads 24. The suction heads 24 are rotatably supported in a cage 25; and are relatively angularly spaced from each other. Hollow spindles 26 lead from the suction heads 24 to an annular groove 27 communicating through a channel 28 with a source of vacuum. The channel 28 extends through a stationary bracket 29.

A collar 30 of the cage 25 is keyed to a gear 31 as at 32. The gear 31 meshes with a gear 33 on a shaft 34 driven by a sprocket 35 which is operated by the cigarette making machine drive.

A sun gear 36 is keyed to a stationary shaft 38 as at 37. The stationary shaft 38 is keyed to the bracket 29 as at 39. Three planetary gears 40 mesh with the sun gear 36 and with six main gears 41 which are rigid with the hollow spindles 26 of the suction heads 24.

At a station 270° removed from the station at which the conveyor belt 20 feeds the cigarettes to the deflector, the cigarettes are removed therefrom. For this purpose a curved plate 42 is provided with fingers 42A which disengage the cigarettes from the suction heads 24. Simultaneously suction is also cut off in this region, since the annular groove 27 extends only that far around the circular arc. Either expedient or both may be used to effectively remove the cigarettes from the suction heads 24.

The cigarettes are guided onto a catcher belt 43 which is driven by a rotating roller 44. A rotating sponge rubber roller 45 co-operates with the belt 43 to receive the cigarettes from the curved plate 42.

In operation, two cigarettes 23 are simultaneously positioned at the pick up location at the very bottom of the Ferris-wheel deflector comprising the cage 25 and the main gears 41 carrying the suction heads 24.

Suction is provided from the source of vacuum through the channel 28 to the 270° annular groove 27 to all spindles 26 of suction heads 24 within this 270° region. Thus the cigarettes are retained by the suction heads.

The Ferris-wheel motion of the suction heads 24 throughout their path will now be explained. The suction heads 24 are each rigid with their spindles 26 and thus with the associated main gear 41. The main gears 41 are rotatably held in the cage 25 which is driven through gear 31, pinion 33, and shaft 34 by the sprocket 35. This accounts for the continuous rotation of the suction heads 24 around the stationary shaft 38 in the direction indicated by the arrow A in FIG. 1.

The suction heads 24 may have their orientation maintained in space while traveling in their orbit, in any suitable manner. For purposes of illustration I have shown how this may be done by employing a sun gear and planetary gears.

To maintain their orientation in space, the suction heads 24, and thus the main gears 41 must further perform one revolution around their own axes for each revolution around the shaft 38.

As the cage 25 advances around the sun gear 36, the planetary gears 40 as well as the main gears 41 are also forced to so advance. Thus the planetary gears must rotate around their own axes in the direction indicated by the arrow B in FIG. 1 which rotation imparts a rotation in the opposite direction, i.e., in the direction of the arrow C, to the main gears 41. Since all these gears are of the same diameter, the main gears 41 will rotate once around their own axes during each rotation around the sun gear

36, and this rotation will be in a direction to maintain their orientation in space.

The cigarettes 23 will thus travel with their axes in a horizontal position and in front of the suction heads, as seen in FIG. 1, as they have been initially retained by the suction heads 24.

After having traveled for 270°, the cigarettes are stripped off the suction heads 24 by stripping fingers 42A and guided onto the curved plate 42. A pair of cigarettes is simultaneously handled by the machine at all times. The sponge rubber roller 45 checks the movement of the cigarettes to adapt it to the speed of the catcher belt 43. Preferably, the speed of the sponge rubber roller 45 is substantially equal to the speed of the catcher belt 43.

Examination of the operation of the cigarette collector and transfer mechanism reveals no damaging acceleration or deceleration of the cigarettes. At the first or retaining station, or at the point of initial gradual deviation from their straight progress in axial direction, no deceleration need be encountered provided the tangential speed of the suction heads 24 equals the speed with which the cigarettes advance. However, some variations are admissible.

At the final station, there may be provided a sponge rubber roller 45 which cooperates with the curved chute 42 to prevent any damage to the cigarettes. Any change in the transverse velocity at this point is gradual and does not have any damaging effect on the cigarette.

FIG. 3 illustrates a single-row cigarette collector and transfer mechanism. Only those parts that differ from the embodiment shown in FIGS. 1 and 2 are shown. Suction heads 47 are shorter and accommodate only one cigarette each. Further, eight suction heads 47 replace the six suction heads 24 of FG. 1; any other suitable number of suction heads may be selected. The cigarettes 23 are delivered through a delivery tube 48. No spacing is necessary between successively supplied cigarettes 23, the spacing in FIG. 1 being required only for the two rows to be properly spaced. In this embodiment, the tangential velocity of the suction heads 47 is slightly in excess of the delivery speed of the cigarettes 23 so that they will be carried away fast enough to provide a narrow spacing between the picked-up cigarettes.

FIG. 4 is a view similar to FIG. 3 and illustrates another embodiment in which the cigarettes are supplied to the highest instead of to the lowest position of the suction heads 49. In this instance, the cigarettes rotate through an angle of 90°, while they rotate through an angle of 270° in the embodiments of FIGS. 1 and 2 and of FIG. 3. An angle equal to an odd multiple of 90° is necessary, since the axially moving cigarettes are to be converted into cigarettes having zero axial velocity but a finite velocity transverse to their axes.

Alternatively, the Ferris-wheel supporting structure of the suction heads and the associated gearing could be arranged to rotate in a horizontal instead of in a vertical plane.

FIG. 5 illustrates a different embodiment of the collector device, replacing chute 42 and sponge rubber roller 45.

Collector 50 is situated at the delivery location of the cigarettes. Collector 50 comprises a drum 51. The periphery of drum 51 is formed with regularly arranged rounded flutes 52. Drum 51 is secured to a gear 56 which is rotated in time with the cage 25. A bent plate 57 guides cigarettes 23 into the flutes 52 and holds them therein until they reach a horizontal delivery belt 58.

In operation, drum 51 is rotated by any suitable means such as by gear 56 rotating as indicated by the arrow. As drum 51 rotates a cigarette is deposited in the flute 52 at the discharge position. As drum 51 rotates, a successive flute 52 is lined up with the cigarette discharge position and another cigarette 23 is delivered into the next flute 52. Simultaneously the first cigarette 23 is moved downward inside the channel formed by flute 52 and the adjacent bent plate 57. Finally this cigarette reaches horizontal delivery belt 58 and is released to continue thereon. Thus the vertically discharged cigarettes are delivered in a horizontally travelling condition to the delivery belt 58.

FIGS. 6 to 11 illustrate the cigarette-inspection device according to the present invention. In the cigarette transfer mechanism described, the cigarettes travel for a section of their path transversely to their axes. This considerably facilitates their inspection.

FIG. 6 is a view similar to FIG. 3 but omitting some of its details while illustrating the cigarette inspection and rejection device. Two light sources 60 and 61 project light on the two opposite ends of a cigarette 23 which ends reflect the light onto conventional photocells 62 and 63, respectively. FIGS. 7 to 10 show the different conditions of the cigarette ends and the associated reflection of the light.

FIG. 7 illustrates the acceptable condition in which the cigarette ends are cut and smooth. A maximum of light will be reflected onto the associated photocell. If the end is badly cut and rough, the reflected light is scattered as in FIG. 8 and the photocell will receive only a fraction of the light compared to FIG. 7. FIG. 9 shows a brushy cigarette end; the projecting ends will cast long black shadows so that again less light will reach the photocell than in FIG. 7. If the end is void as shown in FIG. 10, a very small amount of light will again be reflected onto the photocell.

FIG. 11 illustrates the control device. The outputs from photocells 62 and 63 are amplified in amplifier 64 which is arranged to supply energizing current to the relay 65 when the light falling on cell 62 is equal to or less than the amount corresponding to the quality of cigarettes chosen for rejection. The spring loaded stripping finger 66 is normally held against the relay plunger of 65 when the photocell outputs correspond to the condition shown in FIG. 7. The circuit is suitably gated to provide this signal only when the cigarette is in the inspection position or other known devices are employed to insure that the apparatus is operated only when receiving the light reflected from the ends of the cigarette.

If the reflected light intensity sinks below a predetermined level, the relay is actuated and pushes the spring-loaded stripping finger 66 outwardly to the dotted position into the path of suction head 24, stripping the cigarette found defective. (FIG. 11.) The discarded cigarette stripped by finger 66 drops into a suitably positioned container or chute (not shown).

The operation of the cigarette inspection and rejection device appears self-explanatory. If the light reflected from the cigarette end is more than that which would normally be reflected from ends of cigarettes having desired minimum quality, the relay 65 is not activated, allowing the cigarette to pass. But if the reflected light falls below this minimum, the relay will be activated to move the stripping finger in the path of the defective cigarette which will be discarded.

It will be understood that a great many variations of the inspection method are feasible, the common feature being the direct and immediate removal of the defective cigarette, made possible by its motion transverse to its axis. Thus, no memory device is required.

The stripping of the cigarette from the suction head may alternatively be accomplished by cutting off the suction. In this instance, the relay 65 would operate a suitably located valve.

This feature of the invention is not limited to inspection by light, but is similarly applicable to dielectric devices measuring the density of cigarettes, spring loaded probes to feel soft ends, or other inspection devices.

Although particular embodiments of the present invention are illustrated and described, it is to be understood that this is only for the purpose of description, and that changes and modifications may readily be made therein

without departing from the spirit and scope of the invention.

What is claimed is:

1. A method of transforming the axial velocity of a cigarette or the like into a velocity transverse to its axis, comprising the steps of retaining the cigarette by a cigarette-retaining means moving in a circle tangential to the initial axial path of the cigarette, rotating said cigarette-retaining means with said cigarette through an arc subtending an angle equal to an odd multiple of 90° while retaining its orientation in space, separating the cigarette from said cigarette-retaining means at the termination of this arc, and moving said cigarette away from said cigarette-retaining means in a direction transverse to its axis.

2. A collector and transfer mechanism for cigarettes or the like to which the cigarettes are supplied in an axially progressing stream, comprising in combination, cigarette carrying means adapted to carry the cigarettes through a predetermined circular arc, maintaining them parallel to themselves throughout their travel, said cigarette carrying means being adapted to grip each cigarette as it tangentially enters the arc and to release each cigarette at the termination of the arc at an instant when the axial velocity of the cigarette is substantially zero, and means to guide the cigarettes, when released, in a direction transverse to their axes.

3. A collector and transfer mechanism for cigarettes or the like as claimed in claim 2, in which said cigarette carriyng means are suction heads.

4. A collector and transfer mechanism for cigarettes or the like, comprising at least one suction head, drive means advancing said suction head in a circular path, rotating means rotating said suction head once on its own axis as it completes each circle in a direction to maintain its orientation in space, said suction head being adapted to retain a cigarette over an arc-shaped portion of its circle which is an odd multiple of 90°.

5. A cigarette collector and transfer mechanism to be used with high speed cigarette-making machines supplying a successive stream of cigarettes progressing in a predetermined direction, comprising a plurality of cigarette-retaining means mounted in a circle, a drive for advancing said cigarette-retaining means along the circle, each of said cigarette-retaining means being adapted to grip at least one cigarette when reaching a first position in the circle in which first position the direction of motion of said cigarette-retaining means is substantially identical with the predetermined direction in which the cigarettes progress from the cigarette-making machine, cigarette-releasing means operative to separate each cigarette from each of said cigarette-retaining means when said cigarette-retaining means reaches a second position in the circle, and cigarette collecting means catching each released cigarette.

6. A cigarette collector and transfer mechanism as claimed in claim 5 in which said two positions are removed by an odd multiple of 90° and each of said cigarette retaining means performs an additional complete rotation on its own axis during one complete traverse of the circle, whereby it maintains its orientation in space.

7. A mechanism as claimed in claim 6 in which each of said cigarette-retaining means is a suction head.

8. A mechanism as claimed in claim 6 in which the circle along which said plurality of cigarette-retaining means travels is located in a vertical plane.

9. A mechanism as claimed in claim 7, in which said cigarette-releasing means is a suction-interrupting device.

10. A mechanism as claimed in claim 7, wherein said cigarette-releasing means is a stripping finger.

11. A mechanism as claimed in claim 6 further comprising a faulty-cigarette detector providing a faulty-cigarette signal, and cigarette-disengaging means rendering said cigarette-retaining means ineffective, said faulty-cigarette detector and said cigarette-disengaging means being positioned at the same predetermined location in the circle, said detector signal being directly and immediately effective to operate said cigarette disengaging means.

12. A collector and transfer mechanism for cigarettes or the like, comprising in combination, a cage, a plurality of main gears rotatably mounted and evenly angularly spaced in said cage, a sun gear centrally and stationarily located relative to said cage, a plurality of intermediate gears, each intermediate gear meshing with said sun gear and each of said main gears meshing with one of said intermediate gears, a drive for said cage rotating it on an axis parallel to the axis of said sun gear, and a plurality of suction heads equal to said plurality of main gears, each suction head being rigidly connected to one of said main gears, said suction heads being effective to retain a cigarette over an arc-shaped path extending over an odd multiple of 90°.

13. A collector and transfer mechanism for cigarettes or the like as claimed in claim 12, in which said sun gear axis extends substantially horizontal, further comprising a catcher device at the termination of the arc-shaped path, said catcher device comprising a curved plate having an upper substantially vertical section, a rotating sponge-rubber roller spaced from said curved plate by a distance substantially equal to a cigarette diameter, and a moving belt forming the continuation of said curved plate.

14. A collector and transfer mechanism for cigarettes or the like as claimed in claim 12 in which said suction heads have a row of holes horizontally aligned and positioned at the side of each suction head.

15. A collector and transfer mechanism for cigarettes or the like to which the cigarettes are supplied in an axially progressing stream, comprising in combination, cigarette-retaining means adapted to carry each cigarette through an arc in a vertical plane subtending an angle which is an odd multiple of 90° while maintaining their orientation in space, said cigarette-retaining means being adapted to grip each cigarette as it tangentially enters the arc, a drum at the termination of the arc, the axis of said drum extending horizontally and at right angles to the arc, said drum being formed with a plurality of flutes around its circumference, a substantially horizontal delivery belt adjacent the lowest flute of said drum, guide means extending between the arc and said belt, and means to rotate said suction drum.

16. A collector, transfer and inspection mechanism for cigarettes and the like, comprising a plurality of cigarette-retaining means, each cigarette-retaining means being adapted to retain a limited group of cigarettes picked up while the cigarettes are travelling at a fast axial rate, said cigarette-retaining means advancing at a comparable rate moving the cigarettes substantially transverse to their axis over a portion of their path, a fault-detection device within this portion of their path adapted to provide a fault signal in response to the inspection of a defective cigarette, and disengaging means rendering said cigarette-retaining means ineffective, said disengaging means being directly and immediately responsive to the fault signal.

17. A collector, transfer and inspection mechanism for cigarettes and the like as claimed in claim 16, in which said cigarette retaining means comprises a plurality of suction heads rotating in a circle, said fault-detection device being positioned to inspect a cigarette retained by each of said suction heads as it passes a predetermined position in the circle, the fault signal being effective to temporarily position a cigarette-disengaging member in the path of said suction head in the predetermined position.

18. Apparatus as claimed in claim 17, in which said cigarette-disengaging member is a stripping finger.

19. Apparatus as claimed in claim 16, in which the limited group consists of one cigarette.

20. Apparatus as claimed in claim 16, in which said fault-detection device is a cigarette-end inspection device comprising a light-source projecting light onto the end of the cigarette, a photocell receiving the light reflected from

the end of the cigarette, an amplifier connected to the photocell output, a relay operated by said amplifier, cigarette separating means operated in response to said relay to disengage the cigarette from said cigarette-retaining means in response to an insufficiency in the reflected light reaching said photocell.

21. A method of receiving cigarettes from a source of supply from which the cigarettes are arriving serially with their axes in one line and rearranging them in a stream, in which they move serially with their axes parallel to each other, consisting of gripping the cigarettes whilst they are moving in the axial direction, changing their direction of motion whilst so gripped, and releasing them when they are moving in a direction substantially transverse to their axes.

22. A method of receiving cigarettes from a source of supply from which the cigarettes are arriving serially with their axes in one line and rearranging them in more than one stream in which they move serially with their axes parallel to each other, consisting of serially gripping batches of more than one cigarette whilst they are moving in the axial direction, changing their direction of motion whilst so gripped and releasing them when they are moving in a direction substantially transverse to their axes.

23. A method of changing the direction of velocity of a stream of cigarettes comprising gripping a cigarette as it travels axially at the point of pick up, converting the axial movement to lateral movement gradually and carrying the cigarette laterally to the point of delivery while retaining its orientation in space in such a manner that there is no violent change in the magnitude of velocity whilst the direction of velocity is being changed.

References Cited in the file of this patent

UNITED STATES PATENTS

1,432,762	Ladd	Oct. 24, 1922
1,824,414	Stein	Sept. 22, 1931
1,846,808	Hohn	Feb. 23, 1932
1,887,211	Mortimer	Nov. 8, 1932
2,373,361	Walter	Apr. 10, 1945
2,800,226	Drennan	July 23, 1957
2,809,639	Edwards	Oct. 15, 1957
2,922,519	Radley	Jan. 26, 1960
2,944,667	Stevens	July 12, 1960