

[54] **APPARATUS FOR MANIPULATING FILTER
ROD SECTIONS OF MULTIPLE UNIT
LENGTH**

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[58] **Field of Search**..... 198/20 C, 32; 131/94

[56] **References Cited**

FOREIGN PATENTS OR APPLICATIONS

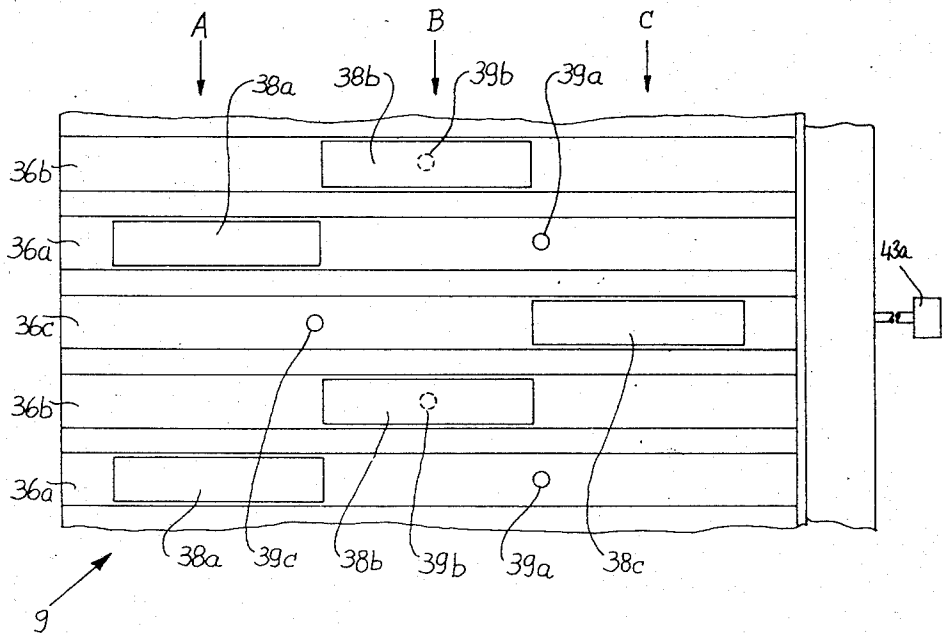
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ABSTRACT

A filter cigarette making machine wherein the shuffling conveyor which converts three discrete files of filter rod sections of double unit length into a single file while the filter rod sections move sideways has a drum-shaped body with axially parallel peripheral flutes for reception of discrete files of filter rod sections from a staggering conveyor in such a way that each flute receives a single filter rod section. At least some of the flutes are in communication with suction ports which draw from the flutes currents of air in such a way that the filter rod sections in the respective flutes move axially into register with the remaining filter rod sections. The pneumatic axial shifting of filter rod sections is particularly desirable in connection with moist filter rod sections which offer considerable resistance to sliding movement under the action of cams, rollers or belts. The staggering conveyor has circumferentially extending recesses of different width which receive discrete filter rod sections of successive rows of axially parallel sections and which cooperate with a stationary rolling device to roll selected filter rod sections of each row rearwardly during sidewise movement of filter rod sections so that the rows of filter rod sections are converted into discrete files which are ready to be transferred onto the shuffling conveyor.

16 Claims, 7 Drawing Figures



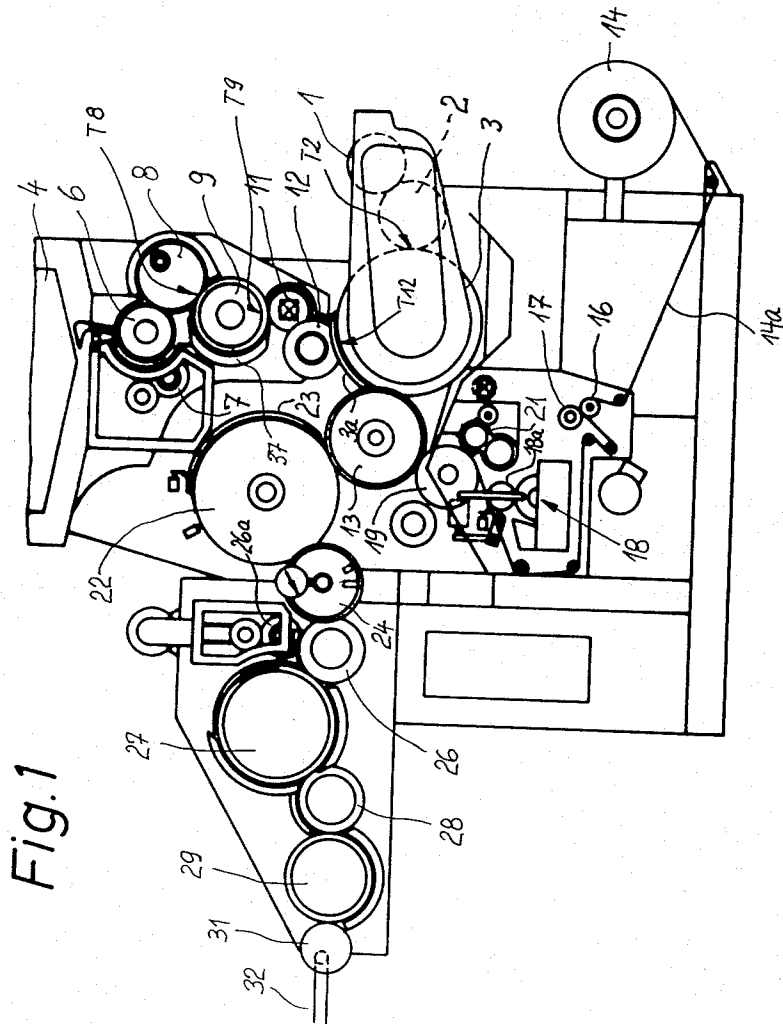


Fig. 2

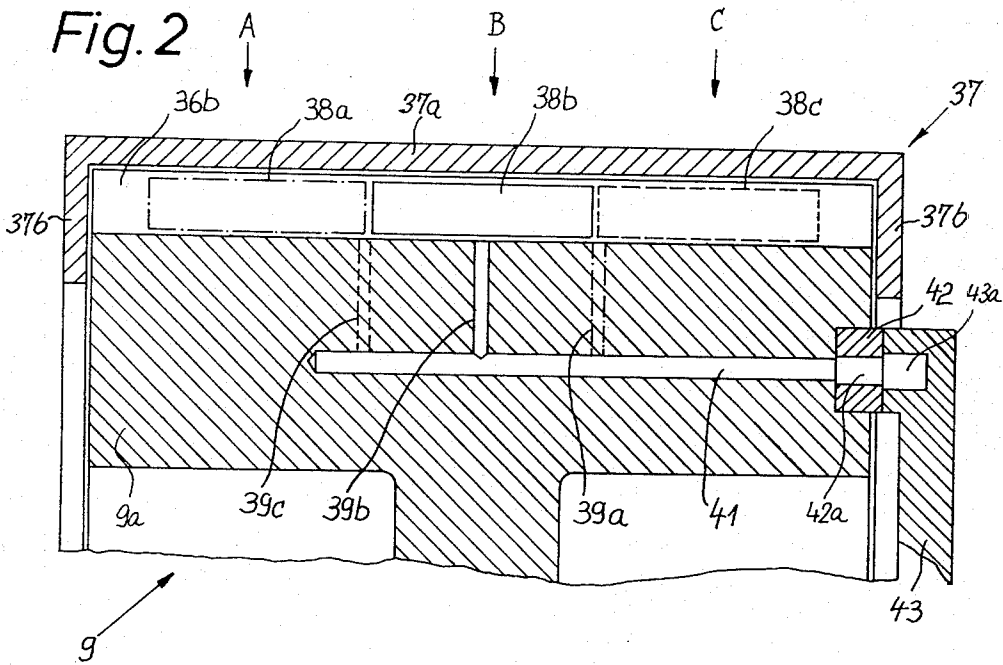
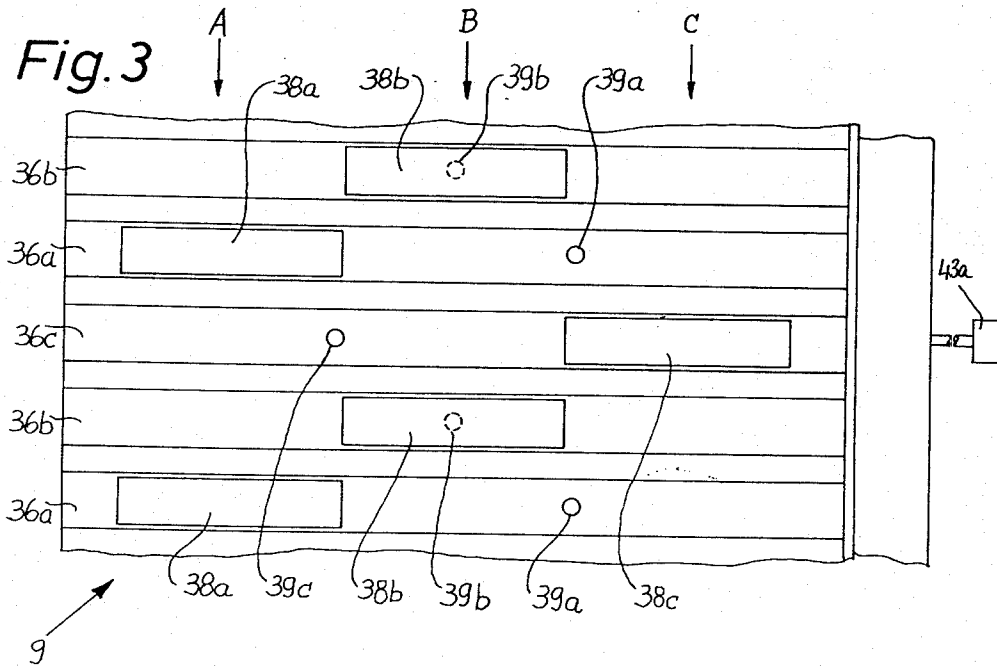
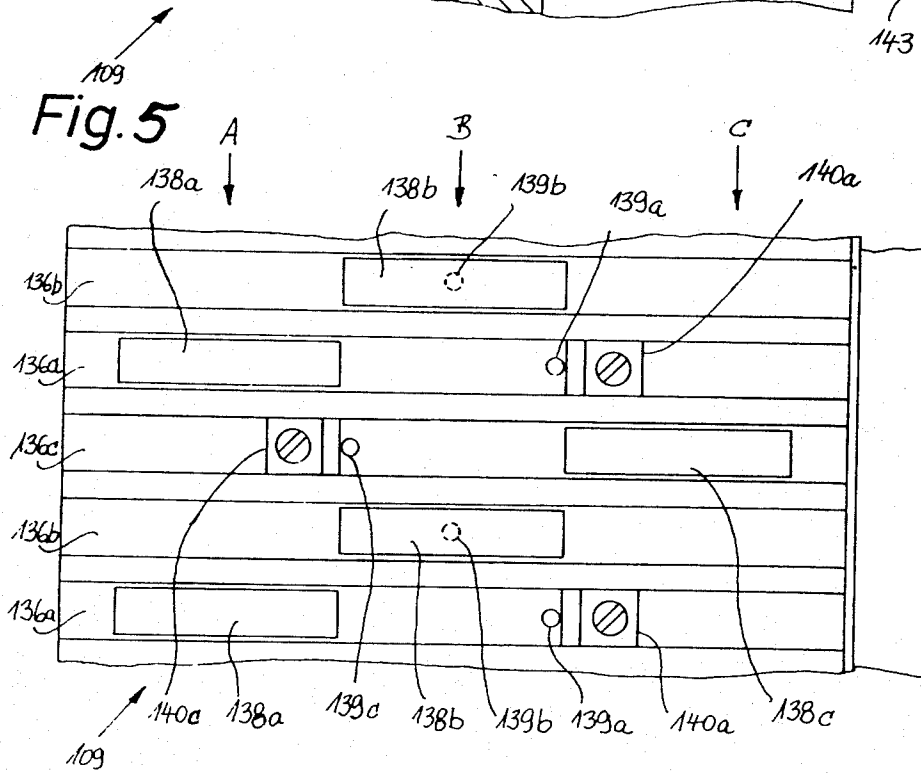
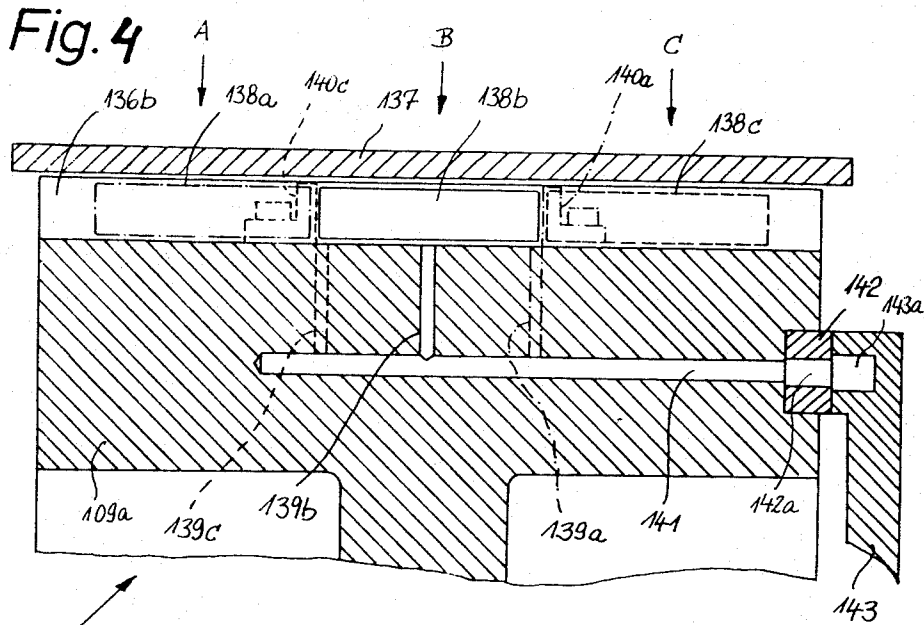
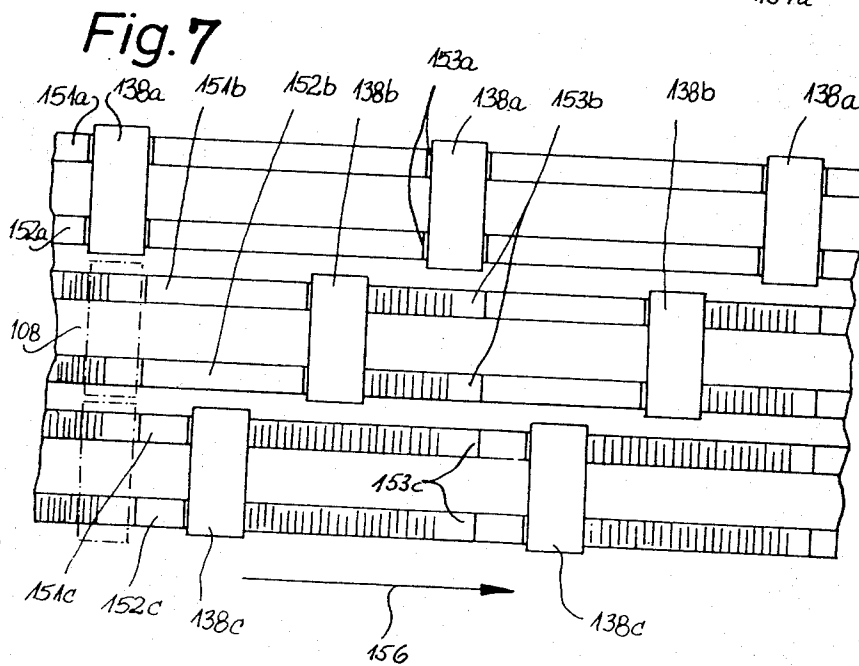
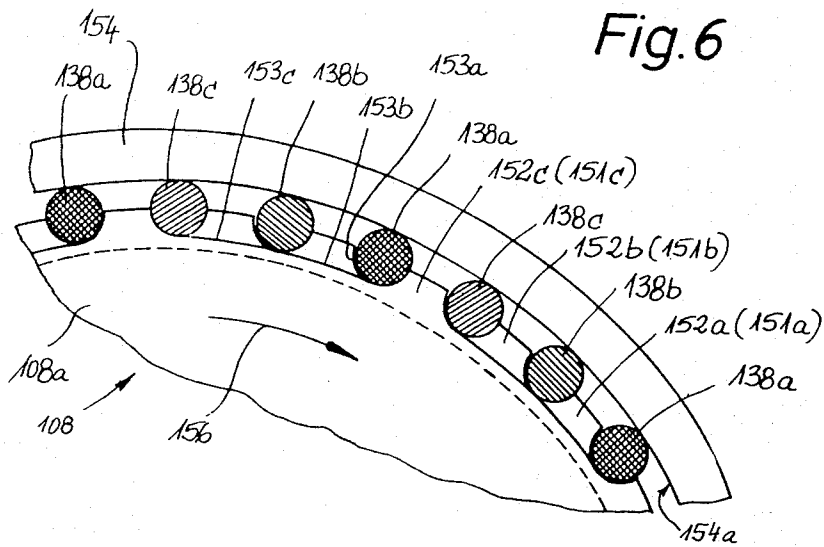


Fig. 3







APPARATUS FOR MANIPULATING FILTER ROD SECTIONS OF MULTIPLE UNIT LENGTH

BACKGROUND OF THE INVENTION

The present invention relates to apparatus for manipulating rod-shaped articles, and more particularly to improvements in apparatus for transporting and changing the relative positions of filter rod sections, especially filter rod sections of multiple unit length. The filter rod sections which are to be manipulated in the apparatus of the present invention can be used in machines for the making of filter-tipped cigarettes, cigars or cigarillos. For convenience, the invention will be described with reference to filter rod sections which are to be used in the manufacture of filter cigarettes.

Filter rod making machines of presently preferred design produce a continuous filter rod which is thereupon subdivided into filter rod sections of multiple unit length (hereinafter called long filter rod sections), for example, of six times unit length. Such long sections are thereupon fed into the hopper of a filter cigarette making machine and are transported sideways past one or more rotary knives which subdivide each long section into two or more short filter rod sections, e.g., into three filter rod sections or plugs of two times unit length. Thus, each long section yields a row of two or more coaxial short sections which are thereupon manipulated to form a single file wherein the short sections travel sideways and wherein each short section is accurately aligned with the preceding and with the next-following short sections. The thus shuffled or interdigitated short sections are ready to be introduced, one after the other, between successive pairs of axially aligned but spaced-apart plain cigarettes of unit length to form therewith groups of three coaxial rod-shaped articles which are thereupon united by adhesive-coated bands to form filter cigarettes of double unit length. Each filter cigarette of double unit length is severed midway across its short filter rod section to yield two filter cigarettes of unit length, and each filter cigarette of unit length consists of a plain cigarette, a filter rod section of unit length, and a tubular adhesive-coated uniting band which surrounds the filter rod section of unit length and the adjacent end portion of the respective plain cigarette.

The conversion of rows of two or more coaxial short filter rod sections into a single file of such short sections is normally effected by transferring successive rows of coaxial short sections onto a staggering conveyor wherein each short section of a row of sections travels at a different speed or covers a different distance so that the originally coaxial short sections are staggered transversely to the direction of their sidewise movement. The thus staggered short sections are transferred into successive flutes of a shuffling or interdigitating conveyor which transports them sideways and cooperates with suitable stationary cams, friction wheels or like devices serving to mechanically shift selected short sections axially so as to form the aforementioned single file of short sections which are ready to be assembled with pairs of plain cigarettes of unit length.

The staggering conveyor may comprise three disks which rotate about parallel axes so that their flutes cover different distances between a first transfer station where the flutes receive short filter rod sections from the preceding conveyor (e.g., a severing conveyor for

long sections) and a second transfer station where the staggered short filter rod sections are transferred into the flutes of the shuffling conveyor. The flutes of the shuffling conveyor are relatively shallow so that at least one-half of each short filter rod section extends outwardly beyond the respective flute. This renders it possible to move the outwardly extending portions of end faces of short filter rod sections in the flutes of the shuffling conveyor past stationary cams in order to shift the short sections axially so that all of the sections form a single file. If a long section is subdivided into three short sections, the shuffling conveyor is normally constructed in such a way that each third short section retains its axial position but that each first and each second section moves axially into exact alignment with the third sections.

The just described mode of staggering and shuffling short filter rod sections is highly satisfactory in connection with the treatment of relatively dry filter rod sections having smooth external surfaces and smooth end faces. However, such mode of manipulation is much less satisfactory for the staggering and/or shuffling of certain recently developed filter rod sections (such as sections of filter rods known as charcoal filter rods) which are permeated with various chemical substances in order to enhance their smoke-filtering action. The drying of such types of filter rod sections often takes up several days, especially if the ingredients of the filter rod sections are caused to react with each other. Such lengthy drying of filter rod sections presents serious problems, for example, as concerns the temporary storage of moist filter rod sections during the interval between permeation with slowly drying and/or slowly reacting substances and the assembly of filter rod sections with plain cigarettes or other wrapped tobacco rod sections. The manipulation of moist or wet filter rod sections in the aforescribed staggering and shuffling apparatus has been found to produce an excessive number of rejects and to cause frequent clogging of the filter cigarette making machine because the mechanical shifting or shuffling devices are incapable of displacing moist or wet filter rod sections with the same degree of accuracy and reliability as relatively dry and smooth-surfaced filter rod sections. A moist filter rod section often adheres to the surface of its flute with such a force that the mechanical shifting action of a belt, cam or friction wheel is likely to cause excessive deformation or crushing and comminution of the filter rod section. The likelihood of deformation and/or crushing of moist filter rod sections is attributable in part to the fact that a cam or an analogous mechanical displacing device can act upon relatively small portions of end faces of moist filters (normally about one-third) because the flutes of the shuffling conveyor must be deep enough to insure satisfactory lateral guidance of filter rod sections therein.

SUMMARY OF THE INVENTION

An object of the invention is to provide a novel and improved apparatus for manipulating sections of filter rods, particularly filter rod sections of multiple unit length for use in filter-tipped cigarettes or analogous rod-shaped smokers' products, in such a way that the filter rod sections can be shifted axially and/or otherwise moved without resorting to mechanical displacing devices which are likely to deform and/or destroy the filter rod sections, especially filter rod sections which

are moist or offer for other reasons a substantial resistance to mechanical shifting action.

Another object of the invention is to provide a machine for connecting pairs of coaxial wrapped tobacco rod sections (e.g., plain cigarettes of unit length) to filter rod sections of double unit length (such sections may constitute hollow tubes or filter rod sections wherein a tubular wrapper contains two or more different types of filter material) with an apparatus or assembly which can convert two or more discrete files of filter rod sections which travel sideways into a single file without any damage to or deformation of filter rod sections.

A further object of the invention is to provide the manipulating apparatus with novel staggering and shuffling or interdigitating conveyors for filter rod sections of multiple unit length.

An additional object of the invention is to provide the shuffling conveyor with novel and improved means for changing the axial positions of some or all filter rod sections thereon.

The improved apparatus is used to manipulate sections of filter rods, particularly filter rod sections of multiple unit length which are to be used in filter-tipped smokers' products. The apparatus comprises a first conveyor which is arranged to transport at least two discrete files of filter rod sections sideways so that the sections of one file are staggered axially and in the direction of their sidewise movement relative to the filter rod sections of the other file, a shuffling conveyor having a plurality of parallel elongated flutes or analogous receiving means which travel sideways along an endless path including a transfer station where the sections of discrete files are transferred one after the other into separate flutes, sealing means for at least partially sealing at least some of the flutes from the atmosphere during travel along a predetermined portion of the endless path which portion is located downstream of the transfer station, and suction producing means which is operative in the sealed flutes to move the sections of at least one of the discrete files axially during travel along the predetermined portion of the endless path so that the discrete files are converted into a single file whose filter rod sections travel sideways.

The shuffling conveyor preferably comprises a drum- or disk-shaped body which is provided with the flutes and rotates about an axis which is parallel to the flutes. The suction producing means includes suction ports machined into the body of the shuffling conveyor and means for drawing into the suction ports currents of air by way of the respective flutes whereby the filter rod sections in such flutes are caused to move axially into alignment with the filter rod sections of the other discrete file or files.

The first conveyor is preferably a staggering conveyor which can convert successively supplied rows of axially aligned filter rod sections into the aforementioned discrete files prior to transfer of discrete files onto the shuffling conveyor. The staggering conveyor may be provided with means for rolling one or more sections of each row sideways to thus stagger the sections of each row in the direction of their sidewise movement toward the transfer station.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved apparatus itself, however, both as to its construction and its mode of operation,

together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic elevational view of a filter cigarette making machine including a filter plug manipulating apparatus which embodies the invention;

FIG. 2 is an enlarged fragmentary axial sectional view of a shuffling conveyor forming part of the manipulating apparatus which is shown in FIG. 1;

FIG. 3 is a plan view of the structure shown in FIG. 2, with a cover for the drum-shaped body of the shuffling conveyor omitted;

FIG. 4 is a fragmentary axial sectional view of a modified shuffling conveyor;

FIG. 5 is a plan view of the structure shown in FIG. 4, with a cover for the drum-shaped body of the shuffling conveyor omitted;

FIG. 6 is an enlarged fragmentary elevational view of a staggering conveyor which forms part of the improved manipulating apparatus and cooperates with the shuffling conveyor of FIGS. 2-3 or 4-5; and

FIG. 7 is a plan view of the structure shown in FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a filter cigarette making machine of the type known as MAX and produced by the West-German Firm of Hauni-Werke, Hamburg-Bergedorf. This machine embodies a system of conveyors which constitute an improved apparatus for manipulating all types of filter rod sections including the conventional "dry" filter rod sections as well as the recently developed "moist" filter rod sections which cannot always be properly shifted and/or otherwise manipulated by mechanical means.

The filter cigarette making machine comprises a large number of conveyors which, unless otherwise defined, are in the form of rotary disks, wheels or drums. The machine is assumed to be directly coupled to a cigarette rod making machine which discharges a continuous stream of plain cigarettes of unit length. Such cigarettes are fed into alternate flutes of a rotary transfer conveyor 1 so that the cigarettes in each evenly numbered flute form a first file and the cigarettes in each oddly numbered flute form a second file whose cigarettes are staggered with reference to the cigarettes of the first row, as considered in the circumferential direction of the conveyor 1. The transfer conveyor 1 delivers the cigarettes of the two files into successive flutes of two aligning conveyors 2 which are driven at such a speed or transport the cigarettes of the respective files through such distances that each cigarette of one file is aligned with but spaced apart from a cigarette of the other file not later than when such cigarettes reach a transfer station T2 where they enter successive axially parallel peripheral flutes of an assembly conveyor 3. Thus, once it advances beyond the station T2, each flute of the assembly conveyor 3 contains a pair of coaxial plain cigarettes of unit length which are spaced apart by a distance at least equalling but preferably slightly exceeding the length of a filter rod section of double unit length.

The filter cigarette making machine further comprises a magazine or hopper 4 which contains a supply of parallel long filter rod sections of six times unit length. A chute at the bottom end of the magazine 4 supplies a single file of long filter rod sections into successive flutes of a severing conveyor 6 which transports such filter rod sections past two co-axial rotary disk-shaped knives 7 (only one shown) so that each long filter rod section is subdivided into a row of three co-axial short filter rod sections or filter plugs of double unit length.

The severing conveyor 6 is followed by a so-called staggering conveyor 8 (for example, of the type shown in FIGS. 6 and 7) which transports successive rows of axially aligned filter plugs sideways and simultaneously staggers the plugs of each row so that the originally aligned plugs are moved out of axial alignment with each other and form three discrete files of filter plugs. The thus staggered filter plugs are transferred at a transfer station T8 into successive flutes of a shuffling or interdigitating conveyor 9 (for example, of the type shown in FIGS. 2 and 3) whereon the filter plugs form three discrete files with the filter plugs of each file out of axial alignment with the filter plugs of the other two files. Also, the filter plugs of the three files are staggered axially with respect to each other (see the filter plugs 38b, 38a, 38c in the upper part of FIG. 3).

The three files of filter plugs on the shuffling conveyor 9 are thereupon converted into a single file of filter plugs in a manner to be described in connection with FIGS. 2 and 3. Successive plugs of the single file are transferred at a transfer station T9 into successive flutes of an intermediate conveyor 11 which delivers successive filter plugs into successive flutes of an accelerating conveyor 12 which inserts discrete filter plugs into the spaces between successive pairs of plain cigarettes in the flutes of the assembly conveyor 3. Such insertion takes place at the transfer station T12. The thus obtained groups (each of which contains two plain cigarettes of unit length and a filter rod section or filter plug of double unit length therebetween) are thereupon caused to advance between two stationary condensing cams 3a which cause the plain cigarettes to move toward each other and to abut against the adjacent ends of the respective filter plugs. The thus condensed groups are introduced into successive flutes of a band attaching conveyor 13.

The uniting bands which are employed to permanently secure the filter plug of each condensed group to the respective plain cigarettes are obtained by severing an elongated web or tape 14a of cigarette paper, cork or analogous wrapping material. The web 14a is drawn from a roll 14 by a pair of driven advancing rolls 16, 17 and is caused to travel along a rotary applicator 18a forming part of a conventional paster 18 which coats the underside of the web 14a with a film of adhesive paste. The leading end of the web 14a is attracted to the peripheral surface of a rotary suction conveyor 19 which cooperates with a rotary knife 21 to subdivide the web 14a into a succession of adhesive-coated uniting bands which are caused to adhere to the filter plugs of successive condensed groups in the flutes of the band-attaching conveyor 13. The latter transports the groups (with a uniting band attached to the filter plug of each group) onto a rolling or wrapping conveyor 22 which cooperates with a driven endless belt 23 or an analogous complementary rolling device to convolute

the uniting bands around the respective filter plugs and around the adjacent inner end portions of the respective plain cigarettes so that each such group is converted into a filter cigarette of double unit length.

The rolling conveyor 22 delivers filter cigarettes of double unit length onto a first testing conveyor 24 which is associated with means for determining the integrity or lack of integrity of wrappers on successive filter cigarettes of double unit length. The defective cigarettes are segregated from satisfactory cigarettes, either on the testing conveyor 24 or subsequent to their severing to yield pairs of filter cigarettes of unit length. In the illustrated filter cigarette making machine, the first testing conveyor 24 delivers filter cigarettes of double unit length onto a severing conveyor 26 cooperating with a rotary disk-shaped knife 26a to subdivide each filter cigarette of double unit length into a pair of filter cigarettes of unit length. Such cigarettes of unit length form two files and are transferred onto an inverting conveyor 27 which inverts the cigarettes of one file end-for-end so that the filter plugs (of unit length) of all cigarettes face in the same direction. The conveyor 27 preferably places the inverted cigarettes into the spaces between successive cigarettes of the other file. The thus obtained single file of filter cigarettes of unit length is transferred onto an intermediate conveyor 28 which delivers them onto a second testing conveyor 29 having or cooperating with means for testing the density of the free ends of tobacco filters of successive filter cigarettes of unit length. The defective cigarettes are segregated and the satisfactory cigarettes are delivered onto a transfer conveyor 31 which deposits them on the upper stretch of an endless conveyor belt 32 for delivery to a packing machine or into storage.

FIGS. 2 and 3 illustrate the details of the shuffling or interdigitating conveyor 9. This conveyor comprises a hollow drum-shaped body 9a whose periphery is provided with groups or sets of equidistant axially parallel flutes numbered 36a, 36b, 36c. At least that portion of the periphery of the drum-shaped body 9a which travels between the transfer station T8 between the conveyors 8, 9 on the one hand and the transfer station T9 between the conveyors 9, 11 on the other hand is surrounded by a sealing device or cover 37 (see also FIG. 1) which establishes a seal between the atmosphere and the flutes 36a-36c on the aforementioned portion of the drum-shaped body 9a. The seal need not be absolutely leakproof. Each of the flutes 36a-36c is deeper than the diameter of a filter rod section or plug 38a, 38b or 38c, and each of these flutes has a median zone or portion B, a first outer zone or portion A and a second outer zone or portion C. The filter plugs 38a, 38b, 38c on the staggering conveyor 8 form three discrete files including a file of filter plugs 38a which are transferred into the zones B of successive flutes 36b, and a file of plugs 38c which are transferred into the zones C of successive flutes 36c. It will be noted that, upon completed transfer onto the shuffling conveyor 9, the filter plugs 38a-38c are staggered with respect to each other as considered in the axial as well as in the circumferential direction of the drum-shaped body 9a. The purpose of the conveyor 9 is to convert such staggered filter plugs into a single file of plugs which, in the illustrated embodiment, are located in the central zones B of the respective flutes 36a-36c prior to transfer into successive flutes of the intermediate conveyor 11 at the transfer station T9 of FIG. 1.

Each flute 36a communicates with a radially inwardly extending suction producing port 39a of the drum-shaped body 9a, and each flute 36c communicates with a radially inwardly extending suction producing port 39c of the body 9a. The ports 39a are located between the zones B, C and the ports 39c are located between the zones A, B of the respective flutes 36a, 36c. The central zone B of each flute 36b communicates with a centrally located radially inwardly extending suction producing port 39b of the body 9a which serves to attract the respective filter plug 38b and to thus hold it against any axial movement. The inner end portion of each of the radial suction producing ports 39a, 39b, 39c communicates with a discrete axially parallel blind bore or channel 41 (only one shown) of the drum-shaped body 9a, and the open ends of the channels 41 communicate with registering bores 42a of a ring 42 which is recessed into the right-hand end face of the body 9a, as viewed in FIG. 2. This ring abuts against the adjacent side of a stationary valve plate 43 which is biased against the ring 42 by suitable spring means (not shown) and has an arcuate groove 43a connected to a suction generating device 43A of any known design. The groove 43 extends from the transfer station T8 between the conveyors 8, 9 to the transfer station T9 between the conveyors 9, 11 so that the suction producing ports 39a-39c located between the transfer stations T8, T9 are connected with the suction generating device 43A and draw air from the respective flutes 36a-36d of the drum-shaped body 9a while the flutes 36a-36c travel along a predetermined portion of their endless path, namely, immediately downstream of the transfer station T8.

The cover 37 includes an arcuate portion or shroud 37a which is adjacent to and surrounds the open outer sides of the flutes 36a-36c, and two end walls or portions 37b which overlie the respective end faces of the drum-shaped body 9a between the transfer stations T8 and T9.

The operation:

The staggering conveyor 8 receives successive rows of coaxial filter plugs from the severing conveyor 6 at the transfer station T8 whereby each such row includes a filter plug 38a, a filter plug 38b and a filter plug 38c. The conveyor 8 staggers the filter plugs in the circumferential direction while leaving the axial positions of the filter plugs at least substantially unchanged (see FIG. 3). The filter plugs 38a, 38b, 38c then form three discrete files wherein each filter plug 38a is staggered with respect to the adjacent filter plugs 38b, 38c and each filter plug 38b is staggered with respect to the adjacent filter plugs 38c. The thus staggered filter plugs 38a, 38b, 38c are respectively transferred into the zones A, B and C of successive flutes 36a, 36b, 36c to form an array of the type shown in FIG. 3. As the thus transferred filter plugs 38a-38c move into the space within the sealing device or cover 37, the respective suction producing ports 39a, 39b, 39c begin to communicate with the groove 43a of the stationary valve plate 43 so that the filter plugs 38b are held against axial movement but the filter plugs 38a and 38c move axially in response to flow of currents air into the respective suction producing ports 39a, 39c. The filter plugs 38a move in a direction to the right, as viewed in FIG. 3, to become aligned with the filter plugs 38b, and the filter plugs 38c move in a direction to the left, as viewed in FIG. 3, also to become aligned with the filter

plugs 38b. This completes the conversion of three discrete files of axially and circumferentially staggered filter plugs 38a-38c into a single file of aligned or registering plugs wherein successive plugs 38b are separated by pairs of plugs each including a plug 38a and a plug 38c.

The filter plugs 38a and 38c shown in FIG. 3 act not unlike flow restrictors by nearly completely filling the zones A and C of the respective flutes 36a, 36c. Thus, and referring to the upper filter plug 38a of FIG. 3, this filter plug reduces the rate of air flow from the left-hand axial end of the respective flute 36a so that the suction at both sides of the corresponding port 39a (zones B and C) exceeds the suction in the zone A with the result that the filter plug 38a is drawn into the central zone B of the respective flute 36a. The same applies for the filter plugs 38c, i.e., the suction in the zones A and B of each flute 36c exceeds the suction in the zone C so that the filter plug 38c moves into the zone B.

The thus shuffled or interdigitated filter plugs 38a-38c are ready for transfer onto the conveyors 11, 12 and into the gaps between pairs of plain cigarettes in the flutes of the assembly conveyor 3.

Since the arcuate portion or shroud 37a of the sealing device 37 prevents any inflow of air in the radial direction of the flutes 36a, 36b, 36c travelling in the arcuate path portion between the transfer stations T8 and T9, the filter plugs 38a and 38c are shifted axially exclusively as a result of development of a pressure differential between their end faces.

FIGS. 4 and 5 illustrate a modified shuffling or interdigitating conveyor 109 wherein all such parts which are identical with or clearly analogous to the corresponding parts of the shuffling conveyor 9 are denoted by similar reference characters plus 100.

Each flute 136a of the drum-shaped conveyor body 109a communicates with a radial suction producing port 139a which is adjacent to a sealing or flow restricting element or stop 140a located in the zone C. Analogously, each flute 136c communicates with a suction producing port 139c adjacent to a sealing or flow restricting element or stop 140c located in the zone A. The flutes 136b do not contain any stops and communicate with centrally located suction producing ports 139b in the zones B. The ports 139a, 139c are located in or are immediately adjacent to the zones B of the corresponding flutes 136a, 136c. The sealing device 137 may but need not be provided with end walls, i.e., it can merely surround the open outer sides of the flutes 136a, 136b, 136c between the transfer station T8 between the staggering and shuffling conveyors and the transfer station T9 between the shuffling and intermediate conveyors. The stops 140a, 140c cooperate with the sealing device 137 to respectively seal the zones C from the zones B of the flutes 136a and the zones A from the zones B of the flutes 136c. The manner in which the filter plugs 138a, 138b, 138c are arrayed in the respective flutes 136a, 136b, 136c immediately subsequent to transfer from the staggering conveyor onto the shuffling conveyor 109 is shown in FIG. 5.

The stops 140a, 140c may but need not completely seal the zones B, C and A, B of the respective flutes 136a, 136c from each other during travel along the inner side of the sealing device 137. Thus, such stops may constitute flow restrictors by merely throttling the flow of air between the adjoining zones to the extent

which is necessary to insure a satisfactory and reliable axial displacement of the respective filter plugs 138a and 138c into register with the filter plugs 138b.

The operation of the shuffling conveyor 109 is as follows:

The staggering conveyor delivers filter plugs 138a, 138b, 138c into the respective flutes 136a, 136b, 136c in a manner as shown in FIG. 5, i.e., the filter plugs 138a, 138b, 138c respectively enter the zones A, B and C of the corresponding flutes. The filled flutes then move below the sealing device 137 and the corresponding suction producing ports 139a, 139b, 139c begin to communicate with the groove 143a of the valve plate 143 so that the ports 139b insure that the filter plugs 138b retain their axial positions in the central zones B of the respective flutes 136b. At the same time, the left-hand end of each flute 136a remains open to the atmosphere while the stops 140a seal or substantially seal the zones B from the zones C of the respective flutes 136a. Consequently, the suction in ports 139a causes the filter plugs 138a to move in a direction to the right, as viewed in FIG. 5, and to become aligned with the filter plugs 138b. Analogously, the right-hand ends of the flutes 136c remain open to the atmosphere while the stops 140c seal or substantially seal the zones A from the zones B of the respective flutes 136c. Consequently, the suction in ports 139c causes the filter plugs 138c to move in a direction to the left, as viewed in FIG. 5, and to become aligned with the filter plugs 138b. Thus, the filter plugs 138a and 138c are shifted axially by air currents which are drawn into the open ends of the respective flutes 136a, c.

The filter plugs 138a-138c then form a single file of filter plugs which are located in the central zones B of the respective flutes 136a-136c, and such filter plugs are ready for transfer onto the intermediate conveyor 11 to be assembled with pairs of plain cigarettes in the same way as described in connection with FIG. 1.

An advantage of the shuffling conveyor 109 is that it requires a simpler sealing device 137. On the other hand, the shuffling conveyor 9 requires a simpler drum-shaped body 9a which need not be provided with stops in the flutes for reception of filter plugs which are to be shifted axially into alignment with the centrally located filter plugs.

The shuffling conveyor 109 can be used with particular advantage for interdigitating filter rod sections or plugs having widely different friction coefficients, e.g., for shuffling of relatively dry and/or relatively moist filter plugs. Thus, when the ports 139a and 139c draw air into the respective flutes 136a, 136c during travel along the concave internal surface of the sealing device 137, suction is generated in the zones B of the flutes 136a and 136c while atmospheric air flows into the left-hand ends of the flutes 136a and into the right-hand ends of the flutes 136c. This promotes the axial displacement of filter plugs 138a and 138c into register with the filter plugs 138b. In other words, such mode of operation insures immediate axial displacement of filter plugs 138a and 138c even if their external surfaces tend to adhere to the surfaces surrounding the respective flutes 136a and 136c. The acceleration to which the filter plugs 138a and 138c are subjected depends on the extent of friction between their external surfaces and the drum-shaped body 109a. The stops 140a, 140c constitute a safety device which insures that the filter plugs 138a and 138c are arrested in optimum positions of register

with the filter plugs 138b even if the extent of friction between the drum-shaped body 109a and some or all of the filter plugs 138a and/or 138c varies within a wide range.

It is clear that the shuffling conveyor 9 or 109 can be modified in a number of ways without departing from the spirit of the invention. For example, the shuffling conveyor may be arranged to receive only two rows of filter plugs so that the filter plugs of one row remain stationary while the filter plugs of the other row are shifted axially by pneumatic means to register with the non-shifted plugs. Also, the shuffling conveyor may convert four or more rows of plugs into a single file. Still further, each and every filter plug on the shuffling conveyor can be moved axially to assume a predetermined axial position in which all of the filter plugs are located one behind the other.

The improved shuffling conveyors 9 and 109 exhibit the advantage that the filter plugs need not be shifted axially by mechanical means. Thus, the end faces or peripheral surfaces of filter plugs in the flutes 36a, 36c or 136a, 136c need not be engaged by cams, rollers, belts or analogous mechanical displacing devices which could result in permanent deformation or total destruction of moist filter plugs which are in strong frictional engagement with the surfaces surrounding the respective flutes. The pneumatic displacing means of the present invention insures that the filter plugs 38a, 38c or 138a, 138c are moved axially without any damage to their end faces and/or wrappers, as well as that the filter plugs which require axial shifting can be moved to accurately determined positions of registry with the filter plugs 38b or 138b. The stops 140a, 140c of the shuffling conveyor 109 constitute an optional feature of this conveyor in that they insure an extremely accurate alignment of filter plugs 138a and 138c with the filter plugs 138b and because they also enhance the action of air which is drawn into the suction ports 139a, 139c by functioning as flow restrictors for air which tends to flow into the ports 139a, 139c from the nearer axial ends of the respective flutes 136a, 136c. In the embodiment of FIGS. 4 and 5, the stops 140a, 140c are L-shaped elements which are secured to the drum-shaped body 109a by screws or analogous fasteners.

FIGS. 6 and 7 illustrate a portion of a staggering conveyor 108 which can be used in the filter cigarette making machine of FIG. 1 to deliver several discrete files of filter plugs to the shuffling conveyor 9 or 109. The conveyor 108 comprises a drum-shaped body 108a which is provided with three pairs of circumferentially extending rings 151a-152a, 151b-152b and 151c-152c. The rings 151a and 152a are provided with equidistant transversely aligned recesses 153a so that each pair of aligned recesses 153a defines a flute for one of the filter plugs 138a furnished by the severing conveyor 6 of FIG. 1. The maximum width of the recesses 153a, as seen in the circumferential direction of the conveyor 108 (arrow 156), equals or only slightly exceeds the diameter of a filter plug. The rings 151b, 152b are also provided with equidistant transversely aligned recesses 153b whose width, as considered in the circumferential direction of the conveyor 108, is at least two times the diameter of a filter plug. Each pair of recesses 153b defines a flute for reception of a filter plug 138b from the severing conveyor 6 whereby the width of such flute suffices to allow for rolling of the respective filter plug 138b through a distance exceeding

its diameter. The rings 151c and 152c are provided with equidistant transversely aligned recesses 153c whose width, as considered in the circumferential direction of the conveyor 108, exceeds the width of the recesses 153b at least by the diameter of a filter plug. The pairs of aligned recesses 153c constitute flutes for reception of filter plugs 138c from the severing conveyor 6. The conveyor 108 further comprises a stationary rolling member 154 having a concave internal surface 154a whose distance from the deepest portions of recesses 153a, 153b, 153c is slightly less than the diameter of a filter plug 138. Thus, when the flutes of the rings 151, 152 receive filter plugs 138 from the severing conveyor 6, and when such filter plugs travel with the drum-shaped body 108a along the concave internal surface 154a, the filter plugs 138a are held against rolling but the filter plugs 138b and 138c roll counter to the direction of rotation of the body 108a (arrow 156) so that they are automatically staggered with respect to each other and with respect to the filter plugs 138a. The final positions of filter plugs 138a, 138b and 138c prior to transfer onto the shuffling conveyor 9 or 109 are shown in the central and right-hand portions of FIG. 7. The initial positions 138b', 138c' of the filter plugs 138b, 138c immediately after transfer into the respective flutes of the drum-shaped body 108a are indicated in the left-hand portion of FIG. 7 by phantom lines.

The distances through which the filter plugs 138a, 138b, 138c roll rearwardly (counter to the direction indicated by the arrow 156) during travel along the concave internal surface 154a of the rolling member 154 include a shortest first distance for the filter plugs 138a (in the embodiment of FIGS. 6 and 7, the first distance is zero because the configuration of recesses 153a is such that the filter plugs 138a cannot roll at all), a longer second distance for the filter plugs 138b (the length of this second distance is determined by the width of the recesses 153b) which suffices to insure that the filter plugs 138b are moved entirely out of axial alignment with the filter plugs 138a, and a longest third distance (determined by the width of the recesses 153c for the filter plugs 138c) which suffices to insure that the filter plugs 138c can move out of axial alignment with the filter plugs 138a as well as with filter plugs 138b. In the illustrated embodiment, the width of recesses 153b is one-half the width of recesses 153c.

The stationary rolling member 154 can consist of one piece or it may include two or more arcuate strips which extend in the circumferential direction of the drum-shaped body 108a and each of which has a concave internal surface. For example, the rolling member 154 may comprise discrete arcuate strips for the filter plugs 138a, 138b and 138c. The strip for the filter plugs 138a can be omitted if the drum-shaped body 108a is provided with suction ports for holding the filter plugs 138a in the respective recesses 153a while the filter plugs 138b and 138c are caused to roll counter to the direction indicated by the arrow 156. The surfaces bounding the recesses 153b and 153c are preferably serrated or ribbed as indicated in FIG. 7 by parallel lines. This insures that the filter plugs 138b and 138c cannot slip during travel along the internal surface 154a of the rolling member 154.

The operation of the staggering conveyor 108 is as follows:

The severing conveyor 6 supplies a series of severed filter rod sections of six times unit length, i.e., rows of

three axially aligned filter plugs of double unit length whereby each such row includes a filter plug 138a, a filter plug 138b and a filter plug 138c. Immediately after transfer, each row assumes a position corresponding to that of the row including the leftmost filter plug 138a, the phantom-line plug 138b' and the phantom-line plug 138c of FIG. 7. The drum-shaped body 108a of the conveyor 108 is driven at a constant speed and advances the thus transferred row into the space adjacent to the concave internal surface 154a of the rolling member 154. The filter plugs 138a retain their positions (as considered in the circumferential direction of the body 108a) but the filter plugs 138b and 138c roll rearwardly (counter to the direction indicated by arrow 156) to the extent determined by the width of the respective pairs of recesses 153b, 153c. The staggering of filter plugs 138b and 138c with respect to each other and with respect to the filter plugs 138a is completed not later than at the transfer station T8 between the staggering conveyor 108 and the shuffling conveyor 9 or 109. The uneven surfaces bounding the recesses 153b, 153c insure that the filter plugs 138b, 138c invariably complete their rolling movement to the extent which is determined by the width of the recesses 153b, 153c to thus guarantee that the filter plugs 138a, 138b, 138c can be respectively transferred into the oncoming flutes 136a, 136b, 136c of the shuffling conveyor 109 or into the similarly numbered flutes of the conveyor 9.

An advantage of the staggering conveyor 108 is that it comprises a single rotary drum-shaped body 108a in contrast to many presently known staggering conveyors which utilize several discrete disks each of which must be driven at a different speed or which must be mounted in such a way that the filter plugs on each of the disks cover different distance during travel from the severing conveyor to the shuffling conveyor.

A filter plug manipulating apparatus which includes the staggering conveyor 108 and the shuffling conveyor 9 or 109 exhibits the advantage that the initial and maintenance costs of the two conveyors are less than in presently known apparatus, that the conveyor 108 invariably insures an optimum sideways displacement of filter plugs 138a and 138c relative to each other and relative to the filter plugs 138b, and that the conveyor 9 or 109 converts the thus staggered filter plugs into a single file without any damage to the filter plugs and in such a way that all filter plugs form a single file which is best suited for the formation of groups of filter plugs and wrapped tobacco rod sections.

The exact construction of the drive means for rotating the various conveyors of the machine which embodies the improved staggering and shuffling conveyors forms no part of the present invention. Such drive means may include a main prime mover (e.g., an electric motor) and trains of gears which synchronize the rotary movements of various conveyors to thus insure proper transfer of plain cigarettes, long and short filter rod sections, groups of plain cigarettes and filter rod sections, filter cigarettes of double unit length, filter cigarettes of unit length, and uniting bands.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of our contribution to the art and,

therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. Apparatus for manipulating sections of filter rods, particularly filter rod sections of multiple unit length for use in filter-tipped smokers' products, comprising a first conveyor arranged to transport at least two discrete files of filter rod sections sideways so that the sections of one file are staggered axially and in the direction of sidewise movement thereof relative to the sections of the other file; a shuffling conveyor having a plurality of parallel elongated flutes travelling sideways along an endless path including a transfer station where the sections of said files are transferred one after the other into discrete flutes; means for at least partially sealing said flutes from the atmosphere during travel along a predetermined portion of said path located downstream of said transfer station; and suction producing means operative in at least some of said flutes to move the sections of at least one of said files axially during travel along said predetermined portion of said path so as to convert said discrete files into a single file of sections which travel sideways.

2. Apparatus as defined in claim 1, wherein each of said filter rod sections has a predetermined diameter and said shuffling conveyor comprises a rotary drum-shaped body, said flutes being provided at the periphery and being parallel to the axis of said body, each of said flutes having a depth — as considered in the radial direction of said body — which at least equals said predetermined diameter.

3. Apparatus as defined in claim 2, wherein said body has two end faces and said flutes have open ends in the regions of said end faces, said means for sealing comprising a cover having a first portion surrounding the flutes located in said predetermined portion of said path and two additional portions adjacent to said end faces and to the ends of flutes located in said predetermined portion of said path.

4. Apparatus as defined in claim 2, wherein said suction producing means includes ports provided in said body and communicating with the flutes which receive the sections of said one file and means for drawing currents of air into said ports from the respective flutes whereby such currents effect an axial displacement of sections of said one file into register with the sections of said other file.

5. Apparatus as defined in claim 4, wherein said first conveyor comprises means for converting rows of co-axial filter rod sections into said discrete files of sections.

6. Apparatus as defined in claim 1, wherein each of said filter rod sections has a predetermined diameter and said shuffling conveyor comprises a rotary drum-shaped body, said flutes being located at the periphery and being parallel to the axis of said body and each having a depth — as considered in the radial direction of said body — which at least equals said predetermined

diameter, said flutes having open ends and said means for sealing including air flow obstructing elements provided in those flutes which receive the sections of said one file.

7. Apparatus as defined in claim 6, wherein each of said elements is located nearer to one than to the other end of the respective flute, said suction producing means including suction ports provided in said body and communicating with the flutes for said one file of sections adjacent to the respective elements.

8. Apparatus as defined in claim 7, wherein said suction ports communicate with the respective flutes between said elements and the filter rod sections of said one file.

9. Apparatus as defined in claim 8, wherein said elements constitute stops which terminate the axial movement of filter rod sections in the respective flutes.

10. Apparatus as defined in claim 8, wherein said means for sealing further comprises a cover surrounding said flutes in said portion of said path and each of said elements cooperates with said cover to at least substantially seal one end of the respective flute from the corresponding suction port during travel of the respective flute in said predetermined portion of said path.

11. Apparatus as defined in claim 1, wherein said suction producing means comprises suction ports provided in said shuffling conveyor and communicating with flutes for the filter rod sections of said one file, and means for connecting said ports with a suction generating device during travel of the respective flutes in said predetermined portion of said path.

12. Apparatus as defined in claim 1, wherein said shuffling conveyor comprises means for holding the filter rod sections of said other file against axial movement during travel along said predetermined portion of said path.

13. Apparatus as defined in claim 1, wherein the flutes for the sections of said one file alternate with flutes for the filter rod sections of said other file.

14. Apparatus as defined in claim 1, further comprising a third conveyor arranged to supply rows of at least two axially aligned filter rod sections each to said first conveyor, said first conveyor having discrete recesses for reception of discrete filter rod sections of said rows and means for moving at least one filter rod section of each row sideways relative to the other filter rod section so as to convert said rows into said discrete files.

15. Apparatus as defined in claim 14, wherein the recesses for said one filter rod section of each of said rows are longer — as considered in the direction of sidewise movement of said sections — than the recesses for the other sections of said rows, said means for moving including means for rolling the filter rod sections in said longer recesses during sidewise movement thereof.

16. Apparatus as defined in claim 14, wherein said means for moving comprises means for rolling said one section of each of said rows counter to the direction of movement of said first conveyor.

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