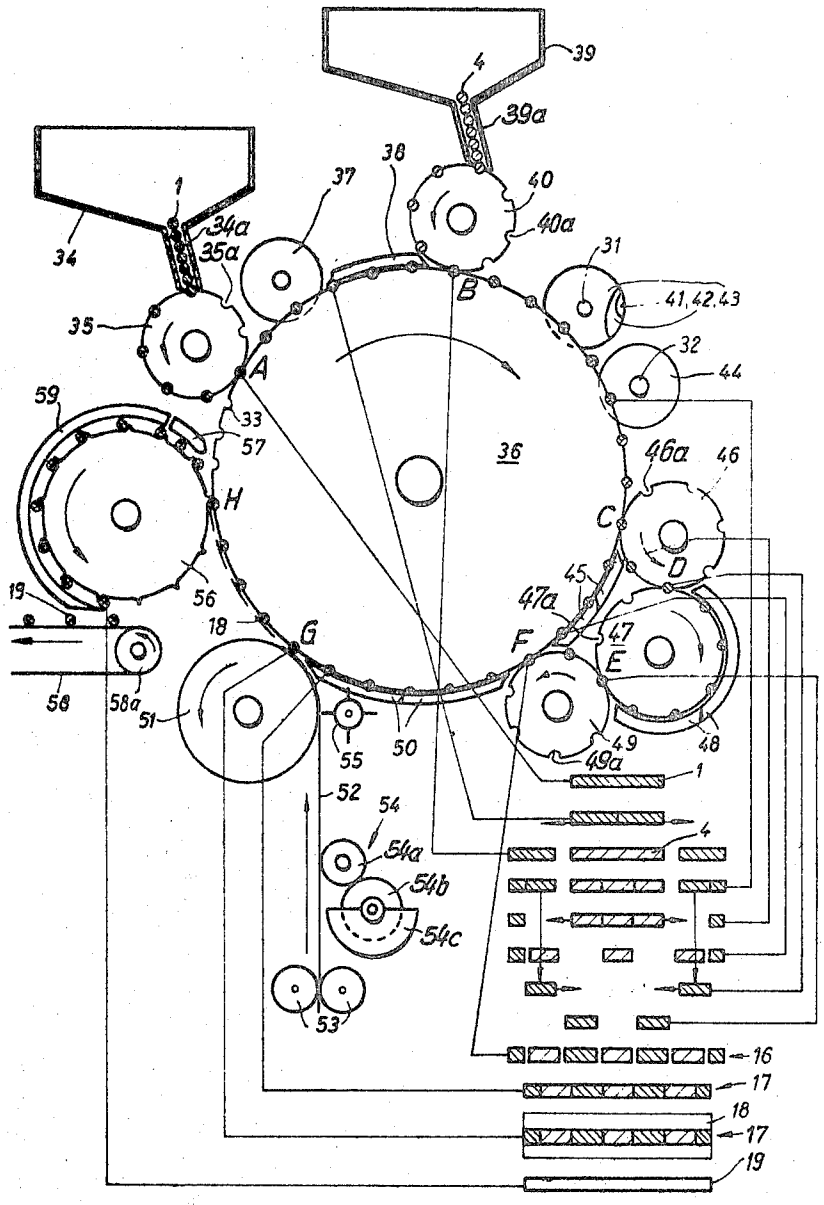
Jan. 6, 1970 J. FLASDIECK 3,487,754

METHOD AND APPARATUS FOR THE PRODUCTION OF MOUTHPIECES

Filed Nov. 4, 1964 4 Sheets-Sheet 1

Fig. 1



Inventor:
Jörn Flasdieck
by Michael J. Striker
Atty.

METHOD AND APPARATUS FOR THE PRODUCTION OF MOUTHPIECES

Filed Nov. 4, 1964

Fig.2

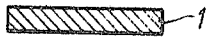


Fig.3

Fig.4

Fig.5

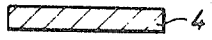


Fig.6

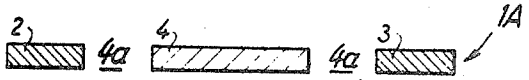


Fig.7

Fig.8

Fig.9

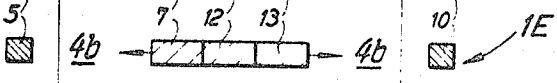


Fig.10

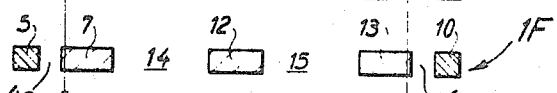


Fig.11

Fig.12

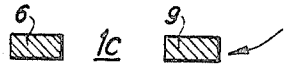


Fig.13

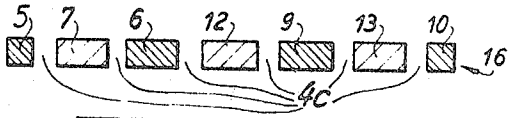


Fig.14

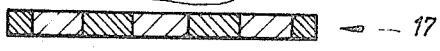


Fig.15

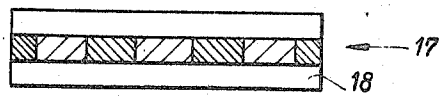
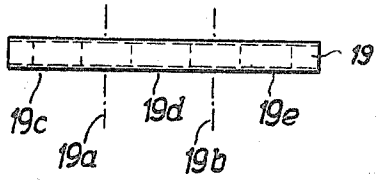


Fig.16



Inventor:
Jörn Flasdieck
By Michael J. Striker
Atty.

METHOD AND APPARATUS FOR THE PRODUCTION OF MOUTHPIECES

Filed Nov. 4, 1964 4 Sheets-Sheet 3

Fig. 18

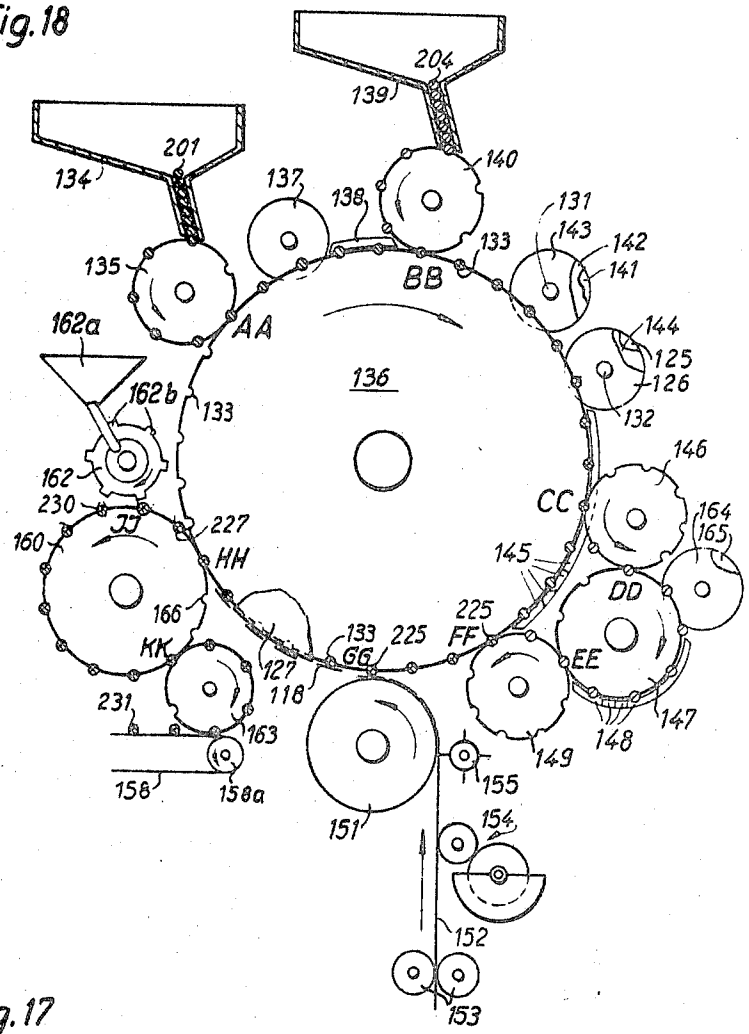
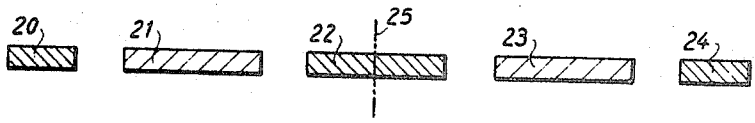


Fig. 17

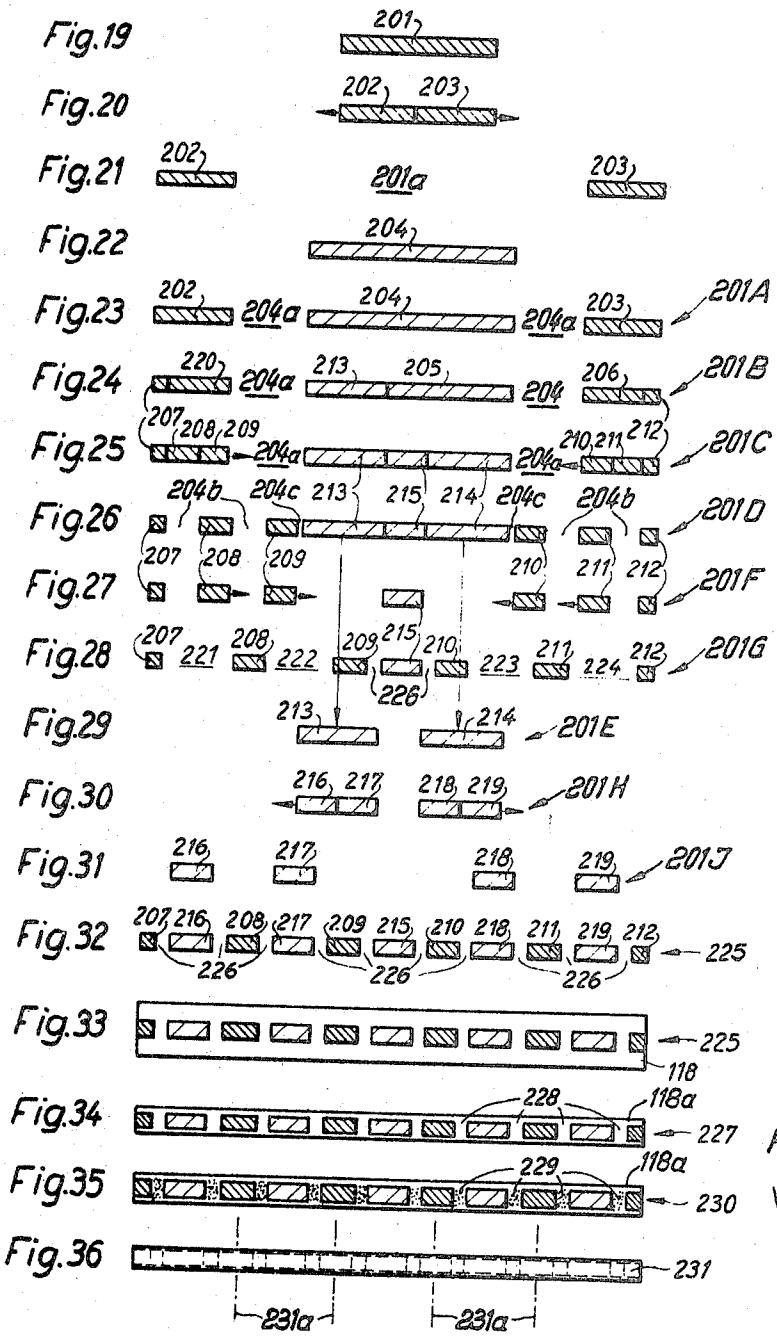


Inventor:
Jörn Flasdieck
by Richard J. Strike
Atty.

Jan. 6, 1970 J. FLASDIECK 3,487,754

METHOD AND APPARATUS FOR THE PRODUCTION OF MOUTHPIECES

Filed Nov. 4. 1964 4 Sheets-Sheet 4



Inventor:
Jörn Flasdieck
By Michael J. Striker
Atty.

United States Patent Office 3,487,754 Patented Jan. 6, 1970

3,487,754

METHOD AND APPARATUS FOR THE PRODUCTION OF MOUTHPIECES

Jörn Flasdieck, Hamburg-Bergedorf, Germany, assignor to Hauni-Werke Körber & Co. K.G., Hamburg-Bergedorf, Germany

Filed Nov. 4, 1964, Ser. No. 408,805
Claims priority, application Great Britain, Nov. 11, 1963, 44,338/63
Int. Cl. B24f 5/50
U.S. Cl. 93—1 9 Claims

ABSTRACT OF THE DISCLOSURE

Composite mouthpieces for filter cigarettes or cigars are produced in an apparatus wherein the flutes of a rotary drum accommodate assemblies including rod-like median elements of first filter material and coaxial rod-like outer elements of second filter material. All elements of each assembly are severed while accommodated in a common flute and are thereupon shuffled to form second assemblies wherein portions of elements of first filter material alternate with portions of elements of second filter material. Each second assembly is then provided with a wrapper which is convoluted around its portions.

The present invention relates to the production of mouthpieces in general, and more particularly to a method and apparatus for the production of composite mouthpieces of the type consisting of at least two coaxial rod-shaped members. Still more particularly, the invention relates to improvements in a method and apparatus for the production of composite mouthpieces while the rod-shaped components of such mouthpieces move sideways with or relative to each other. The mouthpieces which are produced in accordance with the present invention may be utilized in mass production of filter cigarettes, filter-tipped cigars, cigarillos, cheroots and similar rod shaped smokers' products.

In accordance with the presently prevailing practice, composite mouthpieces for filter cigarettes or the like are obtained by subdividing each of two or more filter rods of multiple unit length and consisting of different filter materials into sections of requisite length, by thereupon shifting the sections of each filter rod axially and away from each other, and by ultimately shuffling the thus shifted sections to form assemblies wherein sections consisting of different materials alternate with each other. Such assemblies are then wrapped in sheets of adhesive-coated material to form mouthpieces of multiple unit length. As a rule, the sections which consist of different filter materials are conveyed in separate paths and are shuffled with each other only upon completion of the shifting step. Therefore, the apparatus for carrying out such conventional methods invariably require much space and consist of a large number of relatively movable parts which contributes to the initial and maintenance cost of the machine.

Accordingly, it is an important object of the present invention to provide a novel apparatus for the production of composite mouthpieces and to construct the apparatus in such a way that two or more groups of rod-shaped members consisting of different filter materials may be shifted, aligned and otherwise manipulated while advancing on a common conveyor so that the space requirements of the apparatus and the number of its component parts are reduced to a minimum with resultant savings in material and maintenance cost.

Another object of the invention is to provide an apparatus of the just outlined characteristics which may be readily converted for the production of longer or shorter mouthpieces of multiple unit length, which may be converted for the production of composite mouthpieces with or without turbulence chambers, and which may be utilized for the production of composite mouthpieces of multiple unit length wherein each unit length contains a predetermined quantity of activated granular charcoal or otherwise comminuted filter material.

A further object of the instant invention is to provide a novel assembly conveyor which may be utilized in an apparatus of the above outlined characteristics and to construct the conveyor in such a way that its holders may accommodate and allow for shuffling or other treatment of two or more different types of filter rod stock.

An additional object of the invention is to provide a novel method of producing composite mouthpieces of multiple unit length according to which only a small number of rod-shaped members must be removed from a common path in order to obtain assemblies of rod-shaped members wherein members of unit and/or multiple unit length consisting of different filter materials alternate with each other.

Still another object of the invention is to provide a method of the just outlined characteristics which may be utilized with equal advantage for the production of duplex or triplex mouthpieces of multiple unit length.

Briefly stated, one feature of my invention resides in the provision of a method of producing composite mouthpieces of multiple unit length. The method comprises the steps of shuffling a pair of coaxial rod-shaped elements consisting of a first filter material with a rod-shaped element consisting of a second filter material to form a first assembly of coaxial rod-shaped elements wherein elements consisting of different materials alternate with each other, Subdividing each element into a plurality of rod-shaped members to form a second assembly wherein the number of members consisting of first filter material exceeds by one the number of members consisting of second filter material, removing from the second assembly some members which consist of one of said materials and whose number is less by one than the number of members consisting of the second material whereby the thus removed members form a subgroup of coaxial members and the remaining members of the second assembly form a group of coaxial members, shifting some members of the group axially to form between the members consisting of the other material gaps of a length which at least equals the length of a member in the subgroup, shifting the members of the subgroup axially so that each such member registers with one of the gaps, shuffling the members of the subgroup with the members of the group to form a third asembly of coaxial members wherein members consisting of different materials alternate with each other, and convoluting an adhesive-coated wrapper sheet around the third assembly to form a composite mouthpiece of multiple unit length.

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 drawings, in which:

FIG. 1 is a somewhat diagrammatic side elevational view of an apparatus which is constructed in accordance with a first embodiment of my invention;

FIGS. 2 to 16 illustrate the steps of a method for the production of duplex mouthpieces of multiple unit length which may be carried out by resorting to the apparatus of FIG. 1;

FIG. 17 illustrates one of the initial steps in a somewhat modified method which may be carried out by resorting to an apparatus similar to the one shown in FIG. 1;

FIG. 18 is a diagrammatic side elevational view of a second apparatus which may be utilized for the production of triplex mouthpieces of multiple unit length of the type wherein each mouthpiece of unit length comprises a predetermined quantity of granular filter material; and

FIGS. 19 to 36 illustrate the steps of a method which may be carried out by resorting to the apparatus of FIG. 18.

Referring to the drawings, FIGS. 2 to 16 illustrate the steps of a method which may be carried out in accordance with a first embodiment of my invention. This method comprises the steps of advancing a first filter rod **1** (shown in FIG. 2 and hereinafter called white filter rod) of sextuple unit length and consisting of a first filter material in a direction substantially at right angles to its axis (i.e., sideways) and severing the filter rod midway between its ends (see FIG. 3) to obtain two coaxial white sections **2, 3** of triple unit length. The sections **2, 3** are then shifted axially and away from each other in a manner as illustrated in FIG. 4 to define between themselves an elongated gap **1***a*.

A second filter rod **4** (shown in FIG. 5 and hereinafter called black filter rod) of sextuple unit length and consisting of a second filter material is advanced sideways and is shuffled with the sections **2, 3** to form therewith a first assembly **1A** consisting of three coaxial rod-shaped elements **2, 4, 3** which are separated from each other by two elongated gaps **4***a* of identical length, see FIG. 6. The assembly **1A** is moved sideways and its rod-shaped elements **2, 4, 3** are subdivided in such a way that the white section **2** yields a white end filter **5** of unit length and a white section **6** of double unit length, that the white section **3** yields a white end filter **10** of unit length and a white section **9** of double unit length, and that the black filter rod **4** yields a black section **7** of double unit length and a black section **8** of quadruple unit length. The thus obtained second assembly **1B** of six coaxial rod-shaped members is shown in FIG. 7. In a next-following step which is shown in FIG. 8, the section **8** is subdivided into two coaxial black sections **12, 13** of double unit length to form with the remaining rod-shaped members **5, 6, 7, 9, 10** a third assembly **1C**. This assembly **1C** is then broken up by shifting the white sections **6, 9** transversely with reference to the remainder of the assembly **1C** (see FIG. 11) whereby the sections **6, 9** form a subgroup **1D** whose rod-shaped members are separated from each other by a gap **1***b* and the remainder of the assembly **1C** forms a group **1E** which is shown in FIG. 9 and wherein the end filters **5, 10** are separated from the black sections **7, 12, 13** by two elongated gaps **4***b*. In the next step, shown in FIG. 10, the black sections **7, 13** are moved axially and away from each other to form two elongated gaps **14, 15** and two shorter clearances **4***c* whereby the clearances **4***c* extend between the end filters **5, 10** and the sections **7, 13** respectively. The group **1E** is now transformed into a group **1F**. In a step which is shown in FIG. 12, the sections **6, 9** of the subgroup **1D** are shifted axially and toward each other so that they respectively register with the gaps **14, 15** and form a modified subgroup **1G**. The length of the sections **6, 9** and of the gaps **14, 15** is selected in such a way that, when the subgroup **1G** is thereupon shuffled with the group **1F** in a manner as illustrated in FIG. 13, the rod-shaped members of the resulting assembly **16** are separated from each other by clearances **4***c* of identical length. In other words, the length of the gap **1***c* between the sections **6, 9** of the subgroup **1G** equals the length of the black section **12** plus the combined length of two clearances **4***c*. Also, the length of the gap **14** or **15** equals the length of a white section **6** or **9** plus the combined length of two clearances **4***c*. It will be noted that the assembly **16** comprises seven coaxial rod-shaped members **5, 7, 6, 12, 9, 13, 10** wherein members **5, 6, 9, 10** of first filter material alternate with members **7, 12, 13** of second filter material and wherein the filters **5, 10** are located at the ends.

In a next-following step which is illustrated in FIG. 14, the assembly **16** is shortened or condensed to form a shorter or condensed assembly **17** wherein the adjoining rod-shaped members are in actual abutment with each other. This is achieved by shifting the end filters **5, 10** axially and toward each other until all of the clearances **4***c* are eliminated. The assembly **17** is then contacted by a rectangular wrapper sheet **18** which is shown in FIG. 15 and one side of which is coated with a suitable adhesive substance. The sheet **18** is thereupon convoluted around the assembly **17** to form therewith a composite (duplex) mouthpiece **19** of sextuple unit length (see FIG. 16) wherein white rod-shaped members alternate with black rod-shaped members. By subdividing the mouthpiece **19** along the lines **19***a*, **19***b*, one obtains three composite mouthpieces **19***c*–**19***e* of double unit length. Such mouthpieces may be arranged in a single file of parallel mouthpieces whose elements are ready to be fed between consecutive pairs of axially spaced tobacco rods to form therewith filter cigarettes of double unit length in a manner well known in the art and not forming part of my present invention. It will be noted that the number of white rod-shaped members **5, 6, 9, 10** in the assembly **1C** exceeds by one the number of black rod-shaped members **7, 12, 13**, and that the number of white rod-shaped members **6, 9** in the subgroup **1D** is less by one than the number of black rod-shaped members in the assembly **1C**.

If it is desired to produce mouthpieces wherein the white and black rod-shaped members are separated from each other by clearances or pockets which are not filled with a filter material, the step shown in FIG. 14 is omitted, i.e., a wrapper sheet **18** of requisite length is applied around the assembly **16** of FIG. 13 so that the clearances **4***c* remain and will form air-filled turbulence chambers or pockets which contribute to superior filtering action of a composite mouthpiece. In other words, a wrapper sheet may be applied around the assembly **16** or **17**, depending on the desired length and filtering action of the ultimate product.

If desired, one may start with a white filter rod of eight times unit length so that the assembly **1B** shown in FIG. 7 will comprise four white sections of double unit length, i.e., the end filters **5, 10** will be replaced by sections of double unit length. However, the method of FIGS. 2 to 16 is preferred because there is no waste in filter material.

It will be seen that the method of my invention comprises the basic steps of forming an assembly **1C** of coaxial rod-shaped members including two axially spaced mirror symmetrical groups of rod-shaped members **5, 6** and **10, 9** consisting of a first filter material and a third group **7, 12, 13** located intermediate the two groups **5, 6** and **10, 9** and consisting of a second filter material whereby the total number (three) of members in the third group is less by one than the combined number (four) of members in the two groups, interchanging the positions of some such members to form a different assembly **16** or **17** wherein members consisting of different materials alternate with each other (in FIGS. 10–13 the members **7, 13** have respectively changed positions with the members **6, 9**), and convoluting an adhesive-coated wrapper sheet **18** around the assembly **16** or **17**.

The apparatus which may be used for practicing the method of FIGS. 2 to 16 is shown in FIG. 1. This apparatus comprises a source of parallel white filter rods **1** here shown as a magazine **34** which is provided with an inclined or vertical chute **34***a* arranged to feed the rods **1** seriatim and by gravity to an inserting conveyor in the form of a rotary drum **35** having a plurality of equidistant axially parallel peripheral holders **35***a*. Each such holder **35***a* is provided with one or more rod-receiving grooves of substantially semicircular cross section.

It is clear that the inserting drum **35** embodies or cooperates with suitable retaining means which insure that the filter rods **1** remain in the respective holders **35***a* while advancing to a first transfer station A between the drum **35** and an assembly conveyor here shown in the form of a large rotary drum **36**. Such retaining means may comprise a pneumatic system including suction ducts which retain the rods **1** in the respective holders **35***a* during travel from the discharge end of the chute **34***a* to the transfer station A or, alternatively, the retaining means may comprise one or more arcuate shields which surround a portion of the inserting drum **35**. In FIG. 1, the retaining means were omitted for the sake of clarity.

The assembly drum **36** rotates in a clockwise direction, as viewed in FIG. 1, and advances the white filter rods **1** past a rotary disk-shaped cutter **37** which severs the rods midway between their ends so that each such rod yields two coaxial white sections or elements **2, 3** shown in FIG. 3. The assembly drum **36** also cooperates with a wedge-like shifting or spreading cam **38** which is fixed to the frame of the apparatus shown in FIG. 1 and is located past the cutter **37**, as seen in the direction in which the drum **36** rotates. The cam **38** shifts the sections **2, 3** axially and away from each other to form the gap **1***a* shown in FIG. 4.

Black filter rods or elements **4** are stored in a second magazine **39** having a vertical or inclined chute **39***a* to discharge such rods seriatim and by gravity feed into consecutive holders **40***a* of a second inserting conveyor or drum **40** which defines with the assembly drum **36** a second transfer station B located past the cam **38** so that each black filter rod **4** enters the gap **1***a* between a pair of axially spaced white sections **2, 3** (see also FIG. 6). The thus obtained assemblies **1A** advance past a row of three coaxial rotary disk-shaped cutters **41, 42, 43** which are driven by a shaft **31** whereby the elements **2, 4, 3** of each consectuive assembly **1A** are subdivided in a manner as shown in FIG. 7 to form assemblies **1B** wherein the rod-shaped members **7, 8** remain separated from the rod-shaped members **6, 9** by two gaps **4***a* of identical length. The assemblies **1B** then advance past a single rotary disk-shaped cutter **44** which is driven by a shaft **32** and serves to subdivide the members **8** so that each such member yields two black members **12, 13** of double unit length, see FIG. 8, whereby the assemblies **1B** are transformed into assemblies **1C**.

While advancing with the drum **36**, the assemblies **1C** are thereupon broken up at a third transfer station C where the drum **36** cooperates with a rotary removing conveyor or drum **46** whose holders **46***a* receive the subgroups **1D** consisting of white sections **6, 9** (see FIG. 11) while the groups **1E** (FIG. 9) continue to advance with the drum **36** and are moved past a series of shifting cams **45** which move the black sections **7, 13** axially and away from the black section **12** to form two gaps **14, 15** and two clearances **4***c*, i.e., to transform the groups **1E** into groups **1F** shown in FIG. 10.

The holders **46** deliver the subgroups **1D** into consecutive holders **47***a* of a rotary shifting conveyor or drum **47** (see the transfer station D in FIG. 1), and the drum **47** cooperates with a pair of suitably inclined shifting cams **48** which move the sections **6, 9** of each subgroup **1D** axially and toward each other (see FIG. 12) to form the subgroups **1G** which are thereupon advanced to a transfer station E where the holders **47***a* deliver the subgroups **1G** into consecutive holders **49***a* of a rotary transfer conveyor or drum **49**. This drum **49** delivers the subgroups **1G** to a further transfer station F (see also FIG. 13) where the groups **1F** are shuffled or interdigitated with the subgroups **1G** to form assemblies **16** which are thereupon advanced past a pair of inclined shifting or condensing cams **50** (see also FIG. 14) to form condensed assemblies **17** which are ready for wrapping. The manner in which the drums **46, 47** and **49** manipulate rod-shaped articles is disclosed in Patent No. 3,199,418, granted Aug. 10, 1965 to Schubert and assigned to the same assignee.

The apparatus of FIG. 1 further comprises a source of wrapper tape **52** (e.g., a suitable reel which is not shown in the drawings), and such tape is advanced by a pair of cooperating advancing rolls **53** at least one of which is driven to feed the tape toward the periphery of a rotary suction drum **51** of known construction. On its way from the advancing rolls **53** to the suction drum **51**, one side of the tape **52** is coated with a layer of suitable adhesive in response to contact with the periphery of a rotary applicator roller **54***a* forming part of a conventional paster **54**. The roller **54***a* receives paste from a second roller **54***b* which dips into a paste tank **54***c*. The suction drum **51** cooperates with a bladed rotary knife **55** which severs the leading end portion of the tape **52** into wrapper sheets **18** of requisite length. The peripheral speed of the drum **51** exceeds the speed of the tape **52** so that the sheets **18** are automatically spaced from each other and are applied to consecutive assemblies **17** at a transfer station G so that each sheet **18** is substantially tangential to the corresponding assembly **17**, see also FIG. 15. Such assemblies **17** (each with a sheet **18** adhering thereto) are then advanced to a further transfer station H where they leave the assembly drum **36** to advance with a wrapping drum **56** which moves them past a fixed wrapping member **57** which cooperates with the drum **56** to convolute the sheets **18** around the respective assemblies **17** and to form the mouthpieces **19**. Such mouthpieces are retained on the wrapping drum **56** by one or more arcuate retaining shields **59** and are ultimately allowed to descend onto the upper stringer of an endless take-off conveyor belt **58** driven by a deflecting roller **58***a* and serving to advance the mouthpieces **19** to storage or to a further processing station, for example, to a station where the mouthpieces **19** are severed along lines **19***a*, **19***b* shown in FIG. 16 to yield duplex mouthpieces **19***c*–**19***e* of double unit length.

By the simple expedient of omitting the condensing cams **50** and by replacing the tape **52** with a tape whose width equals the length of an assembly **16**, the apparatus of FIG. 1 may be converted for the production of composite mouthpieces wherein the adjoining rod-shaped members of different filter materials are separated from each other by pockets or turbulence chambers of a length corresponding to the length of clearances **4***c* shown in FIG. 13. The clearances **4***c* are eliminated when the wrapper sheets **18** consist of very thin material having little tensile strength. Such weak material will be capable of forming a satisfactory tubular shell around a condensed assembly **17** but is less likely to form a sufficiently strong tubular shell around the assembly **16** of FIG. 13.

A very important advantage of the apparatus shown in FIG. 1 is that its parts occupy very little room and that the holders of all conveyors are separated from each other by distances of identical length. Thus, the distance between the holders **33** is the same as the distance between the holders of all other drums shown in FIG. 1.

The manner in which rod-shaped members may be transferred at the stations A–F and H is well known in the art. Such transfer may be effected by suction, by compressed air or by mechanical stripping devices. All of the drums shown in FIG. 1 (excepting, of course, the drum **51**) are rotated at the same peripheral speed by a mechanism of the type normally used in filter machines or filter cigarette machines. The axes of all drums are parallel to each other and the holders of all drums are parallel to such axes. A wrapping drum which may be utilized in the apparatus of FIG. 1 is disclosed, for example, in U.S. Patent No. 3,001,528 to Bernhard Schubert.

In addition to being convertible into an apparatus for the production of composite mouthpieces wherein the clearances **4***c* form air-filled turbulence chambers, the apparatus of FIG. 1 may be modified in another way as

follows: The drums shown in FIG. 1 are replaced by drums of double axial length so that the apparatus will be capable of processing twice as many white and black filter rods. For example, and as shown in FIG. 1, the magazine **39** may be replaced by a magazine which discharges a white filter rod **22** between each pair of coaxial white sections **20, 24** of double unit length, such sections **20, 24** corresponding to the sections **2, 3** of FIG. 3. The magazine which replaces the magazine **39** is then followed by two aligned magazines or by a dual magazine which discharges two coaxial black filter rods **21, 23** into the gaps between the sections **20, 24** and the white filter rods **22**. If the centrally located filter rod **22** is then halved along the line **25** shown in FIG. 17, one obtains two assemblies each of which corresponds to an assembly **1A** of the type shown in FIG. 6. Such assemblies are then processed side-by-side in the same way as illustrated in FIGS. 7–16. In other words, the method described in connection with FIGS. 2 to 16 may be modified in such a way that the ultimate product is a duplex mouthpiece of twelve times unit length, i.e., twice the length of the mouthpiece **19** shown in FIG. 16. Of course, the tape **52** must be replaced by a tape whose width equals the combined length of two wrapper sheets **18**. It is clear that a similar procedure may be followed in producing filter mouthpieces of eighteen times unit length.

The sections **20, 22, 24** and **21, 23** may be obtained by respectively severing a white and a black filter rod into a requisite number of sections and by thereupon shuffling such sections to form the assembly of FIG. 17.

Referring now to FIGS. 19 to 36, there are illustrated the steps of a modified method which is resorted to in the production of triplex mouthpieces of multiple unit length. In accordance with this second method, one starts with a white filter rod **201** (FIG. 19) of ten times unit length, and this filter rod is then severed to yield two white sections or elements **202, 203** of quintuple unit length, see FIG. 20. In the next step, the sections or elements **202, 203** are shifted axially and away from each other (FIG. 21) to form a long gap **201***a*.

A black filter rod or element **204** (see FIG. 22) of ten times unit length is then shuffled with the sections or elements **202, 203** in a manner as shown in FIG. 23 to form an assembly **201A** of three coaxial rod-shaped elements. This assembly is then transformed into an assembly **201B**, shown in FIG. 24, by severing the white sections or elements **202, 203** and the black filter rod or element **204** in such a way that the section **202** yields an end filter **207** of unit length and a white section **220** of quadruple unit length, that the section **203** yields an end filter **212** of unit length and a section **206** of quadruple unit length, and that the filter rod **204** yields a black section **205** of sextuple unit length and a black section **213** of quadruple unit length. The assembly **201B** is then transformed into a third assembly **201C**, shown in FIG. 25, by severing the sections **220, 206** to respectively obtain pairs of sections **208, 209** and **210, 211** of double unit length, and by severing the section **205** to obtain a black section **214** of quadruple unit length and a black section **215** of double unit length. The length of the gap **201***a* exceeds the length of the black filter rod **204** by a predetermined extent so that the white sections **208, 209, 210, 211** may be shifted axially and away from the respective end filters **207, 212** to form an assembly **201D** shown in FIG. 26, whereby the rod-shaped members **207–209** and **210–212** are respectively separated from each other by gaps **204***b* of predetermined length and the sections **209, 210** are separated from the sections **213, 214** by gaps **204***c* of short but identical length. The gaps between the rod **204** and white sections **202, 203** (see FIG. 23 and also FIGS. 24, 25) are indicated by reference characters **204***a*.

In a next-following step, the assembly **201D** of FIG. **26** is broken up by staggering the long sections **213, 214** transversely with reference to the remainder of the assembly whereby the sections **213, 214** form a subgroup **201E** shown in FIG. 29 and the remainder of the assembly **201D** forms a group **201F**, see FIG. 27. This group **201F** is then transformed into a group **201G** (see FIG. 28) by shifting the sections **208, 209** and **210, 211** axially and away from the respective end filters **207, 212** so as to transform the gaps **204***b* into longer gaps **221, 222, 223, 224** and to transform the narrow gaps **204***c* into clearances **226** of predetermined identical length, such clearances **226** being provided at the opposite ends of the black filter section **215** which remains coaxial with the end filters **207, 212** and white sections **208–211** to form the central rod-shaped member of the group **201G**.

The subgroup **201E** is then transformed into a subgroup **201H** (see FIG. 30) by subdividing the black sections **213, 214** into black sections **216, 217** and **218, 219** of double unit length, and the subgroup **201H** is ultimately transformed into a third subgroup **201J** by shifting the black sections **216–219** axially and away from each other so that each such section is moved in transverse alignment with one of the gaps **221–224** (compare FIGS. 28 and 31). It is clear that the section **213, 214** may be subdivided into sections **216–219** prior to breaking up of the assembly **201D**. However, it is normally preferred to manipulate comparatively long sections and, therefore, the sections **213, 214** will be subdivided subsequent to breaking up the assembly **201D**.

In the step which is shown in FIG. 32, the group **201G** is shuffled or interdigitated with the subgroup **201J** to form an assembly **225** wherein white rod-shaped members alternate with black rod-shaped members of double unit length, wherein the filters **207, 212** are located at the ends, and wherein the adjoining members are separated from each other by clearances **226** of identical length. In the next-following step, shown in FIG. 33, the assembly **225** is connected with a rectangular wrapper sheet **118** one side of which is coated with a suitable adhesive and which is then partially convoluted around the assembly **225** to form a substantially U-shaped or V-shaped body **118***a* (see FIGS. 34 and 34*a*) whereby the clearances **226** form open-sided pockets **228** having their open sides facing upwardly or substantially upwardly so that each thereof may receive an accurately measured quantity of granular, pulverulent or other flowable solid filter material **229**, see FIG. 35. Thus, by introducing such filter material (e.g., activated charcoal) into the pockets **228** of the assembly **227** shown in FIG. 34, one obtains an assembly **230** (see FIG. 35) which is finally transformed into a triplex mouthpiece **231** of ten times unit length by convoluting the U-shaped body **118***a* around the row of coaxial rod-shaped members and by thereby closing the pockets **228**. The mouthpiece **231** of FIG. 36 may be subdivided into five mouthpieces of double unit length wherein each such mouthpiece of double unit length comprises a centrally located black filter section, two white end filters of unit length, and two granular filters of unit length. This will be readily understood by referring to FIG. 36 which shows four lines **231***a* indicating the planes in which the mouthpiece **231** may be severed to yield five triplex mouthpieces of double unit length.

It will be seen that the number of black rod-shaped members **216–219** in the subgroup **201H** is less by one than the number of black rod-shaped members **215–219** which may be obtained by subdivision of the black filter rod or element **204**, and that the number of black members **215–219** is less by one than the total number of white rod-shaped members **207–209** and **210–212** which are obtained by subdividing the white elements **202, 203**. The method of FIGS. 19–36 differentiate from the method of FIGS. 2–16 in that the subgroups **16, 201H** respectively consist of white and black rod-shaped members, but the number of such members in the subgroup is always less by one than the total number of black rod-shaped members which are obtained by subdividing the element **4** or **204**.

The apparatus which may be used for practicing the

method of FIGS. 19 to 36 is illustrated in FIG. 18. This apparatus comprises a first magazine **134** which discharges white filter rods **201** (see also FIG. 19) into consecutive axially parallel peripheral holders of an inserting drum **135** corresponding to the drum **35** of FIG. 1. The inserting drum **135** delivers the rods **201** sideways into consecutive holders **133** of a large assembly drum **136** (see the transfer station AA) which advances the white filter rods past a cutter **137** serving to subdivide such rods into pairs of white sections or elements **202, 203** shown in FIG. 20. A wedge-like shifting cam **138** is adjacent to the path of sections **202, 203** and serves to shift them axially and away from each other so as to form the gaps **201***a* shown in FIG. 21.

A second magazine **139** contains a supply of parallel black filter rods **204** (see also FIG. 22) and delivers such rods into consecutive holders of a second inserting drum **140** which is located past the cam **138** and feeds the rods **204** into consecutive holders **133** of the assembly drum **136** at a second transfer station BB corresponding to the station B of FIG. 1 so that each holder **133** moving past the station BB accommodates an assembly **201A** (see also FIG. 23). The assemblies **201A** advance past a row of coaxial rotary disk-shaped cutters **141, 142, 143** which are driven by a shaft **131** and serve to transform such assemblies into assemblies **201B** one of which is shown in FIG. 24. Thus, the cutters **141, 142, 143** respectively sever the sections **202, 204, 203** to form the end filters **207, 212** and sections **220, 213, 205** and **206**. A second row of coaxial rotary disk-shaped cutters **125, 144, 126** (mounted on a drive shaft **132**) serves to transform each assembly **201B** into an assembly **201C** wherein the end filters and sections are arranged in a manner as shown in FIG. 25. At a further transfer station CC, the black sections **213, 214** are withdrawn from the holders **133** to enter consecutive holders of a removing drum **146** and to form subgroups **201E** (see FIG. 29), the remainder of each assembly **201C** forming a group **201F** one of which is shown in FIG. 27. It is to be noted that the assembly drum **136** cooperates with a set of suitably inclined shifting cams **145** which extend all the way to a point immediately following the row of cutters **125, 144, 126** so that each assembly **201C** is transformed into an assembly **201D** (see FIG. 26) even before its coaxial rod-shaped members reach the transfer station CC. The cams **145** continue to shift the rod-shaped members **208–211** axially and away from the end filters **207, 212** so that each group **201F** (FIG. 27) is transformed into a group **201G** (FIG. 28) prior to reaching a transfer station FF which corresponds to the transfer station F of FIG. 1. Thus, the sections of the assemblies **201C** and groups **201F** may be shifted gradually because the cams **145** extend all the way from the cutters **125, 126, 144** to the transfer station FF. The subgroups **201E** are transferred into consecutive holders of a rotary shifting drum **147** which cooperates with a pair of rotary disk-shaped cutters **164, 165** so that each section **213, 214** respectively yields a pair of sections **216, 217** and **218, 219** (see the subgroup **201H** of FIG. 30), and such sections are then advanced past a set of four suitably configurated and inclined shifting cams **148** which transform each subgroup **201H** into a subgroup **201J** (see FIG. 31) by moving the sections **216–219** in transverse alignment with the gaps **221–224**. The transfer stations between the shifting drum **147** and the drums **146, 149** are respectively indicated at DD and EE. The drum **149** is a transfer drum and serves to deliver the subgroups **201J** from the transfer station EE to the station FF where the subgroups **201J** are shuffled with consecutive groups **201G** to form assemblies **225** one of which is shown in FIG. 32. Such assemblies **225** then advance past a rotary suction drum **151** which corresponds to the drum **51** of FIG. 1 and serves to apply rectangular wrapper sheets **118** of requisite length. Such sheets **118** are obtained by severing the leading end portion of a tape **152** which is fed by advancing rolls **153** and has one of its sides coated with adhesive while moving along the applicator of a paster **154**. The suction drum **151** cooperates with a rotary bladed knife **155** and immediately staggers the wrapper sheets **118** so that each thereof may be readily attached to one of the assemblies **225** (see also FIG. 33).

The assemblies **225** (each with a wrapper sheet **118** attached thereto) are then delivered into consecutive holders of a rotary wrapping drum **160** in such a way that each sheet **118** is automatically transferred into a U-shaped or V-shaped body **118***a* best shown in FIGS. 34 and 34*a*. The drum **160** is of the type disclosed in U.S. Patent No. 2,714,384 to Bernhard Schubert and comprises pairs of radially reciprocable wrapping members which replace the fixed wrapping member **57** of FIG. 1 and cooperate with each other to complete the convoluting operation. As soon as an assembly **225** is transferred into a holder of the wrapping drum **160**, its adhesive-coated wrapper sheet **118** forms a U-shaped body **118***a* whereby the clearances **226** are transformed into open-sided pockets **228** whose open sides face upwardly while moving along the top portion of the drum **160**. A suitable filling device **162** receives granular filter material from a magazine or hopper **162***a* and is constructed in such a way that its outlets **162***b* discharge measured quantities of granular material **229** into each row of pockets **228** before the wrapping members of the drum **160** complete the wrapping operation. In other words, the filling device **162** (which may be of the type as disclosed in the copending application Ser. No. 384,131, now Patent No. 3,308,832, issued Mar. 14, 1967, of Carl Stelzer) is located along such portion of the path of wrapper sheets **18** where sheets already form U-shaped bodies **118***a* and where the open sides of the pockets **228** face upwardly or substantially upwardly so that the material **229** may be delivered by gravity feed. The mouthpieces **231** then continue to advance with the wrapping drum and are delivered onto the upper stringer of a take-off conveyor belt **158** which is driven by a deflecting roller **158***a*. The belt **158** may advance the mouthpieces **231** to storage, to a further processing station, or to a filter cigarette machine.

The stations GG and HH of FIG. 18 respectively correspond to the stations G and H of FIG. 1. The station JJ is the filling station, and the station KK is the station where the holders of the wrapping drum **160** deliver mouthpieces **231** into consecutive holders of an evacuating drum **163** which thereupon delivers such mouthpieces onto the take-off belt **158**.

The reference numeral **127** in FIG. 18 illustrates a portion of one disk-shaped end wall for the assembly drum **136**. This drum comprises two such end walls which serve to insure that the end filters **207, 212** cannot move beyond two predetermined axial positions shown in FIGS. 24–28 and 32–33. Thus, when the sections or elements **202, 203** of FIG. 20 are shifted axially to take the positions shown in FIG. 21, their outer end faces abut against the end walls **127** of the assembly drum **136**. This insures that the filters **207, 212** are invariably located at the opposite ends of the assemblies **225** and at the opposite ends of the mouthpieces **231**.

The manner in which the shifting and spreading cams may move rod-shaped members and groups or subgroups of such members axially is disclosed in more detail in a copending application Ser. No. 408,998, now Patent No. 3,368,460, issued Feb. 13, 1968 of Bernhard Schubert. It will be noted that the peripheral holders of the drums shown in FIG. 18 are placed at the same distance from each other, i.e., the distance between the holders **133** is the same as that between the holders of the drums **135, 140, 146, 147, 149, 160** and **163**. The peripheral speed of each drum (with the exception of the suction drum **151**) is the same, and these drums are provided with suitable retaining shields or pneumatic retaining devices to insure that the filter rods and their sections are properly

retained in the respective holders while moving from station to station and onto the take-off belt **158**.

The axial length of a black section **215, 216, 217, 218** or **219** exceeds the axial length of a white section **208, 209, 210** or **211**. Since a longer section is easier to handle, the method shown in FIGS. 19–36 may be carried out with utmost precision because the shorter (white) sections and end filters need not be removed from the holders **133** whereas the withdrawal, shuffling and reinsertion of rather long black sections **216–219** presents no problems particularly since the sections **213, 214** which are removed from the holders **133** are of quadruple unit length. By placing the cutters **164, 165** along the path of subgroups **201**E, I insure that the black sections **213, 214** are subdivided immediately prior to reaching the shifting cams **148** so that the drum **146** removes comparatively long sections to reduce the likelihood of misalignment and other problems which arise in connection with the manipulation of short rod-shaped members.

The rod-shaped members which are removed from the elongated path defined by the assembly conveyor **36** or **136** consist of filter material that is less likely to undergo deformation in response to removal and reinsertion into the holders of the assembly drum. Thus, the material of the filter rods **1** is less sensitive than the material of the filter rods **4**, and the material of the filter rods **204** is less sensitive than the material of the rods **201**. The number of rod-shaped members which form a subgroup is comparatively small so that such members may be removed, shifted, aligned and reinserted with utmost accuracy and in a very simple manner.

An examination of FIGS. 1 and 18 will reveal that the rotary disk-shaped cutters are mounted in such a way that each rod-shaped element or member is severed only one at a time. Thus, the cutter **37** of FIG. 1 will sever the rod **1** to form the sections **2, 3**, the cutters **41, 42, 43** will respectively sever the sections **2, 3** and the rod **4** to form the members shown in FIG. 7, and the cutter will sever the section **8** to form the sections **12, 13**. The same applies for FIG. 18 wherein the cutter **137** severes the rod **201** to form the sections **202, 203**, the cutters **141, 142, 143** respectively sever the elements **202, 203, 204** to form the rod-shaped members shown in FIG. 24, the cutters **125, 126, 144** respectively sever the members **220, 205, 206** to form the rod-shaped members shown in FIG. 26, and the cutters **164, 165** respectively sever the members **213, 214** to form the members **216–219** shown in FIG. 30. In other words, each rod-shaped element or member is severed only once at a time which is of advantage because the likelihood of jamming or deforming (such as will take place between two coaxial cutters which sever a single rod-shaped member at two axially spaced points) is eliminated in a very simple manner. The rotational speed of the disk-shaped cutters preferably exceeds the rotational speed of the drums to insure that the cutters will form clean cuts.

It is clear that the filter rods **1, 4, 201, 204** need not consist of a single type of filter material. For example, the filter rod **4** of FIG. 5 may be a composite mouthpiece of multiple unit length so that the mouthpiece **19** of FIG. 16 will consist of three different filter materials. The same applies for the filter rod **1** and for the filter rods **201, 204**.

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

What is claimed as new and desired to be secured by Letters Patent is:

1. In an apparatus for producing composite mouthpieces from assemblies of coaxial rod-shaped elements of the type including outer elements of a first filter material and a median element of a second filter material, assembly conveyor means including a plurality of substantially parallel holder means for advancing the assemblies sideways; means for subdividing each median element into a plurality of members and for subdividing the outer elements of the respective assembly into a plurality of members while such median and outer elements are accommodated in a common holder means; and means for interchanging the positions of some of said members in each of said assemblies to convert each of said assemblies into a second assembly wherein members of first filter material alternate with members of second filter material.

2. An apparatus for producing composite mouthpieces of multiple unit length from assemblies of coaxial rod-shaped elements of the type including two outer elements of a first filter material and a median element of a second filter material, comprising an assembly conveyor including a plurality of parallel holders for advancing the assemblies sideways; means for subdividing each median element into members of double unit length and for subdividing each outer element of the respective assembly into an outer member of unit length and at least one member of double unit length while such median and outer elements are accommodated in a common holder; means for interchanging the positions of some of said members in each of said assemblies to form in each of said holders a second assembly including alternating members of different materials and a member of unit length at each end; and wrapping means for convoluting adhesive-coated wrapper sheets around said second assemblies.

3. An apparatus for producing composite mouthpieces of multiple unit length from assemblies of coaxial rod-shaped elements of the type including a plurality of parallel holders for advancing the assemblies sideways; first rotary disk-shaped cutter means for subdividing each median element into an odd number of members of double unit length and second rotary disk-shaped cutter means for subdividing each outer element of the respective assembly into an outer member of unit length and at least one member of double unit length while such elements are accommodated in a common holder, said odd number exceeding by one the combined number of members of double unit length which consist of said first material; means for interchanging the positions of some of said members in each of said assemblies to form in each of said holders a second assembly including alternating members of different materials and a member of unit length at each end; and wrapping means for convoluting adhesive-coated wrapper sheets around said second assemblies.

4. An apparatus as set forth in claim **3**, wherein each of said rotary cutter means comprises a row of at least two coaxial cutters and a common shaft for such rows of cutters, the cutters of each row being spaced from each other in such a way that each thereof severs a different element of an assembly in the momentarily adjacent holder of said assembly conveyor.

5. An apparatus for producing composite mouthpieces of multiple unit length from assemblies of coaxial rod-shaped elements of the type including two outer elements of a first filter material and a median element of a second filter material, comprising an assembly conveyor including a plurality of parallel holders for advancing the assemblies sideways; means for subdividing each median element into members of double unit length and for subdividing each outer element of the respective assembly into an outer member of unit length and at least one member of double unit length while such elements are accommodated in a common holder; means for interchanging the positions of some of said members in each of said assemblies to form in each of said holders a second as-

sembly including alternating members of different materials and a member of unit length at each end, said last named means comprising means for removing from consecutive holders of said assembly conveyor members of double unit length which consist of one of said materials and whose number equals the combined number of members of double unit length which consist of said first material, means for shifting the remaining members of double unit length in each holder axially to provide between adjoining members of the same material which remain in said holders gaps of a length at least equal to the length of a removed member, means for shifting the removed members axially so that each thereof is moved into transverse alignment with a gap between the remaining members in a holder, and means for transferring the thus shifted removed members into consecutive holders so that each of the thus transferred members is received in one of the gaps in the corresponding holder; and wrapping means for convoluting adhesive-coated wrapper sheets around said second assemblies.

6. An apparatus as set forth in claim 5, wherein said assembly conveyor is a rotary drum and wherein each of said removing and transferring means is a rotary drum.

7. An apparatus as set forth in claim 5, wherein said second assemblies comprise rod-shaped members which are separated from each other by clearances of identical length, and further comprising a filling device for introducing into each of said clearance measured quantities of a third filter material prior to the application of said wrapper sheets around the respective second assemblies.

8. An apparatus for producing composite mouthpieces of multiple unit length from assemblies of coaxial rod-shaped elements of the type including two outer elements of a first filter material and a median element of a second filter material, comprising an assembly conveyor including a plurality of parallel holders for advancing the assemblies sideways; first inserting means for feeding said outer elements into consecutive holders of said conveyor; second inserting means for feeding said median elements into consecutive holders of said conveyor so that such median elements are located between the respective outer elements; means for subdividing each median element into members of double unit length and for subdividing each outer element of the respective assembly into an outer member of unit length and at least one member of double unit length while such elements are accommodated in a common holder; means for interchanging the positions of some of said members in each of said assemblies to form in each of said holders a second assembly including alternating members of different materials and a member of unit length at each end; and wrapping means for convoluting adhesive-coated wrapper sheets around said second assemblies.

9. An apparatus for producing composite mouthpieces of multiple unit length from assemblies of coaxial rod-shaped elements of the type including two outer elements of a first filter material and a median element of a second filter material, comprising an assembly conveyor including a plurality of parallel holders for advancing the assemblies sideways; means for subdividing each median element into members of double unit length and for subdividing each outer element of the respective assembly into an outer member of unit length and at least one member of double unit length while such elements are accommodated in a common holder; means for interchanging the positions of some of said members in each of said assemblies to form in each of said holders a second assembly including alternating rod-shaped members of different materials and a rod-shaped member of unit length at each end, the members of said second assemblies being separated from each other by clearances of identical length and said last named means comprising means for removing from consecutive holders of said assembly conveyor members of double unit length which consist of one of said materials and whose number equals the combined number of members of double unit length which consist of said first material, means for shifting the remaining members of double unit length in each holder axially to provide between adjoining members of the same material which remain in said holders gaps of a length at least equal to the length of a removed member, means for shifting the removed members axially so that each thereof is moved into transverse alignment with a gap between the remaining members in a holder, and means for transferring the thus shifted members into consecutive holders so that each of the thus transferred members is received in one of the gaps in the corresponding holder; wrapping means for convoluting adhesive-coated wrapper sheets around said second assemblies; and a filling device for introducing into each of said clearances measured quantities of a third filter material prior to the application of said wrapper sheets around the respective second assemblies, said wrapping means comprising means for deforming each of said sheets into a substantially U-shaped body to transform each of said clearances into an open-sided pocket, and means for completing the convolution of such U-shaped bodies around the respective second assemblies to close said pockets, said filling device being adjacent to said wrapping means in such position that said third filter material is admitted into said open-sided pockets whereby, upon completion of the convoluting operation, the third filter material is entrapped in said pockets.

References Cited

UNITED STATES PATENTS

Re. 25,917	11/1965	Stelzer	93—1
2,325,386	7/1943	Frank	93—1
2,882,970	4/1959	Schur	93—1
3,039,373	6/1962	Rudszinat	93—77
3,122,974	3/1964	Rowlands	93—1
3,164,243	1/1965	Rudszinat	93—1
2,304,585	12/1942	McMinn	156—185
2,459,721	1/1949	Poltorak	156—185
2,113,655	4/1938	Kellie	156—475
1,789,467	1/1931	Intemann	156—475
3,368,460	2/1968	Schubert	93—1

WAYNE A. MORSE, JR., Primary Examiner

U.S. Cl. X.R.

93—77