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## (54) APPARATUS AND METHOD FOR PRODUCING PAPER TUBES FOR CIGARETTE FILTERS

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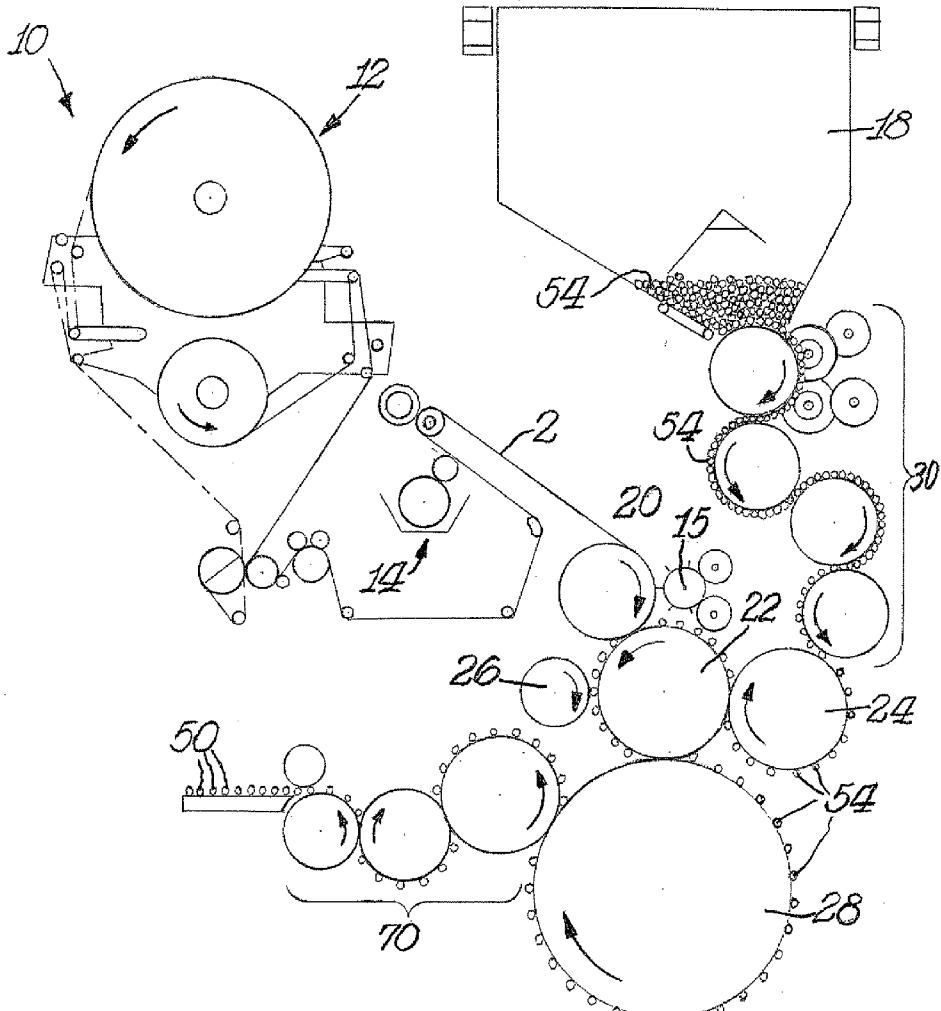
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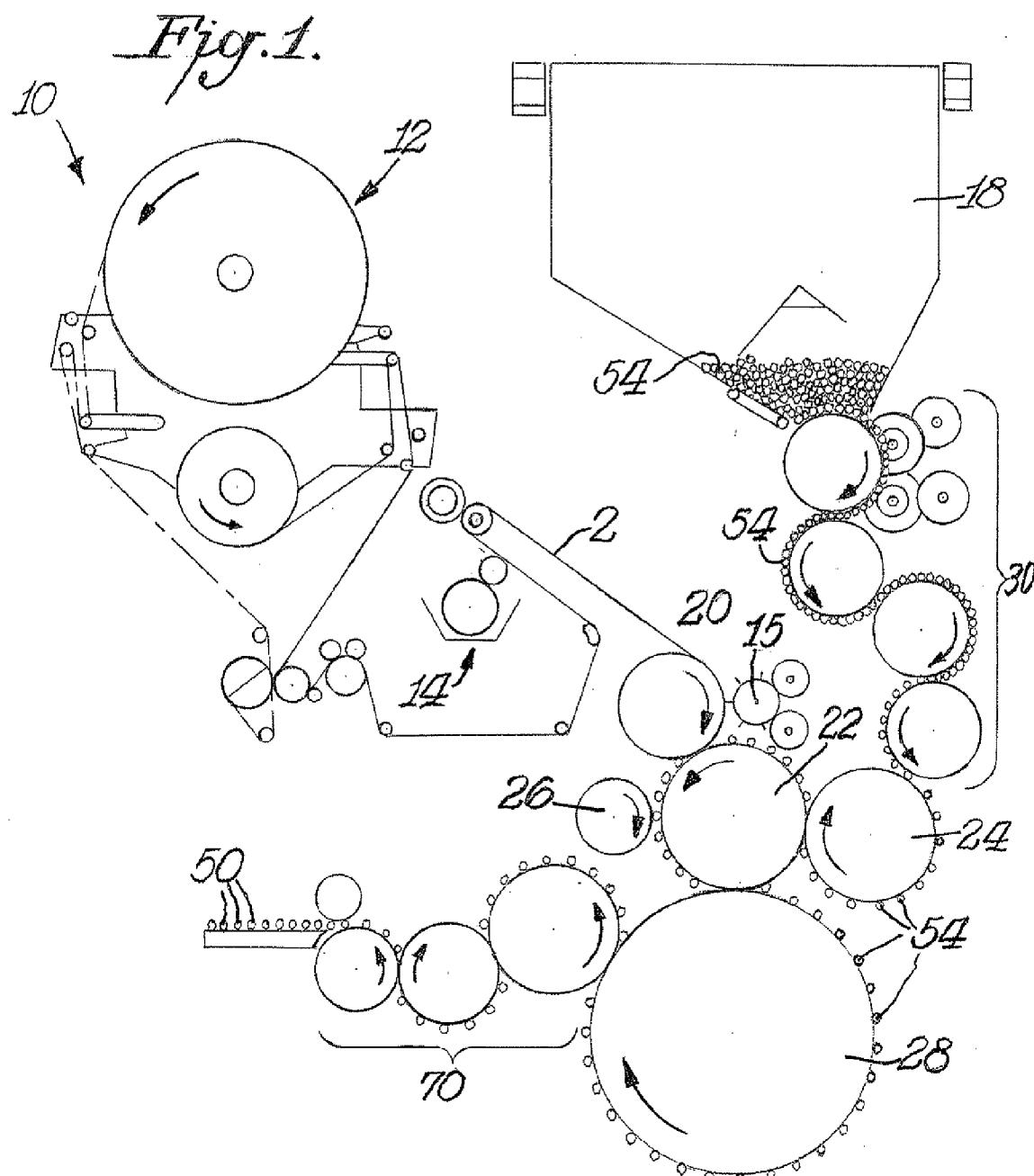
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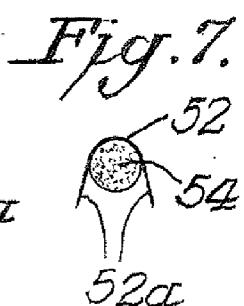
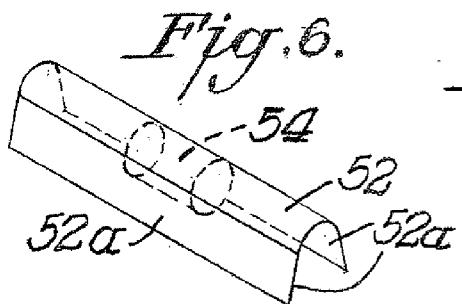
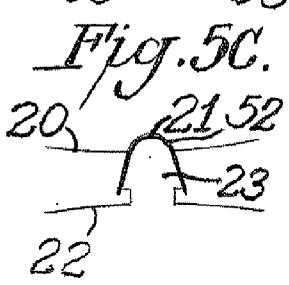
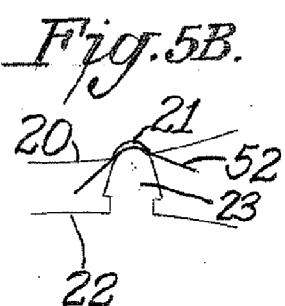
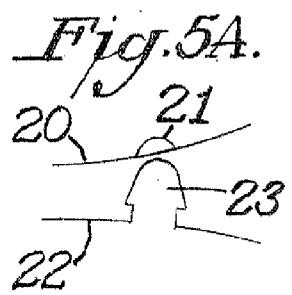
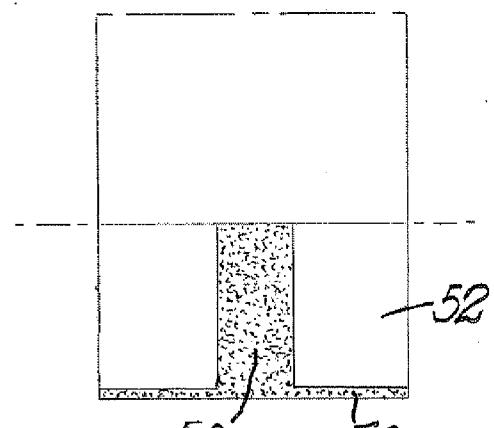
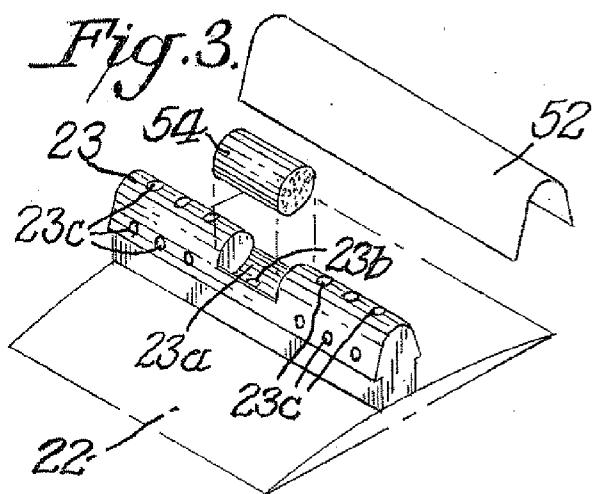
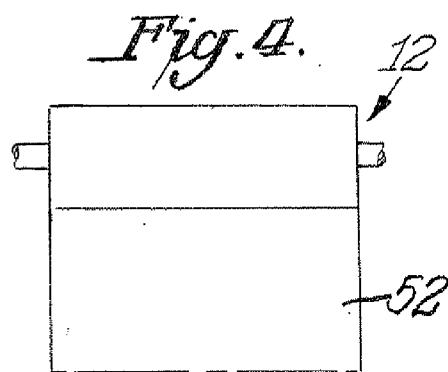
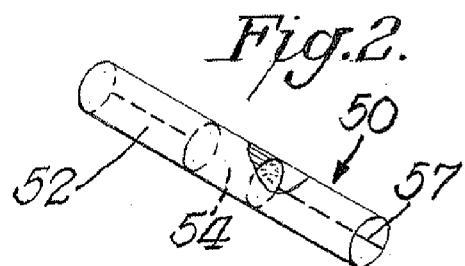
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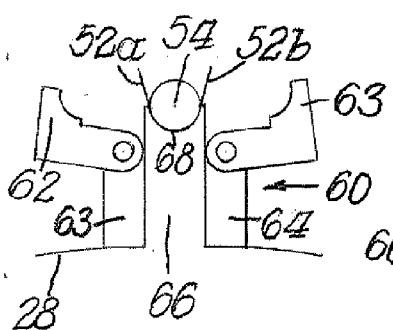
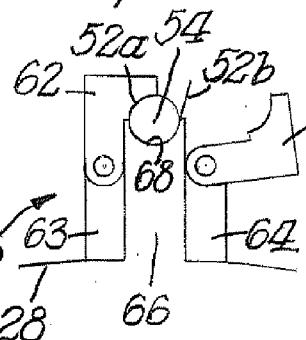
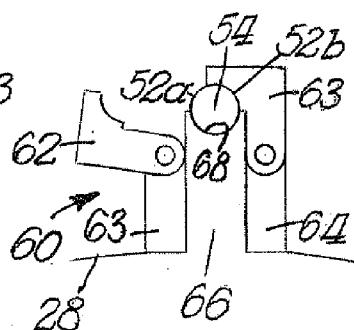
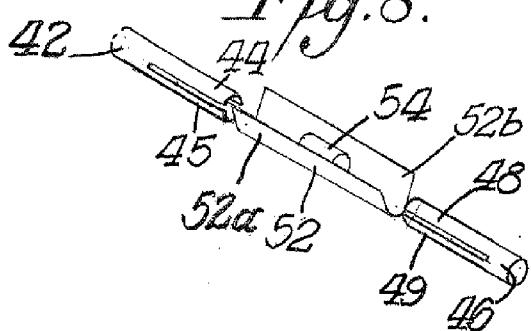
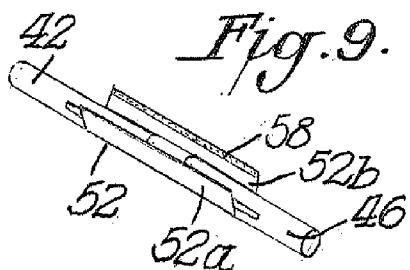
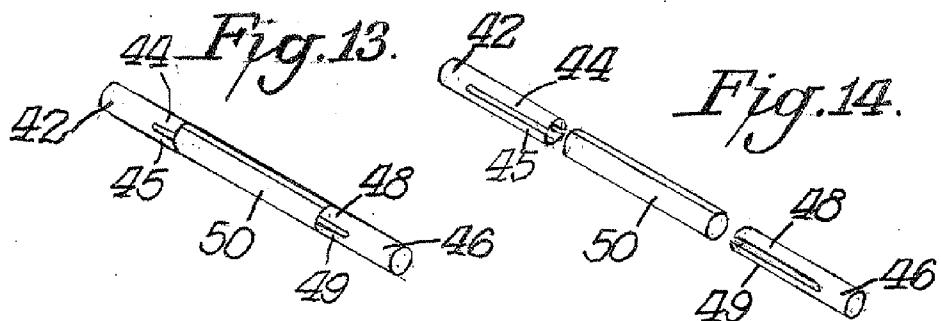
## (57) ABSTRACT

An method and apparatus for producing cigarette filter tubes are disclosed. According to the disclosed method and apparatus, a filter segment is supplied to a rotating delivery drum and a paper wrapper is supplied to the delivery drum and partially wrapped around said the filter segment. Thereafter, the paper wrapper and filter segment are transferred together from the delivery drum to a rotating wrapping drum. Folding arms on the wrapping drum subsequently fold down flaps of the paper wrapper to complete the formation of a filter tube. Wrapping assist members may be inserted into the paper wrapper as the flaps are folded down to ensure that the tube is sufficiently round in shape. Additionally, the wrapping assist members and folding arms may be heated in order to promote faster curing of glue surfaces on the paper wrapper.







*Fig.10.**Fig.11.**Fig.12.**Fig.8.**Fig.9.**Fig.13.**Fig.14.*

**APPARATUS AND METHOD FOR PRODUCING PAPER TUBES FOR CIGARETTE FILTERS****CROSS REFERENCE RELATED TO APPLICATION**

[0001] The present application claims the benefit of provisional application Ser. No. 60/952,621, filed Jul. 30, 2007, for all useful purposes, and the specification and drawings thereof are included herein by reference.

**BACKGROUND OF THE INVENTION**

[0002] The invention relates to cigarette filter tube making, and more particularly to a method of forming a cigarette filter tube with a centrally located filter component within the tube. U.S. Pat. Nos. 3,517,480 and 3,603,058 illustrate and describe machines for the production of composite cigarette filters by directly flowing granular filter material from a storage hopper into a vertically oriented filter tube. Similarly, US Patent Application Publication 2002/0119874A1 describes another machine for producing compound cigarette filters that includes a series of rotating plates with cavities therein into which the granular filter material is deposited. The cavities ultimately are aligned with an open ended filter tube to facilitate deposit of the granular material into the tube.

[0003] Preformed filter tubes are utilized with machinery as described above for primarily producing 2-up (dual) cigarette filters. In each instance these filter tubes primarily comprise a hollow cylindrical tube with a central solid filter segment such as cellulose acetate tow. After both ends of the filter tube are filled with granular material and sealed with solid filter segments a 2-up (dual) filter is produced which when combined with tobacco rods at each end thereof ultimately produces two complete cigarettes. When cutting through the middle of the central solid filter segment, each cigarette filter has a defined length. It is important that the length and inside diameter of the preformed filter tube be accurately controlled so that the tubes can then be easily and accurately filled utilizing vertical filling technology and machinery of the type described above.

[0004] US Patent Application Publication 2006/0281614-A1 discloses a machine for forming cigarette filter tubes, wherein opposed tube-forming rollers engage the ends of a filter paper segment and rotate so as to form the paper segment into a tube shape around a central solid filter segment. Overlapping portions of the paper segment are secured together, and the tube forming-rollers are withdrawn from the paper segment to thereby complete the filter forming operation.

[0005] It is a desire of the invention disclosed herein to provide a novel method and apparatus for forming cigarette filter tubes which provides for increased accuracy in the overall length of the filter tube, positioning of the internal solid filter segment and circumference of the filter tube. It is a further desire of the invention to provide a method and machine which produces rounder filter tubes.

**BRIEF SUMMARY OF THE INVENTION**

[0006] A novel method and apparatus for forming cigarette filter tubes are disclosed herein. The disclosed method and apparatus provide increased accuracy in the length of the filter tube, the positioning of the solid filter segment of the filter tube and the circumference of the filter tube. The method and apparatus additionally produce rounder filter tubes.

[0007] According to one embodiment, a method for forming cigarette filter tubes comprises:

[0008] providing a paper wrapper having glue disposed on a face thereof so as to form a first glue area located at a center region of said wrapper and a second glue area extending along a side edge of said at least one paper wrapper;

[0009] supplying at least one filter segment to a rotating delivery drum;

[0010] supplying said at least one paper wrapper to said delivery drum such that said first glue area contacts said at least one filter segment, said at least one paper wrapper is partially wrapped around said at least one filter segment and said at least one paper wrapper has first a first flap portion and a second flap portion that remain unwrapped from said filter segment;

[0011] transferring said paper wrapper and said filter segment together from said delivery drum to a rotating wrapping drum, said wrapping drum having at least one folding assembly including a first folding arm and a second folding arm;

[0012] pivoting said first folding arm to fold said first flap portion around said at least one filter segment; and

[0013] pivoting said second folding arm to fold said second flap portion around said at least one filter segment, thereby completing a filter tube.

[0014] According to one embodiment, an apparatus for producing cigarette filter tubes comprises:

[0015] a wrapper-cutting drum operable to cut filter paper into at least one paper wrapper having a first glue area located at a center region of said wrapper and a second glue area extending along a side edge of said at least one paper wrapper;

[0016] a rotating delivery drum, wherein said delivery drum is operable to receive at least one filter segment, and wherein said wrapper-cutting drum is operable to transfer said at least one paper wrapper to said delivery drum such that said first glue area contacts said at least one filter segment, said at least one paper wrapper is partially wrapped around said at least one filter segment and said at least one paper wrapper has first a first flap portion and a second flap portion that remain unwrapped from said filter segment; and

[0017] a rotating wrapping drum operable to receive said paper wrapper and said filter segment together from said delivery drum, said wrapping drum having at least one folding assembly comprising:

[0018] a first folding arm pivotable to fold said first flap portion around said at least one filter segment; and

[0019] a second folding arm pivotable to fold said second flap portion around said filter segment, thereby completing a filter tube.

[0020] Additional features and advantages of the method and apparatus will be apparent to those of skill in the art upon considering the following detailed description and drawings.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0021] FIG. 1 is a schematic diagram showing an apparatus for producing a cylindrical filter tube;

[0022] FIG. 2 is a perspective view of a finished paper filter tube after being processed by an apparatus such as that shown in FIG. 1;

[0023] FIG. 3 is a perspective view showing a fluted vacuum delivery drum that receives a central solid filter segment and filter wrapper, shown exploded about the drum;

[0024] FIG. 4 shows an elevational view of filter paper being supplied from a bobbin and having adhesive applied thereto prior to being cut to size to form the filter wrapper;

[0025] FIGS. 5A-5C show various steps of applying the filter wrapper to the delivery drum;

[0026] FIG. 6 is a perspective view of the central solid filter segment and filter wrapper ready for folding into a filter tube;

[0027] FIG. 7 is an end elevational view of the central solid filter segment and filter wrapper ready for folding into a filter tube;

[0028] FIGS. 8-9 show positions of wrapping assist pins prior to folding the wrapper around the central solid filter segment;

[0029] FIG. 10 is a side elevational view showing the wrapper and the central solid filter segment placed in a holder with folding arms disposed on opposing sides of the wrapper;

[0030] FIG. 11 is a side elevational view showing a first folding arm making a first fold from a first side of the wrapper;

[0031] FIG. 12 is a side elevational view showing a second folding arm making a second fold from a second side of the wrapper; and

[0032] FIGS. 13 and 14 show positions of wrapping assist pins following folding of the wrapper around the central solid filter segment.

#### DETAILED DESCRIPTION OF THE INVENTION

[0033] Referring with more particularity to the drawings, FIG. 1 shows an exemplary apparatus 10 for processing cigarette filter tubes. An example of a hollow filter tube 50 produced by the apparatus 10 is shown in FIG. 2. The tube 50 includes a paper wrapper 52 formed into a tube shape and a central solid filter segment 54 (e.g., cellulose acetate segment) disposed within the wrapper 52. Opposing ends of the wrapper 50 are overlapped joined at a seam 57 to form the tube shape.

[0034] Turning back to FIG. 1, filter paper 2 is first fed from a bobbin assembly 12 through a gluing unit 14, where glue is applied to a face of the paper 2. Thereafter, the paper 2 is supplied to a rotating wrapper-cutting drum 20 where it is cut into individual pieces to form paper wrappers 52 whose length is the circumference of the tube 50 plus the length of the seam overlap of the tube 50. FIG. 3 shows glue areas 56, 58 of the wrapper 52. The center glue area 56 is positioned to adhere to the solid filter segment 54, whereas the glue area 58 extending along the side edge of the wrapper 52 is positioned for sealing the wrapper 52 along a seam 57.

[0035] Still referring to FIG. 1, the interior components of the tube 50, such as solid filter segments 54, are fed from a hopper 18 through a series of rotating drums 30 which cut the components to the correct length and grade them into a single stream of segments. The segments are then passed to a rotating delivery drum 22 from a rotating accelerator drum 24.

[0036] As illustrated in FIG. 3, the delivery drum 22 includes a plurality of flutes 23 for receiving and retaining the solid filter segments 54. Each flute 23 includes a center recess 23a and vacuum hole 23b for applying vacuum from a vacuum source (not shown) to hold the solid filter segment 54 in place. The remaining surface of the flute 23 includes vacuum holes 23c for applying suction to hold the paper wrapper 52 wrapped approximately 150 degrees around the filter segment 54.

[0037] Turning back to FIG. 1, each paper wrapper 52 is transferred to the delivery drum 22 from the wrapper-cutting drum 20 and where the wrapper 52 is matched with a solid filter segment 54. FIGS. 5A-5C illustrate the transfer of the paper wrapper 52 to the delivery drum 22. As shown in FIGS.

5A-5C, the exterior surface of the wrapper-cutting drum 20 includes a plurality of concave recesses 21 over which the wrappers 52 are positioned. Each recess 21 is shaped to engage the outer surface of a corresponding flute 23 on the delivery drum 22. Thus, as the wrapper-cutting drum 20 and the delivery drum 22 rotate in opposite directions, the recesses 21 and flutes 23 engage each other and the wrapper-cutting drum 20 presses the wrappers 52 onto the flutes 23 such that the paper wrappers 52 are wrapped approximately 150 degrees around the filter segments 54 and are held in place by suction applied through vacuum holes 23c.

[0038] As shown in FIG. 1, an alignment drum 26 rotates with the delivery drum 22 in an opposite direction to that of the delivery drum 22. The alignment drum 26 contacts the paper wrappers 52 and ensures that the paper wrappers 52 are against the flutes 23 on the delivery drum 22. The vacuum ports 23c on the delivery drum continue to hold the paper wrappers 52 in position for transfer to a wrapping drum 28. FIGS. 6 and 7 show a paper wrapper 52 folded over a segment 54 as it appears on the delivery drum 22. In this state, the wrapper 52 has flap portions 52a, 52b which have not been fully wrapped around the segment 54.

[0039] The steps for folding the flap portions 52a, 52b to form a filter tube 50 will now be described. Referring back to FIG. 1, the paper wrapper 52 and filter segment 54 are transferred together from the delivery drum 22 to the wrapping drum 28. As illustrated in FIG. 10, the wrapping drum 28 includes a plurality of wrapper folding assemblies 60 which include a first folding arm 62 pivotally attached to a first folding arm support 63, a second folding arm 64 pivotally attached to a second folding arm support 65, and a tube holder 66 disposed between the folding arm supports 63, 65. When the paper wrapper 52 and filter segment 54 are transferred to the wrapping drum 28, they are placed in a concave recess 68 of the tube holder 66 for folding the flap portions 52a, 52b.

[0040] As shown in FIGS. 8-9, prior to the flap portions 52a, 52b being folded, cam-driven wrapping assist members 42, 46 are inserted into opposite ends of the wrapper 52. Each wrapping assist member 42, 46 includes a half-round upper pin 44, 48 and a half-round lower pin 45, 49 for assisting in folding the flap portions 52a, 52b. Preferably, when the members 42, 46 are inserted into the wrapper 52, the upper pins 44, 48 and lower pins 45, 49 abut ends of the filter segment 54 to stabilize the filter segment 54.

[0041] After the wrapping assist members 42, 46 are inserted into the wrapper 50, the upper pins 44, 48 and the lower pins 45, 49 are vertically separated from each other such that the lower pins 45, 49 hold the wrapper 52 against the tube holder 66. Thereafter, as illustrated in FIG. 11, the first folding arm 62 pivots inward so as to fold the flap portion 52a around the segment 54. Then, as shown in FIG. 12, the second folding arm 64 pivots inward so as to fold the flap portion 52b around the segment 54 such that the glue area 58 overlaps the flap portion 52a at seam 57 to complete formation of the tube 50. During folding of the flap portions 52a, 52b, the upper pins 44, 48 provide a backing surface against which the folding arms 62, 64 press flap portions 52a, 52b at the location of the seam 57 (see FIG. 13). Once folding of the flaps 52a, 52b is completed, the upper pins 44, 48 and the lower pins 45, 49 are moved vertically closer to each other, and the wrapping assist members 42, 46 are then removed from the tube 50 (see FIG. 14).

[0042] The folding arms 62, 64 and/or the wrapping assist members 42, 46 may be heated in order to expedite drying of

the glue when folding the flaps **52a**, **52b** to form the fully wrapped tube **50'**. As shown in FIG. 1, after tubes **50** are formed on the wrapping drum **28**, they travel through a series of transfer drums **70** and are delivered to a subsequent station for further processing.

[0043] It should be understood that the above detailed description while indicating preferred embodiments of the invention are given by way of illustration only since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from the detailed description.

I claim:

**1.** A method for producing paper cigarette filter tubes, comprising:

providing a paper wrapper having glue disposed on a face thereof so as to form a first glue area located at a center region of said wrapper and a second glue area extending along a side edge of said at least one paper wrapper; supplying at least one filter segment to a rotating delivery drum;

supplying said at least one paper wrapper to said delivery drum such that said first glue area contacts said at least one filter segment, said at least one paper wrapper is partially wrapped around said at least one filter segment and said at least one paper wrapper has first a first flap portion and a second flap portion that remain unwrapped from said filter segment;

transferring said paper wrapper and said filter segment together from said delivery drum to a rotating wrapping drum, said wrapping drum having at least one folding assembly including a first folding arm and a second folding arm;

pivoting said first folding arm to fold said first flap portion around said at least one filter segment; and

pivoting said second folding arm to fold said second flap portion around said at least one filter segment, thereby completing a filter tube.

**2.** The method of claim 1 comprising, prior to pivoting said first folding arm to fold said first flap portion around said at least one filter segment:

inserting a pair of wrapping assist members into opposite ends of said paper, wherein said wrapping assist members comprise upper pins and lower pins; and

vertically separating said upper pins and said lower pins from each other such that said lower pins hold said wrapper against a holding element of said wrapping drum and said upper pins provide a backing surface for said first and second folding arms when folding said first and second flap portions.

**3.** The method of claim 2, comprising applying heat to said wrapping assist members to expedite curing of said glue.

**4.** The method of claim 2, comprising, after pivoting said second folding arm to fold said second flap portion around said filter segment:

moving said upper pins and said lower pins vertically closer to each other; and

removing said wrapping assist members from said filter tube.

**5.** The method of claim 1, comprising applying heat to said first and second folding arms to expedite curing of said glue.

**6.** The method of claim 1, wherein said delivery drum comprises at least one flute, and wherein:

transferring said at least one filter segment to said delivery drum comprises placing said filter segment in a recess in said at least one flute; and

supplying said at least one paper wrapper to said delivery drum comprises pressing said at least one wrapper onto said at least one flute from a wrapper-cutting drum.

**7.** The method of claim 6, comprising applying suction to said at least one filter segment and said at least one paper wrapper through vacuum holes in said at least one flute.

**8.** The method of claim 6, comprising rotating an alignment drum to contact said at least one paper wrapper while said at least one paper wrapper is on said at least one flute, thereby ensuring that said at least one paper wrapper is secured against said at least one flute.

**9.** The method of claim 6, comprising, prior to supplying said at least one paper wrapper to said delivery drum, positioning said at least one paper wrapper over at least one concave recess on said delivery drum, wherein said at least one concave recess is shaped to engage said at least one flute in order to press said at least one wrapper onto said at least one flute.

**10.** The method of claim 1, wherein said first flap portion and said second flap portion are folded such that said second flap area is located at a seam of said filter tube.

**11.** An apparatus for producing paper cigarette filter tubes, comprising:

a wrapper-cutting drum operable to cut filter paper into at least one paper wrapper having a first glue area located at a center region of said wrapper and a second glue area extending along a side edge of said at least one paper wrapper;

a rotating delivery drum, wherein said delivery drum is operable to receive at least one filter segment, and wherein said wrapper-cutting drum is operable to transfer said at least one paper wrapper to said delivery drum such that said first glue area contacts said at least one filter segment, said at least one paper wrapper is partially wrapped around said at least one filter segment and said at least one paper wrapper has first a first flap portion and a second flap portion that remain unwrapped from said filter segment; and

a rotating wrapping drum operable to receive said paper wrapper and said filter segment together from said delivery drum said wrapping drum having at least one folding assembly comprising:

a first folding arm pivotable to fold said first flap portion around said at least one filter segment; and

a second folding arm pivotable to fold said second flap portion around said filter segment, thereby completing a filter tube.

**12.** The apparatus of claim 11, comprising a pair of wrapping assist members having upper pins and lower pins, wherein, prior to pivoting said first folding arm to fold said first flap portion around said at least one filter segment:

said wrapping assist members are operable to be inserted into opposite ends of said at least one paper wrapper; and said upper pins and said lower pins are operable to be vertically separated from each other such that said lower pins hold said wrapper against a holding element of said wrapping drum and said upper pins provide a backing surface for said first and second folding arms when folding said first and second flap portions.

**13.** The apparatus of claim 12, wherein said wrapping assist members are heated to expedite curing of said glue.

**14.** The apparatus of claim **12**, wherein, after pivoting said second folding arm to fold said second flap portion around said filter segment:

    said upper pins and lower pins are operable to be moved vertically closer to each other; and

    said wrapping assist members are operable to be removed from said filter tube.

**15.** The apparatus of claim **11**, wherein said first and second folding arms are heated to expedite curing of said glue.

**16.** The apparatus of claim **11**, wherein said delivery drum includes at least one flute comprising:

    a recess for retaining said at least one filter segment; and  
    an outer surface for retaining said least one paper wrapper.

**17.** The apparatus of claim **16**, wherein said at least one flute comprises vacuum holes which apply suction to said at least one filter segment and said at least one paper wrapper.

**18.** The apparatus of claim **16**, comprising an alignment drum operable to contact said at least one paper wrapper while said at least one paper wrapper is on said at least one flute, thereby ensuring that said at least one paper wrapper is secured against said at least one flute.

**19.** The apparatus of claim **16**, wherein said wrapper-cutting drum includes at least one concave recess over which said at least one wrapper is positioned when said at least one wrapper is on said wrapper-cutting drum, and wherein said at least one concave recess is shaped to engage said at least one flute in order to press said at least one wrapper onto said at least one flute.

**20.** The apparatus of claim **11**, wherein said first and second folding arms are operable to fold said first flap portion and said second flap portion, respectively, such that said second flap area is located at a seam of said filter tube.

\* \* \* \* \*