

- [54] **APPARATUS FOR REGULATING THE OPERATION OF FILTER ROD MAKING MACHINES**
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- [58] **Field of Search**..... **93/1 C, 77 FT; 131/21 R, 21 B, 94; 156/356, 357, 367**

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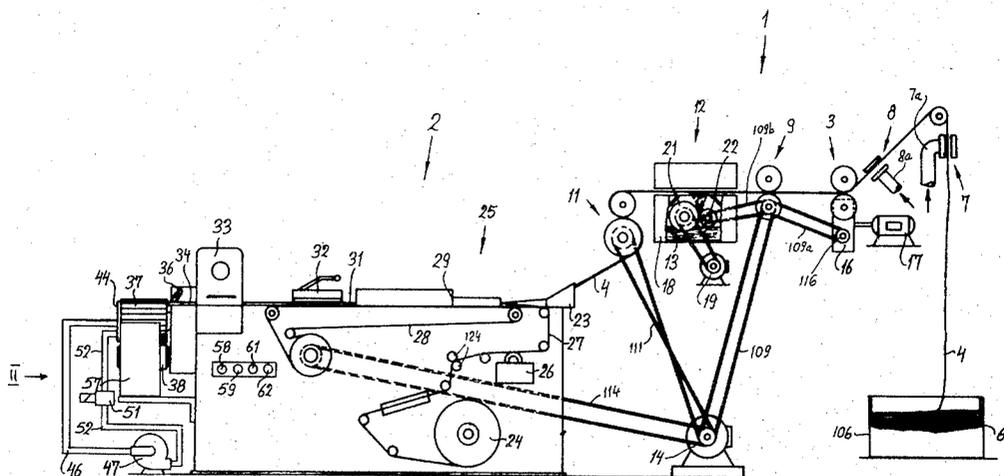
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[57] **ABSTRACT**

Filter rod sections which are produced in a variable-speed filter rod making machine are automatically expelled from the flutes of a transfer drum in response to any changes in the speed of the machine. Such changes may involve acceleration of the machine from zero speed to a first speed, acceleration from the first speed to a second higher speed, deceleration from the second higher to the first speed, and deceleration from the second higher or first speed to zero speed. The ejection is carried out in order to prevent filter rod sections which contain the customary plasticizing or bonding agent from remaining in the machine when the machine is idle, and to prevent filter rod sections which contain insufficient or excessive quantities of bonding agent from reaching the same destination as the satisfactory sections when the machine is started or accelerated from a lower to a higher speed. The application of bonding agent to the filaments of the tow which is to form the fillers of filter rod sections is terminated in immediate response to actuation of the device which causes a deceleration of the machine.

10 Claims, 3 Drawing Figures



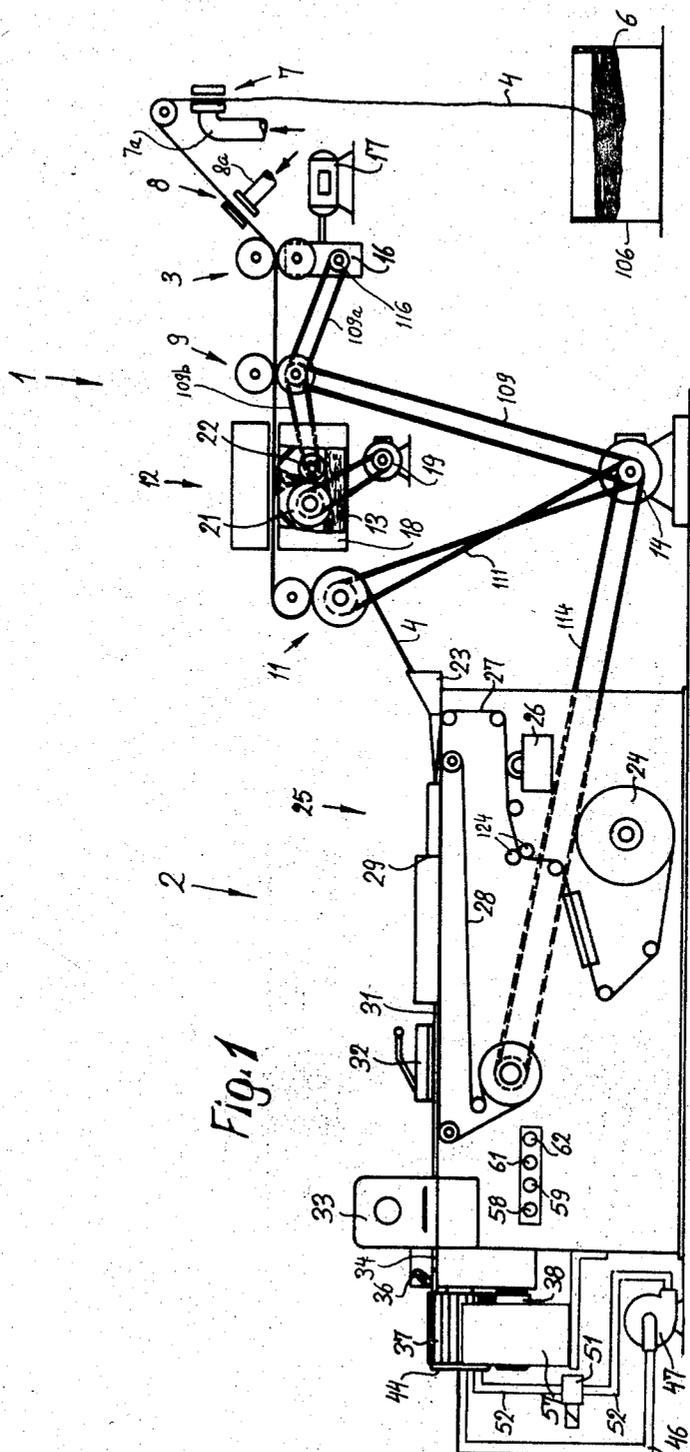


Fig. 1

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 II

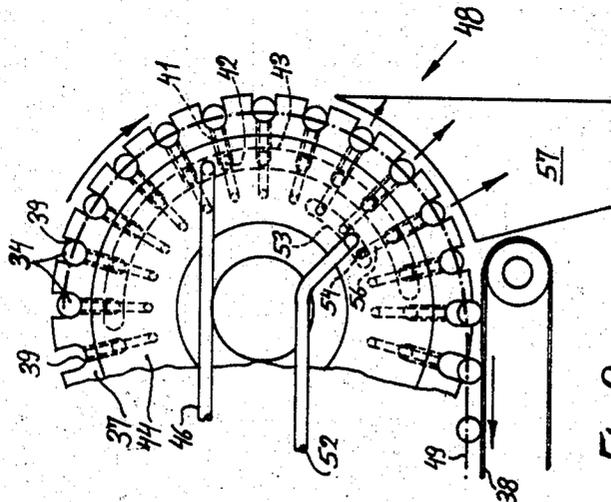
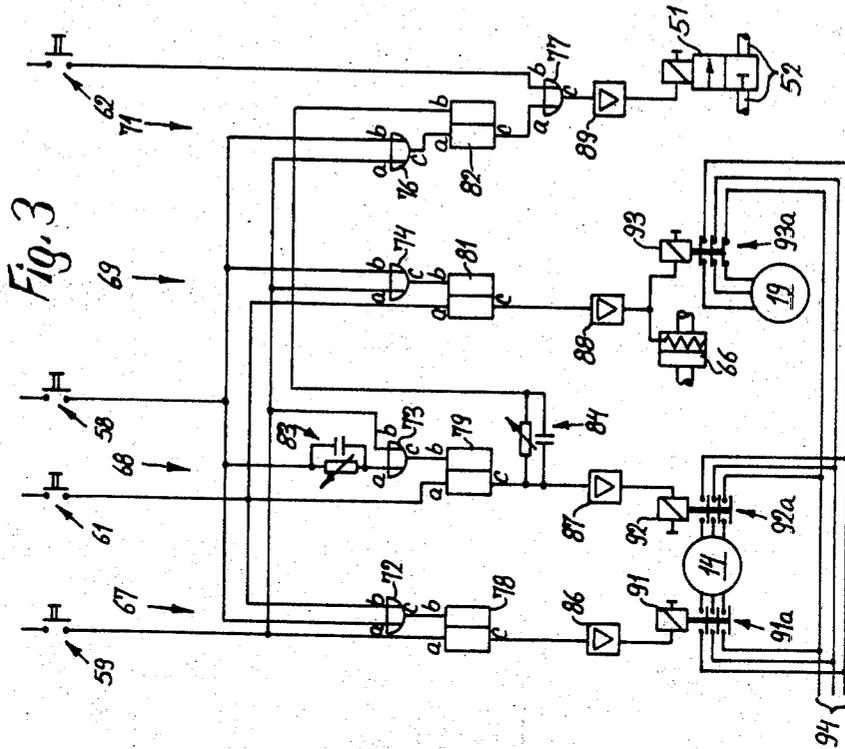


Fig. 2

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APPARATUS FOR REGULATING THE OPERATION OF FILTER ROD MAKING MACHINES

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus for regulating the operation of filter rod making machines. More particularly, the invention relates to improvements in an apparatus for regulating the operation of filter rod making machines of the type wherein a multifilament tow is treated by a liquid bonding medium or plasticizer prior to being converted into a wrapped filter rod which is thereupon subdivided into filter rod sections or filter elements of desired length.

The purpose of the plasticizer is to soften portions of synthetic plastic filaments in the tow and to thus insure that the softened portions of filaments adhere to each other when the conversion of the tow into a filter rod is completed. The plasticizer is thereupon caused to set whereby the filter rod sections exhibit a certain resistance to deformation. In presently known filter rod making machines, the application of plasticizer to the filaments of a multifilament tow is started in automatic response to begin of lengthwise movement of the tow and is terminated in response to complete stoppage of the tow. Therefore, those increments of the tow which advance through the plasticizing station during acceleration from zero speed to normal speed as well as during deceleration to zero speed receive relatively large quantities of plasticizer. This invariably causes problems because the hardened plasticizer which remains in the machine while the latter is idle is likely to affect the operation of moving parts when the machine is restarted. Furthermore, the filter rod sections which contain insufficient or excessive quantities of plasticizer are unsatisfactory and should not be permitted to enter a machine for the production of filter-tipped cigarettes, cigars, cigarillos or like smokers' products.

SUMMARY OF THE INVENTION

An object of the invention is to provide a novel and improved apparatus for regulating the operation of filter rod making machines, especially as concerns the start and termination of treatment of multi-filament tows with a bonding or plasticizing medium and as concerns the segregation of unsatisfactory filter rod sections from satisfactory sections.

Another object of the invention is to provide a novel and improved apparatus for producing filter rod sections containing fillers of filamentary material which were treated with a bonding or plasticizing medium, and for automatically segregating all such filter rod sections which are defective or are likely to be defective because they are produced during certain stages of operation of the filter rod making machine.

A further object of the invention is to provide a filter rod making machine with novel means for insuring that all such filter rod sections or portions of filter rod which contain at least some plasticizing or bonding medium are automatically expelled before the machine is brought to a halt.

An additional object of the invention is to provide a filter rod making machine with novel automatic ejecting or segregating means which prevents retention in the machine of such portions of filter rod or tow which are likely to interfere with proper operation of the ma-

chine when the latter is started after a relatively short or relatively long period of idleness.

Still another object of the invention is to provide a novel and improved control system or regulating system which can be built into or combined with presently known and utilized filter rod making machines of the type wherein a tow of filamentary material is treated with a bonding medium prior to conversion into a wrapped filter rod.

The apparatus of the present invention is resorted to for the forming or making and manipulating of rod-like filter elements, particularly filter rod sections of multiple unit length. The apparatus comprises the means of moving a multifilament tow lengthwise, means for treating the moving tow with a bonding medium, preferably with a finely atomized plasticizing agent such as triacetin, means for converting the thus treated tow into a rod-like filler, preferably by moving the tow through a horn-shaped condensing device, means for providing the filler with a wrapper to form a wrapped filter rod, means for subdividing the filter rod into discrete filter elements or sections, means for moving the filter elements along a predetermined path, means for changing the speed of the tow, filler and filter rod, and means for removing from the predetermined path at least some filter elements in response to each such speed change, preferably a predetermined number of filter elements or a number which is transported along a given portion of the path within a predetermined period of time.

The speed changing means preferably comprises means for producing an electric, pneumatic or other suitable signal simultaneously with the initiation of a speed change, and the removing means preferably comprises means for expelling from the path a predetermined number of filter elements in response to each signal or for expelling from the path filter elements for a predetermined period of time in response to each signal.

If the speed changing operation involves reducing the speed of the tow, filler and filter rod to zero speed, such reduction in the speed preferably takes up a predetermined interval of time and the removing means then preferably comprises means for expelling from the predetermined path all such filter elements which enter a certain portion of the path within such interval of time. The treating operation is preferably terminated at the start of the interval, i.e., in immediate response to initiation of a reduction in the speed of the tow, filler and filter rod from a predetermined speed to zero speed. It is preferred to select the length of the interval in such a way that all filter elements which contain at least some bonding medium are expelled from the path prior to full stoppage of the tow.

If the speed changing operation involves an acceleration of the tow, filler and filter rod from zero speed to a predetermined speed, such acceleration preferably takes up a predetermined interval of time and the treating means preferably comprises means for applying to the tow an effective amount of bonding medium immediately from the start of such interval. The removing means then comprises means for expelling filter elements from the predetermined path from the start of the interval and for a predetermined period of time which may approximate or equal the length of the interval.

The acceleration of the tow, filler and filter rod to the predetermined speed can be accomplished in two stages which respectively take place during first and second portions of the interval, and the length of the aforementioned period of expulsion of filter elements from their path preferably exceeds the length of the first portion of the interval. As a rule, the length of the period during which the filter elements are being expelled from their path starting with the begin of acceleration of the tow from zero speed to the predetermined speed will at least equal the combined length of both portions of the aforementioned interval.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved filter rod making machine 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 side elevational view of a variable-speed filter rod making machine which embodies the invention;

FIG. 2 is an enlarged fragmentary end elevational view as seen in the direction of arrow II in FIG. 1; and

FIG. 3 is a diagram of the control system of the filter rod making machine.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. 1 and 2, there is shown a filter rod forming or making machine of the type known as KDF and produced by Hauni-Werke Körber & Co. K.G., of Hamburg-Bergedorf, West Germany. The machine comprises a first main section 1 which includes means for treating synthetic plastic filaments and for forming a loose multi-filament tow 4 of filter material, and a second main section 2 which converts the tow 4 into a continuous filler rod, wraps the filler rod into a web 27 of wrapping material to form a continuous wrapped filter rod 31, and severs the rod 31 to furnish discrete filter rod sections or filter elements 34 of desired length.

The first main section 1 comprises a source 6 of filaments which supplies a tow 4, and a pair of cooperating advancing rolls 3 which continuously draw the tow 4 from the source 6. The source 6 is a bale of filter material which is being withdrawn from a container 106 in the form of the tow 4. On its way toward the advancing rolls 3, successive increments of the tow 4 pass along two opening or spreading nozzles 7 and 8 which receive compressed air from a suitable source by way of conduits 7a, 8a and serve to discharge compressed air across the path of the tow 4 so as to separate the filaments from each other, i.e., to loosen or open the tow 4 and to impart to it the shape of a band. The advancing rolls 3 are followed by two additional pairs of advancing and tensioning rolls 9 and 11 which are spaced from each other, as considered in the longitudinal direction of the tow 4, so as to provide room for a treating unit 12 which serves to apply to discrete filaments of the tow 4 a liquid plasticizer or bonding medium 13 (e.g., triacetin) and to thus convert the tow 4 into a treated tow. The treating unit 12 includes applicator means for

spraying the liquid plasticizer across the path of the opened tow 4 which is preferably in the form of a wide layer or band to insure adherence of liquid particles to a large number of filaments. At least one roll of each of the pairs of rolls 9 and 11 is preferably provided with circumferentially extending grooves or flutes and the second roll of each of the pairs of rolls 9 and 11 preferably consists of or comprises a peripheral layer of elastomeric material having a smooth external surface.

The drive means for the advancing rolls 3, 9 and 11 includes a prime mover here shown as a variable-speed electric motor 14 which has an output shaft for several pulleys one of which drives a belt 111 for the lower roll 11 and another of which drives a belt 109 for the lower roll 9. The lower roll 9 drives a further belt 109a for the input member 116 of a variable-speed transmission 16. The output member of the transmission 16 drives the lower advancing roll 3. The ratio of the transmission 16 can be regulated by a servomotor here shown as a variable-speed electric motor 17. The rotational speed of the advancing rolls 3 is less than the speed of the rolls 9 and 11 so that the filaments of the tow 4 are stretched or tensioned in the zone between the rolls 3 and 9 to further insure that the filaments are spaced from each other during travel through the station accommodating the treating unit 12.

The treating unit 12 comprises a vessel or tank 18 which constitutes a source for a supply of plasticizer or bonding medium 13, a first applicator in the form of a roller 21 which dips into the supply of plasticizer in the tank 18 and is driven by an electric motor 19, and a second applicator in the form of a brush 22 which withdraws the film of plasticizer 13 from the periphery of the rotating roller 21 and atomizes and sprays the thus withdrawn plasticizer across the path for the filaments of the tow 4. The brush 22 is driven by a belt 109b which is trained around a pulley on the shaft for the lower advancing and tensioning roll 9.

The second main section 2 of the filter rod making machine comprises a funnel-shaped condensing horn 23 which causes successive increments of the treated tow 4 leaving the lower advancing and tensioning roll 11 to assume the shape of a rod (so-called filter rod). The horn 23 is mounted on the frame of the filter rod making machine upstream of a wrapping unit 25 which includes an endless belt 28 cooperating with a draping device 29 to wrap successive increments of the treated tow 4 into the web 27. The latter is stored on a bobbin 24 and is being withdrawn by tow feeding rolls 124 to move along a suitable paster 26 serving to coat at least one marginal portion of the web 27 with a strip of adhesive. The draping device 29 causes the web 27 to form a tube which surrounds the filler rod and wherein the adhesive-coated marginal portion overlaps the other marginal portion. The adhesive is then heated by a heated sealer plate 32 which insures that the wrapper of the filter rod 31 issuing from the wrapping unit 25 does not open up during further treatment of the rod 31 and rod sections or filter elements 34.

The sealer plate 32 is followed by a severing device 33, known as cutoff, which severs the wrapped filter rod 31 at regular intervals to form a file of discrete filter rod sections or filter elements 34. Successive sections 34 are accelerated by a revolving cam or kicker 36 which propels the sections 34 into successive flutes 39 of an endless transporting conveyor 37 (see also FIG. 2) here shown as a drum which is rotated about

a horizontal axis in synchronism with the rate at which the cutoff 33 severs the rod 31. In the illustrated machine, the transporting drum 37 serves to convert a single file of filter rod sections 34 which move axially into at least one row wherein the sections 34 move side-ways. Such sections 34 can be introduced into the magazine of a filter cigarette making machine to be subdivided into filter plugs and to be assembled with plain cigarettes to form filter cigarettes. The illustrated transporting drum 37 is assumed to form a single row of filter rod sections 34 which are deposited on the upper stretch of an endless belt 38 for transport into the magazine of the filter cigarette making machine, not shown. It is clear that the belt 38 can transport the filter rod sections 34 into storage, into a machine for the production of filter-tipped cigars or cigarillos, or into a machine for the production of composite (multiplex) filter plugs which may contain, for example, one or more plugs containing fillers of filamentary material and a plug containing granular material.

FIG. 2 shows that the transporting drum 37 is provided with radially inwardly extending channels or ports 41, there being at least one port 41 for each flute 39, and with axially parallel channels or blind bores 42 each of which extends to one end face of the transporting drum 37 (to the left-hand end face, as viewed in FIG. 1). Each bore 42 is in communication with the port or ports 41 for one of the flutes 39. The transporting drum 37 rotates with reference to a stationary valve plate 44 which abuts against its left-hand end face, as viewed in FIG. 1, and is formed with two arcuate grooves 43 and 53. The groove 43 is connected with a suction generating device or blower 47 (FIG. 1) having a suction side connected with the groove 43 by way of a suction conduit 46. The groove 43 is located at such a distance from the axis of the transporting drum 37 that it communicates with those blind bores 42 which are located between a first transfer station accommodating the accelerating cam 36 and a second transfer station where the filter rod sections 34 leave the respective flutes 39 to descend onto the upper stretch of the belt 38. Thus, the filter rod sections 34 which are propelled into the flutes 39 by the accelerating cam 36 are held in such flutes by suction during travel toward the belt 38. The path of the filter rod sections 34 in the flutes 39 of the transporting drum 37 and on the upper stretch of the belt 38 is indicated by a phantom line 49.

The transporting drum 37 further cooperates with a pneumatic segregating or ejector unit 48 which includes a supply conduit 52 connected to the pressure side of the blower 47 and serving to supply compressed air into the groove 53 of the valve plate 44. The segregating unit 48 serves to expel filter rod sections 34 from the respective flutes 39 in response to opening of a normally closed electromagnetically operated valve 51 in the supply conduit 52. The thus ejected or segregated sections 34 are propelled into a removable collecting or intercepting receptacle 57. The transporting drum 37 is provided with additional radially extending ports or channels 56, at least one for each flute 39, and with axially parallel channels or blind bores 54, one for each flute 39 and each communicating with the respective port or ports 56. The groove 53 is located at such a distance from the axis of the transporting drum 37 that it communicates with successive bores 54, and, when the valve 51 in the supply conduit 52 is open, a stream of compressed air is free to enter the respective ports 56

and to expel filter rod sections 34 from their flutes 39 by overcoming the suction in the corresponding ports 41.

A belt 114, which is driven by the motor 14, serves to drive the belt 28 and other movable parts of the second main section 2 (including the transporting drum 37).

The filter rod making machine further comprises a set of three signal producing speed-changing devices here shown as pushbuttons 58, 59 and 61 mounted on a control panel of the machine frame (see FIG. 1). The pushbuttons 58, 59, 61 serve to produce signals which change the speed of the drive means 14 for the advancing means 3, 9, 11 of the filter rod making machine. A further pushbutton 62 serves to operate the segregating unit 48 at the will of the operator.

The pushbutton 62 is actuated by the person in charge when it is desired to expel one or more filter rod sections 34 from the respective flute or flutes 39 of the transporting drum 37, for example, to test the wrappers or fillers of such filter rod sections in a suitable testing apparatus, not shown. The pushbutton 58 is an arresting device because it can produce signals which serve to arrest the motor 14; the pushbutton 59 is a starting device because it can produce signals which start the motor 14 to accelerate the movable parts to the lower of two speeds; the pushbutton 61 is actuated in order to accelerate the motor 14 from the lower speed to the higher or normal speed. Actuation of the pushbuttons 58, 59, 61, 62 results in closing of switches which are schematically shown in FIG. 3.

The control system of the filter rod making machine is shown in FIG. 3. This control system serves to operate the segregating unit 48 and the applicator means 21, 22 of the testing unit 12. FIG. 3 shows the aforementioned signal producing pushbuttons 58, 59, 61, 62, the electric motors 14 and 19, and the electromagnetically operated valve 51 in the supply conduit 52. The motor 14 is a polyphase synchronous motor, preferably a pole-changeable motor. FIG. 3 further shows an electromagnetically operated clutch 66 which is mounted between the rotary applicator brush 22 of the treating unit 12 the shaft of a pulley driven by the belt 109a of FIG. 1 and must be energized to transmit torque to the brush 22 when the motor 14 is on.

A first branch or portion 67 of the control system serves to start the filter rod making machine and to accelerate its moving parts to the first of the two speeds. A second branch or portion 68 of the control system serves to accelerate the machine from the lower to the higher speed. A third branch 69 of the control system serves to start or arrest the treating unit 12, and a fourth branch 71 of the control system serves to regulate the operation of the segregating unit 48.

The components of the control system of FIG. 3 include logical circuits 72, 73, 74, 76 and 77 of the type known as OR-gates, signal storing circuits or devices 78, 79, 81 and 82, R-C links 83 and 84, amplifiers 86, 87, 88 and 89, and relays 91, 92, 93 respectively having sets of contacts 91a, 92a, 93a. The output c of each OR-gate transmits a signal in response to reception of a signal at one or both inputs a, b of the respective OR-gate. The signal storing circuits have outputs c which transmit signals in response to reception of signals at the respective inputs a, and such signals are erased in response to reception of signals at the respective inputs b. The R-C links 83 and 84 constitute adjustable time-

delay means. The contacts 91a or 92a of the relay 91 or 92 can connect the motor 14 with a source of polyphase current by way of leads 94. The contacts 93a of the relay 93 can connect the motor 19 with the source of polyphase current, also by way of the leads 94.

The operation of the filter rod making machine is as follows:

If the person in charge wishes to start the machine, the starting pushbutton 59 is actuated to cause the transmission of an electric signal to the input a of the signal storing circuit 78. The output c of the signal storing circuit 78 transmits a signal to the amplifier 86 (also after the finger pressure against the pushbutton 59 is terminated) to energize the relay 91 which closes its contacts 91a to thereby connect one winding of the motor 14 with the energy source by way of the leads 94. Such winding causes the motor 14 to rotate at the lower of two speeds.

The signal which is generated in response to actuation of the starting pushbutton 59 is further transmitted to the input a of the OR-gate 76 whereby the latter's output c transmits a signal to the input a of the signal storing circuit 82. Therefore, the output c of the signal storing circuit 82 transmits a continuous signal to the input a of the OR-gate 77. The transmission of such signal is not terminated in response to termination of finger pressure against the pushbutton 59. The output c of the OR-gate 77 transmits a signal to the amplifier 89 which energizes the solenoid for the valve 51 so that the latter opens and enables the supply conduit 52 to admit a stream of compressed air from the pressure side of the blower 47 into the groove 53 of the valve plate 44. During the interval which is required to accelerate the motor 14 to the lower of two speeds in response to actuation of the pushbutton 59, the treating unit 12 remains idle because the clutch 66 remains disengaged so that the motor 14 cannot drive the applicator brush 22. Also, the motor 19 is disconnected from the energy source because the contacts 93a of the relay 93 are held in the illustrated open positions so that the applicator roller 21 is idle. The filter rod sections or filter elements 34 which are being produced during the interval of acceleration of the motor 14 are ejected by streams of compressed air which flow from the groove 53 of the valve plate 44 into successive bores 54 and thence into the respective ports 56 to impinge against the filter rod sections in the flutes 39 and to expel them into the receptacle 57. Such filter rod sections are unsatisfactory because their filaments did not pass through a spray of atomized plasticizer during travel between the advancing and tensioning rolls 9 and 11.

The operator thereupon actuates the pushbutton 61 which causes the transmission of a signal to the input a of the signal storing circuit 79 and to the input b of the OR-gate 72. The output c of the OR-gate 72 transmits a signal to the input b of the signal storing circuit 78 so that the latter ceases to transmit a signal to the amplifier 86. The relay 91 is deenergized and its contacts 91a reassume the illustrated open positions to disconnect the respective winding of the motor 14 from the energy source. The signal which is transmitted to the input a of the signal storing circuit 79 causes the latter's output c to transmit a signal to the amplifier 87 which energizes the relay 92. The latter moves its contacts 92a to the closed positions to thus connect the other (high-speed) winding of the motor 14 with the energy source by way of the leads 94. The transmission

of a signal to the amplifier 87 is not terminated in response to termination of finger pressure against the pushbutton 61. Thus, the motor 14 is not arrested in response to deenergization of the relay 91 because such deenergization takes place simultaneously with energization of the relay 92. The motor 14 is accelerated to the normal or higher speed during an interval which consumes a certain amount of time.

The signal which is generated in response to actuation of the pushbutton 61 is further transmitted to the input a of the signal storing circuit 81 so that the latter's output c transmits a signal to the amplifier 88 which energizes the clutch 66 and the relay 93. The contacts 93a connect the motor 19 with the energy source by way of the leads 94 so that the motor 19 drives the applicator roller 21 and the clutch 66 couples the applicator brush 22 with the pulley which is driven by the belt 109b whereby the brush forms a fine spray of atomized plasticizer 13 which is being removed from the peripheral surface of the roller 21 and is caused to move in a direction transversely of the path of the filaments which form the tow 4. The output c of the signal storing circuit 81 continues to transmit a signal to the amplifier 88 even after the finger pressure against the pushbutton 61 is terminated. The output signal from the signal storing circuit 79 is transmitted not only to the amplifier 87 for the relay 92 but also to the input b of the signal storing circuit 82. The signal is delayed by the R-C link 84 so that the circuit 82 ceases to transmit a signal to the amplifier 89 with a delay which is needed for acceleration of the motor 14 to its normal speed. The amplifier 89 deenergizes the solenoid for the valve 51 so that the blower 47 is sealed from the groove 53 of the valve plate 44. Thus, the ejection or segregation of filter rod sections is terminated when the motor 14 begins to drive the movable parts of the filter rod making machine at the normal speed.

It will be noted that the applicators 21, 22 of the treating unit 12 are operated in response to acceleration of the motor 14 to its normal speed because the signal which is generated in response to actuation of the pushbutton 61 causes an energization of the clutch 66 which drives the brush 22 and because such signal also causes the motor 19 to drive the roller 21 which withdraws a film of plasticizer 13 from the tank 18. The R-C link 84 insures that the belt 38 receives only those filter rod sections 34 whose filaments were properly treated with plasticizer 13. The satisfactory filter rod sections 34 are fed into a filter cigarette making machine or into storage.

If desired, the applicators 21, 22 of the treating unit 12 can be operated in response to actuation of the pushbutton 59, i.e., in response to starting of the motor 14 and during the interval of acceleration of the motor 14 to the lower speed. This would result in a higher consumption of plasticizer 13 because the rate at which the treating unit 12 sprays plasticizer onto the adjacent increments of the tow 4 is normally selected with a view to insure satisfactory treatment during normal (high-speed) operation of the filter rod making machine. The filter rod sections 34 which would be produced during the low-speed operation of the machine would have to be discarded anyway because they would contain a higher-than-normal amount of plasticizer.

In order to arrest the machine, the operator actuates the arresting pushbutton 58 to thus produce a signal which is transmitted to the inputs b of the OR-gates 74

and 76. The output *c* of the OR-gate 74 transmits a signal to the input *b* of the signal storing circuit 81 to erase the signal which causes energization of the clutch 66 and relay 93. The brush 22 is disengaged from the belt 109b and the motor 19 for the roller 21 is arrested. The output *c* of the OR-gate 76 transmits a signal to the input *a* of the signal storing circuit 82 which energizes the solenoid for the valve 51 by way of the OR-gate 77 and amplifier 89 so that the supply conduit 52 admits compressed air into the groove 53 of the valve plate 44 in order to eject all such filter rod sections which are being produced subsequent to termination of operation of applicators 21, 22 in the treating unit 12.

The signal which is produced in response to actuation of the pushbutton 58 is delayed by the R-C link 83 and is thereupon transmitted to the input *a* of the OR-gate 73 so that the output *c* of this gate transmits a signal to the input *b* of the signal storing circuit 79. This causes deenergization of the relay 92 so that the motor 14 is disconnected from the energy source. The R-C link 83 is adjusted in such a way that the motor 14 is arrested with a delay which is necessary to insure ejection of those filter rod sections which are being produced subsequent to termination of operation of applicators 21, 22 in the treating unit 12 and still contain at least some plasticizer 13. This prevents setting of the plasticizer in the main section 2 of the filter rod making machine. Hardened plasticizer could adversely affect the operation of the machine upon renewed starting of the motor 14.

If the operator wishes to reduce the operating speed of the machine from the normal speed to the lower speed, the pushbutton 59 is actuated while the relay 92 is energized to connect the second winding of the motor 14 with the energy source. The signal which is produced in response to actuation of the pushbutton 59 is transmitted to the input *b* of the OR-gate 73 whose output *c* transmits a signal to the input *b* of the signal storing circuit 79. This results in deenergization of the relay 92 so that the second winding of the motor 14 is disconnected from the energy source. At the same time, the relay 91 is energized by the amplifier 86 because the output *c* of the signal storing circuit 78 transmits a signal in response to actuation of the pushbutton 59. Thus, the motor 14 is decelerated to the lower speed. The operation of applicators 21, 22 in the treating unit 12 is terminated because the input *b* of the signal storing circuit 81 receives a signal by way of the input *a* and output *c* of the OR-gate 74. Also, the input *a* of the OR-gate 76 receives a signal to energize the solenoid for the valve 51 so that the segregating unit 48 expels those filter rod sections which are being produced while the motor 14 drives the respective movable parts at the lower speed.

Should the operator wish to remove samples of filter rod sections 34 while the machine is operated at normal speed, the receptacle 57 is replaced with another receptacle (not shown) and the pushbutton 62 is actuated to cause the transmission of a signal to the input *b* of the OR-gate 77. The output *c* of the OR-gate 77 transmits a signal to the amplifier 89 which energizes the solenoid for the valve 51 to admit compressed air into the groove 53 of the valve plate 44. The solenoid for the valve 51 remains energized as long as the operator continues to maintain the pushbutton 62 in depressed position. When the second receptacle accumulates a desired number of ejected filter rod sections 34,

the pushbutton 62 is released to close the valve 51 and the receptacle 57 is returned to the position shown in FIGS. 1 and 2.

An important advantage of the just described control system is that it prevents the setting of plasticizer 13 in the filter rod making machine when the machine is idle. This is due to the fact that the segregating unit 48 automatically expels all such filter rod sections which contain plasticizer and are in the machine subsequent to termination of operation of applicators 21, 22 in the treating unit 12. The unit 12 is deactivated prior to stoppage of the motor 14 which is arrested with such a delay that all filter rod sections 34 which are located upstream of the ejecting station are expelled before the parts of the main section 2 come to a halt.

Another advantage of the control system is that it causes segregation of all such filter rod sections 34 which are produced immediately after the machine is started, i.e., of all such filter rod sections which might not contain the optimum quantity of plasticizer.

A further advantage of the control system is that it can operate a segregating unit which is designed to expel filter rod sections while such filter rod sections travel sideways rather than lengthwise. It is much more difficult to insure expulsion of selected filter rod sections from a path wherein the sections move in a single file, i.e., lengthwise, especially if the filter rod sections are transported at a very high speed which is the case in a modern filter rod making machine.

It is clear that the improved filter rod making machine is susceptible of many further modifications without departing from the spirit of the invention. For example, the supply conduit 52 can communicate with the atmosphere and the ports 56 can constitute extensions of the respective ports 41 so that suction in the ports 41 moving past the groove 53 collapses when the valve 51 is open to permit communication of the groove 53 with the atmosphere. The ejection of selected filter rod sections from the flutes 39 of the drum 37 then takes place under the action of centrifugal force and gravity.

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 my 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. In a variable-speed machine for the production of rod-like filter elements, a combination comprising advancing means for moving a multi-filament tow lengthwise; treating means including a source of bonding medium and applicator means operable to apply bonding medium to the filaments of said tow; condensing means for converting the thus treated tow into a rod-like filler; wrapping means for providing the filler with a wrapper to form a filter rod; severing means for subdividing the rod into discrete filter elements; transporting means for advancing the filter elements along a predetermined path; segregating means operable to remove filter elements from said path; speed changing means actuatable to change the speed of said advancing means, said speed changing means comprising an arresting device

which is actuatable to arrest said advancing means; and control means for operating said segregating means in response to actuation of said speed changing means, said control means comprising means for terminating the operation of said applicator means in immediate response to actuation of said arresting device.

2. In a variable-speed machine for the production of rod-like filter elements, a combination comprising advancing means for moving a multi-filament tow lengthwise; treating means including a source of bonding medium and applicator means operable to apply bonding medium to the filaments of said tow; condensing means for converting the thus treated tow into a rod-like filter; wrapping means for providing the filler with a wrapper to form a filter rod; severing means for subdividing the rod into discrete filter elements; transporting means for advancing the filter elements along a predetermined path; segregating means operable to remove filter elements from said path; speed changing means actuatable to change the speed of said advancing means, said speed changing means comprising a starting device actuatable to start the movement of said advancing means; and control means for operating said segregating means in immediate response to actuation of said speed changing means, said control means comprising means for starting the operation of said applicator means in response to actuation of said starting device.

3. A combination as defined in claim 2, further comprising drive means for said advancing means, said drive means being operable at a plurality of speeds including a first speed and a higher second speed, said starting device being actuatable to start said drive means and to effect the acceleration of said drive means to said first speed within a first interval of time and said speed changing means further comprising a second device actuatable to accelerate said drive means from said first to second speed during a second interval of time, said control means being arranged to operate said segregating means for a period of time starting with actuation of said starting device and exceeding the length of said first interval.

4. A combination as defined in claim 1, wherein said

transporting means comprises an endless conveyor and said segregating means is adjacent to said conveyor.

5. A combination as defined in claim 1, wherein said segregating means comprises pneumatic ejector means.

6. A combination as defined in claim 1, wherein said advancing means is arranged to undergo deceleration to zero speed for a predetermined interval of time following the actuation of said arresting device and wherein said control means is arranged to maintain said segregating means in operative condition during said interval.

7. A combination as defined in claim 2, wherein said control means is arranged to operate said segregating means for a predetermined period of time following the actuation of said starting device.

8. A combination as defined in claim 1, further comprising drive means for said advancing means, said drive means being operable at a plurality of speeds including a first speed and a higher second speed, said speed changing means further comprising a starting device actuatable to start said drive means and to effect the acceleration of said drive means to said first speed within a first interval of time and a second device actuatable to accelerate said drive means from said first to said second speed during a second interval of time, said control means being arranged to operate said segregating means for a period of time starting with actuation of said starting device and exceeding the length of said first interval.

9. A combination as defined in claim 8, wherein said period of time at least approximates the combined length of said first and second intervals.

10. A combination as defined in claim 2, wherein said means for starting the operation of said applicator means in response to actuation of said starting device comprises means for starting said applicator means with a delay following the operation of said segregating means so that said applicator means does not apply bonding medium to the filaments of that portion of the tow which moves past said treating means immediately following the actuation of said starting device.

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