METHOD AND MEANS FOR REGULATING THE OPERATION OF APPARATUS FOR THE PRODUCTION AND PROCESSING OF CIGARETTES OR THE LIKE

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ABSTRACT
The operation of a production line including a cigarette making machine and a filter cigarette machine is regulated by a shift register which transports signals serving to initiate the starting and stoppage of various assemblies in the production line in a predetermined sequence. The shift register also serves to transport further signals produced by detectors which track filter cigarettes and their components. Such further signals are transmitted to an ejecting device which segregates those cigarettes which exhibit one or more defects or which are likely to exhibit defects because they are produced during certain stages of operation of the production line. The detectors scan the splices in a web of cigarette paper, the seam on the wrapper of a cigarette rod, plain cigarettes, filter rods, filter plugs and filter cigarettes.

17 Claims, 4 Drawing Figures
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CROSS REFERENCE TO RELATED APPLICATION

This is a continuation of our copending application Ser. No. 535 filed Jan. 5, 1970, now U.S. Pat. No. 3,672,373 granted June 27, 1972.

BACKGROUND OF THE INVENTION

The present invention relates to improvements in apparatus for the production of rod-shaped articles, particularly for the production of plain and/or filter-tipped cigarettes, cigars, cigarillos or analogous rod-shaped articles wherein two or more components are connected to or otherwise assembled with each other, for example, by means of adhesive-coated uniting bands or the like. The invention also relates to a novel method of producing and assembling two or more components to form plain and/or composite rod-shaped articles. The invention further relates to improvements in a method and means for segregating defective rod-shaped articles and/or their components from satisfactory articles and/or components.

It is already known to provide a filter cigarette machine or a cigarette packing machine with detectors which produce signals whenever they locate a defective cigarette and/or a defective component of a cigarette. Such signals are stored and thereupon used to effect ejection or segregation of defective articles or components when such articles reach a predetermined ejecting station. The means for delaying the transmission of signals to the ejecting device may include a chain of time-lag relays or a shift register through which the signals indicating defective articles and/or components are caused to travel stepwise in synchronism with travel of defective articles and/or components toward the ejecting station. A magnetic shift register is disclosed, for example, in British Pat. No. 1,071,985.

SUMMARY OF THE INVENTION

An object of the invention is to provide a filter cigarette machine or another apparatus for the production of rod-shaped articles (particularly rod-shaped tobacco-containing products) with novel and improved means for storing and transporting signals which are indicative of defective articles and/or components and to construct the signal storing and transporting means in such a way that it can perform one or more additional important functions.

Another object of the invention is to provide an apparatus (such as a production line including one or more machines) which embodies the improved signal storing and transporting means.

A further object of the invention is to provide an apparatus wherein the production of components and the assembly of such components into rod-shaped articles are started, regulated, terminated and otherwise controlled in a novel and improved way to reduce waste in the material of components and to reduce the number of rejected articles.

An additional object of an invention is to provide an apparatus for the production of filter cigarettes or the like wherein all of the assemblies which perform predetermined functions in connection with the production and further treatment of components of rod-shaped articles are automatically started and stopped in a predetermined sequence to reduce waste and to facilitate supervision.

Still another object of the invention is to provide a novel method of operating a production line which includes one, two or more discrete machines and of operating the assemblies of parts in such machine or machines in an optimum sequence.

A further object of the invention is to provide a novel method of programming the operation of various assemblies in a production line, of automatically starting, regulating and terminating the operation of such assemblies, and of automatically segregating defective articles or their components with minimal losses in time and material.

The method of the present invention is utilized for regulating the operation of apparatus which includes assemblies for the production and/or processing of cigarettes or analogous rod-shaped articles and wherein the articles and their components travel along a predetermined path. The apparatus may include a cigarette making machine and/or a filter cigarette machine. The method comprises the steps of tracking the articles and their components along the path, generating first signals in response to detection of defective articles and/or components, producing a succession of shift pulses and utilizing such pulses for transport of signals, at the speed of travel of articles, to at least one first station, generating second signals for starting and/or stoppage of assemblies, and utilizing the pulses for transport of second signals to at least one second station. The first signals can be utilized at the first station to effect segregation of respective (defective) articles and/or components from the path.

The first and second signals are preferably transported by a shift register which transports the signals at the operating speed of the apparatus and whose inputs and outputs are connected with controller circuits which respectively initiate stoppage and starting of various assemblies in a predetermined sequence.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved apparatus itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1a is a schematic front elevational view of a cigarette making machine which forms one part of the improved apparatus;

FIG. 1b is a schematic front elevational view of a filter cigarette machine which forms another part of the improved apparatus; and

FIG. 2 (composed of FIGS. 2a and 2b) is a diagram of the means for controlling the operation of the apparatus which includes the machines of FIGS. 1a and 1b.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1a and 1b illustrate an apparatus, here shown as a production line, which includes a cigarette making machine (FIG. 1a) of the type known as GARANT and produced by Hauni-Werke Korber & Co. K.G., of
Hamburg-Bergedorf, Western Germany, and a filter cigarette machine (FIG. 1b) of the type known as MAX and also produced by the Huni-werke. The filter cigarette machine receives plain cigarettes Z from the cigarette making machine and is placed at right angles thereto. For the sake of clarity, the machine of FIG. 1b is shown at right angles with reference to its position relative to the machine of FIG. 1a.

The cigarette making machine of FIG. 1a comprises a distributor 1 which discharges tobacco shreds into an elongated channel 2 and onto the upper stretch of an endless belt 3. The latter advances the resulting tobacco stem lengthwise toward and into the circumferential groove of a suction wheel 7 which is driven to rotate in a counterclockwise direction, as viewed in FIG. 1a. A trimming device 8 is adjacent to the groove of the suction wheel 7 and serves to remove the surplus so that the uppermost part of the suction wheel 7 transports a filler stream which advances along the lower stretch of a compacting belt 13. The latter subjects the filler stream to a compressing action and the thus compressed filler stream thereupon enters a wrapping unit 14 which applies therearound a continuous web 17 of cigarette paper in a manner well known in the art. The web 17 is drawn from a reel 16 and is led above the upper stretch of a garniture belt 15 in the wrapping unit 14.

A photosensitive detector 419 (shown in the lower left-hand portion of FIG. 1a) forms part of a testing or control unit 319 (FIG. 2a) and serves to generate signals in response to detection of splices between successive sections of the web 17. Such splices are preferably opaque to facilitate detection by the detector 419.

The wrapped cigarette rod Zs is transported lengthwise along a paste 4 which applies adhesive to at least one of the marginal portions of the web 17. The thus coated marginal portions pass along a sealer or heater 6 which applies heat and pressure to form a reliable seam and to thus convert the filler and the web 17 into the wrapped cigarette rod Zs. The pasted 4 is movable by an electromagnet 404 (FIG. 2a) which activates the pasted in response to starting of the cigarette making machine. The heater 6 is movable up and down toward and away from the path of the cigarette rod Zs by an electromagnet 406 (FIG. 2a) which lowers the heater and places it in operative position in response to starting of the cigarette making machine. The formation of the seam on the wrapper of the cigarette rod Zs is tracked by a photosensitive detector 407 which forms parts of a controller circuit 807 (FIG. 2a) for starting the cigarette making machine. The detector 407 generates signals as long as the heater 6 fails to produce a satisfactory seam.

A cigarette rod mutilating or breaking device 9 is located downstream of the detector 407 and is movable between an operative position 9A and an inoperative or idle position 9B. When in the position 9A, the mutilating device 9 directs the cigarette rod Zs into a collecting receptacle 18; this takes place when or as long as the seam on the wrapper of the rod Zs is unsatisfactory. When the mutilating device 9 moves from the position 9A to the position 9B, it breaks or severs the rod Zs whereupon the leading end of the satisfactory rod (delivered by the garniture belt 15) advances past the mutilating device 9 and into the aligned tubes 19 of a cutoff 21. A tube cleaner, here shown as a blower nozzle 403a, is located at the cutoff 21 to expel cigarettes, tobacco shreds and dust from the tubes 19 on starting of the cigarette making machine. The cutoff 21 severs the rod Zs at regular intervals to produce a single file of cigarettes Z of unit length. The nozzle 403a receives compressed fluid in response to opening of a solenoid-operated valve 403 (FIG. 2a).

The cigarette making machine further comprises a controller circuit 810 (FIG. 2a) which also regulates the starting of assemblies in the machine and includes a photosensitive detector 410 located past the cutoff 21. The detector 410 is designed to detect the absence of cigarettes Z in the path along which the cigarettes move away from the left-hand tube 19. For example, if the leading end of the cigarette rod Zs which was broken off by the mutilating device 9 fails to enter the tubes 19, the detector 410 generates signals to indicate the absence of cigarettes Z at the outlet of the cutoff 21.

The detector 410 is followed by an ejecting device 11 which preferably includes a nozzle 411a serving to discharge compressed air or other suitable gaseous fluid to thereby expel from the path a certain number of those cigarettes Z which are produced immediately after starting of the cigarette making machine. The admission of pressurized fluid into the nozzle 411a is controlled by a solenoid operated valve 411 (FIG. 2a).

A further photosensitive detector 413, which forms part of a controller circuit 813 (FIG. 2a) tracks the entry of cigarettes Z into the flutes of a transfer drum 26. The controller circuit 813 regulates the operation of the cigarette making machine and the detector 413 tracks the entry of cigarettes Z into the flutes of the drum 26 when the machine is started and accelerated. The drum 26 transfers cigarettes Z to the filter cigarette machine of FIG. 1b. The detector 413 generates signals when the flow of cigarettes into the flutes of the transfer drum 26 is interrupted. Once the cigarette making machine operates at normal speed, the detector 413 takes over or performs the functions of the detector 407 and 410.

Referring to FIG. 1b, the filter cigarette machine includes a magazine or hopper 35 for filter rods F of 6 times unit length. Such rods are discharged through a duct 33 into the flutes of a cutting drum 36 which cooperates with two rotary disk-shaped knives 34 to subdivide each rod F into three filter plugs of double unit length. A photosensitive detector 421 tracks the filter rods F in the duct 33 and forms part of a controller circuit 821 (FIG. 2a) which serves to supervise the operating condition of the filter cigarette machine. The detector 421 generates signals in response to interruption of feed or filter rods F toward the cutting drum 36.

The filter plugs of double unit length are staggered on a staggering or shuffling conveyor 37 which comprises three wheels having different diameters and/or traveling at different speeds. The shuffling conveyor may be similar to that shown in FIGS. 2–5 in U.S. Pat. No. 3,164,243 Rudszinzat et al. On leaving the conveyor 37, the filter plugs of double unit length are accepted by an aligning drum 38 which causes them to form a single file wherein the plugs move sideways into the flutes (not shown) of a further drum 39. The drive for the drum 39 includes an electromagnetic clutch 414 which can be disengaged to thus interrupt the transport of filter plugs to the flutes (not shown) of a transfer drum 40. The drum 39 drives the drums 36, 37, 38 through a system of mating gears, not shown, so that these
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The transfer drum 26 at the discharge end of the cigarette-making machine arranges the cigarettes Z in two rows and moves the cigarettes sideways into the flutes of an aligning drum 27 which in turn transfers pairs of cigarettes Z into successive flutes (not shown) of an assembly drum 28. Thus, once a flute of the assembly drum 28 moves past the transfer station between the drums 28 and 46, it accommodates a group of coaxial rod-shaped articles including a centrally located filter plug of double unit length. The drums are delivered into the flutes of a further transfer drum 29 which provides each group with an adhesive-coated uniting band. Such bands are supplied by a suction drum 46 which receives a continuous tape or web 41a from a bobbin 41. The tape 41a is drawn by two advancing rolls 47 and is moved along a roller-shaped applicator 43 of a paster 42. The applicator 43 receives a film of paste from a roll 43a which slips into the adhesive-containing tank of the paster 42. The leading end of the tape 41a is severed by a revolving cutter 44 so that the tape yields a succession of uniting bands which are coated with adhesive at those sides which face away from the periphery of the suction drum 46 and adhere to successive groups in the flutes of the transfer drum 29. The drive for the advancing rolls 47 of the feeding means for uniting bands includes an electromagnetic clutch 416 which can be disengaged to thus terminate the delivery of uniting bands to the transfer drum 29. The paster 42 becomes effective in response to energization of an electromagnet 417 whose armature 417a constitutes a lever arm supports a pair of rolls flanking a portion of the tape 41a. When the electromagnet 417 is energized, the armature 417a moves the adjacent portion of the tape 41a downwardly and into contact with the film of adhesive on the applicator 43. A control unit 323 (FIG. 2b) includes a detector 424 (FIG. 1b) which is adjacent to the applicator 43 and produces a signal at the start and on termination of application of paste to the tape 41a. Such signal is transmitted by way of an electric switch 423. The energy source for the switch 423 has been omitted for the sake of clarity.

The groups of rod-shaped articles in the flutes of the transfer drum 29 (each such group is connected with an adhesive-coated uniting band delivered by the suction drum 46) advance past a further detector or initiator 426 which forms part of a control unit 326 (FIG. 2b) and serves to produce signals in response to detection of splices between successive lengths of the tape 41a. Such splices are made readily detectable by application of pieces of metallic foil or the like in said splices. The drum 29 thereupon delivers groups and adhesive-coated uniting bands to a wrappings or rolling drum 48 which causes the groups to roll about their axes (preferably more than once) and to thus convert each uniting band into a tube which connects the respective filter plug of double unit length to the adjoining ends of aligned cigarettes Z. Thus, the drum 48 converts each group and the associated uniting band into a filter cigarette of double unit length. The shaft 48a of the drum 48 carries certain elements of a synchronization device 332. This device comprises a disk 332a on the shaft 48a and magnetic heads 332b, one for each flute (not shown) of the drum 48. The synchronization device 332 further comprises an induction coil 332c which is adjacent to the path of magnetic heads 332b and produces shift pulses at the rate at which the drum 48 receives and transports groups and uniting bands. The disk 332a rotates with and at the speed of the drum 48. The freshly wrapped filter cigarettes of double unit length move past and displace the trip 427a of an electric switch 427 which forms part of a control unit 327 (FIG. 2b). The trip 427a is positioned in such a way that it detects the presence or absence of filter plugs in successive filter cigarettes of double unit length. The switch 427 is caused to close when the trip 427a detects a defective cigarette of double unit length, i.e., a cigarette which does not include a filter plug of double unit length.

The presence or absence of uniting bands (i.e., tubes) in successive filter cigarettes of double unit length is detected by a photosensitive detector 428 which is located past the trip 427a and is also adjacent to the periphery of the wrapping drum 48. The detector 428 forms part of a control unit 328 (FIG. 2b) and generates a signal in response to detection of a filter cigarette of double unit length which is without a convoluted uniting band.

The wrapping drum 48 delivers filter cigarettes of double unit length into successive flutes (not shown) of a testing drum 49 which is provided and associated with means for determining the presence of leaks in the convoluted uniting band and/or in the wrappers of cigarettes Z. Such means includes a nozzle 429a which blows a stream of air through successive filter cigarettes of double unit length. An evaluating device 429 evaluates the streams which have passed through the cigarettes and forms part of a testing or control unit 329 (FIG. 2b). The device 429 may include a diaphragm which causes the generation of an electric current having a strength which is indicative of the quality of tested cigarettes. A suitable testing unit which can be used in the machine of FIG. 1b is disclosed for example, in U.S. Pat. No. 3,412,856.

The testing drum 49 transport filter cigarettes of double unit length past the solenoid valve controlled nozzle or nozzles 431 of an ejecting or segregating device 31 which receives signals from the unit 329 and expels from the drum 49 defective cigarettes before such cigarettes enter the flutes (not shown) of a cutting drum 50. The latter cooperates with a rotary disk-shaped cutter 50a which severs successive cigarettes of double unit length so that each individual cigarette yields two filter cigarettes of unit length. The cutting drum 50 delivers pairs of filter cigarettes of unit length to an inverting drum 51 which inverts one cigarette or each pair end-for-end so that the filter plugs of all cigarettes face in the same direction. Such cigarettes are then delivered to a transfer drum 52 which transports them to a take-off drum 53. The latter can feed cigarettes to a belt or the like which transports them to a tray filling device or directly to a packing machine, not shown.
FIGS. 2a and 2b show schematically a shift register 300 which includes the synchronizing device 332 and has inputs I to XII for signals indicating defects and/or serving to trigger the terminate various operation, and outputs D to T for such signals. These Figures further show control means 303, 309, 311 and 318 for controlling the starting of the assemblies of the production line including the machines of FIGS. 1a and 1b, control means 308, 322, 321 for stopping the assembling of the production line, and control means 304, 306, 312, 314, 316, 317, 307, 310, 313 which serve to control the starting as well as stoppage of assemblies of the production line. FIGS. 2a and 2b further show the aforementioned control units 318, 322, 321, 327, 328, 329 and a logical connection 912. These means detect defective products (cigarettes) or their components. The numeral 331 denotes the electrical means of the device 31 which serves for segregating or ejecting defective articles from their path. Still further, FIGS. 2a and 2b illustrate the operative connections between the just enumerated means and the shift register 300. The latter includes one hundred and twenty shifting stages S1 to S120 for signals which serve to control the operation of the production line and for signals which indicate defects, and corresponding driving stages 333 (indicated by broken lines) for pushing forward by the synchronizing device 332. The register 300 is assembled in integrated building blocks of the series DT-MU-L produced by the Firm SGS of Milan, Italy. The number of stages in the register 300 corresponds to the number of discrete and unsevered cigarettes between the channel of the cigarette making machine and the nozzle 431 in the filter cigarette machine. Each of the shifting stages S1 to S120 is a JK-Master-Slave flip-flop. The register 300 is of the type which is cleared prior to reception of a signal for starting or stoppage of the production line. The erasing inputs 334 are indicated in part by solid lines and in part by broken lines. The elements of the control units and other means shown in FIGS. 2a and 2b are known in the art and include logical circuits such as AND-, OR-, NOT-gates, storages, photosensitive detectors, initiators, relays, and monostable multivibrators which perform the function of trigger circuits (hereinafter called triggers).

The starting means 303 of the group of means for controlling the starting of assemblies in the production line includes a start controller circuit 803 (composed of two AND-gates 703a and 703b, a storage 603 and an amplifier 503) and the aforementioned activating or setting member 403 (solenoid operated valve in the supply conduit for compressed air) for the tube cleaner nozzle 403a of the machine shown in FIG. 1a. The outputs E and D of the register 300 are each connected with one input of the AND-gates 703a and 703b. The outputs of the AND-gates 703a, 703b and connected with the inputs a and b of the storage 603. The output d of the storage 603 is connected with the input of the amplifier 503 and the output of this amplifier is connected with the solenoid operated valve 403.

The starting means 309 of the group of means for controlling the starting of assemblies in the production line includes a start controller circuit 809 (composed of an AND-gate 709, storage 609 and an amplifier 509) and a setting or activating member 409 (electromagnet) for the mutilating device 9. The output K of the register 300 is connected with one input of the AND-gate 709 and the output of the gate 709 is connected with the input b of the storage 609. The output c of the storage 609 is connected with the input of the amplifier 509 and the output of this amplifier is connected with the electromagnet 409.

The starting means 311 comprises a start controller circuit 811 (composed of two AND-gates 711a, 711b, a storage 611 and an amplifier 511) and the setting or activating member 411 (solenoid operated valve) for the nozzle 411a of the ejecting device 11. The outputs M and L of the register 300 are connected with inputs of AND-gates 711a, 711b and the outputs of the AND-gates 711a, 711b are connected with the inputs a and b of the storage 611. The output d of the storage 611 is connected with the input of the amplifier 511 and the output of this amplifier is connected with the valve 411.

The control means 318 comprises a start controller circuit 818 which produces a control signal serving to automatically start the assemblies in the machines of the production line in a predetermined sequence and to terminate the starting operation. The start controller circuit 818 includes a trigger 518, an OR-gate 618, a storage 320 and an associated OR-gate 720, and the starting means 318 further comprises a master switch 418 which is connected with the drive for the cigarette making machine by an operative connection indicated by arrow 1,000. The switch 418 is connected with the input of the trigger 518. The output of the trigger 518 is connected with one input of the OR-gate 618, and the output of the gate 618 is connected with the input XII of the register 300. The output of the trigger 518 is further connected with the input b of the storage 320 and with the input a of a storage 330. Still further, the output of the trigger 518 is connected with the input a of the storage 609 in the circuit 809 (mutulating device 9).

The output S of the register 300 is connected with one input of the OR-gate 720 and the output of the gate 720 is connected with the input a of the storage 320. The output of the OR-gate 720 is further connected with the input a of a storage 607 of the controller circuit 807 and with the input b of a storage 610 of the controller circuit 810.

The starting and stopping means 304 which is active during starting as well as during stoppage of the production line includes a controller circuit 804 (composed of an AND-gate 704, a storage 604 and an amplifier 504) and the setting member (electromagnet) 404 for activating the heater 4. The output F of the register 300 is connected with one input of the AND-gate 704 and the output of the gate 704 is connected with the input a of the storage 604. The output c of the storage 604 is connected with the input of the amplifier 504 and the latter's output is connected with the electromagnet 404.

The means 306 comprises a controller circuit 806 (composed of an AND-gate 706, a storage 606 and an amplifier 506) and the setting member (electromagnet) 406 for activating the heater 6. As stated before, the electromagnet 406 can move the heater 6 relative to the path of the filler rod and web 17 on the upper stretch of th garniture belt 15. The output G of the register 300 is connected with one input of the AND-gate 706, and the output of the gate 706 is connected with the input a of the storage 606. The output c of the storage 606 is connected with the input of the amplifier 506, and the output of this amplifier is connected with the electromagnet 406.
The means 312 comprises a controller circuit 812 (composed of an AND-gate 712, a storage 612 and an amplifier 512) and a setting member relay 412 which serves to switch the drive of the cigarette making machine from operation at a lower speed to operation at a higher speed. The output M of the register 300 is connected with one input of the AND-gate 712 and the output of this gate is connected with the input b of the storage 612. The output d of the storage 612 is connected with the input of the amplifier 512 and the output of this amplifier is connected with the relay 412.

The means 314 comprises a controller circuit 814 (composed of two AND-gates 714a, 714b, a storage 614, and an amplifier 514) and the setting member (clutch) 414 which controls the drive for delivery of filter rods F. The output R and O of the register 300 are connected with one input each of the AND-gates 714a, 714b and the outputs of these gates are connected with the inputs a and b of the storage 614. The output c of the storage 614 is connected with the input of the amplifier 514 and the latter's output is connected with the clutch 414.

The means 316 comprises a controller circuit 816 (composed of two AND-gates 716a, 716b, a storage 616 and an amplifier 516) and a setting member (electromagnetic clutch) 416 in the drive for the advancing rolls 47. The outputs R and Q of the register 300 are connected with one input each of the AND-gates 716a, 716b and the outputs of these gates are connected with the inputs a and b of the storage 616. The output c of the storage 616 is connected with the input of the amplifier 516 and the latter's output is connected with the clutch 416.

The means 317 comprises a controller circuit 817 (composed of two AND-gates 717a, 717b, a storage 617 and an amplifier 517) and a setting member 417 (namely, the aforementioned electromagnet which is energizable to activate the paster 42 of the filter cigarette machine). The outputs S and P of the register 300 are connected with one input each of the AND-gates 717a, 717b and the outputs of these gates are respectively connected with the inputs a and b of the storage 617. The output c of the storage 617 is connected with the input of the amplifier 517 whose output is connected with the electromagnet 417.

The means 307 comprises the second controller circuit 807 which monitors the seam on the wrapper of the cigarette rod Zs and is composed of an AND-gate 707, storage 607, and amplifier 507. The means 307 also includes the aforementioned photosensitive detector 407 which constitutes a setting member. The means 307 further comprises a second controller circuit 907 (composed of three AND-gates 940, 960, 970 and a NOT-gate 950) and an OR-gate 530 connected with the stopping means 308. The output B of the register 300 is connected with one input of the AND-gate 707 and the output of this gate is connected with the input b of the storage 607. The output d of the storage 607 is connected with the input of the amplifier 507, and the output of this amplifier is connected with the light source or lamp 407a of the photosensitive detector 407. The receiver 407b of the detector 407 is connected with one input of the AND-gate 960 in the controller circuit 907.

The output J of the register 300 is connected with one input of the AND-gate 970 in the controller circuit 907. The output of the AND-gate 970 is connected with one input each of the AND-gate 960 and 940. The output of the AND-gate 940 is connected with the input VIII of the register 300. The output of the AND-gate 960 is connected with one input of the OR-gate 530 and with the input of the NOT-gate 950. The output of the NOT-gate 950 is connected with one input of the AND-gate 940. The output of the OR-gate 530 is connected with one input of the OR-gate 720 of the controller circuit 818, with one input of the OR-gate 608 of the means 308 and with one input of the OR-gate 340 in the means 322 which serves to stop the production line.

The means 310 comprises the controller circuit 810 whose photosensitive detector (setting member) 410 determines the absence of the cigarettes A at the tubes 19 of the cutoff 21. The controller circuit 810 further comprises AND-gate 710, the storage 610 and an amplifier 510 which is connected with the detector 410. The means 310 further comprises the OR-gate 530 which is connected with the means 308. The output L of the register 300 is connected with one input of the AND-gate 710 and the output of the gate 710 is connected with the input a of the storage 610. The output c of the storage 610 is connected with the input of the amplifier 510 and the output of the amplifier 510 is connected with the light source or lamp 410a off the detector 410. The receiver 410b of the detector 410 is connected with one input of the OR-gate 530.

The means 313 comprises the controller circuit 813 (which monitors the entry of cigarettes Z into the flutes of the transfer drum 26 and is composed of an AND-gate 713, a storage 613, an amplifier 513 and the aforementioned photosensitive detector or setting member 413), a NOT-gate 630 and two AND-gates 620, 640. The AND-gate 640 is operatively connected with the OR-gate 530 and means 308 which latter controls stoppage of the production line. The AND-gate 620 is connected with the means 322 which also controls stoppage of the production line. The output N of the register 300 is connected with one input of the AND-gate 713 and the output of this AND gate is connected with the input b of the storage 613. The output d of the storage 613 is connected with the input of the amplifier 513 and the output of this amplifier is connected with the light source or lamp 413a of the photosensitive detector 413. The receiver 413b of the detector 413 is connected with one input each of the AND-gates 620 and 640. The output of the AND-gate 640 is connected with one input of the OR-gate 530. The output of the OR-gate 630 is connected with one input of the AND-gate 620. The output of the AND-gate 620 is connected with one input each of the OR-gates 340 and 522. The latter forms part of the means 322 for controlling the stoppage of the production line.

The means 308 comprises a controller circuit 808 (composed of an AND-gate 708, the OR-gate 608 and an amplifier 508) and a setting member 408 which is a relay in the drive for and capable of stopping the production line. The output R of the register 300 is connected with one input of the AND-gate 708 and the output of this gate is connected with one input of the OR-gate 608. The output of the OR-gate 608 is connected with the input of the amplifier 508 and the latter's output is connected with the relay 408. The output of the OR-gate is further connected with the input a of the storage 612 of the controller circuit 812 which can
switch the cigarette making machine from operation at a lower speed to operation at a higher speed.

The means 322 comprises a controller circuit 822 which can transmit to the register 300 a signal for stoppage of the components of the production line in a predetermined sequence. The controller circuit 822 comprises OR-gates 522 and 722, a trigger 622, the storage 330 and the associated OR-gate 340, and the means 322 further comprises a setting member or pulse generator 422. The latter is an electric switch which triggers stoppage of the production line and is connected with one input each of the OR-gates 722 and 522. The output of the OR-gate is connected with the input of the trigger 622 and the latter's output is connected with the input VII of the register 300. The output of the OR-gate 722 is connected with one input of the OR-gate 340, and the output of the OR-gate 340 is connected with the input b of the storage 330.

The means 321 comprises the controller circuit 821 which monitors the delivery of filter rods F and includes the setting member or photosensitive detector 421, a storage 521, an AND-gate 621 and a trigger 721. The means 321 further comprises the OR-gate 722 which also forms part of the controller circuit 822 which stops the filter cigarette machine. The output J of the register 300 is connected with the input b of the storage 521 and the latter's output is connected with one input of the AND-gate 621. The receiver 421d of the detector 421 is connected with the other input of the AND-gate 621. The output of the AND-gate 621 is connected with the input of the trigger 721 and the latter's output is connected with the input IX of the register 300 and also with one input of the OR-gate 722.

The output d of the storage 320 of the controller circuit 818 is connected with one input each of the following previously mentioned logical circuits: AND-gates 703a and 703b, 709, 711a and 711b of the controller circuit 803, 809, 811, respectively; AND-gates 704, 706, 712, 714a, 716a, 717a of the controller circuits 804, 806, 812, 814, 816, 817, respectively; AND-gate 707 of the controller circuit 807; AND-gate 970 of the controller circuit 907; AND-gate 710 of the controller circuit 810; AND-gate 713 and 640 of the controller circuit 813.

Furthermore, the output d of the storage 320 is connected with one input of NOT-gate 630 in the controller circuit 813. The output d of the storage 330 of the controller circuit 822 is connected with one input each of the following circuits; storages 604, 606 of the controller circuits 804, 806, respectively; storages 613, 521 of the controller circuits 813 and 821, respectively; storage 519 of the testing unit 319; AND-gates 714b, 716b, 717b of the controller circuits 814, 816, 817, respectively; AND-gate 708 of the means 322.

Signals which are indicative of defective portions of the cigarette rod, cigarettes with or without filter tips and their components (such as the cigarette paper web 17 and the tape 41a) are transmitted to the register 300 by the means 319, 323, 326, 327, 328, 329 and 812. The testing unit 319 serves to locate splices in the web 17 and includes the photosensitive detector 419, storage 519, and an AND-gate 619 and a trigger 719. The output H of the register 300 is connected with the input b of the storage 519 and the output d of the storage 519 is connected with one input of the AND-gate 619. The receiver 419d of the detector 419 is connected with the other input of the AND-gate 619. The output of the AND-gate 619 is connected with the input of the trigger 719 and the output of this trigger is connected with the inputs X of the register 300.

The logical connection 912 connects the output of the AND-gate 712 of the controller circuit 812 with the inputs XI of the register 300 and with one input of the OR-gate 618. The output of the OR-gate 618 is connected with the input XII of the register 300. As mentioned above, the controller circuit 812 can change the operating speed of the production line.

The control unit 323 detects those uniting bands which are not coated with adhesive past subsequent to completion of operation or prior to start of operation of the paste 42. It comprises the initiator 423 with the detector 424 and trigger 523, 524. Depending on the operating condition, the detector 424 is connected with the input of the trigger 523 or 524. The output of the trigger 523 in connected with the inputs VI and the output of the trigger 524 is connected with the inputs V of the register 300.

The control unit 326 detects the splices in the tape 41a and includes the initiator 426 and a trigger 526. The initiator 426 is connected with the input of the trigger 526 and the latter's output is connected with the inputs IV of the register 300. The control unit 327 determines the absence of filter plugs in the groups of rod-shaped articles and includes the switch 427, the trip 427a and a trigger 527. The switch 427 is connected with the input of the trigger 527 and the latter's output is connected with the input III of the register 300.

The control unit 328 determines the absence of uniting bands and includes the photosensitive detector 428 and a trigger 528. The receiver 428a of the detector 428 is connected with the input of the trigger 528 and the output of this trigger is connected with the input II of the register 300.

The testing unit 329 serves to locate defective filter cigarettes and includes the signal evaluating device 429 and a trigger 529. The device 429 is connected with the input of the trigger 529 and the output of this trigger is connected with the input I of the register 300.

The means 331 ejects defective parts of the cigarette rod and defective filter cigarettes from their respective paths and includes an amplifier 531 and the nozzle 431. The output T of the register 300 is connected with the input of the amplifier 531 and the latter's output is connected with the nozzle 431.

The operation of the circuitry shown in FIGS. 2a and 2b (with continuous reference to the machines shown in FIGS. 1a and 1b) is as follows:

It is assumed that the wrapping unit 14 of the cigarette making accommodates a length of the filler stream and a length of the web 17. The automatic starting of assemblies in the production line is then carried out in the following way. The master switch 418 is closed to start the low-speed operation of the cigarette making machine. The thus produced signal or pulse is transmitted to the trigger 518 which converts the signal into a definite control signal and transmits the signal to the input XII of the register 300 by way of the OR-gate 618. The control signal also causes the output d of the storage 320 to produce a signal A which remains there until the input a of the storage 320 receives an erasing signal. The control signal from the trigger 518 transmits an erasing signal to the input a of the storage 330 so that no signal B is present at the latter's output d. The storage 609 is caused to produce at its output c a signal
which is transmitted to the amplifier 509. The latter emits a signal which energizes the electromagnet 409 so that the mutilating device 9 is moved to the position 9A.

Closing of the master switch 418 also causes the transmission of a signal in the direction indicated by arrow 1,000 to the starter of the drive for the cigarette making machine. Such drive preferably includes a pole reversing electric motor which drives the filter cigarette machine of FIG. 1b by way of the cigarette making machine of FIG. 1a. The just mentioned signal causes the drive to operate the belts and other movable conveying parts of the machine of FIG. 1a in the production line at a low speed.

The synchronization device 332 produces transporting pulses in synchronism with the operating speed of the production line and such pulses are transmitted parallel to all of the shifting stages S1 to S120. Such pulses push the control signal, which was admitted into the stage S11 at the input X1, through the shift register 300 in stepwise fashion. This control signal triggers a series of operations during travel through the register 300, and such operations are started in a predetermined sequence. The output D emits a signal which is transmitted to one input of the AND-gate 703b; the other input of the AND-gate 703b receives the signal A from the storage 320. The output of the AND-gate 703b then produces a signal which is transmitted to the input b of the storage 603 whereby the output d of the storage 603 produces a signal which is transmitted to the amplifier 503. The signal which is produced at the output of the amplifier 503 actuates the valve 403 so that the latter admits pressurized fluid into the nozzle 403a of the cleaner for the tubes 19 of the cutoff 21.

In response to five successive stepwise advances, the control signal in the register 300 reaches the shifting stage S16. The output E then delivers a signal to one input of the AND-gate 703a. The other input of the AND-gate 703a receives the signal A and its output transmits a signal to the input a of the storage 603. Such signal erases the signal at the output of the storage 603 so that the valve 403 closes to terminate the cleaning of tubes 19.

In response to two further stepwise advances of the control signal through the register 300, the signal reaches the shifting stage S18. The output F then transmits a signal to one input of the AND-gate 704 the other input of which receives the signal A. The output of the AND-gate 704 transmits a signal to the input a of the storage 604 whereby the output c of the storage 604 transmits a signal to the amplifier 504. The output of the amplifier 504 transmits a signal which energizes the electromagnet 404 for the pasteur 4. The latter then applies paste to one marginal portion of the web 17.

In response to seven further stepwise advances the control signal in the register 300 reaches the shifting stage S25 whereby the output G emits a signal to the corresponding inputs of the AND-gates 706 and 707. The other inputs of the AND-gates 706, 707 receive the signal A. The output of the AND-gate 706 transmits a signal to the input a of the storage 606 whereby the output c of this storage transmits a signal to the amplifier 506. The latter actuates the electromagnet 406 which moves the heater 6 to operative position, i.e., the heater heats the web which is formed by the overlapping marginal portions of the web 17 (with a film of paste furnished by the pasteur 4 therebetween). The output of the AND-gate 707 transmits a signal to the input b of the storage 607 whereby the output d of this storage transmits a signal to the amplifier 507 which completes the circuit of the light source 407a in the photosensitive detector 407 at the time when the electromagnet 406 moves the heater 6 to operative position. The receiver 407b of the detector 407 then produces a signal as long as and until the seam between the marginal portions of the web 17 is defective. Such signal is transmitted to one input of the AND-gate 960.

When the control signal in the register 300 reaches the shifting stage S32, the output J emits a signal to one input of the AND-gate 970; the other input of this gate receives the signal A. The output of the AND-gate 970 then emits a signal to one input of the AND-gate 960. If the seam of the web 17 is not closed during travel of the control signal from the stage S25 to stage S32 (seven steps), the receiver 407b of the detector 407 continues to transmit a signal to the other input of the AND-gate 960. The output of the gate 960 then emits a signal which is transmitted to the amplifier 508 by way of the OR-gate 530 and 608. The output signal from the amplifier 508 actuates the relay 408 which opens the circuit of the electric motor in the drive for the cigarette making machine so that the latter is brought to a full stop.

The signal at the output of the OR-gate 530 is transmitted to one input of the OR-gate 608 and to the input a of the storage 607 (by way of the OR-gate 720). This erases the output signal of the storage 607 so that the circuit of the light source 407a in the detector 407 is interrupted. Still further, the output signal from the OR-gate 530 is transmitted to the storage 330 by way of the OR-gate 340 so that the output d of the storage 330 produces a signal B. This signal is transmitted to the inputs b and erases the output signals of the storages 606 and 604. When the storages 606 and 604 cease to transmit output signals, the heater 6 and the pasteur 4 become inoperative in response to deenergization of the electromagnets 406 and 404, respectively. Furthermore, the output signal from the OR-gate 530 is transmitted to the input c and erases the output signal of the storage 607. This deactivates the detector 407 by opening the circuit of the light source 407a.

If the seam between the marginal portions of the web 17 closes properly in response to travel of the control signal from the shifting stage S25 to the stage S32, the receiver 407b of the detector 407 does not produce a signal so that no output signal is produced by the AND-gate 960. The output of the NOT-gate 950 produces a signal which is transmitted to one input of the AND-gate 940. The other input of the AND-gate 940 receives the output signal from the AND-gate 970. Therefore, the output of the AND-gate 940 transmits a signal to the input VIII of the register 300. Such signal constitutes a fresh second control signal for starting of the production line as a function of closing of the seam during travel of the first control signal between the shifting stages S25 and S32. The first control signal is pushed through the register 300 behind the second control signal and cannot initiate any operations because the condition of the storages does not change in response to reception of additional signals.

The second control signal must perform five stepwise advances prior to reaching the shifting stage S37. The output K transmits a signal to one input of the AND-gate 709; the other input of this gate receives the signal
A and its output transmits a signal to the input b of the storage 609 to thus erase the output signal from 609. This interrupts the circuit of the electromagnet 409 whereby the springbiased mutilating device 9 moves from the position 9A to the position 9B to thereby break or sever the cigarette rod Zs. After eight additional stepwise advances, the second control signal reaches the shifting stage S45 whereby the output L transmits a signal to the one input each of the AND-gates 710 and 711b. The other inputs of these AND-gates receives the signal A. The output of the AND-gate 710 transmits a signal to the input a of the storage 610 whereby the latter's output c transmits a signal to the amplifier 510 which completes the circuit of the light source 410c in the detector 410. The latter is located downstream of the cutoff 21. The receiver 410b of the detector 410 produces a signal in response to absence of cigarettes Z; this occurs, for example, when the leading edge of the cigarette rod Zs fails to enter the tubes 19. The signal from the receiver 410b is transmitted to the amplifier 508 by way of the OR-gates 530 and 608. The amplifier 508 actuates the relay 408 which opens the circuit of the motor in the drive of the cigarette making machine to immediately bring the production line to a full stop. The output signal from OR-gate 530 is further transmitted to the input b of the storage 610 (by way of the OR-gate 20) whereby the output signal from the storage 610 is erased and the detectors 407, 410 become inactive (opening of the circuits of light sources 407a and 410a). The output signal from the OR-gate 530 is further transmitted to the input b of the storage 330 (by way of the OR-gate 340) whereby the storage 330 produces the signal B which is transmitted to the inputs b of the storages 604, 606. This erases the output signals of the storages 604, 606 whereby the paster 4 and heater 6 are deactivated in the same way as described above (i.e., in response to deenergization of the electromagnets 404, 406).

The output signal from the AND-gate 711b is transmitted to the input b of the storage 611 so that the latter's output d emits a signal which is transmitted to the amplifier 511. The latter transmits an amplified signal to the valve 411 for the nozzle 411a in the ejecting device 11. If the flow of cigarettes Z is uninterrupted, no signal is transmitted by the detector 410. Then, in response to three further stepwise advances, the second control signal reaches the shifting stage S48 whereby the output M transmits signals to one input each of the AND-gates 712 and 711a. The other inputs of these AND-gates receive the signal A. The output of the AND-gate 711a transmits a signal to the input a of the storage whereby the latter erases its output signal. The valve 411 is then closed and the nozzle 411a of the device 11 ceases to eject cigarettes Z. Thus, the foremost three cigarettes Z are automatically ejected from the path in which they travel lengthwise toward the fluted drum 26.

The output of the AND-gate 712 transmits a signal to the input b of the storage 612 whereby the latter's output d transmits a signal to the amplifier 512. This energizes the relay 412 which effects operation of the production line at a higher speed.

When the second control signal reaches the shifting stage S51, the output N transmits a signal to one input of the AND-gate 713; the other input of the gate 713 receives the signal A and its output transmits a signal to the input b of the storage 613 so that the latter's output d transmits a signal to an amplifier 513 which completes the circuit of the light source 413a in the detector 413. As mentioned above, the detector 413 forms part of the controller circuit 813. The receiver 413b of the detector 413 produces a signal when no orderly transfer of cigarettes Z takes place into the flutes of the transfer drum 26. Such signal is transmitted to one input of the AND-gate 640. The other input of the gate 640 receives the signal A and the output of this gate transmits a signal to the amplifier 508 by way of the OR-gates 530 and 608. The output of the amplifier 508 transmits a signal to the relay 408 which immediately stops the two machines and the starting procedure is repeated, from the beginning. The output signal of the OR-gate 608 is also transmitted to the input a of the storage 612 whereby the latter deenergizes the relay 412 which has caused the machine to operate at the higher speed. The output signal from the OR-gate 530 is further transmitted to the inputs b and a of the storages 610 and 607 by way of the OR-gate 720. The storages 610 and 607 erase their output signals to thus deactivate the photosensitive detectors 410 and 407. Still further, the output signal from the OR-gate 530 is transmitted to the input b of the storage 330 by way of the OR-gate 340; the storage 330 then produces the signal B which is transmitted to the inputs b of the storages 604 and 606 whereby the latter storages erase their output signals to deenergize the electromagnets 404 and 406 and to thus deactivate the paster 4 and heater 6. The signal B is further transmitted to the input a of the storage 613 so that the latter erases its output signal and causes opening of the circuit of the light source 413a in the detector 413.

When the second control signal reaches the shifting stage S70 (after nineteen additional steps), the output R emits a signal which is transmitted to the corresponding inputs of the AND-gates 716a and 716a. The other inputs of these AND-gates receive the signal A. The output of the AND-gate 714a transmits a signal to the input a of the storage 614 whereby the latter's output c transmits a signal to the amplifier 514 which engages the magnetic clutch 414 in the filter cigarette machine. The output of the AND-gate 716a transmits a signal to the input a of the storage 616 whose output transmits a signal to the amplifier 516 which engages the clutch 416 for the advancing rolls 47. Thus, the bobbin 41 begins to pay out the tape 41a.

When the second control signal reaches the stage S76 (after six additional steps), the output S transmits a signal to one input of the AND-gate 717a the other input of which receives the signal A. The output of the AND-gate 717a then transmits a signal to the input a of the storage 617 whose output c transmits a signal to the amplifier 517 which energizes the electromagnet 417 so that the armature 417a lowers the tape 41a into contact with the applicator 43 of the paster 42. The signal from the output S is further transmitted to the OR-gate 720 and thence to the inputs b and a of the storages 610 and 607, respectively. This erases the output signals of the storages 610 and 607. Thus, the detectors 407 and 410 become inactive and the detector 413 takes over their functions. The signal from the output S is further transmitted to the input a of the storage 320 (by way of the OR-gate 720) whereby the storage 320 erases its output signal A (at d). This completes automatic starting of the production line.
The production line is stopped in the following way: The first control signal is used for energization of the controller circuit 821 during starting of the production line. The output signal at J is transmitted to the input b of the storage 521 whose output d transmits a signal to one input of the AND-gate 621. This completes energization of controller circuit 821, i.e., the photosensitive detector 421 can participate in regulation of operation of the filter cigarette machine because one input of the AND-gate 621 receives a signal from the output d of the storage 521. Thus, the AND-gate 621 can transmit a signal as soon as its other input receives a signal from the detector 421. If the feed of filter rods F in the duct 33 is interrupted, the detector 421 transmits such signal to the other input of the AND-gate 621 whereby the latter's output transmits a signal to the trigger 721 whose output transmits a signal to the trigger 721 whose output transmits a control signal to the input IX (shifting stage 531) of the register 300. At the same time, the output signal of the trigger 721 is transmitted to the input b of the storage 330 by way of the OR-gates 722 and 340 whereby the output d of the storage 330 produces the signal B. The signal B is transmitted to the input b of the storages 604 and 606 so that these storages erase their output signals to thereby deactivate the paste 4 and heater 6. The signal B is further transmitted to the input e of the storage 613 which erases its output signal and deactivates the detector 413 of the controller circuit 813. Still further, the signal B is transmitted to the input e of the storage 521 which erases its output signal and deenergizes the controller circuit 821. The testing unit 319 is rendered inactive in response to transmission of the signal B to the input a of the storage 519.

The aforementioned third control signal which is transmitted to the input IX in the shifting stage 531 travels stepwise and initiates operations which result in automatic stoppage of the production line. The operations which bring about the stoppage take place in a predetermined sequence to make sure that satisfactory cigarettes Z which are located in the flutes of drums in the filter cigarette machine are provided with filter plugs formed therewith by filter cigarettes. During evacuation of cigarettes from the filter cigarette machine, the filter rod is caused to enter the collecting receptacle 18 (FIG. 1c) as soon as the electromagnet 404 deactivates the paste 4 and the electromagnet 406 deactivates the heater 6.

When the third control signal reaches the stage 552 (21 steps), the register output O transmits a signal to one input of the AND-gate 714b the other input of which receives the signal B. The output of the AND-gate 714b then transmits a signal to the input b of the storage 614 whereby the latter erases its output signal to deenergize the clutch 414. When the third control signal reaches the stage 556, the output P transmits a signal to one input of the AND-gate 717b the other input of which receives the signal B. The output of the AND-gate 717b then transmits a signal to the input b of the storage 617 which erases its output signal and thereby deenergizes the electromagnet 417 whose armature 417a moves the tape 41e away from the applicator 43.

When the third control signal reaches the stage 560, the output O transmits a signal to one input of the AND-gate 716b the other input of which receives the signal B. The output of the AND-gate 716b then transmits a signal to the input b of the storage 616 which erases its output signal whereby the clutch 416b is deenergized and the rolls 47 stop the transport of the tape 41a.

When the third control signal reaches the shifting stage 570, the output R transmits a signal to one input of the AND-gate 708 the other input of which receives the signal B. The output of the AND-gate 708 transmits a signal to the amplifier 508 by way of the OR-gate 608 and the amplifier 508 deenergizes the relay 408 which immediately stops the motor drive for the cigarette making machine. At the same time, the input a of the storage 612 receives a signal which erases the output signal from storage 612 so that the relay 412 is deenergized. When energized, the relay 412 causes the motor for the cigarette making machine to operate at the higher speed.

The controller circuit 813 is energized by the second control signal during automatic starting of the production line. This controller circuit remains energized upon completion of starting of the production line. If there develops a flaw in operation of the machines, e.g., if the detector 413 detects the absence of cigarettes Z at the transfer drum 26, this detector produces a signal which is transmitted to corresponding inputs of the AND-gates 620 and 640. Since the signal A is erased on completion of starting of assemblies in the production line, the other input of the AND-gate 640 is without a signal and this gate fails to transmit a signal which, when present, would cause immediate stoppage of the motor for the cigarette making machine. The transmission of signal A is also terminated to the input of the NOT-gate 630, i.e., the gate 630 produces an output signal which is transmitted to one input of the AND-gate 620. The other input of the AND-gate 620 receives a signal from the detector 413 so that the gate 620 transmits a signal to the input b of the storage 330 by way of the OR-gate 340. The output d of the storage 330 then produces the signal B which causes stoppage of various assemblies of the production line in the aforementioned sequence. The output signal from the AND-gate 620 is also transmitted to the trigger 622 by way of the OR-gate 522 whereby the trigger 622 transmits a control signal to the input VII (stage 536) of the register 300. This fourth control signal travels through the register and causes automatic stoppage of various assemblies in the necessary sequence. This was described above.

The production line can be stopped manually by way of the switch 422. When this switch is closed by hand, a signal is transmitted to the input of the trigger 622 by way of the OR-gate 522 whereby the trigger 622 transmits a signal to the input VII of the register 300. The resulting control signal travels through the register and causes stoppage of various assemblies of the production line in the aforementioned predetermined sequence. The signal which is produced in response to actuation of the switch 422 is further transmitted to the input b of the storage 330 by way of the OR-gates 722 and 340 so that the output d of the storage 330 emits the signal B.

The various testing and ejecting devices which locate and segregate defective portions of the cigarette rod Zs, defective cigarettes Z and other components are operated in the following way: The first control signal is utilized to activate the testing unit 319 during starting of various assemblies of the
production line. The testing unit 319 determines the presence of splices in the web 17. When the first control signal reaches the shifting stage 529, the output \( H \) transmits a signal to the input \( b \) of the storage 519. The output \( d \) of the storage 519 then transmits a signal to one input of the AND-gate 619. The detector 419 transmits a signal when it detects a splice in the web 17, and such signal is transmitted to the other input of the AND gate 619, which then sends a signal to trigger 719. The latter transmits a signal to the inputs X of the register 300. The testing unit 319 is activated only when the first control signal advances past the shifting stages 526, 527, 528, i.e., past those stages which receive the signal from the output of the trigger 719. This insures that the signals which indicate the presence of defective splices in the web 17 and enter the register ahead of the first control signal cannot start the assemblies of the production line. Thus, those splices which are detected while the first control signal travels from the input XII (stage S11) to the stage 529 (eighteen steps) cannot cause the generation of signals which would enter the register 300 because the storage 519 does not as yet transmit a signal to the corresponding input of the AND-gate 619.

The signal which appears at the output of the AND-gate 712 (and is transmitted by way of storage 612 and amplifier 512 to the relay 412) which effects operation of the motor at a higher second speed) is also transmitted to the inputs XI by way of the logical connection 912 and controller circuit 812. The logical connection 912 is further connected with the input XII by way of the OR-gate 618. Thus, the inputs XI and XII receive signals which are indicative of defective articles. This is desirable because it was determined, by experience, that the fillers of cigarettes which are produced during shifting from lower speed to higher speed are unsatisfactory, i.e., that the weight of cigarettes which contain such fillers is without an optimum range.

The detector 424 of the control unit 323 transmits a signal to the trigger 523 during the initial stage of application of paste to the tape 41a. The signal transmitted by the trigger 523 is indicative of defective material and is admitted to the register 300 by way of the inputs VI. This is desirable because it was found that it requires a certain interval of time before the paste 42 begins to apply adhesive at an optimum rate, i.e., that cigarettes containing the corresponding uniting bands should be segregated. The same applies for the last series of cigarettes which are produced directly prior to stoppage of the production line. The detector 424 produces a signal upon completion of operation of the paste 42 and such signal is transmitted to the trigger 524 which transmits a signal to the inputs V of the register 300.

The splices between the sections of the tape 41a consists of adhesive-coated aluminum foil. When such a splice passes along the initiator 426 of the control unit 326, the initiator produces a signal which is transmitted to the trigger 526. The latter then transmits a signal (indicative of a defect) to the inputs IV of the register 300. The trip 427a of the switch 427 in the control unit 327 contacts successive groups in the flutes of the wrapping drum 48 to detect the presence or absence of filter plugs of double unit length. The switch 427 transmits a signal to the trigger 527 whenever the trip 427a detects the absence of a filter plug, and the trigger 527 transmits a signal (indicative of a defect) to the input III of the register 300.

The photosensitive detector 428 of the control unit 328 detects the presence or absence of convoluted uniting bands on the filter cigarettes of double unit length. If the detector 428 detects the absence of a uniting band, it produces a signal (indicative of a defect) which is transmitted to the trigger 528. The latter transmits a signal to the input II of the register 300.

The signal evaluating device 429 of the testing device 329 is the last detecting or monitoring means along the path of cigarettes and of their components in the production line. This evaluating device is adjacent to the testing drum 49 and its function is to determine the presence or absence of leaks in the wrappers of filter cigarettes of double unit length. Such leaks can develop as a result of damage to wrappers during travel in the machines of FIGS. 1a and 1b, as a result of opening of a seam on a cigarette Z, as a result of imperfect convolution of a uniting band around the corresponding filter plug and the adjacent cigarettes Z, and/or for other reasons. The testing device 329 tests the streams of air which are conveyed through filter cigarettes of double unit length and compares the results of measurement with a standard value. For example, if a tested filter cigarette of double unit length has a leak, the rate of air flow is greater than normal. Some air will always pass through the wrapper of a filter because the web 17 is normally porous. The evaluating device 429 produces electric signals which are transmitted to the trigger 529. In the event that the signal transmitted to the trigger 529 is indicative of a defective article, the trigger transmits a signal to the input I of the register 300.

The ejection of defective articles is carried out in the following way:

When the register 300 receives a signal from the means 321, control unit 323, 326, 327 or 328, testing unit 329 or controller circuit 812, such signal travels toward the shifting stage S12 whereby the output \( T \) transmits a signal to the amplifier 531 which amplifies the signal and transmits it to the nozzle 431 of the means 331. The nozzle 431 then expels the defective article from the corresponding flute (not shown) of the testing drum 49. It will be seen that, irrespective of the nature of their defects, all defective completed articles can be segregated from satisfactory articles at a single station.

In heretofore known cigarette making machines, the tubes of the cutoff which severs a cigarette rod to form discrete cigarettes are cleaned manually by resorting to bellows, brushes or the like. In the apparatus of the present invention, the valve 403 which controls the tube cleaning nozzle 403a receives a signal directly from the output D of the register 300 and insures automatic cleaning of tubes 19 at an appropriate time during starting of the apparatus. The control signal which reaches the output E of the register 300 automatically terminates the cleaning of tubes 19.

Also, in conventional cigarette making machines the heater and the pasteur for the web of cigarette paper are activated with a predetermined delay following starting of the machine. In such machine, the means for starting the pasteur and the heater normally comprises time-lag devices which delay the signal for a predetermined period of time to insure that the paste does not apply adhesive to the web and that the heater does not heat and press the seam until the conditions are such that the
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paster can engage a properly convoluted web which surrounds a satisfactory filler rod. In the improved apparatus, the signals for activating the paster 4 and heater 6 are received from the outputs F and G of the register 300 so that they need not be stored in separate time-lag devices. Proper timing of activation of paster 4 and heater 6 is desirable to avoid ejection of too many satisfactory cigarettes and/or the formation of an unsatisfactory cigarette rod which must be discarded prior to reaching the cutoff 21. As a rule, defective detections of the rod Zs and defective cigarettes Z are opened up in special machines which serve to recover tobacco shreds for reuse in the cigarette making machine.

An advantage of the detector 407 is that it immediately detects a satisfactory seam so that the multilulating device 9 can immediately break off the defective part of the rod and thus insures that the leading end of the satisfactory rod can enter the tubes 19 of the cutoff 21. In many presently known cigarette making machines, the formation of the seam is observed by the person in charge; this requires much experience and care, especially in modern machine wherein the rod travels at a high speed. The multilulating device 9 reacts to signals which are furnished by the register 300 (output K).

In accordance with presently prevailing practice, a cigarette making machine is designed to automatically eject a certain number of cigarettes which are produced immediately after starting of the machine. The device which effects such ejection receives a signal in response to starting of the machine and remains operative for a predetermined interval of time of average length. This is normally achieved by employing a suitable time-lag relay or the like. As a rule, the ejecting device is set to effect segregation of more cigarettes than necessary. In the apparatus of the present invention, the number of segregated cigarettes (namely, of those cigarettes which are produced immediately after starting) is reduced to a minimum because the ejection is started and terminated in response to signals which are shifted through the register 300. The means for ejecting those cigarettes which are produced immediately after starting of the cigarette making machine is capable of ejecting a certain minimum number of cigarettes irrespective of the operating speed of the machine. The register 300 transports signals which initiate ejection of presumably defective articles immediately after starting as well as such signals which terminate the ejection of potentially defective articles. It will be seen that the register 300 performs a large number of operations including transport of signals which are used to control the operation of various assemblies in the production line in a predetermined sequence during starting and stoppage as well as the transport of signals which are indicative of defective articles or defective components of articles and are used either to stop the production line (or one of its machines) or to effect segregation of defective articles or components.

The shift register also controls the changes in operation of the drive for the machine from low speed to higher speed. This reduces waste because the number of cigarettes which are produced during the short-lasting low-speed operation is reduced to a minimum. At the present time, the person in charge determines the moment when the speed of the cigarette making machine is changed from lower to higher speed. This requires much experience and much carefulness on the part of the personnel.

As described above, the register also transmits signals which are used to stop the apparatus in response to detection of faulty operation. Stoppage in response to faulty operation is initiated by the detectors 413 (cigarettes Z) and detector 421 (filter rods F). In presently known apparatus, the signals which are produced in response to detection of flaws in operation of the machine or machines immediately stop the conveying parts. This produces considerable waste because many partly assembled components of the filter cigarettes remain in the apparatus. The register of the present invention causes stoppage of various assemblies in a predetermined sequence so that the waste is reduced to a minimum.

All such filter cigarettes which include one or more defective components are ejected at a single station (testing drum 49). Signals which are indicative of defective articles or components are transported to the output T.

Without further analysis, the foregoing will sufficiently reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that fairly constitute essential characteristics of the generic and specific aspects of the above described contribution to the art and, therefore, such adaptation 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:

1. In an apparatus for the production and/or processing of cigarettes and/or analogous rod-shaped articles travelling continuously along a predetermined path, a combination comprising a plurality of assemblies adjacent to said path, each of said assemblies being activable to treat the articles and/or their components; control means for starting and/or terminating the activation of said assemblies; shift register means having a plurality of shifting stages whose number at least equals the number of articles in said path, said shift register means further having a plurality of outputs connecting said shifting stages with said control means and signal receiving inputs connected with said shifting stages; means for furnishing pulses to said shifting stages at a frequency corresponding to the number of articles and/or their components which are being produced and/or processed per unit of time; and means for furnishing signals to said inputs whereby such signals are transported with said pulses to successive outputs and to said control means to effect the activation and/or deactivation of said assemblies in a predetermined sequence.

2. A combination as defined in claim 1, further comprising detector means connected with said inputs and operable to monitor said assemblies and to produce signals in response to detection of defective assemblies, said control means being arranged to deactivate said assemblies in a predetermined sequence in response to signals from said detector means.

3. A combination as defined in claim 2, wherein at least one of said outputs is connected with said detector means to operate the latter in response to said first mentioned signals.

4. A combination as defined in claim 3, wherein said apparatus includes a machine having means for trans-
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porting filter stubs along said predetermined path and said detector means comprises means for scanning said path for the presence or absence of filter stubs.

5. A combination as defined in claim 3, wherein said apparatus includes a machine having means for transporting a wrapped tobacco rod along said path and said detector means includes means for scanning said path for the presence or absence of said wrapped tobacco rod.

6. A combination as defined in claim 1, further comprising detector means for scanning said path for the presence of defective articles and/or components thereof and for furnishing to said shift register means signals which effect the deactivation of at least one of said assemblies.

7. A combination as defined in claim 1, wherein said control means is arranged to activate at least one of said assemblies in response to a signal from an output of said shift register means and to thereupon maintain said one assembly in activated condition.

8. A combination as defined in claim 7, wherein said apparatus includes a machine having means for producing rod-shaped articles and comprising an adhesive-applying device, said adhesive-applying device forming part of said one assembly.

9. A combination as defined in claim 7, wherein said apparatus includes a machine having means for producing rod-shaped articles and comprising a heating device, said heating device forming part of said one assembly.

10. A combination as defined in claim 7, wherein said apparatus includes a machine having means for processing filter stubs and comprising a filter stub feeding device, said filter stub feeding device forming part of said one assembly.

11. A combination as defined in claim 7, wherein said apparatus includes a machine having means for processing adhesive-coated bands and comprising a device for supplying adhesive-coated bands, said device for supplying adhesive-coated bands forming part of said one assembly.

12. A combination as defined in claim 1, including means for varying said producing and/or processing frequency, said control means being arranged to temporarily activate at least one of said assemblies in response to a signal from an output of said shift register means.

13. A combination as defined in claim 12, wherein said one assembly comprises means for removing from said path articles produced during the starting of said assemblies.

14. A combination as defined in claim 12, wherein said one assembly includes means for removing from said path articles produced during changes in the rate of production and/or processing of articles per unit of time.

15. A combination as defined in claim 12, wherein said apparatus includes a machine having means for producing and subdividing a wrapped filler rod of fibrous material and comprising a cutoff for said rod and means for cleaning said cutoff; said means for cleaning said cutoff forming part of said one assembly.

16. A combination as defined in claim 12, wherein said apparatus includes a machine having means for producing a wrapped filler rod of fibrous material and means for mutilating said rod in response to signals furnished by said one output of said shift register means, said means for mutilating forming part of said one assembly.

17. A combination as defined in claim 1, wherein said control means is arranged to activate at least one of said assemblies in response to a signal from an output of said shift register means and to thereupon maintain said one assembly in activated condition, and to deactivate said one assembly in response to a signal from said signal furnishing means for terminating the production and/or processing of articles.

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