United States Patent [19]

Dogl et al.

[11] **3,874,391**

[45] ***Apr. 1, 1975**

[54] **METHOD AND MEANS FOR REGULATING THE OPERATION OF APPARATUS FOR THE PRODUCTION AND PROCESSING OF CIGARETTES OR THE LIKE**

[75] Inventors: **Ernst Dogl; Albrecht Funck,** both of Bayreuth; **Dieter Wellach; Hans-Georg Winkler,** both of Hamburg, all of Germany

[73] Assignee: **Hauni-Werke Korber & Co. KG,** Hamburg-Bergedorf, Germany

[*] Notice: The portion of the term of this patent subsequent to June 27, 1989, has been disclaimed.

[22] Filed: **May 2, 1972**

[21] Appl. No.: **249,542**

Related U.S. Application Data

[63] Continuation of Ser. No. 535, Jan. 5, 1970, Pat. No. 3,672,373.

[30] **Foreign Application Priority Data**

Jan. 8, 1969 Germany 1900701

[52] **U.S. Cl.** ..... **131/21 R,** 131/21 B, 307/203, 307/221, 328/37, 328/92, 235/151.3,

[51] **Int. Cl.** **A24c 05/34**

[58] **Field of Search** ..... 131/65, 94, 21 R, 21 B, 131/21 D; 307/221, 203; 328/37, 92; 235/151.13, 151.3; 205/209, 219 DF, 223

[56] **References Cited**

UNITED STATES PATENTS

2,737,186	3/1956	Molins et al.	131/21 B
3,067,754	12/1962	Pinkham et al.	131/94 X
3,073,963	1/1963	Marko	250/209 X
3,123,195	3/1964	Hewitt et al.	131/21 R UX
3,194,244	7/1965	Powell	131/21 B
3,244,183	4/1966	Pym	131/65
3,363,452	1/1968	McArthur	131/21 R UX
3,373,052	3/1968	Rode	131/21 R
3,428,819	2/1969	Quinn et al.	250/223
3,491,767	1/1970	Kaeding	131/21 R
4,242,321	3/1966	Chope	131/21 R X

FOREIGN PATENTS OR APPLICATIONS

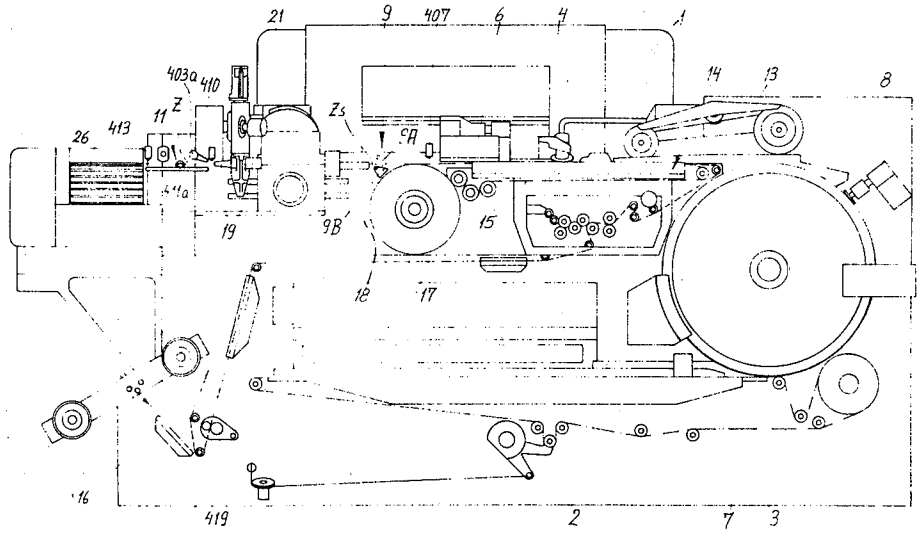
994,035	6/1965	United Kingdom	131/21 R
928,743	6/1963	United Kingdom	131/21 R
866,213	4/1961	United Kingdom	131/21 R
738,210	7/1966	Canada	131/21 R

Primary Examiner—Joseph S. Reich
Attorney, Agent, or Firm—Michael S. Striker

[57] **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



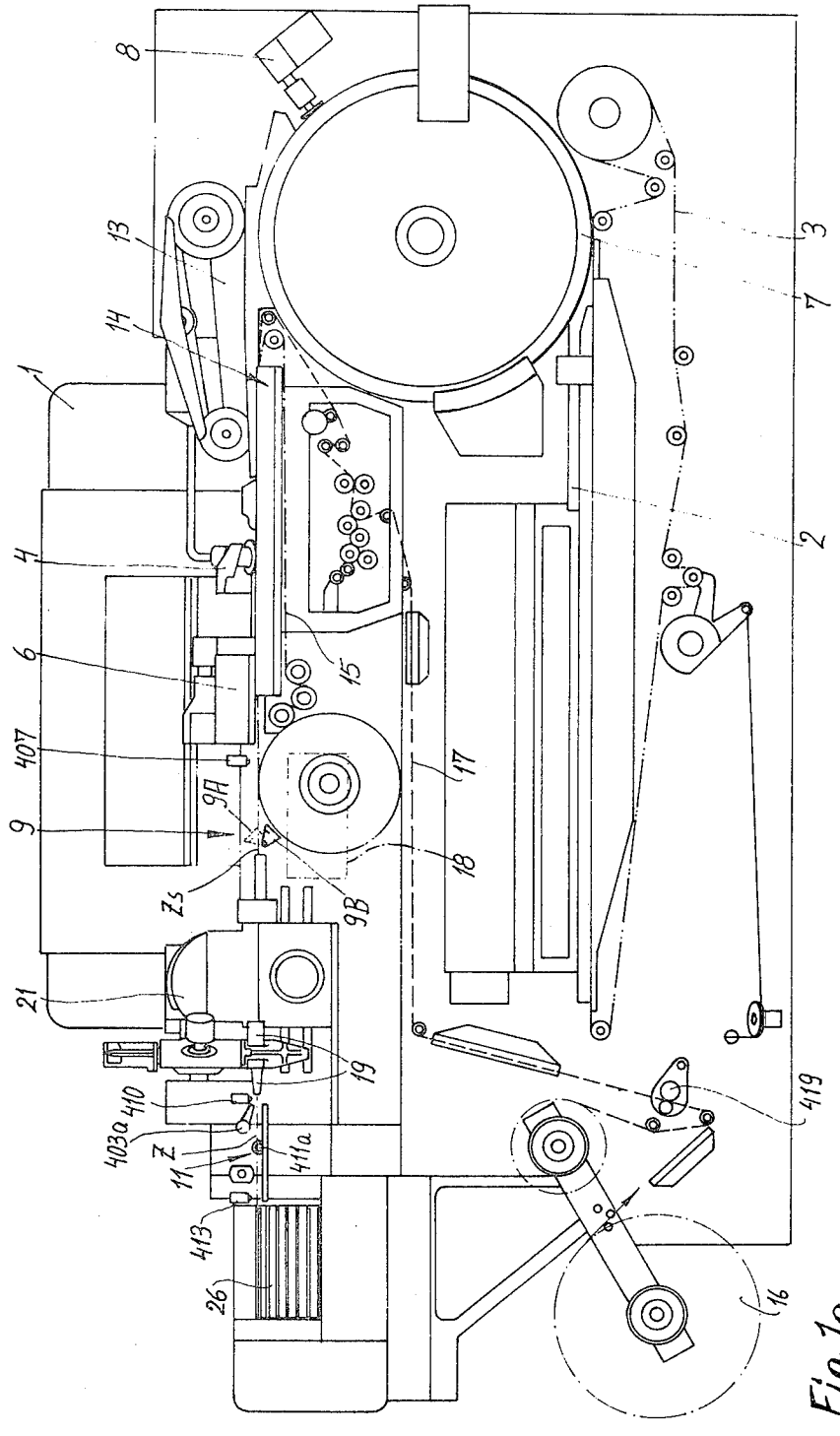

8
13
14
1
4
6
407
9
9A
9B
15
17
18
21
19
410
403a
Z
11
411a
413
26
16
419
2
3
7

Fig. 1a

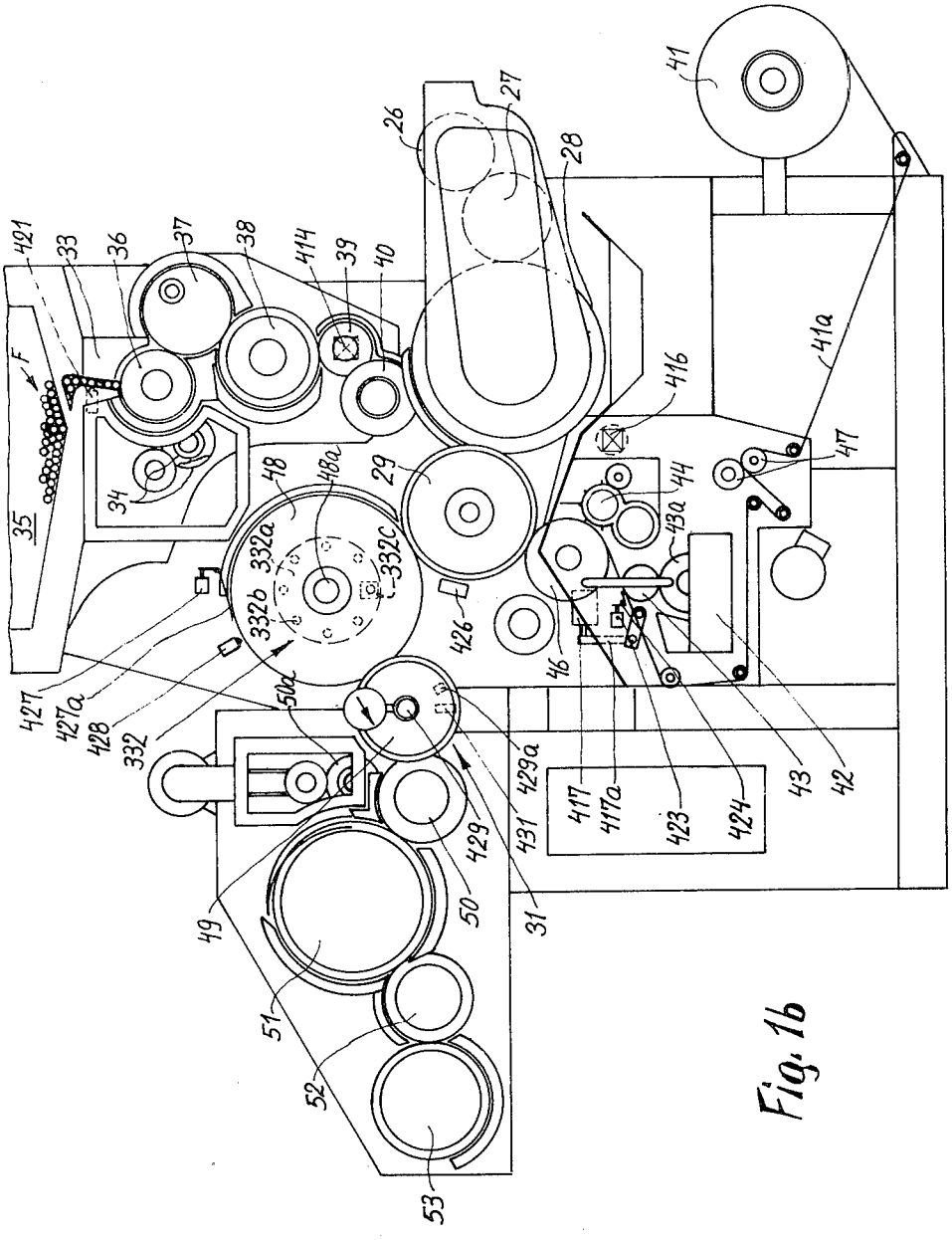

41
27
26
28
421
33
36
37
38
414
39
40
F
35
34
48
48a
29
332a
332b
332c
427
427a
428
332
50a
49
51
52
53
50
31
429
431
429a
426
46
44
43a
416
41a
47
43
42
417
417a
423
424

Fig. 1b

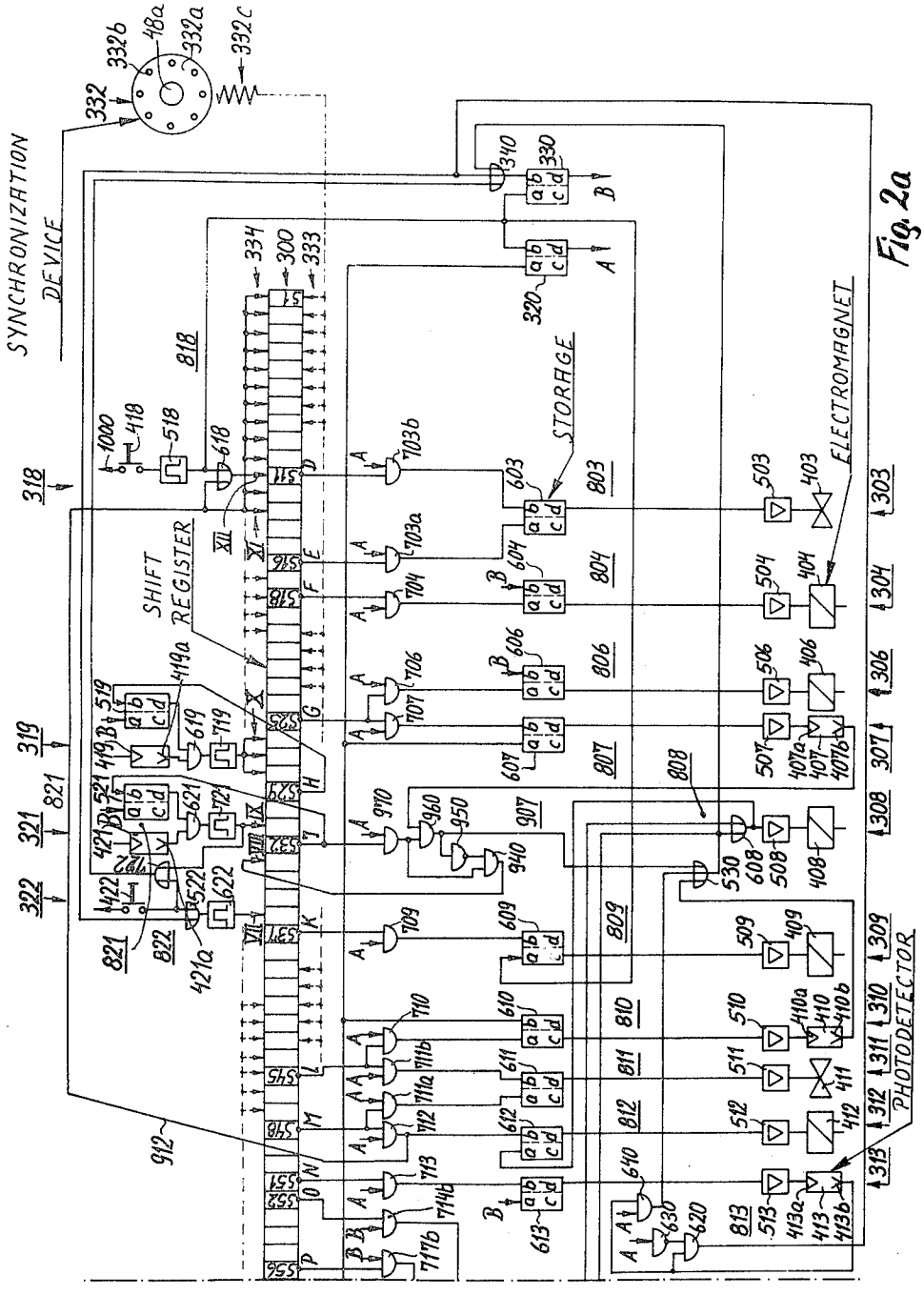

SYNCHRONIZATION DEVICE
SHIFT REGISTER
STORAGE
ELECTROMAGNET
PHOTODETECTOR

Fig. 2a

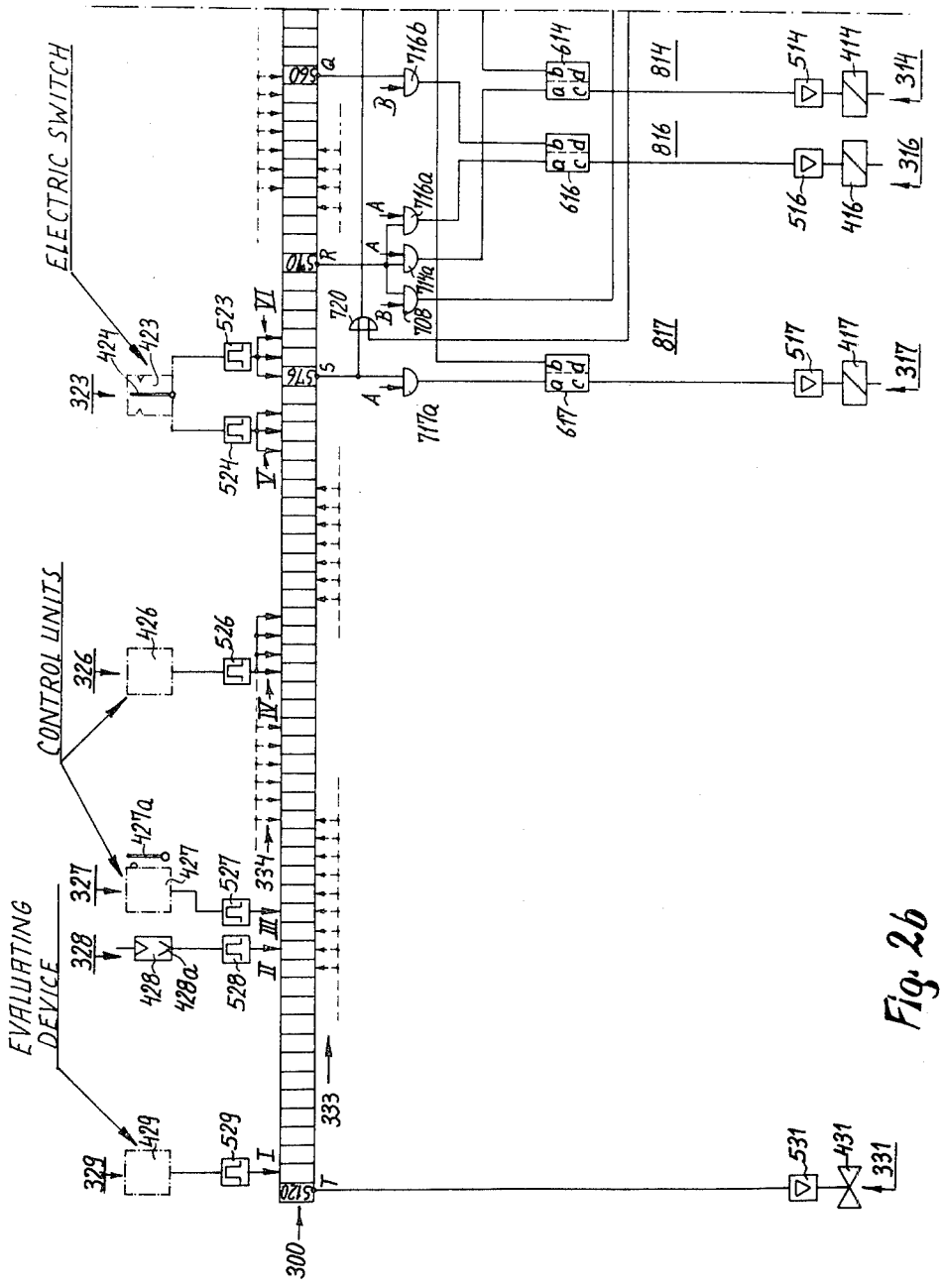

ELECTRIC SWITCH
CONTROL UNITS
EVALUATING DEVICE
323
424
423
523
524
526
326
426
327
427a
427
527
328
428
428a
528
329
429
529
334
333
300
720
708
717a
717b
717c
614
616
617
814
816
817
514
516
517
414
416
417
314
316
317
531
431
331

Fig. 2b

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

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 withthe 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 first signals, at the speed of travel of articles, to at least one first station, generating second signals for starting and/or stoppage of asseblies, 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. 1*a* is a schematic front elevational view of a cigarette making machine which forms one part of the improved apparatus;

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

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1*a* and 1*b* illustrate an apparatus, here shown as a production line, which includes a cigarette making machine (FIG. 1*a*) 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. 1*b*) of the type known as MAX and also produced by the Hauni-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. 1*b* is shown at right angles with reference to its position relative to the machine of FIG. 1*a*.

The cigarette making machine of FIG. 1*a* 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 steam 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. 1*a*. 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. 1*a*) forms part of a testing or control unit **319** (FIG. 2*a*) 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 Z*s* is transported lengthwise along a paster **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 Z*s*. The paster **4** is movable by an electromagnet **404** (FIG. 2*a*) which activates the paster 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 Z*s* by an electromagnet **406** (FIG. 2*a*) 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 Z*s* is tracked by a photosensitive detector **407** which forms parts of a controller circuit **807** (FIG. 2*a*) 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 multilating device **9** directs the cigarette rod Z*s* into a collecting receptacle **18**; this takes place when or as long as the seam on the wrapper of the rod Z*s* is unsatisfactory. When the multilating 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 multilating device **9** and into the aligned tubes **19** of a cutoff **21**. A tube cleaner, here shown as a blower nozzle **403***a*, 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 **21** the rod Z*s* at regular intervals to produce a single file of cigarettes Z of unit length. The nozzle **403***a* receives compressed fluid in response to opening of a solenoid-operater valve **403** (FIG. 2*a*)

The cigarette making machine further comprises a controller circuit **810** (FIG. 2*a*) 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 Z*s* 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 **411***a* 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 **411***a* is controlled by a solenoid operated valve **411** (FIG. 2*a*).

A further photosensitive detector **413**, which forms part of a controller circuit **813** (FIG. 2*a*) 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. 1*b*. 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. 1*b*, 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. 2*a*) 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 travelling at different speeds. The shuffling conveyor may be similar to that shown in FIGS. **2–5** in U.S. Pat. No. 3,164,243 Rudszinat 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

drums are arrested in response to disengagement of the clutch **414.**

The transfer drum **26** at the discharge end of the cigarette making machine arrays 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** in such a way that the cigarettes Z of each pair are spaced from each other by a distance which at least equals the length of a filter plug of double unit length.

The drum **49** is an accelerating drum which moves the plugs of double unit length at a speed exceeding the speed of such plugs on the drum **39** and serves to deliver filter plugs of double unit length into the gaps between pairs of cigarettes Z in successive flutes of the assembly drum **28.** Thus, once a flute of the assembly drum **28** moves past the transfer station between the drums **28** and **40,** it accommodates a group of coaxial rod-shaped articles including a centrally located filter plug of double unit length flanked by two cigarettes Z of unit length. The groups 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 bu a suction drum **46** which receives a continuous tape or web **41***a* from a bobbin **41.** The tape **41***a* 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 **43***a* which dips into the adhesive-containing tank of the paster **42.** The leading end of the tape **41***a* 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 electomagnetic 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 electormagnet **417** whose armature **417***a* constitutes a lever ans supports a pair of rolls flanking a portion of the tape **41***a*. When the electromagnet **417** is energized, the armature **417***a* moves the adjacent portion of the tape **41***a* downwardly and into contact with the film of adhesive on the applicator **43.** A control unit **323** (FIG. **2***b*) includes a detector **424** (FIG. **1***b*) which is adjacent to the applicator **43** and produces a signal at the start and on termination of application of paste to the tape **41***a*. 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. **2***b*) and serves to produce signals in response to detection of splices between successive lengths of the tape **41***a*. 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 wrapping 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 **48***a* of the drum **48** carries certain elements of a synchronization device **332.** This device comprises a disk **332***a* on the shaft **48***a* and magnetic heads **332***b*, one for each flute (not shown) of the drum **48.** The synchronization device **332** further comprises an induction coil **332***c* which is adjacent to the path of magnetic heads **332***b* and produces shift pulses at the rate at which the drum **48** receives and transports groups and uniting bands. The disk **332***a* 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 **427***a* of an electric switch **427** which forms part of a control unit **327** (FIG. **2***b*). The trip **427***a* 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 **427***a* 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 **427***a* and is also adjacent to the periphery of the wrapping drum **48.** The detector **428** forms part of a control unit **328** (FIG. **2***b*) 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 convolted uniting band and/or in the wrappers of cigarettes Z. Such means includes a nozzle **429***a* which blows a stream of testing 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. **2***b*). 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. **1***b* 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 **50***a* which severs successive cigarettes of double unit length so that each such 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. 2*a* and 2*b* 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. 1*a* and 1*b*, 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. 2*a* and 2*b* further show the aforementioned control units **319, 323, 326, 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. 2*a* and 2*b* 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 pulses furnished by the synchronization 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 **2** 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. 2*a* and 2*b* 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 **703***a* and **703***b*, 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 **403***a* of the machine shown in FIG. 1*a*. The outputs E and D of the register **300** are each connected with one input of the AND-gates **703***a* and **703***b*. The outputs of the AND-gates **703***a*, **703***b* 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 electormagnet **409.**

The starting means **311** comprises a start controller circuit **811** (composed of two AND-gates **711***a*, **711***b*, a storage **611** and an amplifier **511**) and the setting or activating member **411** (solenoid operated valve) for the nozzle **411***a* of the ejecting device **11.** The outputs M and L of the register **300** are connected with inputs of AND-gates **711***a*, **711***b* and the outputs of the AND-gates **711***a*, **711***b* 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** (mutilating 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 th 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 paster **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 to two AND-gates **714***a*, **714***b*, 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 **714***a*, **714***b* 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 **716***a*, **716***b*, 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 **716***a*, **716***b* 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 ouput is connected with the clutch **416**.

The means **317** comprises a controller circuit **817** (composed of two AND-gates **717***a*, **717***b*, 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 **171***a*, **717***b* and the outputs of these gates are respectively connected with the inputs *a* and *b* of the storage **617**. Teh 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 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 ouput *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 **407***a* of the photosensitive detector **407**. The receiver **407***b* 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** int he 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 absense of the cigarettes A at the tubes **19** of the cutoff **21**. The controller circuit **810** further comprises and 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 soruce or lamp **410***a* off the detector **410**. The receiver **410***b* 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 amplifer **513** and the output of this amplifier is connected with the light source or lamp **413***a* of the photosensitive detector **413**. The receiver **413***b* 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 of the OR-gate **530**. The output of the Not-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 ciurcuit **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 **421***a* 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 **703***a* and **703***b* , **709**, **711***a* and **711***b* of the controller circuits **803, 809, 811**, respectively; AND-gates **704**, 706, 712, 714*a*, **716***a*, **717***a* 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 **714***b*, **716***b*, **717***b* 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 **41***a*) 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 **419***a* 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 withthe 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 paster **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 **41**a 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 **427***a* 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 **428***a* 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 deffective 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. **2***a* and **2***b* (with continuous reference to the machines shown in FIGS. **1***a* and **1***b*) 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 electormagnet **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 reversible electric motor which drives the filter cigarette machine of FIG. **1***b* by way of the cigarette making machine of FIG. **1***a*. The just mentioned signal causes the drive to operate the belts and other movable conveying parts of the machine of FIG. **1***a* 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 XII, 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 **703***b*; the other input of the AND-gate **703***b* receives the signal A from the storage **320.** The output of the AND-gate **703***b* 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 **403***a* 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 **703***a*. The other input of the AND-gate **703***a* 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 *d* 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 paster **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 seam which is formed by the overlapping marginal portions of the web **17** (with a film of paste furnished by the paster **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 **407***a* in the photosensitive detector **407** at the time when the electromagnet **406** moves the heater **6** to operative position. The receiver **407***b* 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 the stage S32 (seven steps), the receiver **407***b* of the detector **407** continues to transit 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 **407***a* 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 paster **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 *a* and erases the output signal of the storage **607.** This deactivates the detector **407** by opening the circuit of the light source **407***a*.

If the seam between the maginal 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 **407***b* 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 **711***b*. 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 **410***a* in the detector **410.** The latter is located downstream of the cutoff **21.**

The receiver **410***b* of the detector **410** produces a signal in response to absence of cigarettes Z; this occurs, for example, when the leading end of the cigarette rod *Zs* fails to enter the tubes **19.** The signal from the receiver **410***b* 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 **720**) whereby the output signal from the storage **610** is erased and the detectors **407, 410** become inactive (opening of the circuits of light sources **407***a* and **410***a*). 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 **711***b* 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 **411***a* 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 **711***a*. The other inputs of these AND-gates receive the signal A. The output of the AND-gate **711***a* 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 **411***a* 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 second 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 the amplifier **513** which completes the circuit of the light source **413***a* in the detector **413.** As mentioned above, the detector **413** forms part of the controller circuit **813.**

The receiver **413***b* 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 deenergized 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 **413***a* 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 **716***a* and **714***a*. The other inputs of these AND-gates receive the signal A. The output of the AND-gate **714***a* 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 **716***a* 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 **41***a*.

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 **717***a* the other input of which receives the signal A. The output of the AND-gate **717***a* 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 **417***a* lowers the tape **41***a* 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 sson 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 **S31**) 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 paster **4** and heater **6**. The signal B is further transmitted to the input *a* 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 *a* 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 **S31** 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 to form therewith filter cigarettes. During evacuation of cigarettes from the filter cigarette machine, the filler rod is caused to enter the collecting receptacle **18** (FIG. **1***a*) as soon as the electromagnet **404** deactivates the paster **4** and the electromagnet **406** deactivates the heater **6**.

When the third control signal reaches the stage **S52** (**21** steps), the register output O transmits a signal to one input of the AND-gate **714***b* the other input of which receives the signal B. The output of the AND-gate **714***b* 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 **S56**, the output P transmits a signal to one input of the AND-gate **717***b* the othet input of which receives the signal B. The output of the AND-gate **717***b* 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 **417***a* moves the tape **41***a* away from the applicator **43**.

When the third control signal reaches the stage **S60**, the output Q transmits a signal to one input of the AND-gate **716***b* the other input of which receives the signal B. The output of the AND-gate **716***b* then transmits a signal to the input *b* of the storage **616** which erases its output signal whereby the clutch **416** is deenergized and the rolls **47** stop the transport of the tape **41***a*.

When the third control signal reaches the shifting stage **S70**, 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 of the 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 **S36**) 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 aforedescribed 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 S29, 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** whose output then transmits a signal to the 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 **S26, S27, S28,** 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 S29 (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, the 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 **41***a*. 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 paster **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 paster **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 **41***a* 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 **427***a* 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 **427***a* 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. **1***a* and **1***b*, 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 S120 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 controlls the tube cleaning nozzle **403***a* 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** automaticaly terminates the cleaning of tubes **19.**

Also, in conventional cigarette making machines the heater and the paster 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 paster and the heater normally comprises time-lag devices which delay the signal for a predetermined period of time to insure that the paster 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

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 sections 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 multilating 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 a modern machine wherein the rod travels at a high speed. The mutilating 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 termnated 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 durng 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 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 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 activatable 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 selected shifting stages with said control means and signal receiving inputs connected with selected 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-

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.

* * * * *