Jan. 27, 1970 H. KAEDING 3,491,767

METHOD AND APPARATUS FOR REJECTING DEFECTIVE ARTICLES

Original Filed July 6, 1962 4 Sheets-Sheet 1

Fig. 1

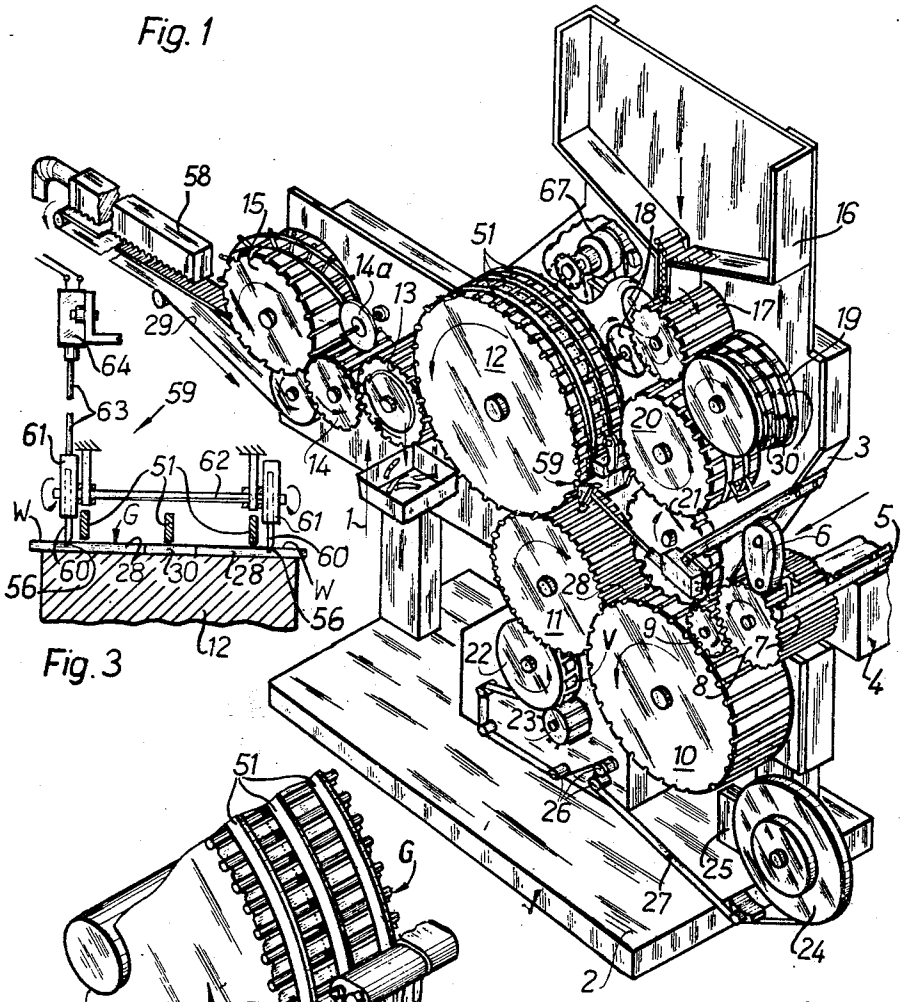


Fig. 3

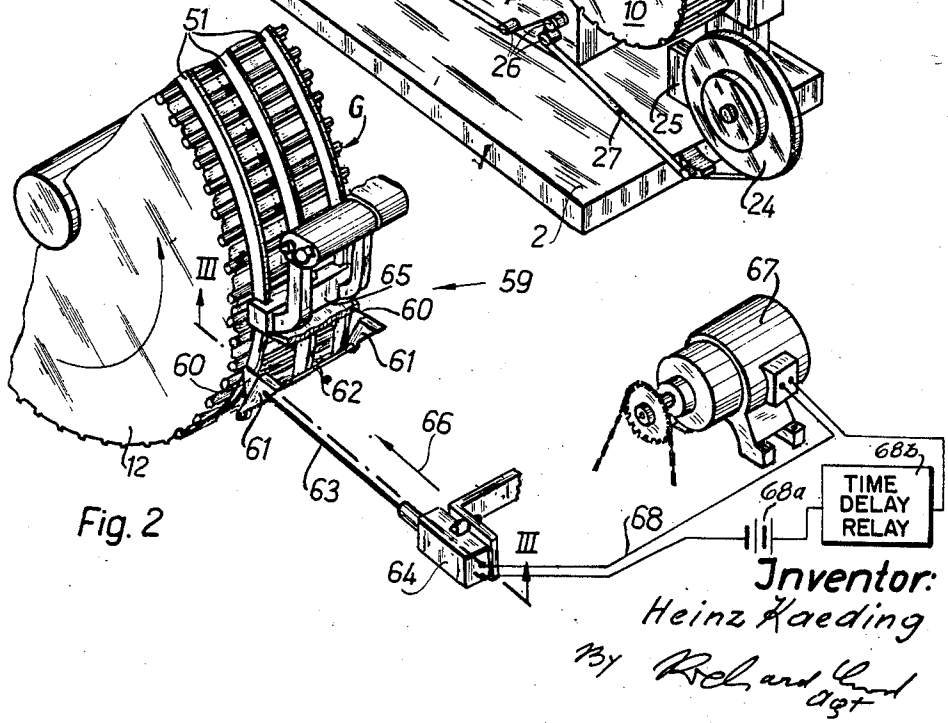


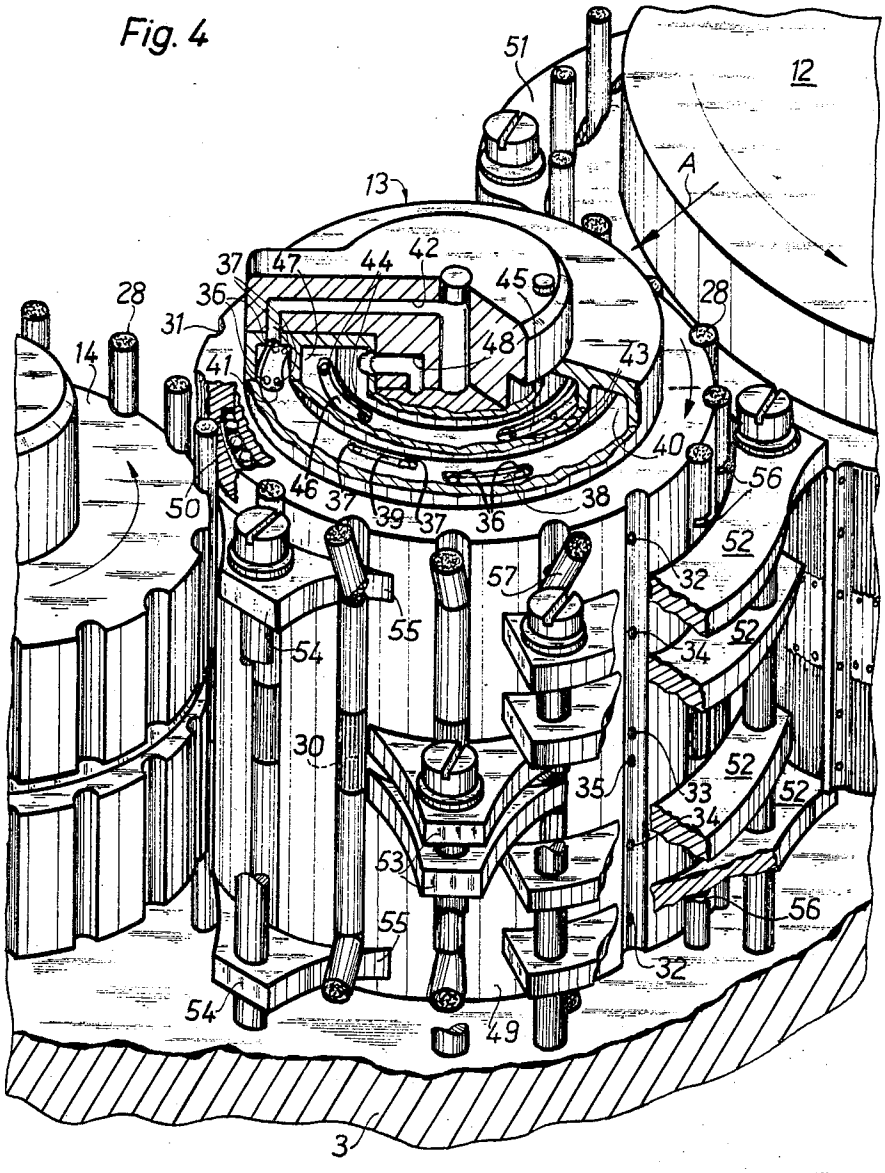
Fig. 2

Inventor:
Heinz Kaeding
By Roland and Ward
Agt

METHOD AND APPARATUS FOR REJECTING DEFECTIVE ARTICLES

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Fig. 4



Inventor:
Heinz Kaeding
By Richard Close
Agt

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Fig. 5

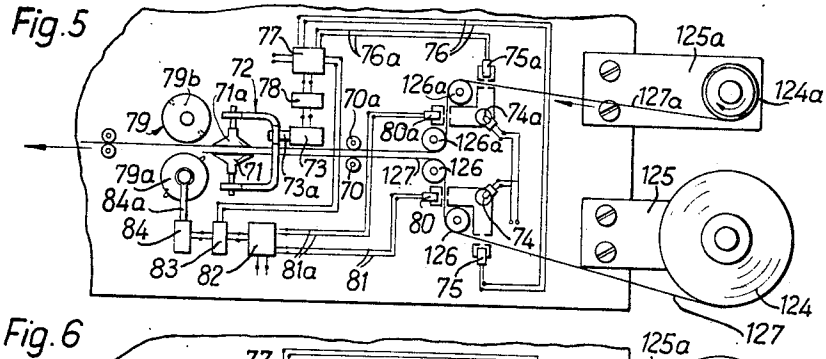


Fig. 6

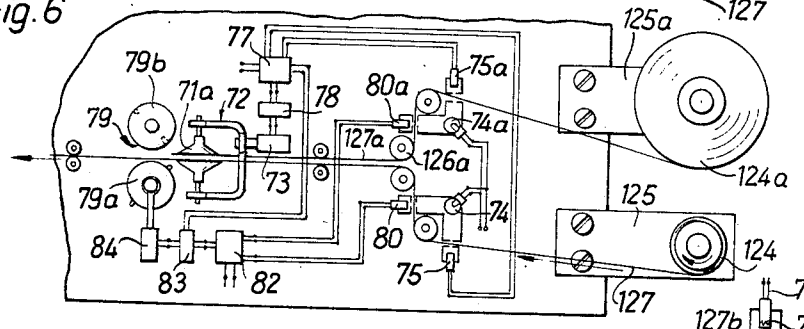


Fig. 7b

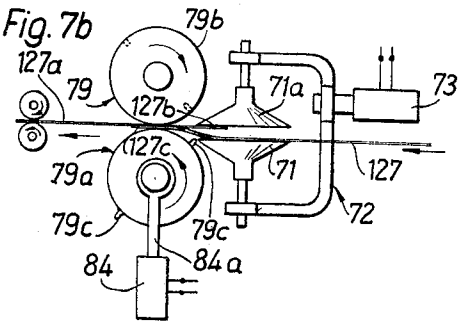


Fig. 7a

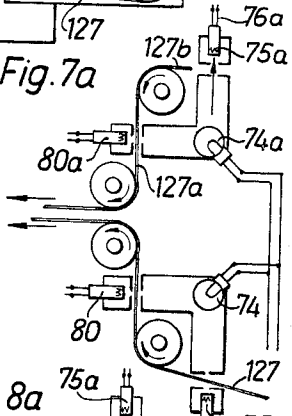


Fig. 8b

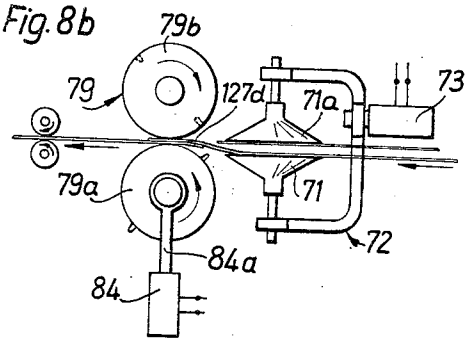
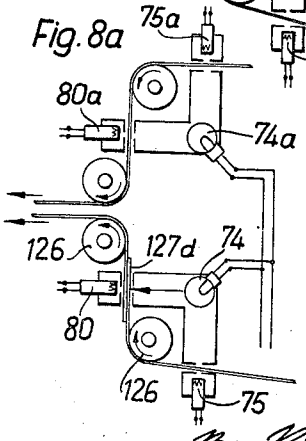


Fig. 8a



Inventor:
Heinz
Kaeding
By Richard Lind
Agt

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METHOD AND APPARATUS FOR REJECTING DEFECTIVE ARTICLES

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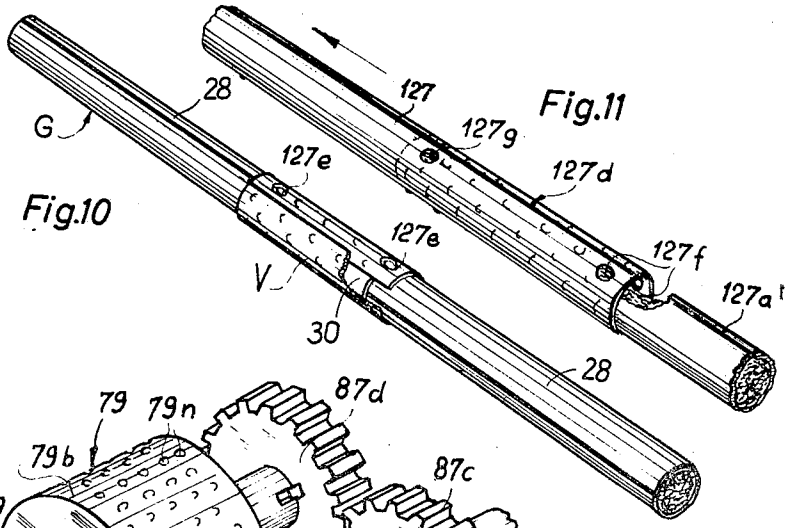


Fig.10

Fig.11

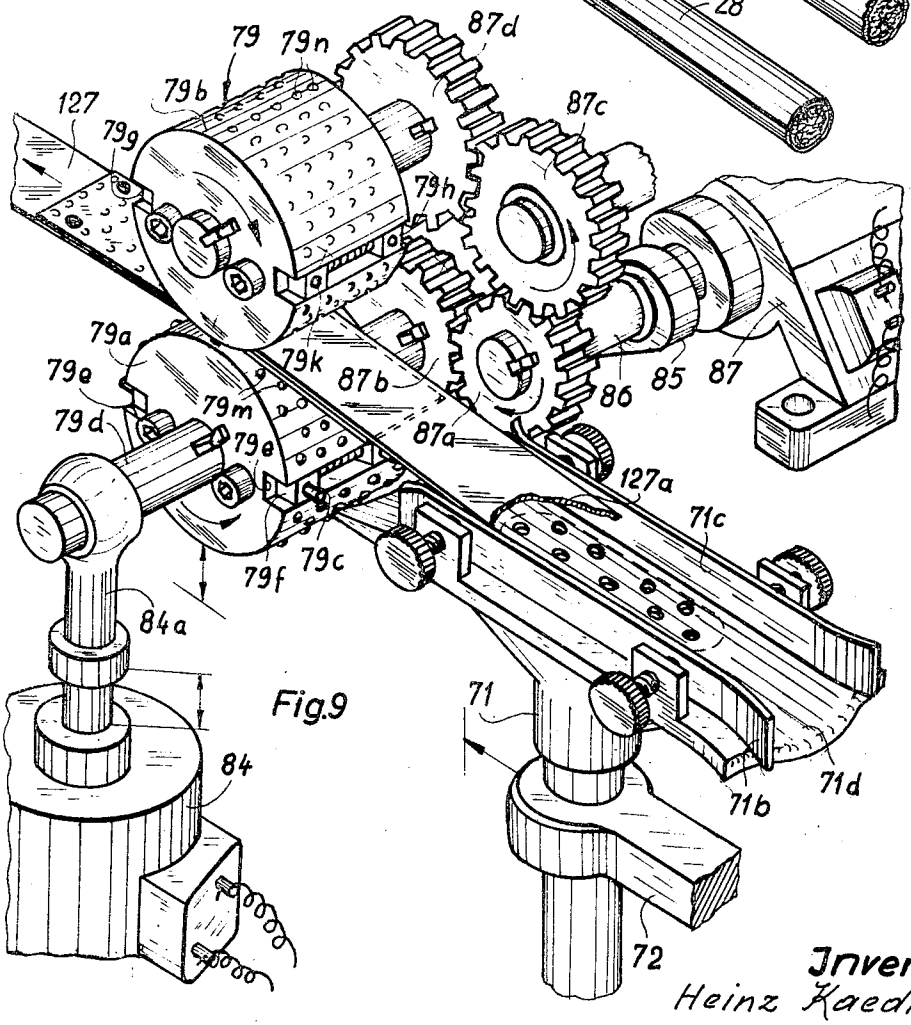


Fig.9

Inventor:
Heinz Kaeding
By Richard Lund
Agt

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3,491,767

METHOD AND APPARATUS FOR REJECTING DEFECTIVE ARTICLES

Heinz Kaeding, Hamburg-Bergedorf, Germany, assignor to Hauni-Werke Koerber & Co. KG., Hamburg-Bergedorf, Germany

Continuation of application Ser. No. 208,030, July 6, 1962. This application Oct. 9, 1967, Ser. No. 674,016
Claims priority, application Great Britain, July 7, 1961, 24,631/61; July 5, 1962, 25,780/62
Int. Cl. A24b 3/00; A24c 5/12; G01m 19/00
U.S. Cl. 131—21 10 Claims

ABSTRACT OF THE DISCLOSURE

A cigarette producing machine normally operated at a speed which is within a predetermined range of speeds, and a monitoring device to produce characteristic indications when the operating speed of the machine is outside of the predetermined range. The machine is adapted to produce filter cigarettes and the indications are produced on the cigarette or the filter portions of the same before the machine assembles a double length filter element between two cigarette portions. Detection and ejection of defectives takes place after such assembly. An ejector is responsive to such characteristic indications to segregate from satisfactory cigarettes those cigarettes which are produced when the speed of the machine is outside of the predetermined range.

This is a streamlined continuation of my application Ser. No. 208,030, filed July 6, 1962, and now abandoned.

This invention relates generally to the production of rod-shaped objects, such as, cigarettes, cigars, cigarillos and the like, with or without filters or mouthpieces.

It is essential that, during the production of such rod-shaped objects or the further treatment thereof following such production, defective objects should be discarded either prior to, or following the further processing. There are a variety of ways in which defects are apt to arise during the production of cigarettes and filters, or during the joining together of the cigarettes and filters. Some of the defects occur during commencement of the operation of the machine when the machine is operated at a speed which is outside of a predetermined range of speeds, and upon replacement of the supply spools of paper or other wrapping material in which the rods of tobacco or the filters are encased, or by which the cigarettes and filters are joined to each other.

It is an object of this invention to provide a process and devices by which cigarettes and filters, or other rod-shaped objects having manufacturing defects are sensed or detected and rejected or discharged from the machine.

In accordance with an important aspect of this invention, the rod-shaped objects, or the materials used in producing such objects, for example, the paper or other wrapping material, are provided with characteristic indications during the periods of operation of the machine during which manufacturing defects occur, for example, during the commencement of operation of the machine, or upon replacement of the supply spools of paper or other wrapping material, and such characteristic indications provided on the rod-shaped objects or in the material from which the latter are formed are thereafter sensed to cause rejection or discharge from the machine of the defective objects.

In a preferred embodiment of this invention, the defective rod-shaped objects or the defective materials used for the production of the rod-shaped objects are automatically provided with apertures or incisions which weaken the defective rod-shaped objects so that, when

the latter are scanned by a suitable testing device, the weakened defective objects are deformed from their normal shape and thus acted upon by a rejecting device for discharge from the machine.

Further, the testing device may be sensitive to the air permeability of the wrapping material of the rod-shaped objects so that the apertures or incisions provided in the defective objects or in the wrapping material from which the latter are formed alter the air permeability of the defective objects sufficiently to permit the testing device to detect the altered air permeability and to cause operation of the device by which the defective rod-shaped objects are rejected or discharged from the machine.

The above and other objects, features and advantages of the invention will be apparent in the following detailed description of illustrative embodiments thereof which is to be read in connection with the accompanying drawings, forming a part hereof, and wherein:

FIG. 1 is a perspective view illustrating a machine for producing rod-shaped objects, and which is provided with devices embodying the present invention for identifying and rejecting defective objects;

FIG. 2 is a fragmentary perspective view illustrating details of a device provided in the machine of FIG. 1 for the purpose of identifying defective rod-shaped objects;

FIG. 3 is a sectional view taken along the line III—III on FIG. 2;

FIG. 4 is an enlarged perspective view of the testing and rejecting devices as viewed substantially in the direction of the arrow 1 in FIG. 1;

FIG. 5 is a schematic side elevational view of a reel changing device that can be employed on the machine of FIG. 1 to identify the joints or splices connecting the ends of the wrapping material fed from successive supply reels;

FIG. 6 is a view similar to that of FIG. 5, but showing the condition of the reel changing device when the supply of wrapping material on a reel is almost depleted;

FIG. 7*a* is an enlarged view of a part of the device shown in FIG. 5, and illustrates the device in the process of detecting the exhaustion of the wrapping material on one of the reels;

FIG. 7*b* is an enlarged view of another part of the device shown in FIG. 5, and illustrates the splicing together of the wrapping material on successive reels;

FIG. 8*a* is a view similar to that of FIG. 7*a*, but illustrates the device while sensing a splice in a continuous web of wrapping material;

FIG. 8*b* is a view similar to that of FIG. 7*b*, but illustrating the device while performing the splice sensed in a continuous web of the wrapping material, as in FIG. 8*a*;

FIG. 9 is a detail perspective view illustrating structural details of a portion of the device shown in FIG. 5;

FIG. 10 is an enlarged perspective view of a rod-shaped object of the kind handled by the machine of FIG. 1; and

FIG. 11 is a perspective view of a portion of a continuous rod or shaft of cigarette tobacco encased in wrapping material a portion of which is broken away, in which perforations have been performed in a splice connecting ends of the wrapping material drawn from successive reels.

Referring to the drawings in details, and initially to FIG. 1 thereof, it will be seen that a machine for producing filter cigarettes and having devices for detecting and rejecting defective products in accordance with the present invention generally includes a base plate 2 and a frame 3 extending upwardly from the latter. The illustrated machine receives successive cigarettes which are transported in longitudinal alignment on the discharge conveyor 5 of a conventional cigarette making machine 4. The conveyor 5 terminates adjacent the periphery of

a cigarette receiving drum **8** at one side of the latter, and a cigarette transfer unit **7** rockably mounted on a crank arm **6** receives cigarettes **28** from the conveyor **5** and deposits such cigarettes, two at a time, in the axially extending grooves spaced apart around the circumference of the drum **8**.

The pairs of cigarettes thus deposited in the grooves of receiving drum **8** are transferred, by way of an intermediate drum **9**, to axially extending, spaced apart grooves formed in the surface of an assembling drum **10** on which each pair of cigarettes is axially spaced apart in the related groove and a double filter plug or member **30** is interposed therebetween. The double filter plugs **30** are received from a filter cutting and arranging device which is preferably of the kind disclosed in the application for United States Letters Patent, Ser. No. 60,929, filed by Willy Rudszinat et al. on Oct. 6, 1960, now Patent No. 3,164,243 granted on Jan. 5, 1965. Such a filter cutting and arranging device generally comprises a magazine **16** delivering filter elements each intended to form a plurality, for example, three, of the double filter plugs **30**. These relatively long filter elements are deposited in the axially extending grooves on the surface of a transfer drum **17** mounted rotatably below the magazine **16** and cooperating with two rotary cutting blades **18** disposed at axially spaced apart locations along the surface of drum **17** so that each filter element is thereby cut into three double filter plugs. The three double filter plugs **30** in each groove of the drum **17** are transferred to a drum **19** of stepped diameter which cooperates with a filter plug shuffling drum **20** to bring all of the filter plugs **30** into a single plane of rotation, whereupon the filter plugs **30** are deposited successively by a transfer drum **21** of relatively small axial extent in the central portions of the grooves of assembling drum **10** between the pairs of cigarettes previously deposited in such grooves.

Each filter plug **30** is intended to form the filters for the two cigarettes deposited in the same groove of assembling drum **10**. Each group of two cigarettes **28** and a double filter plug **30** therebetween is transferred from drum **10** to a groove in the surface of a consolidating drum **11** which is provided with conventional mechanisms for moving the two cigarettes into end-to-end abutment with the intervening filter plug, for example, as in United States Letters Patent No. 2,821,201.

The illustrated machine further operates to join each filter plug **30** to the adjacent ends of the two cigarettes **28** between which the filter plug is located by means of a sleeve V of paper or other wrapping material (FIG. 10) so as to form a cigarette and filter unit G. In order to form the connecting sleeves V, the illustrated machine includes a holder **25** rotatably supporting a spool or reel **24** from which a web or strip **27** of paper or other wrapping material is unwound. The web or strip **27** passes around feed and guide rollers **26** and then through a sheeting unit that includes a back-up drum **22** and a revolving knife **23** having axially extending, spaced apart blades projecting from the surface thereof to cooperate with the surface of drum **22** in cutting the strip or web **27** into successive sections of paper or wrapping material each intended to form a connecting sleeve V. The successive paper sections are carried on the surface of drum **22** and are each made to adhere to a filter plug **30** and a pair of cigarettes **28** in a groove of the consolidating drum **11**.

The filter plugs, cigarettes and paper sections adhering thereto are transferred from the successive grooves of consolidating drum **11** to axially extending grooves in the surface of a rolling drum **12** which operates to roll each paper section and to form the sleeve V by which each pair of cigarettes **28** and the double filter plug **30** interposed therebetween are connected together to form a cigarette and filter unit G. A suitable rolling drum is disclosed, for example, in U.S. Patent No. 3,137,302 to Schubert. The successive cigarette and filter units G are transferred from drum **12** to an ejecting device **13** provided in accordance with the present invention and which is hereinafter described in detail. At this point, it is sufficient to note that the device **13** singles out and ejects the defective units G which are deposited in an underlying receptacle, while those units G having the desired properties and characteristics are further transferred into the axial grooves of a transfer drum **14** cooperating with a rotary cutting blade **14***a* associated therewith to cut each unit G at the center thereof, and thereby provide two filter cigarettes from each unit. Since the filter cigarettes cut from each unit on the drum **14** have their filtered ends extending toward each other, the pairs of filtered cigarettes are transferred by way of a turning drum **15** to a belt conveyor **29**, and the turning drum **15** operates, in a known manner, to reverse the direction of one of the filtered cigarettes in each groove so that the filtered ends of the cigarettes delivered to the conveyor **29** will all lie at one side of the latter. The filtered cigarettes delivered to the belt conveyor **29** in the manner indicated above are further transported to a packaging or other machine (not shown) by way of a suction device **58**.

It is to be noted that, with the exception of the ejecting device **13** mentioned briefly above, the described machine for producing filter cigarettes does not form a part of the present invention, and has merely been described for the purpose of indicating a machine in which devices embodying the invention may be advantageously employed.

It will be apparent that, when operation of the described filtered cigarette making machine is halted for any substantial period of time, the adhesive by which the successive sections of paper cut from the web **27** are to be joined to the related filter plugs and cigarettes to form the units G will dry out so that, upon subsequent restarting of the machine, the initially produced units G will not be properly secured or joined. In accordance with the present invention, the units G produced by the machine during the commencement of operation thereof are characteristically identified, for example, by apertures or incisions cut therein as hereinafter described in detail, so that such units may be readily singled out by the device **13** and ejected from the machine, thereby avoiding the discharge onto the conveyor **29** of defective filter cigarettes.

Referring now to FIGS. 2 and 3, it will be seen that the device **59** provided in accordance with the present invention for identifying those cigarette and filter units G produced upon commencement of operation of the machine may include a pair of knife blades **60** carried by knife holders **61** which are rockable together on a shaft **62** which is suitably supported on the usual outer guides **51** of the rolling drum **12**. The assembly of knife blades **60**, holders **61** and shafts **62** may be disposed immediately below a sleeve rolling member **65** (FIG. 2) associated with drum **12**, and the knife blades **60** are spaced apart so as to be disposed adjacent the opposite end portions of the cigarettes **28** in each of the grooves of drum **12**. Further, the knife blades **60** are rockable simultaneously between an operative position where such blades are closely adjacent to the surface of drum **12** and cut partially through the end portions of the cigarettes passing the location of the knife blades, and an inoperative position where the knife blades **60** are spaced a substantial distance from the surface of drum **12** and thereby avoid contact with the cigarettes included in each unit G transported by the drum. One of the blade holders **61** is pivotally connected through a link or rod **63** to the armature of a signal generator here shown as a solenoid **64** so that, when the latter is energized, and thereby displaces its armature in the direction of the arrow **66** (FIG. 2), the blades **60** are moved to their operative positions and thereby cut incisions in the paper envelopes or casings W of each pair of cigarettes **28** passing the location of the knife blades. The solenoid **64** is energized to move the knife blades **60** to their operative positions only when the operative speed of the associated filter cigarette making machine is less than a predetermined value. When

the operating speed of the machine reaches such predetermined value, the solenoid **64** is automatically deenergized and thereby returns the blades **60** to their inoperative positions. Such control of the energization of solenoid **64** may be effected by a centrifugal monitoring switch **67** interposed in the energizing circuit **68** and driven, as by the illustrated chain and sprocket transmission, from the main drive of the cigarette making machine. The source of energy in the electric circuit **68** is shown at **68***a*.

The time normally required for the filter cigarette making machine to attain the predetermined speed at which centrifugal switch **67** opens is sufficient to ensure that blades **60** will form cuts or incisions in all of those cigarettes **28** of the units G on drum **12** during the shutdown period of the machine and to which paper sections are adhesively applied, but not rolled, prior to shutdown of the machine. Thus, upon commencement of the operation of the filter cigarette making machine, all of those initially produced units G to which the sleeves V are inadequately secured are identified by the incisions or cuts **56** formed therein by the blades **60**. If the centrifugal switch **67** does not provide for energization of the solenoid **64** for a period of time sufficient to ensure the identifying cutting of all of the units G which are defective, then a conventional time delay relay **68***b* can be interposed between the centrifugal switch **67** and the solenoid **64** for further delaying the deenergization of the latter.

In accordance with the present invention, the ejecting device **13** which receives the successive units G from rolling drum **12** is operative to sense or detect each of the units G having incisions **56** cut therein, as described above, and further to eject or discharge such defective units from the machine. The device **13**, as hereinafter described in detail, is also effective to detect and reject defective units from which either the cigarettes **28**, the filter plugs **30** or the connecting sleeves V are missing, or units in which the connecting sleeves are not securely attached to the cigarettes or the cigarettes are improperly filled.

As shown on FIG. 4, the ejecting device **13** is generally in the form of a drum made up of an outer cylinder **49** having a circumferentially spaced apart series of axially extending grooves **31** in its outer surface and being rotatably mounted, as by bearings **50**, on a stationary core unit. Each groove **31** which receives a cigarette and filter unit G from the rolling drum **12** is provided with ports **32** adjacent its opposite ends and a centrally located port **33** which, when the related groove **31** passes through predetermined zones during rotation of cylinder **49** about the stationary core unit, are in communication with a source of compressed air so that blasts of compressed air then issue radially outward from the ports **32** and **33**. Further each groove **31** is provided with additional ports **34** located approximately midway between the ports **32** and **33** and with a centrally located port **35**, and the ports **34** and **35** are intended to be in communication with a source of partial vacuum during movement of the related groove **31** through other predetermined zones around the stationary core unit.

As shown in FIG. 4, the stationary core of the ejecting device **13** has a cylindrical body provided with ducts **36** which are parallel with the axis of the device **13** and open radially at suitable locations on the surface of the cylindrical body so as to communicate with the compressed air ports **32**. The ducts **36**, at one axial end, open into a control slot **38** which in turn communicates with a compressed air chamber **40** formed in a cap at one end of device **13**. The annular compressed air chamber **40** communicates with a passage **42** in the cap which is suitably connected to a source of compressed air (not shown). The compressed air chamber **40** of the cap further communicates with a slot **39** located after the slot **38**, considered in the direction of rotation of the outer cylinder **49**, as shown by the arrow thereon, and the slot **39** further communicates with openings at the upper ends of ducts **37** which open radially adjacent the center of the body of the fixed core so as to communicate with the central compressed air ports **33** of the successive grooves **31**. Another slot **41** is formed in the end of the body to communicate with the compressed air chamber **40** and is located after the line of tangency of the cylinder **49** with the transfer drum **14**. Axial ducts **36** and **37** also extend from the slot **41** and open radially at the surface of the body of the central core at locations for communication with the ports **32** and **33**, simultaneously, thereby to blow out any material remaining in the grooves **31** after the latter have passed the point at which the units G are transferred to the drum **14**.

The cap at one end of the stationary core of device **13** further has an annular suction chamber **47** disposed concentrically within the compressed air chamber **40** and communicating through a passage **48** with a suitable source of suction or partial vacuum (not shown). Formed in the end surface of the body of the stationary core and communicating with the suction chamber **47** are slots **45** and **46** which in turn communicate with axial ducts **43** and **44** located angularly in advance of the ducts **36** and following the ducts **37**, respectively, considered in the direction of rotation of cylinder **49**. The ducts **43** and **44** communicate with the suction ports **34** and **35**, respectively .

Each of the grooves **31** moves with cylinder **49** from the station or location A of tangency with the rolling drum **12**, at which each groove receives a cigarette and filter unit G, to the substantially diametrically opposed location at which the successive units are transferred to the drum **14**, the ports **32** and **33** and the ports **34** and **35** of the groove are connected to the sources of compressed air and partial vacuum, respectively, in the follwing order: Initially partial vacuum is applied to the suction ports **34**, then compressed air is applied, in sequence, to the outer ports **32** and to the central port **33**, and thereafter suction is applied to the central suction port **35**.

Further, as shown in FIG. 4, the device **13** includes arcuate guides **52**, **53** and **54** extending, in sequence, around the lower portion of cylinder **49** substantially between the station A at which units G are received from drum **12** and the station at which the units G are transferred from cylinder **49** to the drum **14**. Four of the guides **52** are provided and are spaced apart so as to be engageable with the cigarettes **28** of each unit G, with the guides **52** located between the locations at which the incisions **56** are formed in the cigarettes by the knife blades **60** upon operation of the identifying device **59**. Only two of the guides **53** are provided, and these guides are located adjacent the central portion of the cylinder **49** so as to be engageable only with the double filter plugs **30** of the successive units G. Two of the guides **54** are also provided, but these guides are located adjacent the opposite ends of cylinder **49**, that is, between the incisions **56** that may be formed in the cigarettes **28** and the outer ends of the latter, and the guides **54** have their ends **55** which extend in the direction opposed to the rotation of cylinder **49** formed as deflectors. The deflectors **55** are located relative to the surface of cylinder **49** so that the end portions **57** of the cigarettes **28** can pass freely over the deflectors **55** when the end portions of the cigarettes lie closely within the related grooves **31**. However, if the end portions **57** of the cigarettes are bent or projected outwardly from the related grooves **31**, as shown in FIG. 4, then the deflectors **55** at the ends of guides **54** engage between such outwardly bend end portions **57** and cylinder **49** and thereby strip the cigarette and filter unit G from the slot of cylinder **49** for discharge into the underlying receptacle.

The device **13** operates as follows:

If cigarette and filter units G are delivered to the grooves **31** of device **13** from the drum **12**, but the cigarettes of such units have incisions **56** formed therein to indicate that the same were produced during the com-

mencement of operation of the machine, as previously described herein, then the end portions **57** of the cigarettes are blown radially outward from the related grooves **31** by jets of compressed air issuing from the ports **32** when the latter communicate with the compressed air supply ducts **36**. During the action of the compressed air issuing from ports **32** against the outer end portions **57** of the cigarettes, the middle portions of the unit G are held in the related groove **31** by the guides **52**. Since the outer end portions **57** are deflected out of the grooves **31**, the deflectors **55** of guides **54** can pass between such end portions **57** and the surface of cylinder **49** for stripping the defective unit G from the latter. During such stripping of the defective unit G from the related groove **31**, the central port **33** of the latter is communicated with the ducts **37** supplying compressed air so that a jet of compressed air also acts outwardly against the central portion of the defective unit G to further cause ejection of the latter from the groove.

If a unit transferred to a groove **31** of cylinder **49** is lacking the cigarettes **28** normally forming a part thereof, for example, by reason of an interruption in the feeding of cigarettes to the machine, then such unit is rejected immediately after it passes the guides **53**, at which time the central port **33** of the related groove is communicated with the compressed air supplying ducts **37** so that the jet of compressed air issuing from the port **33** then drives the filter plug of the incomplete unit out of the related groove.

If a unit received in a groove **31** of cylinder **49** consists only of the two cigarettes **28**, for example, by reason of an interruption in the feeding of filters from the magazine **16** to the machine, then such unconnected cigarettes are ejected from the related groove **31** immediately upon the movement of the latter beyond the guides **52** at which time jets of compressed air issue from the ports **32** by reason of the continued communication of the latter with the compressed air supplying ducts **36**.

If a defective or incomplete unit G delivered to a groove **31** of cylinder **49** consists of two cigarettes **28** joined together by a hollow connecting sleeve V, that is, a sleeve without a filter plug therein, the jets of air issuing from the outer ports **32** while the hollow connecting sleeve is engaged by the guides **53** exerts sufficiently strong forces to overcome the strength of the hollow connecting sleeve, whereby the latter is bent or pinched and the cigarettes **28** are deflected outwardly from the related groove **31** and thereby are engageable by the deflectors **55** at the ends of the guides **54** for ejection of the unit G from the related groove.

If a cigarette and filter unit G is delivered to a groove **31** of cylinder **49** without a connecting sleeve V joining together the filter plug and cigarettes, then the cigarettes **28** are ejected from the groove **31** when the ports **32** thereof communicate with the compressed air supplying ducts **36**, and the double filter plug **30** is ejected from the groove when the latter clears the guides **53** and the central port **33** is in communication with the compressed air supplying ducts **37**.

Finally, if a complete cigarette and filter unit G is delivered to a groove **31**, but the cigarettes of such unit are inadequately filled or too soft, or if the connecting sleeve V is inadequately adhered to the cigarettes **28**, then the compressed air issuing from the ports **32** during communication of the latter with the compressed air supplying ducts **36**, and while the central portion of the unit G is engaged by the guides **53**, will cause the cigarettes **28** to be bent outwardly from the related groove **31** and thereby moved into the range of effectiveness of the deflectors **55** of guides **54** for stripping of the defective unit G from cylinder **49**.

It will be noted that the device **59** is operative to identify the defective cigarette and filter units G which are produced upon the commencement of operation of the machine, and does so by cutting incisions in the paper envelopes or casings W of the cigarettes, which incisions also extend partly through the tobacco filling of the cigarettes. However, in accordance with the present invention, the defective units or other rod-shaped objects being produced may be identified for convenient detection thereof merely by forming perforations or apertures in the paper or other wrapping material.

In the machine described above with reference to FIG. 1, the connecting sleeves V which join together the cigarettes **28** and filter plugs **30** of the units G are formed from sections cut from a strip **27** of paper or other wrapping material which is unwound from a roll on a spool or reel **24**. When the roll of wrapping material on the spool or reel **24** is depleted, the operation of the filter cigarette making machine has to be halted to permit replacement of the empty spool or reel with one having a new supply of wrapping material thereon. However, FIGS. 5 to 9, inclusive, illustrate a device that can be substituted for the single spool **24** on the holder **25** of FIG. 1 and that is adapted to supply a continuous and uninterrupted strip of paper or other wrapping material to a cigarette making machine to be formed by the latter into connecting sleeves for securing filter plugs to cigarettes, as in the machine of FIG. 1, or to form the paper casings or envelopes of cigarettes.

The device shown in FIG. 5 includes two spaced apart holders **125** and **125***a* respectively supporting reels or spools **124** and **124***a* from which strips or webs **127** and **127***a* of paper or other wrapping material may be unwound successively. During the unwinding of the strip of paper from one of the spools or reels, for example, from the spool **124***a* as shown on FIG. 5, and the feeding of the unwound strip to the drums **22** and **23** (FIG. 1) by which the strip is cut into sections intended to form the connecting sleeves V of the units G, a full spool or reel of paper or other wrapping material, for example, the spool **124** on FIG. 5, is held in readiness and, upon exhaustion or depletion of the paper strip on the spool **124***a* from which the wrapping material is being unwound, the device operates automatically to splice the leading end of the strip **127** on the full spool **124** to the trailing end of the strip **127***a* unwound from the empty spool **124***a*.

The strips **127** and **127***a* withdrawn from the spools **124** and **124***a* pass around guide pulleys **126** and **126***a* and then travel along parallel, closely spaced apart paths past guide rolls **70** and **70***a*. Lower and upper suction heads **71** and **71***a* arranged beyond the guide rolls **70** and **70***a* and suitably connected to a source of partial vacuum (not shown) are provided with perforated surfaces for adhering engagement with the strips **127** and **127***a*, respectively. The suction heads **71** and **71***a* are located immediately ahead of a splicing and perforating mechanism **79** that includes an upper roller **79***b* rotated about a fixed axis and a lower roller **79***a* rotated about a vertically movable axis, and being normally downwardly spaced from the upper roller **79***b*. Both of the suction heads **71** and **71***a* are mounted in a common support **72** that is movable parallel to the paths of travel of strips **127** and **127***a* between the suction heads, that is, toward and away from the splicing and perforating mechanism **79**. The support **72** is normally disposed in the position illustrated in FIGS. 5 and 6, that is, with the suction heads **71** and **71***a* spaced a relatively large distance from rollers **79***a* and **79***b*, and the support **72** is connected to the armature **73***a* of a solenoid **73** so that, upon energization of the latter, support **72** is moved towards rollers **79***a* and **79***b* to the position illustrated on FIG. 7*b*.

The lower roller **79***a* of the splicing and perforating mechanism **79** is connected to the armature of a solenoid **84** so that, upon energization of the latter, the roller **79***a* is moved upwardly from its normal inoperative position (FIGS. 5 and 6) against the upper roller **79***b* (FIGS. 7*b* and 8*b*).

In order to control the energization of the solenoids **73** and **84**, the device illustrated in FIGS. 5 and 6 further includes light sources **74** and **74***a* each directing two beams of light against the strips **127** and **127***a*, respectively, at spaced apart locations along the paths of travel of the respective strips around the guide pulleys **126** and **126***a*. Photoelectric cells **75** and **80** and photoelectric cells **75***a* and **80***a* are disposed adjacent the paths of travel of the strips **127** and **127***a* at the locations where the beams of light are directed against such strips by the light sources **74** and **74***a*, respectively. The photoelectric cells **75** and **75***a* are connected by conductors **76** and **76***a* to a control unit **77** which is, in turn, connected to relays **78** and **83** for energizing the solenoids **73** and **84**, respectively. When either one of the photoelectric cells **75** and **75***a* is energized by a light beam from the related light source **74** or **74***a*, the resulting electrical signal fed to the control unit **77** causes the latter to energize both relays **78** and **83**, and thereby close the contacts of the relays, for a predetermined period of time during which solenoids **73** and **84** are energized.

The photoelectric cells **80** and **80***a* are connected by conductors **81** and **81***a* to a control unit **82** which controls the relay **83** in the energizing circuit of solenoid **84**. The control unit **82** is operative to energize the relay **83** and thereby close its contacts for energizing the solenoid **84** for a predetermined period of time whenever the diffused light reaching one or the other of the photoelectric cells **80** and **80***a* through the related paper strip **127** or **127***a* is further reduced in intensity by the passage of a double thickness of paper.

As shown in detail on FIG. 9, from which the upper suction head **71***a* has been eliminated for the purpose of clarity, the lower roller **79***a* of the splicing and perforating mechanism **79** is mounted on a shaft **79***d*. One end of the shaft **79***d* is journalled in a bearing carried by the armature **84***a* of solenoid **84**, while the opposite end of shaft **79***d* is journalled in a bearing carried by an arm **85** which is rockably supported on the output shaft **86** of the reduction gearing of an electric motor **87**. A gear transmission is provided for driving rollers **79***a* and **79***b* from the motor shaft **86** and includes meshing spur gears **87***a* and **87***b* respectively secured on the shafts **86** and **79***d*, and a further spur gear **87***c* meshing with the gear **87***a* and also with a spur gear **87***d* fixed on the shaft of the upper roller **79***b*. The lower roller **79***a* has two diametrically opposed, axially extending grooves **79***e* in which blocks **79***f* are secured at axially adjusted positions, and punches or pins **79***c* project radially outward from the blocks **79***f*. The upper roller **79***b* is similarly provided with diametrically opposed axial grooves **79***g* having blocks **79***h* adjustably secured therein and provided with bores **79***k* into which the punches or pins **79***c* are adapted to extend. The bottom roller **79***a* has rounded projections **79***m* extending from its surface, while the upper roller **79***b* has its surface formed with corresponding recesses or dimples **79***n*.

Further, as is apparent in FIG. 9, the perforated surface **71***d* of each of the suction heads, for example, of the suction head **71** appearing in FIG. 9, is transversely arcuate or concave so that, when the leading end portion of the strip **127** or **127***a* is held to the surface **71***d*, as hereinafter described, such end portion of the strip is longitudinally stiffened and thereby prevented from dipping downwardly from a path directed toward the nip between the rollers **79***a* and **79***b*. Further, each suction head is provided with laterally adjustable guides **71***b* and **71***c* at the opposite sides thereof for laterally guiding the related strip **127** or **127***a*.

The device described above with refenrence to FIGS. 5 to 9, inclusive, operates as follows:

When the strip **127***a* from spool or reel **124***a* is to be initially fed to the cigarette making machine, as in FIG. 5, the strip **127***a* is threaded around guide pulleys **126***a* and over guide roller **70***a* so that its leading end portion is held by the suction head **71***a* and projects a small distance beyond the latter toward the splicing and perforating mechanism **79**. If a break occurs in the strip **127***a*, or when the strip **127***a* is completely unwound from its spool **124***a* so that its trailing end **127***b* moves past the associated photoelectric cell **75***a*, as in FIG. 7*a*, whereby the beam of light from source **74***a* is unimpeded by the strip, then solenoids **73** and **84** are both simultaneously energized in response to the increased intensity of illumination received by the photoelectric cell, as described above. The energization of solenoid **73** moves support **72** toward mechanism **79** so that the leading end **127***c* is projected between rollers **79***a* and **79***b* and, after a suitable time delay, the solenoid **84** raises roller **79***a* so that, when the trailing end **127***b* of the strip **127***a* reachesh the location of rollers **79***a* and **79***b*, the latter press together the trailing end portion **127***b* and the leading end portion **127***c* to roll a pressure splice therebetween, as shown in FIG. 7*b*. Thus, strip **127** is connected to strip **127***a* to permit the continuous, uninterrupted feeding of the paper or wrapping material to the filtered cigarette making machine. During the feeding of the strip **127** from spool or reel **124**, the empty reel on support or holder **125***a* is replaced by a full reel **124***a* and the strip unwound from the latter is threaded around the guide pulleys **126***a* and past the guide roller **70***a* so that its leading end portion is then held by the upper suction head **71***a*, as shown in FIG. 6. Thus, the strip unwound from the new reel or spool **124***a* is then positioned for attachment or splicing to the trailing end of the strip **127** then being unwound from the spool **124**.

Since the double thickness of paper or wrapping material occurring at the location of the splice or joint between the ends **127***b* and **127***c* of the joined together strips **127***a* and **127**, respectively, would produce a connecting sleeve V of double thickness, which is not desired, the punches or pins **79***c* and the cooperating bores **79***k* provided on the rollers **79***a* and **79***b*, in accordance with this invention, act to form perforations in the portion of the strip having a double thickness of material so that, when the perforated portion of the strip is formed into a connecting sleeve V joining two cigarettes **28** to a double filter plug **30**, as in FIG. 10, the perforations **127***e* appear adjacent the opposite ends of the sleeve and the respective unit G can be easily detected so that the unit G including the sleeve of double thickness can be ejected or discharged from the filter cigarette making machine. It will be apparent that the perforations **127***e* appearing adjacent the ends of the connecting sleeve V substantially weaken the connections between the cigarettes **28** and the centrally located filter plug **30**. Thus, when the unit G having a connecting sleeve with the perforations **127***e* therein passes through the ejecting device **13** previously described herein with reference to FIG. 4, the jets of compressed air issuing from the ports **32** of the related groove **31** while the central portion of the unit G is retained by the guides **53** is effective to bend the cigarettes **28** outwardly from the groove **31** at the weakened connections to the sleeve V defined by the perforations **127***e*. Thus, the deflectors **55** of guides **54** can thereafter engage between the outwardly bent cigarettes and the surface of cylinder **49** for ejecting the defective unit from the machine.

Although the operation of the device illustrated in FIGS. 5 and 6 has been described above with respect to a splice appearing at the connection between strips of paper or wrapping material fed successively from two rolls or spools **124** and **124***a*, it will be apparent that each strip of paper wound on each roll **124** or **124***a* may be, in turn, formed of several strips which are united by similar splices or overlapping joints, as at **127***d* on FIG. 8*a*. When a splice **127***d* is sensed by the related photoelectric cell **80** or **80***a*, the control unit **82** and relay **83**

cause energization of the solenoid **84** after a suitable time delay so that, when the splice or overlap joint **127***d* passes between rollers **79***a* and **79***b*, as in FIG. 8*b*, the lower roller **79***a* is pressed upwardly against the upper roller **79***b* and the punches or pins **79***c* again cooperate with the bores **79***k* to form perforations in the joint or splice **127***d*. Such perforations can be sensed, as indicated above, by the device **13** which causes ejection of the units G having connecting sleeves formed from the joint **127***d*.

It is further to be noted that the projections **79***m* and the corresponding recesses **79***n* of the rollers **79***a* and **79***b* cooperate to dimple the splice or overlapped joint simultaneously with the forming of the perforations in the latter, so that, when the corresponding portion of the paper strip is rolled into the form of a connecting sleeve V, the dimples prevent secure adherence of the sleeve to itself and also to the adjacent cigarettes **28**, thereby to further ensure the correct operation of the device **13** in detecting and ejecting those units G having connecting sleeves formed from the splice or joint portion of the strip.

Although the device illustrated in FIGS. 5 to 9, inclusive, has been described above in connection with the supplying of a strip of paper or wrapping material to a filter cigarette making machine, as shown in FIG. 1, in which sections of the paper strip are formed into connecting sleeves securing two cigarettes to an interposed double filter plug, it will be apparent that the described device may be similarly employed for feeding a paper strip to a conventional cigarette making machine in which the successive or joined together paper strips **127** and **127***a* are rolled around a continuous rod of tobacco to form the paper casing or envelope of successive cigarettes cut from the rod. In this case, as shown in FIG. 11, the splice or overlapped joint between the paper strips **127** and **127***a'* is formed with pairs of perforations **127***f* and **127***g* adjacent the opposite ends of the joint **127***d* and the latter is further dimpled, whereby a cigarette cut from the portion of the tobacco rod encased in the splice or joint **127***d* may be conveniently detected and rejected.

I claim:

1. In a process for manufacturing rod-shaped articles having tubes of wrapping material and including articles having and articles free of manufacturing defects, the steps of forming apertures at least in the wrapping material of articles having manufacturing defects, subjecting each article to bending forces so that those articles having manufacturing defects, and which are formed with said apertures which weaken the articles, are bent by said forces, and segregating those articles which are bent from articles which are free of manufacturing defects.

2. In a machine for making filter cigarettes, and wherein rod-shaped units are produced each normally including a filter plug portion and at least one cigarette portion joined to said plug portion by a connecting sleeve portion, the combination of transporting means arranged to move successive units along a predetermined path from the machine with each unit extending laterally with respect to the direction of movement thereof along said path; guide means extending along successive zones of said path and laterally located so as to be engageable respectively with said filter plug portions and cigarette portions of each unit moving along the related zones of said path; and means for directing jets of compressed air against said cigarette portions and filter plug portions of each unit as the latter moves along said zones of the path at which said guide means engage said filter plug portions and cigarettes portions, respectively, of the unit, whereby units lacking said cigarette portions, said sleeve portions or said filter plug portions and sleeve portions have the remaining portions thereof ejected from said transporting means by said jets of compressed air to avoid the discharge of incomplete units from the machine.

3. In a machine for making filter cigarettes, the combination as in claim **2** wherein such guide means engageable with the cigarette portions includes deflector means operative to strip from said transporting means those units having cigarette portions projecting out of said predetermined path, whereby units lacking only said filter plug portions are bent by said jets of compressed air acting on the cigarette portions thereof so that the latter thereby project from said path and the corresponding units are stripped from the transporting means by said deflector means.

4. In a machine for making filter cigarettes, the combinations as in claim **3** wherein said guide means engageable with the cigarette portions is laterally located near the ends of the latter remote from the related filter plug portions and sleeve portions, and further comprising additional guide means extending along a zone of said path in advance of said guide means engageable with the filter plug portions of the units, said additional guide means being engageable with the cigarette portions of the units intermediate the ends thereof, means for directing jets of compressed air transversely against the end portions of the cigarette portions of units while the filter plug portions of the latter are engaged by said additional guide means, and means acting during the initial stage of operation of the machine to form incisions in the end portions of cigarette portions which are insecurely joined to the related filter plug portions so that, when said units with incisions in the end portions of their cigarette portions are engaged by said additional guide means, the jets of compressed air acting against the end portions of the cigarette portions bend the latter at said incisions to project said end portions from said path whereupon the projecting end portions are engaged by said deflector means for stripping of the related units from said transporting means.

5. In a machine for making filter cigarettes, the combination as in claim **4** wherein said means for forming incisions in the end portions of the cigarette portions includes blade means movable between an operative position in which said blade means extends into said path and an inoperative position, and means responsive to the operating speed of the machine and arranged to move said blade means to said operative position thereof only when the speed of operation of the machine is below a predetermined value.

6. In a machine for producing a succession of rod-shaped articles which are likely to have manufacturing defects during the initial stage of operation of the machine, the combination of means operative to reduce the bending strength of articles produced during said initial stage of operation of the machine; transporting means for moving successively produced articles along a predetermined path; means operative to subject successively produced articles to bending forces during their transport along said predetermined path so that the articles of reduced bending strength are bent and project from said path; and ejecting means disposed adjacent to said path and operative to remove from said transporting means such articles which project from said path.

7. In a machine for producing a succession of rod-shaped articles including sleeves rolled from sections of an adhesive-coated strip of wrapping material and adhering to the related articles so that the latter have manufacturing defects when produced during the initial stage of operation of the machine and when including sleeves formed from joint portions of the strip, the combination of means operative to form apertures in the articles during said initial stage of operation and to form apertures in the joint portions of the strip of wrapping material so that articles produced during said initial stage of operation of the machine and articles including sleeves formed from said joint portions have a reduced bending strength by reason of said apertures therein; transporting means for moving successively produced articles along

a predetermined path; means for subjecting successively produced articles to bending stresses during their movement along said path so that the articles of reduced bending strength are bent and project from said path; and ejecting means disposed adjacent to said path and operative to remove from said transporting means such articles which project from said path.

8. In combination, a machine for producing cigarettes with or without filters or analogous rod-shaped articles, said machine being normally operated at a speed within a predetermined range of speeds; monitoring means for checking the operating speed of said machine during and subsequent to starting and for producing characteristic indications when the operating speed of said machine is outside of said predetermined range; and ejector means responsive to such indications and arranged to eject from said machine articles which are produced when the operating speed of said machine is outside of said predetermined range.

9. The structure as defined in claim **8**, wherein said machine comprises means for transporting the articles and said characteristic indications along a predetermined path and at the same speed.

10. In a process for selecting the destination of cigarettes with or without filters or analogous rod-shaped articles in a machine wherein such articles are produced and which is normally operated at a speed within a predetermined range of speeds, the steps of conveying along a predetermined path those articles which are produced while the machine is operated at a speed which is within said predetermined range of speeds; monitoring the operating speed of the machine during and subsequent to starting and producing characteristic indications when the machine is operating at a speed which is outside of said predetermined range of speeds and at which the machine is likely to produce defective articles; and utilizing such characteristic indications to prevent entry into said path of articles which are produced when the machine is operated at a speed which is outside of said predetermined range of speeds so that only those articles which are produced when the machine is operated at a speed which is within said predetermined range of speeds can enter said path.

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