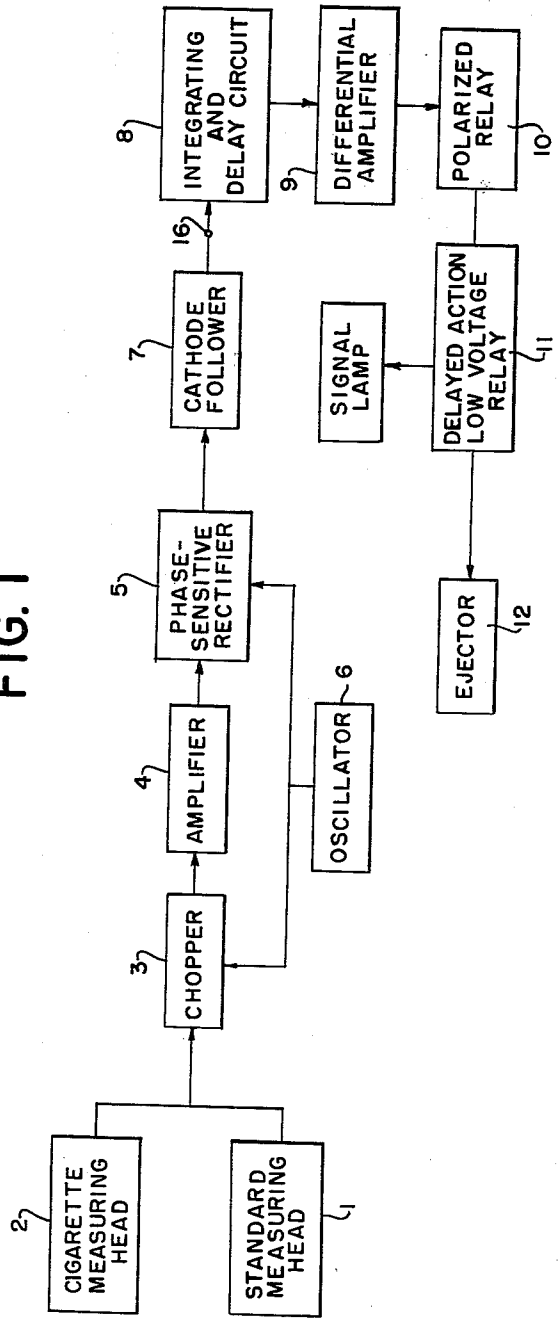
June 25, 1963 J. A. BLUNT 3,095,091

CIGARETTE EJECTING SYSTEM

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FIG. 1



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FIG. 2

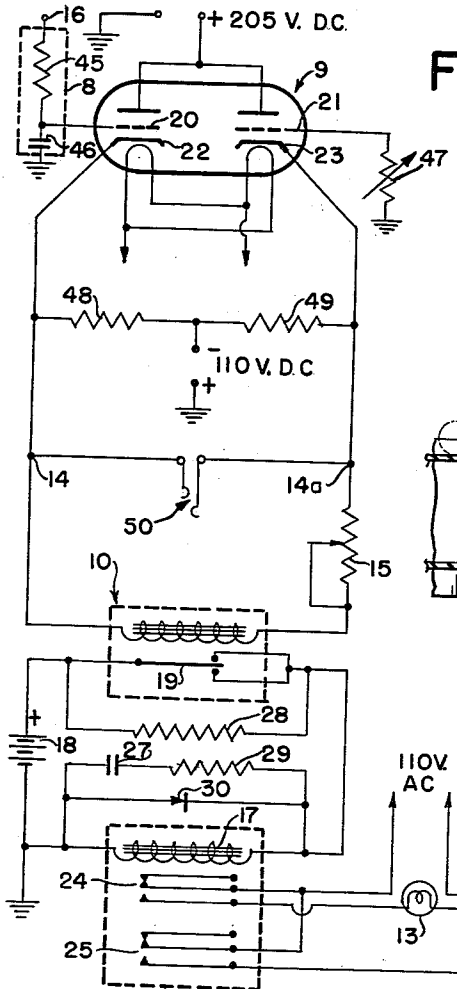


FIG. 3

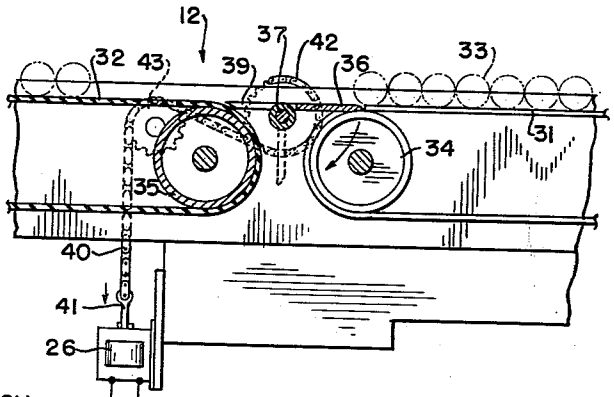
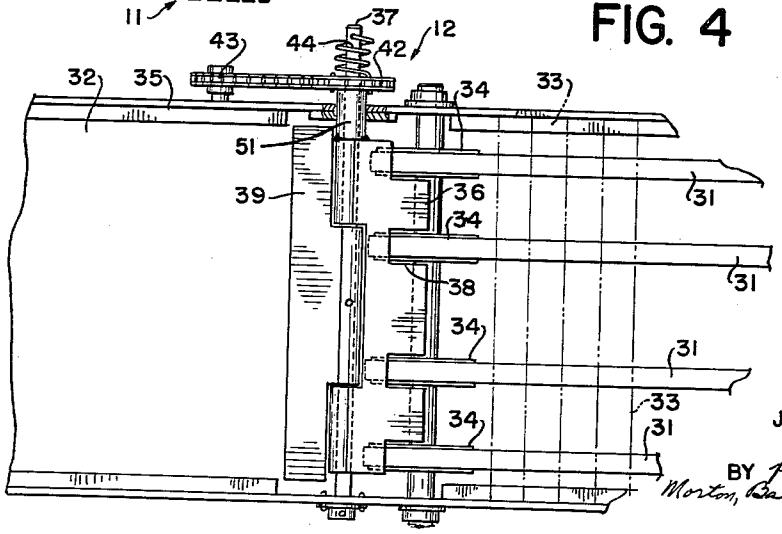


FIG. 4



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CIGARETTE EJECTING SYSTEM

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5 Claims. (Cl. 209—121)

This invention relates to the manufacture of cigarettes and more especially to the automatic selection and segregation of cigarettes in accordance with their weights.

In the manufacture of cigarettes it is important to maintain the density or firmness of the tobacco in the cigarettes within a rather close tolerance in order to meet the requirements of the manufacturers, as well as of the consumers. To this end various systems have been devised for controlling the rate of feed of tobacco onto the paper before it is rolled into rod in the cigarette making machine, customarily referred to as a "maker." Such systems have proved successful to the extent that they are automatic in their operation and that if maintained in good condition they restrict the weight variations within closer limits than can ordinarily be achieved by manual controls. However, because of the inevitable delay between the time of detection of the off-weight condition and the correction thereof, a certain length of off-weight rod will be formed. It is accordingly the object of this invention to select and discard only such off-weight lengths.

The nature and manner of operation of the invention will be understood by consideration of the following specification in connection with the accompanying drawings, in which:

FIG. 1 is a block diagram representing a basic system according to the invention which continuously measures the weight of cigarettes and selects and rejects those which are off-weight;

Fig. 2 is a circuit diagram of the electrical system which responds to an electric signal representing off-weight cigarettes so as to actuate the ejector mechanism;

FIG. 3 is an elevational view, partly in cross section, of a cigarette ejector mechanism actuated by the system of FIG. 2, being a continuation of that figure; and

FIG. 4 is a plan view of the mechanism of FIG. 3.

The system of the invention may be briefly described as follows: First, the weights of the cigarettes to be measured are compared with a predetermined standard weight. The difference or deviation in weight, if any, is caused to produce an electric signal which in magnitude and direction represents the departure from the standard. The electric signals thus proportioned actuate a polarized relay, which, for reasons below described, actuates a second relay, and this relay, in turn, controls the operation of the ejector and lamps or other signals of a visible or audible nature. Means are included to assure that only off-weight cigarettes are rejected.

FIG. 1 is a block diagram representing a system which as above described includes the present invention. Here a voltage derived from a standard measuring head 1 is electrically compared with a voltage from a cigarette measuring head 2, and the output voltages are impressed on a chopper 3. Measuring heads suitable for the present purpose have heretofore been proposed and need not be described in detail. A practical embodiment comprises a suitable source of penetrating rays, for example, beta rays or X-rays, which are arranged to pass through the cigarette and through the standard, respectively, so that the unabsorbed fractions of the rays impinge upon suitable detecting means such as ionization chambers. One chamber responds to the unabsorbed rays which pass through the cigarette to be measured, and the other responds to the unabsorbed rays which pass through the standard.

The radiation sources being alike and the respective detectors being alike, the outputs of the detectors are measures of the relative densities or weights of the interposed materials. This is on the assumption that the moisture content of the tobacco is maintained sufficiently constant.

After suitable amplification in amplifier 4 the signals are rectified in a phase-sensitive rectifier 5. The output of oscillator 6 controls the rate of the chopper and also furnishes a reference voltage which is impressed on the phase-sensitive rectifier. The output of the rectifier is thus proportional to the voltage difference between the outputs of heads 1 and 2. After passing through the cathode follower 7 and an integrating and delay circuit 8 (later to be described) the signal is impressed on differential amplifier 9. If the weight of the cigarette to be measured is the same as the standard, then there is no measurable output voltage from the differential amplifier. If, on the other hand, the cigarette weight is above or below that of the standard, then the polarity and magnitude of the output voltage of the differential amplifier will vary accordingly.

Polarized relay 10 is connected to be actuated by the output voltage from differential amplifier 9, and this relay, in turn, controls the operation of a second or low-voltage relay 11. The latter relay is connected to actuate ejector mechanism 12 which rejects off-weight cigarettes whether they be above or below the standard weight. Simultaneously suitable signal means such as a lamp 13 is actuated by relay 11 in order to inform the operator that off-weight cigarettes are being made and rejected.

As previously stated, the rate of tobacco feed in cigarette-making machines has heretofore been automatically controlled by signals derived from weight-measuring systems somewhat similar to the system above outlined. However, such control systems permitted off-weight cigarettes to be made for short intervals which represented the time required for readjustment of the feed. The ejector mechanism and electrical control system below described in connection with FIGS. 2–4, provide means by which such off-weight cigarettes are automatically rejected prior to packaging.

The circuit diagram comprising FIG. 2 shows the electrical system of the present invention by which signals representing off-weight cigarettes are caused to actuate the ejector mechanism without also rejecting cigarettes of correct or standard weight. In this and in the other figures, similar reference numbers represent similar component parts.

Referring to FIG. 2, the differential amplifier 9 is of fundamentally well known form in which two triodes are connected so that the voltage across the output terminals 14, 14*a* varies as to magnitude and polarity from a desired standard or zero voltage to which the amplifier is adjusted. The operation of this differential amplifier may be explained briefly as follows: The variable D.C. input signal which is connected to input terminal 16 is impressed on the grid 20 of the left-hand triode, thus impressing a correspondingly variable bias thereon. After initial adjustment, as by adjusting resistor 47, the bias voltage on grid 21 of the right-hand triode is fixed in normal operation. Hence, the respective cathodes 22 and 23 are at a positive or negative potential depending on the input signal. Since output terminals 14 and 14*a* are connected to these cathodes, respectively, the voltage between these output terminals will vary as to polarity and magnitude in accordance with increases and decreases in the input signal. This output voltage is available for other purposes at the jack 50.

As will be observed from the circuit diagram, the output voltage across terminals 14, 14*a* causes a current to flow through the actuating coil of polarized relay 10. The sensitivity of this relay is adjusted by variable resis-

tor 15, and the relay will actuate on a few micro-amperes. For the purposes of the present invention the direction of flow of this current is immaterial because it is desired only to reject off-weight cigarettes regardless of whether they are over-weight or under-weight. Hence, the two fixed contacts of this relay are connected together and thence to the coil 17 of low voltage relay 11. This circuit is completed to the low voltage source 18 and thence to the armature 19 of polarized relay 10. Direct-current voltage source 18 is for simplicity here represented as a battery of 24 volts.

Low voltage relay 11, as here connected, has two principal functions. Actuation of this relay closes contacts 24 which connect signal lamp 13 to a power source, here represented as being 110 volts A.C. This signal lamp conveniently is mounted in view of the operator of the cigarette-making machine, who will thereby be aware of the fact that an off-weight cigarette has been detected and has arrived at the ejector, or at the operator's position where she may remove it manually, if desired. It may be assumed that additional control circuits and mechanism, not here shown, will simultaneously be actuated so as to control the tobacco feed and thus compensate for the erroneous feed rate.

Actuation of relay 11 simultaneously closes contacts 25 which energizes solenoid 26 by connecting it to the 110 volt A.C. power source, as indicated. This solenoid actuates the ejector 12 (FIG. 3), later described.

The manner of operation of the above-mentioned relays may be explained as follows: While polarized relay 10 is deactuated, a positive potential from battery 18 is applied to condenser 27 through resistors 28, 29, the resistance of coil 17 being in shunt across resistor 29 and condenser 27. This tends to charge condenser 27, although to a voltage lower than the 24 volts of the battery. By maintaining a normal charge in the condenser, the tendency to arcing of the contacts of relay 10, on make, is minimized. Diode 30, which is connected across coil 17, does not provide a shortcircuit to the charging potential across condenser 27 because it is oppositely polarized. When relay 10 actuates, resistor 28 is shortcircuited, and 24 volts is applied to condenser 27 through resistor 29. This charges the condenser to 24 volts and also actuates the 24 volt relay 11. When the polarized relay 10 deactuates, the voltage across diode 30 reverses, so that the diode shortcircuits coil 17, thus preventing this reversed voltage, or counter-E.M.F., from causing arcing at the contacts of relay 10.

An ejector mechanism which has been found satisfactory in the present invention is illustrated in FIGS. 3 and 4. As shown, it comprises a trap or gate which is interposed in the normal cigarette travel path between the catcher belt 31 and the stacker belt 32 of the cigarette making machine. Here the stacker belt is subdivided into four parallel sections. A few cigarettes 33 are shown on the catcher belt as they progress toward ejector 12 and stacker belt 32. As shown in the drawings, catcher belt 31 passes around pulleys 34 and stacker belt 32 passes around one or more pulleys 35.

The ejector 12 is situated in the space or gap between the catcher and stacker belts, and basically comprises a movable gate or vane which in normal position (as shown) bridges the gap between the two belts, and provides a continuous travel path or conveying surface therebetween. Thus the cigarettes which are conveyed along on the catcher belt, from right to left in the drawing, are pushed onto the vane 36 by the movement of those coming behind, and so continue until they are picked up again by the stacker belt 32. To clarify the drawing, no cigarettes are shown on the vane, but the procession of cigarettes is, of course, continuous. The vane 36 is supported on a transverse stationary axle 37 on which vane 36 is hinged. Sprocket 42 is secured to hollow shaft 51, which, in turn, is attached to the movable vane. When sprocket 42 is rotated clockwise, vane 36 swings into the vertical position shown by dotted lines. When it is in this position the cigarettes will, of course, pass around the end of pulley 34 and drop down into a container, not shown. In order to permit vane 36 to be rotated into its downward position without striking the pulleys 34 it is cut away, so as to form a recess 38, as shown in FIG. 4, where it spans each pulley. Behind the vane 36 a metal apron 39 is secured to axle 37, as shown, to fill the opening between the back of vane 36 and the stacker belt 32. Apron 39 may be positioned so as just not to touch the stacker belt.

The means for operating the ejector vane comprises a link chain 40 which is secured at one end to the solenoid plunger 41 and at the other end to the sprocket 42 around which it passes. To change its direction the chain passes over idler sprocket 43. Thus, when plunger 41 is drawn downwardly by the solenoid 26 the chain unwinds from sprocket 42 causing the sprocket to rotate approximately 90° in a clockwise direction. In so doing, it rotates hollow shaft 51 to which it is secured. This drops vane 36 as above described, and also tightens coil spring 44, one end of the spring being secured to shaft 37 and the other end to sprocket 42. When solenoid 26 is de-energized, spring 44 unwinds, turning the sprocket 42 in a counterclockwise direction, thus restoring the trap to its original position as shown in the drawing.

In cigarette making machines controlled as previously mentioned, the measuring head (FIG. 1) is located at a position ahead of the knife, so that the cigarette rod passes under or through the measuring head just before it reaches the knife. As the cigarettes are severed, they drop on the catcher belt, of which a portion is indicated by the reference numeral 31 at FIG. 3. Thus, although the cigarettes move at a rate of approximately 251 feet per minute, there is an inevitable delay between the initial detection of an off-weight portion of the rod and the time when the first of a series of off-weight cigarettes reaches the gate 36. Furthermore, after the tobacco feed rate has been corrected and the weight restored to standard, there is a similar delay between the time when the head measures "normal" and the time when the first correct-weight cigarettee arrives at the gate. Therefore, the present invention provides means for compensating for this delay period, so that the gate is opened at or just prior to the time when the first of a series of off-weight cigarettes arrives there, and closes at or just after the time when the last of said series of cigarettes has been rejected.

It will be noted that in the block diagram, FIG. 1, the input signal voltage is impressed on input terminal 16 of the integrating and delay circuit 8. This terminal 16 is represented at the top of the circuit diagram, FIG. 2. As there shown, the integrating and delay circuit 8 comprises resistor 45 and capacitor 46. In the given example this circuit has a time constant of approximately 2 seconds. Thus, rapid voltage fluctuations will be smoothed out and maximum potential will not be impressed on grid 20 until after a delay of approximately that time. Similarly, when the potential is removed from terminal 16 there will be a corresponding delay before the effective signal potential on the grid is dissipated.

It will also be noted that actuating coil 17 of relay 11 is shunted by a delay circuit comprising series-connected resistor 29 and capacitor 27 which have a time constant of approximately 1 second. However, the effective time constant of this circuit is affected by the resistance of coil 17, by the resistance of resistor 28, and by the conductivity of diode 30 in the discharge direction. Additionally, the operational characteristics of relays 10 and 11 are necessary factors in the timed operation of the system. As is well known, different types of relays have different pull-in and drop-out voltages; and this must be considered in designing the circuits to provide the desired operating delay.

To facilitate the construction of a control system and ejector mechanism according to the invention, the follow-

ing values of circuit elements are given by way of example. It must be understood, however, that many specific modifications of the circuit and appropriate changes in values of the circuit elements within the scope of the appended claims, will occur to those skilled in the art.

Circuit Components

Resistors:

17, 29	500 ohms.
28	1500 ohms.
48, 49	39K.
15	50K.
45, 47	1 meg.

Capacitors:

46	2 μf.
27	2000 μf.
Tube 9	6SN7.
Diode 30	1N48.
Relay 10	Weston polarized 100–0–100 micro-ampere type.
Relay 11	Potter-Brumfield 24 volt. D.C., D.P.D.T.

I claim:

1. In a cigarette maker, means for selecting and ejecting off-weight cigarettes, which includes a measuring head and circuit means connected thereto adapted to generate electric signals commensurate with the weight of tobacco in the cigarettes, a differential amplifier which has a signal input electrode and an output circiut, means for establishing in said output circuit a a preselected reference voltage representative of a preselected cigarettee weight, a polarized relay having an actuation coil connected in said output circuit so as to respond to signal voltage in both polarities, a second relay having an actuating coil connected to be energized by operation of said polarized relay in either direction, a cigarette catcher belt, a stacker belt spaced therefrom, a cigarette ejector including a movable vane positioned normally to bridge the space between said belts so as to provide a conveying surface therebetween, electromechanical means for moving said vane so as to interrupt said surface and prevent cigarettes from being conveyed to said stacker belt, electric connections operatively connecting said second relay to said electromechanical means, first delay-circuit means connected to said signal input electrode, and second delay-circuit means connected to the actuating coil of said second relay, said first and second delay-circuit means together being proportioned such that the time delay between the detection of an off-weight cigarette and the resultant operation of said ejector is substantially equal to the travel time of a cigarette between said measuring head and said ejector.

2. In a cigarette maker, means for selecting and ejecting off-weight cigarettes, which includes a measuring head and circuit means connected thereto for producing an electric measurement voltage commensurate with the weight of tobacco in the cigarettes, means for deriving a fixed voltage preselected as a standard, differential means on which said measurement voltage and fixed voltage are impressed for producing from said voltages a control voltage based on the difference between said voltages, a

cigarette ejector and electrically actuated mechanism for operating the same, conveyor means for conveying cigarettes in close continuous procession past said measuring head and thence to said mechanism in a predetermined fixed travel time, a control circuit through which said mechanism is actuated in response to said control voltage, and delay-circuit means included in said control circuit for delaying actuation of said mechanism with respect to the instant each off-weight cigarette passes said head, for a period substantially equal to said travel time.

3. A cigarette maker according to claim 2, in which said ejector operates with an inherent delay, said control circuit includes an electromechanical relay which is actuated in response to said control voltage, and said delay-circuit means comprises time-delay circuit elements connected to said relay, said elements being proportioned such that the total time delay introduced by said ejector means and by said control circuit including said elements is substantially equal to the conveyor travel time of a cigarette between said head and said ejector.

4. A cigarette maker according to claim 2, in which said ejector is movable by said mechanism into ejecting position in response to said control voltage, and said mechanism includes means for moving said ejector into non-ejecting position in the absence of said control voltage, and delay means including said delay-circuit means which introduces into the operation of said mechanism a total time delay in moving said ejector into ejecting position and an equivalent total time delay in moving said ejector into non-ejecting position which is substantially equal to the conveyor travel time of a cigarette between said head and said ejector.

5. In a cigarette maker, means for detecting an off-weight cigarette and signalling its arrival at a fixed rejection station, which includes a measuring head and circuit means connected thereto for producing an electric measurement voltage commensurate with the weight of tobacco in the cigarettes, means for deriving from said measurement voltage a control voltage commensurate with the departure of the cigarette weight from a preselected weight, a cigarette selecting and rejecting station, conveyor means for conveying cigarettes in close continuous procession past said measuring head and thence to said station in a predetermined constant travel time, means disposed at said station for rejecting off-weight cigarettes, signalling means observable from said station, a control system including means for actuating said rejecting means and said signalling means in response to a predetermined magnitude of said control voltage, and delay-circuit means included in said control system for delaying actuation of said rejecting means and said signalling means with respect to the instant each off-weight cigarette passes said head for a period substantially equal to said travel time.

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