United States Patent

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[33] **Great Britain**
[31] **18422/63**
Continuation of application Ser. No. 366,007, May 8, 1964, now abandoned.

[54] **CONTINUOUS ROD CIGARETTE-MAKING MACHINES AND CONTROL SYSTEMS THEREFOR**
5 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **131/21,** 131/65, 131/68
[51] **Int. Cl.** **A24c 5/26,** A24c 5/31
[50] **Field of Search** 131/21B, 61, 65, 68; 131/21

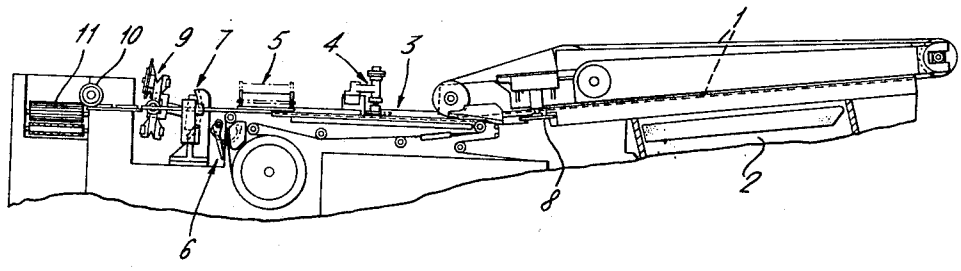
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ABSTRACT: Electrical control circuitry for a cigarette-making machine of the continuous rod type including a solenoid for moving a seam heater element into operative position, after a predetermined delay activating another solenoid to actuate a rod breaking mechanism, and after a further delay activating a detector device which stops the machine whenever a portion of the cigarette rod which has passed the heating means is not properly sealed.



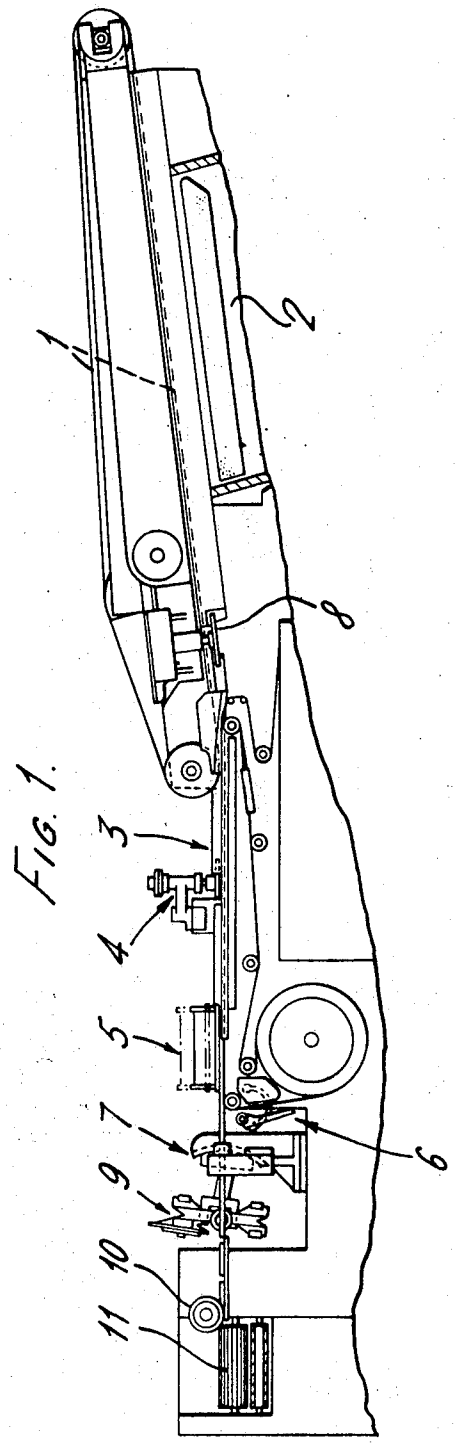
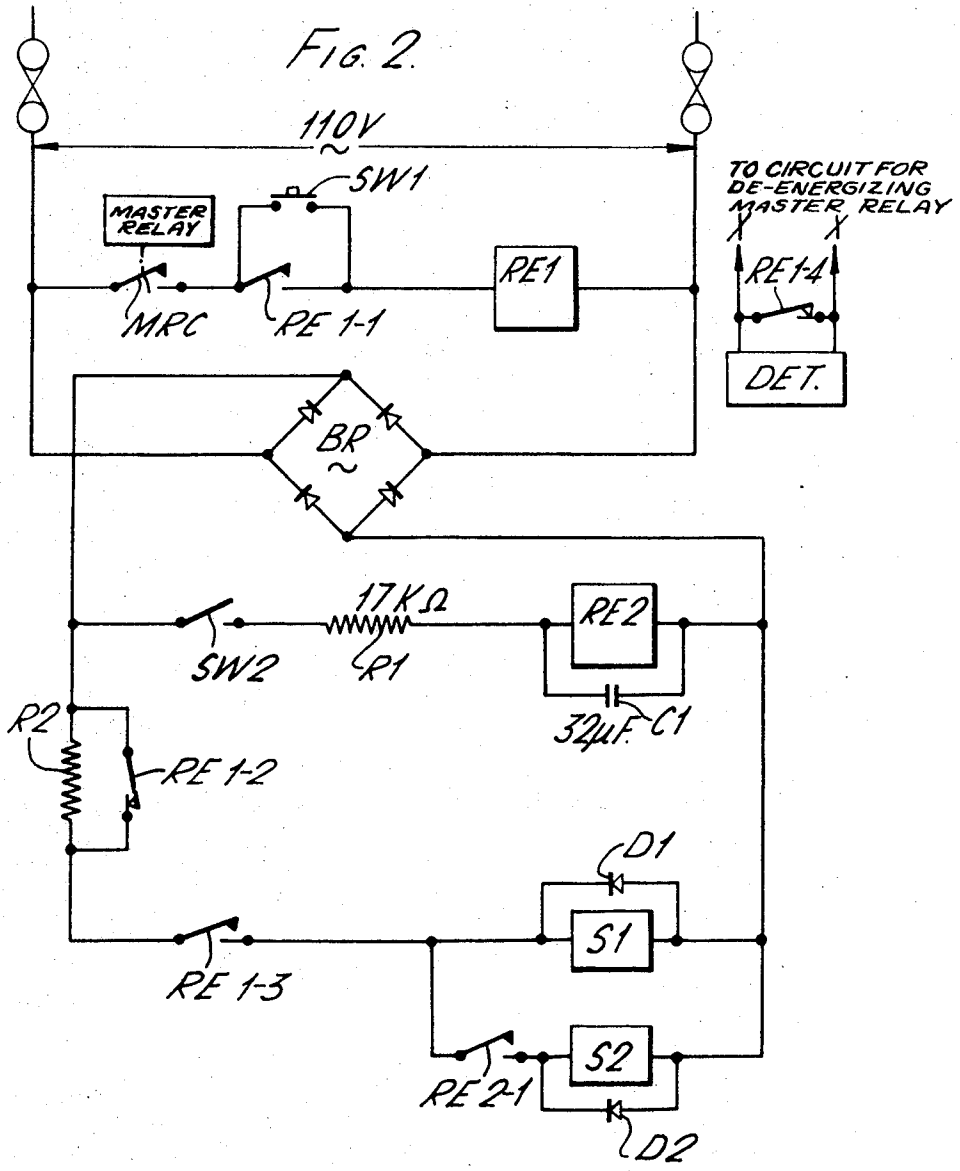


FIG. 1.

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FIG. 2.



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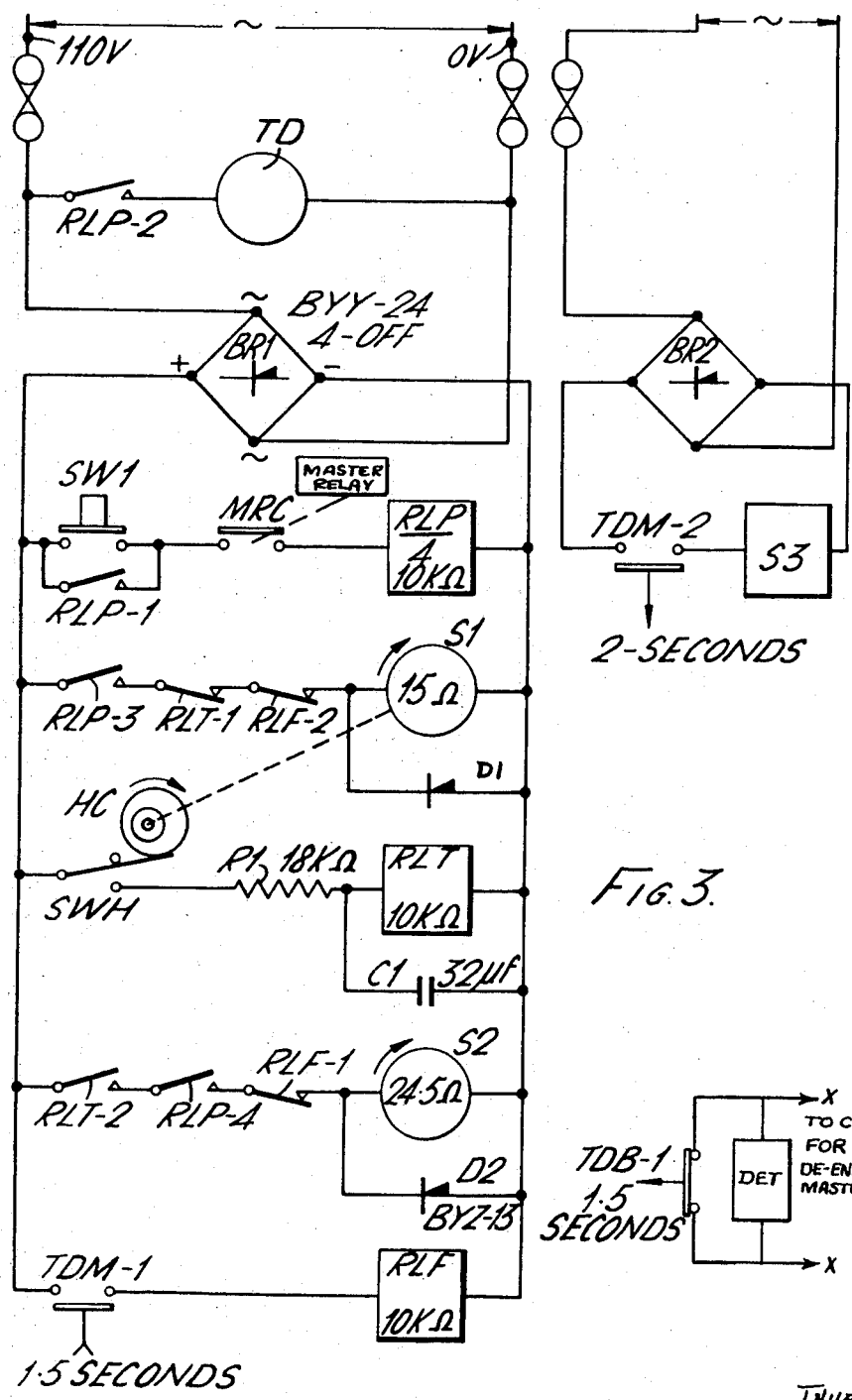


FIG. 3.

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CONTINUOUS ROD CIGARETTE-MAKING MACHINES AND CONTROL SYSTEMS THEREFOR

The present application is a continuation of application Ser. No. 366,007 filed May 8, 1964, which has been abandoned.

This invention relates to cigarette-making machines of the continuous rod type, and more particularly to control systems for such machines.

As is well known in the art, when cigarettes are manufactured by machines of the continuous rod type the sequence of operations is as follows; tobacco is fed continuously to a moving belt or the like where it settles to form a filler rod, then a continuous strip of paper is fed into engagement with the rod and folded therearound to form a slightly lapped tube enclosing the tobacco, the overlapped edge portions of paper are caused to adhere to one another, and the resulting cigarette rod is cut into suitable lengths. Commonly the adhesion of the edge portions of the paper to form a seam is achieved by applying an adhesive paste to the inner face of the outer edge portion just before folding of the paper around the tobacco is complete. To ensure proper adhesion on a high-speed machine, there is usually provided a heater arranged to warm the seam sufficiently to dry out the adhesive before the cigarette rod is cut into lengths.

Whenever such a machine is started, it is necessary for each section of the machine to be functioning correctly before the next succeeding section is brought into operation, i.e. the tobacco and paper feeding section must be producing a satisfactory wrapped rod before the application of adhesive is started, then the adhesive application must be satisfactory before the heater is brought into use, and lastly the rod delivered by the heater must be satisfactory before the cutting into lengths starts. If these conditions are not met, the result is usually that a jam occurs at some part of the machine as the rod comes apart or distorts.

Hitherto, the starting of such machines has generally been manual. An operator starts the tobacco and paper feeds; when a satisfactory wrapped rod is reaching the adhesive application position, the adhesive application is started e.g. by bringing an adhesive applicator from a withdrawn position to an operative position in contact with the rod; once the application of adhesive is proceeding as required the heater is also brought from a withdrawn position into contact with the rod. Up to this stage, the rod produced is diverted out of its normal path and goes to waste just after passing the heater position but once the operator is satisfied that rod passing the heater is properly sealed, he breaks off the rod emerging from the heater and the succeeding length of rod then feeds forward in its normal path, i.e. past any inspection device with which the machine may be fitted to be cut into individual cigarettes in a so-called cutoff mechanism and thereafter discharged.

The manual starting of such machines, however, has become somewhat more difficult with increases in the machine speed and furthermore, as the time taken by the operator in checking correct operation as each successive part of the machine is brought into operation is substantially constant any speed increase necessarily involves a proportionate increase in the wastage incurred during each starting sequence, which has an appreciable effect on the overall economy of cigarette manufacture.

It is an object of the present invention to provide an improved cigarette-making machine of the continuous rod type in which starting may be accomplished expeditiously and waste thereby minimized.

According to the invention, a cigarette-making machine of the continuous rod type is provided comprising means for forming a tobacco filler, means for applying a paper strip to said filler and folding said strip to enclose the filler in a paper tube with an overlapped seam to form a cigarette rod, including means for continuously applying adhesive to one longitudinal edge portion of said paper strip before completion of folding thereof, means for heating the seam, said adhesive applying means and said heating means together serving to seal the rod but being each independently movable between inoperative and operative positions, means for breaking the rod leaving said heating means, and means for cutting the rod into cigarette lengths, including control means operable to move the heating means into operative position and at a predetermined time after thereafter to cause operation of the rod breaking means.

In order that the invention may be well understood a preferred embodiment thereof will now be described in more detail, reference being made to the accompanying drawing in which:

FIG. 1 shows in elevation the general layout of a cigarette-making machine embodying the invention; and

FIGS. 2 and 3 are block and schematic diagrams of two forms of electrical control means for the cigarette-making machine of FIG. 1.

It should be noted that in FIGS. 2 and 3 various electrical relays are represented by the so-called "detached contact" method; as is well known, a relay comprises one or more coils (often termed windings) which when energized cause movement of one or more pairs of contacts from open to closed positions or vice versa (or in the case of "changeover" contacts cause movement of the central contact of a set of three from a position engaging one of the outer contacts of the set to a position engaging the other of the outer contacts). When a circuit diagram employs "detached contact" representation, the coil or coils and the several pairs (or sets) of contacts of each relay are shown separately in the diagram, in the positions most convenient for securing a neat and readily comprehensible showing of the circuit as a whole, and association between the pairs (or sets) of contacts and the corresponding coils is indicated by systematic references. As a good example of this practice, attention is directed to FIG. 3, where a relay RLP appears in five parts; its coil is represented as a plain square block containing the reference RLP, the FIG. 4 indicating that this relay has four pairs (or sets) of contacts, and the legend **10kΩ** informing the reader of a significant electrical characteristic of the coil, i.e. its resistance; four pairs of contacts appearing in different positions in the figure are respectively referenced by the symbols **RLP–1**, **RLP–2**, **RLP–3**, and **RLP–4**. These pairs of contacts are each drawn in the position (open or closed) they assume when the coil of the relay is not energized, e.g. contacts **RLP–3** are shown separated, being what are conventionally termed "normally open" contacts.

Referring first to FIG. **1**, the machine shown comprises an overhead endless belt suction conveyor **1** whose lower run carries tobacco received from a hopper (not shown) via a passage **2** to a cigarette rod-forming assembly generally indicated at **3**. When a rod is formed in assembly **3**, a rodlike tobacco filler is enfolded in cigarette paper, passes to an adhesive-applying device **4** and thence to a heater unit **5**, so that an overlapping edge portion of the cigarette paper is first coated with adhesive paste and then heated while pressed against an underlying edge portion of the paper to provide the usual seam completing enclosure of the tobacco within a tube formed by the paper.

Next, the rod passes a rod breaker device **6**, goes through a detector unit **7** arranged to provide an indication of the density of the tobacco in the rod (which indication is employed to control the tobacco feed, preferably by adjusting the position of a trimmer **8** placed just "upstream" of the rod-forming assembly **3**) to a cutoff device **9** where the rod is cut into individual cigarettes. The individual cigarettes are then pushed forward by a section wheel **10** to a fluted drum **11** which delivers them to the output of the machine. Associated with the wheel **10** is a conventional detector device arranged to respond to pressure variations in the suction system due to missing or improperly sealed cigarettes.

Turning now to FIG. **2**, a single manually operable pushbutton switch **SW1** is connected in series with the coil of a relay **RE1** across a fused AC supply. The relay **RE1** has a pair of normally open contacts **RE1–1** connected in parallel with switch **SW1** to serve as hold contacts, and also in series both with the coil of relay **RE1** and with the switch **SW1** are a pair

of normally open contacts MRC forming part of a master relay for the machine.

The AC supply is also connected to a bridge rectifier BR from which direct current is delivered to two branch circuits. The first branch circuit comprises a microswitch SW2, a resistor R1, and the coil of a relay RE2 all in series, with a capacitor C1 shunted across the relay coil. The second branch circuit comprises a resistor R2, shunted by normally closed relay contacts RE1–2 normally open relay contacts RE1–3, and solenoid S1 all in series. The solenoid S1 is shunted by normally open contacts RE2–1 in series with a solenoid S2. Both the solenoids S1, S2 are further shunted by diodes D1, D2 respectively, said diodes being connected to be nonconducting to current from the rectifier BR and serving to suppress reverse voltage pulses generated by the inductance of their associated relay coils upon deenergization.

Electrically isolated from the circuits mentioned above is a detector unit DET connected at X, X to a separate circuit as illustrated) but associated with the relay RE1 in that a pair of normally closed contacts RE1–4 of said relay are connected across the unit DET to short circuit the latter whenever relay RE1 is not operated.

It will be observed that relay RE1 has four pairs of contacts and should be noted that, while contacts RE1–1 and RE1–3 operate immediately upon energization of the relay coil, the remaining contacts viz. RE1–2 and RE1–4 are arranged not to operate until some 1¼—1½ seconds after such energization.

In relation to the cigarette-making machine in which the circuits illustrated serve as control means, the master relay (including contacts MRC) is a main on-off control relay for the machine and when it is operated the hopper, conveyor 1, rod-forming assembly 3 and adhesive-applying device 4; will operate and so will the cutoff device 9 for cutting finished cigarette rod into lengths. The detector unit DET is a pneumatic or photoelectric unit employed with suitable ancillary devices to inspect the finished cigarette rod or the individual cigarettes, to check for any unsealed or insufficiently sealed seams in the products of the machine; said unit DET is arranged to stop the machine by deenergizing the master relay coil (not shown) on detection of a faulty seam. Such an arrangement is disclosed in U.S. Pat. No. 3,194,244, issued July 13, 1965.

Solenoids S1, S2 serve when energized to move the heating unit 5 and the rod breaker device 6 (FIG. 1), respectively, to operative positions; each of said solenoids is preferably a so-called "rotary solenoid," i.e. a solenoid provided with an armature cooperating with a stationary inclined surface so that when energization of the solenoid causes the armature to move axially of the solenoid, the armature also is constrained to rotate, so that the result of energization is an angular movement of an arm attached to the armature. The switch SW2 contacts are associated with a microswitch mounted in or by the heater unit 5 so as to be operated (i.e. closed) just before the latter reaches its operative position.

Starting procedure for a machine so fitted can now be described quite briefly. The operator starts the tobacco and paper feeds, by means of a switch which causes the master relay to operate. As soon as the tobacco and paper feed is satisfactory, he brings the adhesive applicator to operative position and then, once the adhesive application is sufficiently established, he closes switch SW1. As contacts MRC are already closed, the master relay being operated, the coil of relay RE1 is energized via contacts MRC, switch SW1. Contacts RE1–1 at once close, so that relay RE1 is held and switch SW1 may be released. Contacts RE1–3 also close immediately but contacts RE1–2 do not yet open, hence the whole DC voltage produced by rectifier BR is applied to solenoid S1 which brings the heating means to operative position.

Just before the heating means reaches its operative position, the microswitch contacts SW2 close. This causes the branch circuit containing the coil of relay RE2 to be completed, but relay RE2 does not operate immediately as capacitor C1 has to be charged to a sufficient voltage before relay RE2 can operate. With the values of R1, C1 shown (17,000 ohms, 32 microfarads) a delay of some 75—90 milliseconds elapses if the coil of relay RE2 has a resistance of 10,000 ohms; then relay RE2 operates and contacts RE2–1 close energizing solenoid S2 which operates the rod breaker device 6 (FIG. 1) which preferably takes the form shown in U.S. Pat. No. 3,244,183 to Michael Aren Pym. The operation of solenoid S2 cannot be completed instantaneously, and as a result the rod is broken some one-third to one-half second after the switch is closed.

The contacts RE1–2 and RE1–4 operate some 1¼—1½ seconds after closure of switch SW1 has energized relay RE1, and serve to remove short circuits from resistor R2 and detector unit DET respectively. With resistor R2 no longer short circuited, the current drawn by solenoids S1, S2 is reduced but is still sufficient to keep said solenoids operated, while the removal of the short circuit across unit DET allows the detector unit to operate normally so that if at this time (or subsequently) cigarette rod or cigarettes, as the case may be, reaching the ancillary apparatus associated with unit DET are not properly sealed, the machine is stopped and/or a warning indication given to the operator.

In FIG. 3, there is shown a somewhat more complex circuit arrangement which may be preferred in many applications as it affords rather more electrical interlocking, as will appear. The circuit layout is as follows: Across a fused 110 volt AC supply is connected a normally open relay contact pair RLP–2 in series with a coil TD of a relay having one normally open and two normally closed contact pairs. Also across the AC supply is a bridge rectifier BR1, from which current is delivered to five branch circuits, as follows:

First branch - a pushbutton switch SW1, a pair of normally open contacts MRC forming part of a master relay for the machine, and a relay coil RLP/4 all in series; also a pair of normally open contacts RLP–1 shunting switch SW1.

Second branch - a normally open contact pair RLP–3, normally closed contact pairs RLT–1 and RLF–2, and a solenoid S1 all in series, with a suppression diode D1 shunting said solenoid.

Third branch - a cam-operated normally open pair of contacts SWH, a resistor R1, and a relay coil RLT all in series, with a capacitor C1 shunting said relay coil RLT, (The contacts SWH are arranged to be closed by a cam HC movable with the heater unit 5 (FIG. 1) whenever the latter is in operative position).

Fourth branch - normally open pairs of contacts RLT–2, RLP–4, normally closed pair of contacts RLF–1, and a solenoid S2 all in series, with a suppression diode D2 shunting said solenoid.

Fifth branch - a normally open pair of contacts TDM–1 in series with a relay coil RLF; contacts TDM–1 are "slow-to-make" contacts, closing 1.5 seconds after energization of coil TD, but opening immediately upon deenergization thereof.

Electrically isolated from the parts mentioned above is a detector unit DET connected at X–X to a separate circuit (as illustrated) but associated with relay coil TD in that a pair of normally closed contacts TDB–1 of said relay are connected across the unit DET to short circuit the latter whenever relay coil TD is not energized.

A third electrically isolated circuit comprises a fused 10.5 volt AC supply supplying a further bridge rectifier BR2 from which DC is fed to a solenoid S3 via a normally open pair of contacts TDM–2; this pair of contacts is "slow-to-break," being arranged to close immediately upon energization of relay coil TD, but not to break until 1.5 seconds after deenergization thereof.

The three solenoids to which reference has been made, namely solenoids S1, S2, S3, perform the following functions when energized:

S1 - moves the heater unit 5 to operative position.

S2 - moves the rod breaker device 6 to operative position.

S3 - retains the heater unit in operative position, once reached.

The operation of the circuit of FIG. 3 is initiated, as with the circuit of FIG. 2, by manual closure of the pushbutton switch SW1; as this is only done after the cigarette-making machine has been started, contacts MRC will be closed and hence relay coil RLP is energized. Contacts RLP–1, RLP–2, R:LP–3 and RLP–4 all immediately close; contacts RLP–1 maintain the energization of coil RLP/4 after the switch SW1 has been released, and relay coil TD is energized through contacts RLP–2. Contacts RLP–3 complete the second branch circuit, hence solenoid S1 is energized causing the heater unit 5 to start to move towards operative position and hence contacts SWH to start closing. Contacts RLP–4 prepare the fourth branch circuit for completion whenever contacts RLT–1 close.

The energization of relay coil TD causes the operation of contacts TDM–1, TDB–1, and TDM–2. Contacts TDM–2 close immediately when coil TD is energized so that solenoid S3 is energized ensuring that as soon as the heating means reaches its operative position it is held there. After a delay of 1.5 seconds from the time of energization of coil TD, contacts TDM–1 close and contacts TDB–1 open, respectively completing the fifth branch circuit to energize relay coil RLF and removing the short circuit from the detector unit DET to permit the latter to function.

The movement of the heater unit 5 to operative position takes less than 1.5 seconds, hence before operation of contacts TDM–1 and TDB–1 the movement of the heating means is complete and the contacts SWH have closed to complete the third branch circuit, energizing relay coil RLT after a delay (of the order of one-fourth to one-third second) due to the presence of resistor R1 and capacitor C1. Contacts RIT–1 open to break the second branch circuit and hence terminate the energization of solenoid S1, while contacts RLT–2 close to complete the fourth branch circuit, energizing solenoid S2 which causes operation of the rod breaker device 6.

When the 1.5 seconds delay mentioned above has passed, therefore, the heater unit 5 has already been brought to operative position and held there and, after a shorter delay governed by the values of the resistor R1 and capacitor C1, the rod breaker device 6 has been operated; the operation of contacts TDM–1 and TDB–1 now occurs, and the resultant energization of relay coil RLF causes contacts RLF–1 and RLF–2 to break the fourth and second branch circuits respectively. The second branch circuit has previously been broken by the operation of contacts RLT–1 but the breaking of the fourth branch circuit causes the energization of solenoid S2 to be terminated.

When operation of the machine is stopped, the contacts MRC will open, relay coil RLP/4 will cease to be energized and the consequent opening of contacts RLP–1, RLP–2, RLP–3 and RLP–4 will reset the circuit generally. In particular, it may be noted that contacts RLP–2 will open immediately and deenergize relay coil TD, as a consequence of which contacts TDB–1 will close immediately to prevent operation of the detector device DET while the machine is stopped, and contacts TDM–2 will open after a delay of 2 seconds to deenergize solenoid S3, permitting the heater unit to return to an inoperative position, opening contacts SWH to deenergise relay coil RLT/4. The delay of 2 seconds in the opening of contacts TDM–2 is sufficient to ensure that the heater unit does not return until the machine has come to rest.

The contacts MRC, although closed whenever the machine is running continuously may not be closed when the machine is being checked or having setting-up adjustments made using an "inch" or "jog" control, i.e. a control permitting the machine to run only while an operator holds a switch down. In such cases, a further relay (not shown) may have contacts wired in parallel with contacts MRC, said further relay being arranged to remain operated so long as "inch" or "jog" control is required to be available.

Various changes or modifications may be made without departure from the scope of the invention e.g. the switch SW2 may be replaced by a photoelectric device arranged to detect the presence of the heater unit in its operative position. The necessary time delay may be obtained by using devices other than those described above, e.g. the detector unit DET may be brought into operation in response to a signal from an electronic or electromechanical counter arranged to count the cigarettes produced by the machine and emit such signal when a predetermined number has been reached.

We claim:

1. A cigarette-making machine of the continuous rod type, comprising; means for forming a tobacco filler, means for applying a paper strip to said filler and folding said strip to enclose the filler therein with an overlapped seam to form a cigarette rod, means for continuously applying adhesive to one longitudinal edge portion of said paper strip before completion of folding thereof, means for heating the seam, said adhesive applying means and said heating means together serving to seal the rod but each being independently movable between inoperative and operative positions, means for breaking the rod leaving said heating means, means for cutting the rod into cigarette lengths, means to stop the machine whenever a portion of the cigarette rod which has passed the heating means is not properly sealed, and control means operable to move the heating means into operative position, a predetermined time thereafter to cause operation of the rod breaking means, and a further predetermined time after operation of the rod breaking means to bring said means to stop the machine into operation.

2. A machine as claimed in claim 1 in which said machine stopping means includes a detector device for individual cigarettes at the delivery end of the machine.

3. A machine as claimed in claim 1, in which the control means comprises electrical means including solenoids.

4. Claim 4 a machine as claimed in claim 3 in which a solenoid is arranged to operate the rod breaking means and is controlled by a relay having a capacitor in shunt with its coil, means being provided for applying a voltage to the relay coil via a series resistor as the heating means is brought into operative position.

5. A machine as claimed in claim 4, in which the voltage applying means includes a cam movable with the heating means and switch means arranged to be closed by said cam whenever the heating means is in operative position.