July 13, 1965 G. F. W. POWELL 3,194,244

CIGARETTE-MAKING MACHINES

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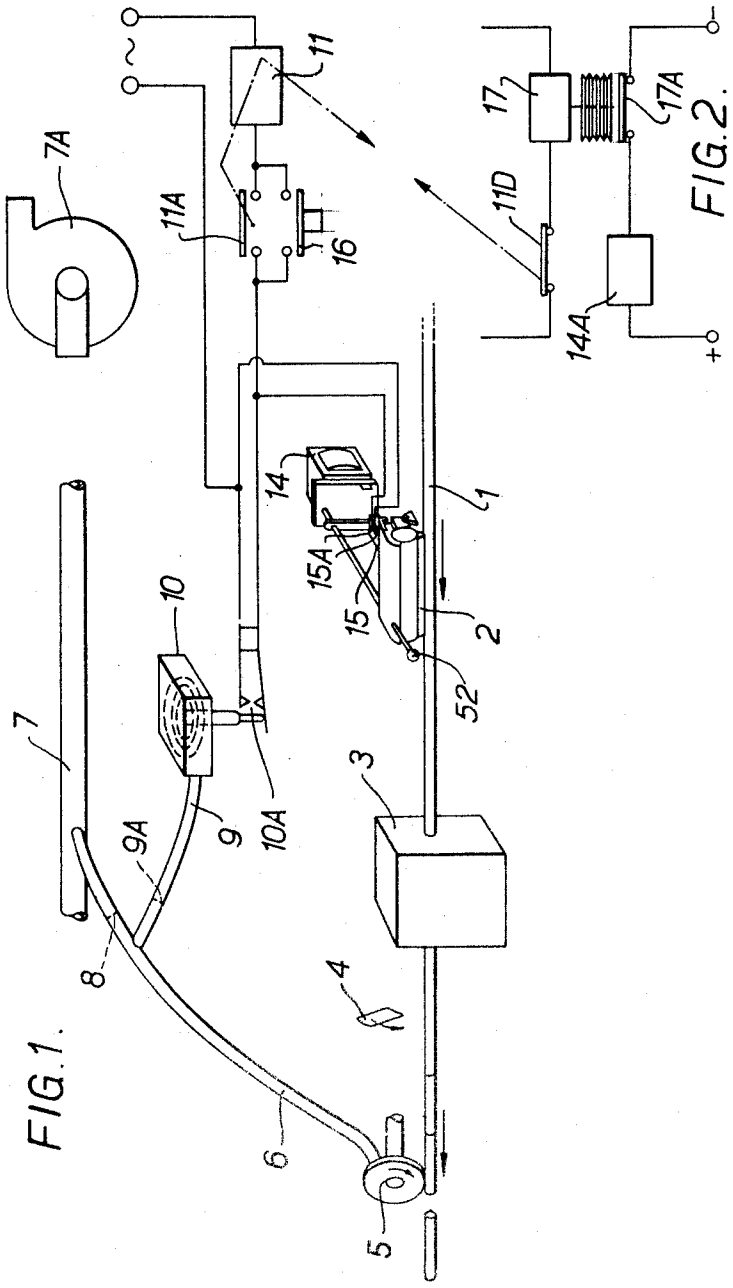


FIG. 1.

FIG. 2.

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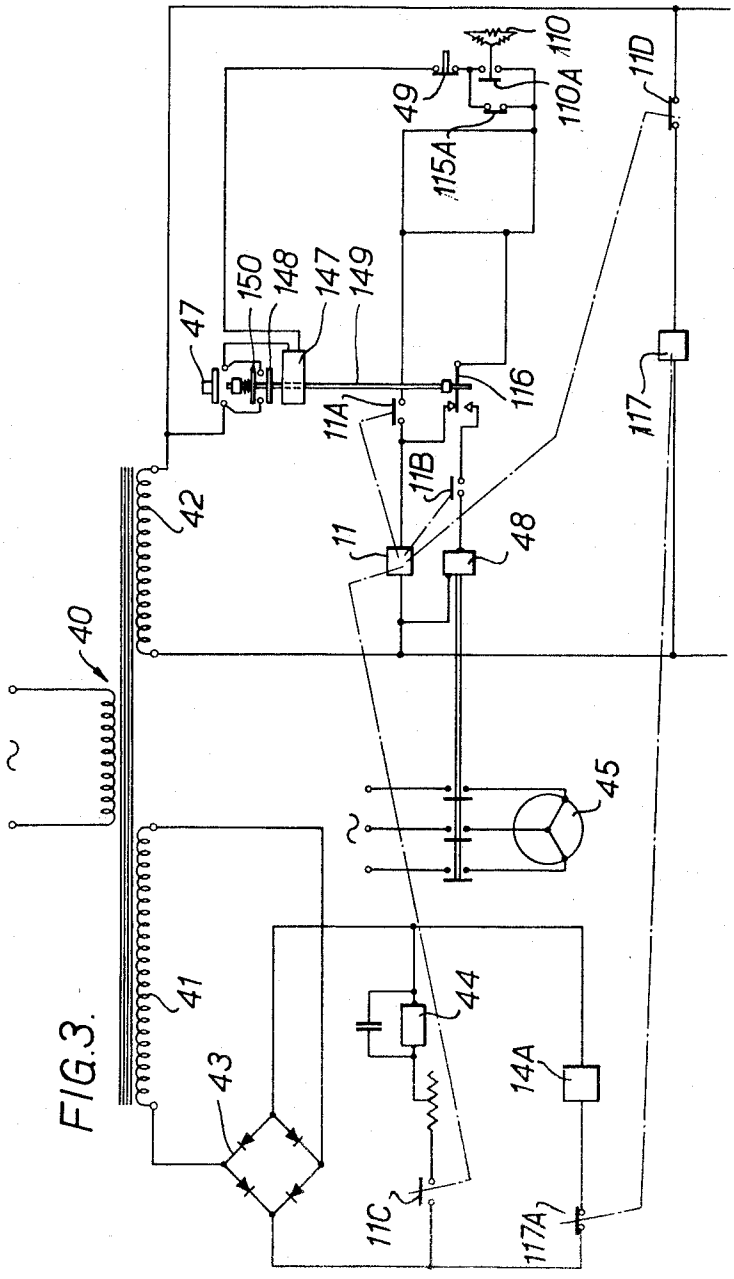


FIG. 3.

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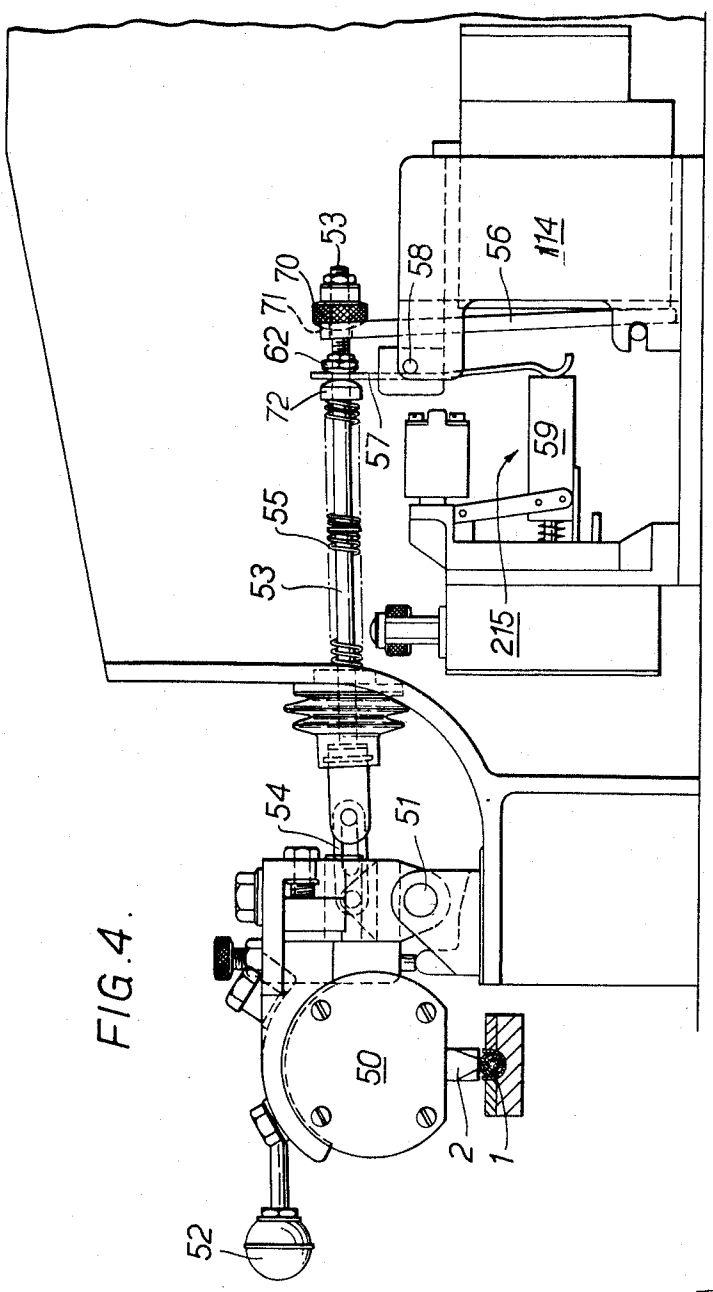


FIG. 4.

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CIGARETTE-MAKING MACHINES

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FIG.5.

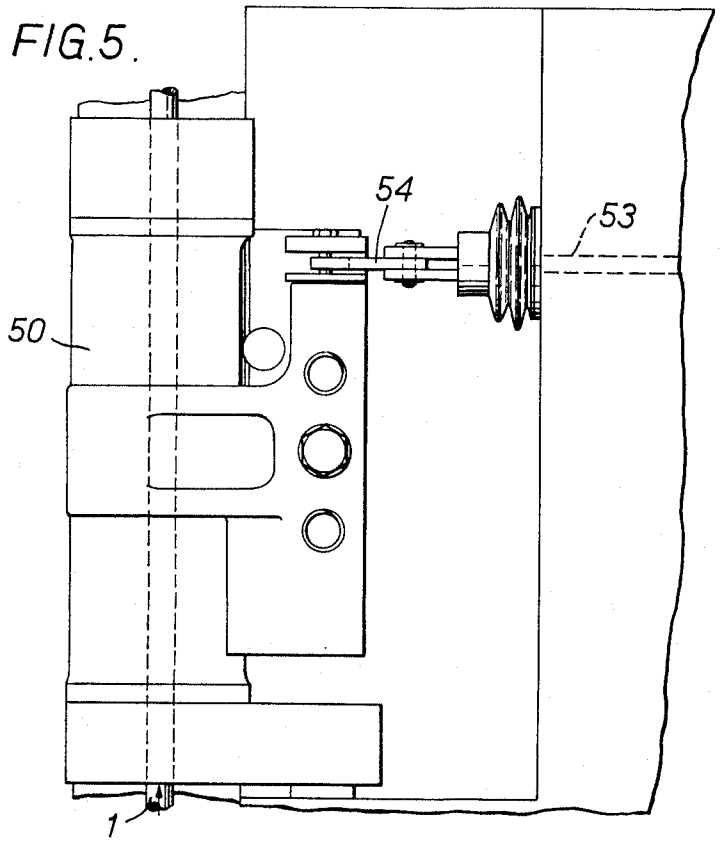
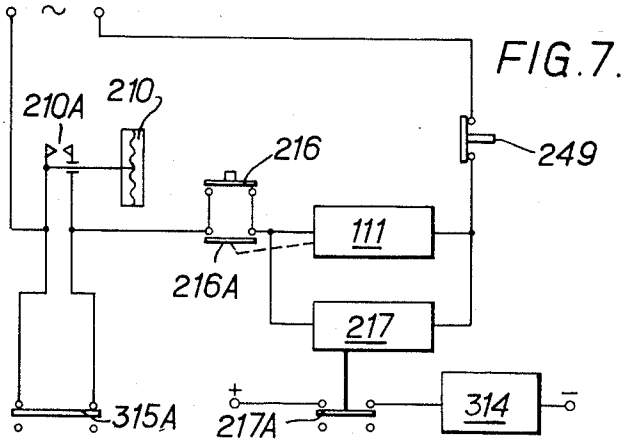


FIG.7.



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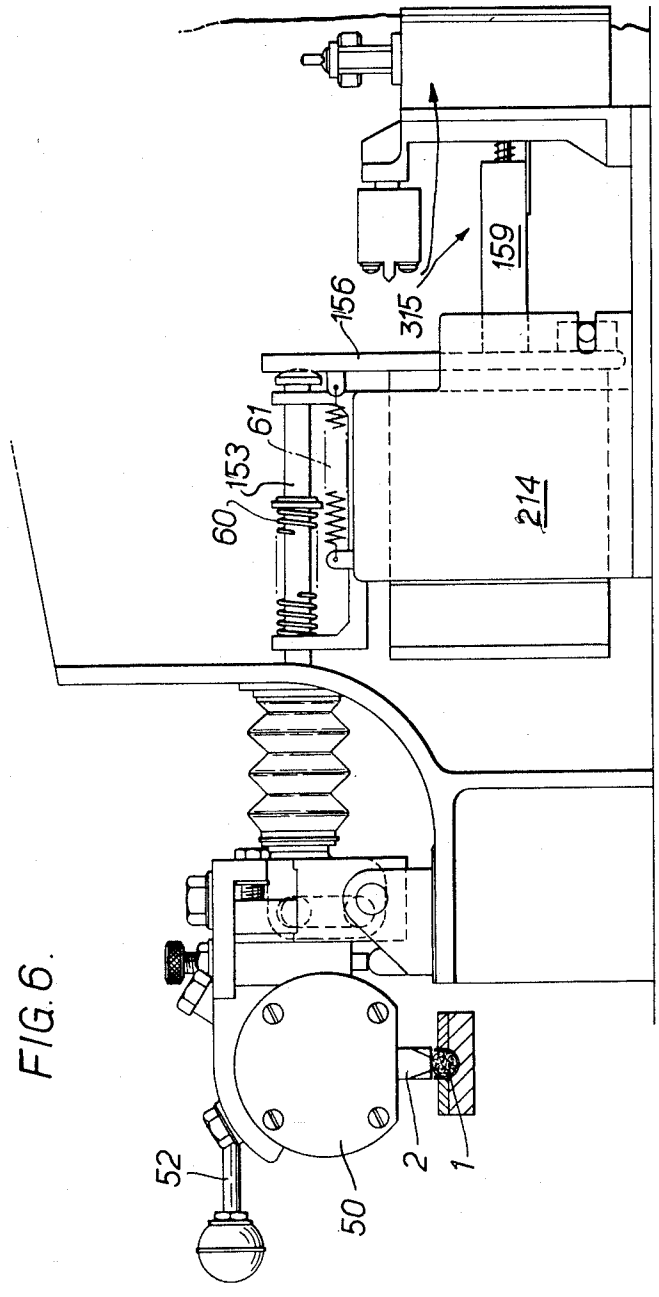


FIG. 6.

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United States Patent Office 3,194,244 Patented July 13, 1965

3,194,244

CIGARETTE-MAKING MACHINES

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Filed Dec. 14, 1961, Ser. No. 159,247
Claims priority, application Great Britain, Dec. 22, 1960, 44,070/60
3 Claims. (Cl. 131—21)

This invention concerns improvements in continuous-rod cigarette-making machines and more particularly machines of this kind havng a rod heater whereby the detecton of a fault in the operation of the machine may be used to control the operation of other apparatus to stop the machine and move the heater away from the rod.

In some machines of the kind referred to, cigarettes coming from the cut-off of the machine are engaged by a suction wheel which transports the cigarettes to a desired position. In such a case a detecting device may be associated with the suction wheel to sense an increase in air pressure when cigarettes cease to arrive at the wheel.

The paper web surrounding most cigarettes has a pasted seam and the paper-covered continuous rod is run under a heater shortly after the seam is made so that the seam is properly sealed before the rod is cut into separate cigarettes. Various kinds of heaters are used, such as hot tapes, wheels, or bars, the latter being the commonest. One embodiment of the invention will therefore be related to a hot bar heater.

The invention is embodied in a continuous-rod cigarette-making machine driven by an electric motor having a rod heater movable into and out of contact with the rod, a cut-off for cutting the rod into separate cigarettes, and a suction wheel arranged to engage the cigarettes emerging from the cut-off of the machine to transfer them to another location. When cigarettes cease to reach the suction wheel because the cigarette rod breaks, means are provided for stopping the motor and moving the rod heater away from the cigarette rod. Such means may include an electro-magnet or solenoid having a movable armature to move the rod heater away from the cigarette rod upon actuation of the solenoid. A diaphragm switch is connected to the interior of the suction wheel and is responsive to the air pressure in the interior of the wheel. The switch is closed while the cigarettes continue to reach the suction wheel but it will automatically open when air pressure on the diaphragm is increased because cigarettes cease to reach the wheel. The diaphragm switch, when closed, maintains the energization of a relay controlling the electric motor driving the machine. If the diaphragm switch is opened due to an increase in air pressure in the suction wheel, the relay will be de-energized, so that the motor will stop, and a contact of the relay will close a circuit to energize a time delay switch, which at the end of a pre-selected time interval will energize the solenoid to move the rod heater away from the cigarette rod. A further time delay switch is closed, short-circuiting the diaphragm switch when the rod heater has been moved away from the rod. This is to restore the relay circuit so that the motor can be restarted. The latter time delay switch will remain closed for a sufficient time after the machine is restarted and the rod heater has been lowered to permit the cigarettes to again reach the suction wheel. At this time, the diaphragm switch is closed and the latter time delay switch associated with the rod heater is opened, thus restoring control to the relay circuit.

The rod heater is moved away from the rod when the machine stops in response to a signal from the detector and such movement is used to close a pressure responsive

switch. Then the solenoid armature movement pulls the heater out of contact with the rod. Alternatively the heater may be held in contact with the rod by the electromagnet which is de-energized in response to a detector signal so that the armature can move by force of a spring to pull the heater away from the rod. It is not desirable for the heater to move out of contact with the rod immediately after a signal is transmitted so that operation of the electro-magnet is subject to a time-delay device delaying the heater movement following the signal.

The invention will be described by way of example with reference to the accompanying drawings in which:

FIGURE 1 is a diagrammatic representation of part of a continuous-rod cigarette-making machine and some associated circuit elements embodying the invention.

FIGURE 2 is a diagram showing further circuit elements used with the machine of FIGURE 1.

FIGURE 3 is a circuit diagram of a typical control system embodying the invention, the view including circuit details for controlling the electrical driving motor for the machine.

FIGURE 4 shows a cross-section through the cigarette rod and its supports, the second being taken in front of the rod heater and the means for moving it being shown in elevation.

FIGURE 5 is a plan view of the rod heater operating mechanism shown in a portion of FIGURE 4.

FIGURE 6 is a view similar to FIGURE 4, showing a further embodiment of the invention with a modified heater moving means and switch operated thereby; and

FIGURE 7 is a circuit diagram of control circuits operable with the embodiment of FIGURE 6.

Referring to the drawings, the basic features of the invention are outlined in FIGURES 1 and 2 in connection with part of the rod line of a continuous-rod cigarette-making machine.

From four to six feet of cigarette rod per second are commonly made on a machine. Thus there is very little time for sealing the paper web seam since the heater bar is generally short. Therefore, the bar is relatively hot and will readily burn or char any combustible material in prolonged contact with its, or near it. Thus, when the machine stops, either at the will of the operator, or automatically because of the detection of a fault, the heater will soon burn the paper, or even char the garniture tape on which the rod is formed, unless the heater is moved moved away from its normal position where it rests on the cigarette rod.

At times a seam in the rod is not properly sealed and the rod will open out on leaving the tape, the fault being known as rod break-out. Break-out also occurs if the cigarette paper web breaks or if for any reason the tobacco filling is grossly inadequate. When break-out occurs it is necessary to stop the machine as promptly as possible because paper and tobacco are spread around the neighboring parts and tobacco is wasted and it is also necessary to lift the heater for the reasons given above. Before the machine is returned to operation, a new rod has to be formed and run in to the cut-off.

Referring to FIGURE 1, the rod 1 is shown as passing beneath a bar type rod heater 2 and the finished rod then passes through a radiation gauge at 3 and is cut into separate cigarettes by a cut-off 4. The cigarettes leaving the cut-off abut for a short time and are then separated by a suction wheel 5 so that they can be deflected on to a catcher band (not shown) in the usual way. This wheel 5 may be constructed as shown in United States Patent No. 3,039,589, issued June 19, 1962, but the essential fact is that a suction wheel is employed having suction ports which are closed when a cigarette is in contact with the wheel. Then the suction remains high

enough to close the contacts of a diaphragm switch 10 mentioned below. The wheel 5 is connected by a pipe 6 to a larger suction pipe, or trunking 7 with a restriction provided at 8 in the pipe 6. A fan 7A is shown to indicate suction means in the trunking 7. In FIGURE 1 the heater bar 2 is shown touching the rod 1 and the suction wheel 5 is separating cigarettes, all as if the machine were actually running, but the circuit elements illustrated are shown in the "off" position so that, in fact, the heater would be raised and there would not be any cigarettes at the suction wheel.

A by-pass pipe 9 having a restriction 9A leads to a diaphragm switch 10, having contacts 10A. The restriction 8 tends to isolate the part of pipe 6 from the suction wheel to the restriction, from the main suction line 7 so that the comparatively small change in suction caused by the difference between a cigarette being present, or absent, at the wheel is sufficient to operate the diaphragm of switch 10. At the same time there are slighter fluctuations in pipe 6 due to the fact that separate cigarettes in succession come into contact with the wheel. The restriction 9A, combined with the capacity of the diaphragm switch 10 and that of the pipe 9 between the restriction and the switch, serves to attenuate these slighter fluctuations in suction in line 6 which, without restriction 9A, would cause the contacts 10A of switch 10 to chatter continually. When the machine is operating normally, the suction is high and the switch contacts 10A of switch 10 are closed. This is because the suction holds up the switch diaphragm and allows the lower contact of 10A to spring up from the position shown and engage the upper contact. The switch contacts 10A are in the circuit of a relay 11. This relay has four contact bars, only two of which are shown in FIGURES 1 and 2 at 11A and 11D, respectively. Push button switch 16 parallels contact bar 11A. Another contact bar 11B (FIGURE 3) is in the control circuit of a machine driving motor 48. A motor is not shown in FIGURE 1, which is only a diagrammatic view explaining the general idea of the invention, because the relay contact bar 11B is not on that figure and the relay itself is actually controlled by more elaborate means than the simple push button switch 16, which is only illustrated in FIGURE 1 to show a means of energizing the relay, but it is clear that the switch 16 could also be used to start a suitable motor.

An A.C. supply is connected to the coil of the relay 11 and to the switch contacts 10A to energize the relay. Thus, contact bar 11A closes and keeps the relay energized. As long as the switch contacts 10A are closed by the suction on the diaphragm the machine will continue to run as the relay 11 will remain energized and the further contact bar 11B (FIGURE 3) of the relay will keep the motor 48 running.

The heater bar is pivoted for lifting from rod 1 by an electro-magnet 14 when energized. The magnet 14 raises the heater about 5 mm. from the rod 1 but further upward movement of the heater is possible by manual operation of a handle 52, whereby the heater can be raised to an extreme "up" position. Associated with the magnet lifting device is a time-delay switch 15, for example, of the pneumatic-delay type. The contacts 15A of switch 15 are joined to the leads of contacts 10A. Thus the contacts 15A can be closed to short-circuit the contacts 10A when the latter are open. When the machine is stopped the contacts 10A open because cigarettes cease to reach the suction wheel and it is necessary to provide means whereby the relay 11 can be energized on restarting the machine in spite of the fact that the contacts 10A will remain open until cigarettes once more reach the suction wheel. It is for this reason that the time-delay switch 15 is provided. When the heater is raised to the extreme "up" position, the time-delay device of the switch 15 is set and the contacts 15A are closed and remain closed until the heater bar is lowered again, when the time delay starts to run out. During the time delay

period, the contacts 15A short-circuit the open contacts 10A, so it is possible to restart the machine as there will be a circuit for the relay 11, through the contacts 15A, equivalent to the circuit through contacts 10A when closed. In FIGURE 1, the push-button switch 16 could as aforesaid be regarded as the starting switch which is pressed to cause the motor to start as well as to energize the relay 11, since when the machine is at rest the relay 11 is de-energized. The contact bar 11A will close when the relay is energized and maintain the relay circuit.

As will be seen from FIGURE 2, the heater magnet coil, shown schematically in block form 14A, is energized by a D.C. supply through a contact bar 17A of a time-delay switch 17 of the electro-magnetic pneumatic-delay type. The time-delay switch 17 is energized when the machine is still, through the contact bar 11D of the relay 11. As soon as the relay 11 is de-energized as shown, the switch 17 is energized and at the end of its time-delay its bar 17A makes contact to energize magnet coil 14A and pull up the heater 2. When the machine is restarted the bar 11D will lift and the switch 17 will be de-energized and its contact bar 17A will rise and break the circuit of the electro-magnet coil 14A. As before described, the heater is then lowered manually from the extreme "up" position to start the time delay period of switch 15 for holding the heater 2 down until cigarettes begin to reach the suction wheel 5 and the resulting suction on the diaphragm of switch 10 will close its contacts 10A. The time delay period of switch 15 is long enough to last until contacts 10A close whereupon its contacts 15A open again.

Having now explained the general points of the invention, a first specific embodiment will now be described with references to FIGURES 3 to 5.

The essentials of the complete circuit are shown in FIGURE 3 where parts, whose showing is identical with that of parts already referred to, have the same references as in FIGURES 1 and 2, while parts which are shown differently but perform the same functions have their references increased by 100. The circuit elements are shown as they are when the machine is at rest.

Power from A.C. lines is supplied to a transformer 40 having two secondary windings 41 and 42. The winding 41 is at ten volts, for example, and feeds a full-wave rectifier 43 which powers the lifting magnet 14 and a magnetic clutch 44. The latter is fitted on the driveshaft (not shown) of the machine driving motor 45, and operates when the motor circuit is broken to stop the machine. Thus, the clutch is de-energized and the motor is disengaged so that the run-down of the machine is not delayed by the inertia of the motor rotor. It will be seen that the circuit of this clutch is controlled by a contact bar 11C of the relay 11.

Contacts equivalent to the contacts 10A of the diaphragm switch 10 are shown here in bar form at 110A, the switch being marked 110. A further switch bar 115A which is equivalent to the contacts 15A in FIGURE 1 forms part of a time-delay switch identical with 15 but not shown in FIGURE 3.

A button 47 serves as a starting switch and when it is pressed a relay 147 is energized to pull down a bar 148 attached to a rod 149. Above the bar 148 is a contact bar 150 movable on the rod but pressed into the position shown in FIG. 3 by a spring. As the rod moves down under the pull of the relay, the contact bar 150 moves down into contact with the two contacts shown beneath it and makes a circuit parallel to that through the button 47 which can then be released. Further rod movement compresses the spring. A movable blade 116 is equivalent in function to the push button switch 16 of FIGURE 1. As the button 47 is pressed, the relay 11 is energized and its contact bars 11A, 11B and 11C close on their contacts while contact bar 11D moves away from its contacts. Then movement of the rod 149 moves blade 116 to the other contact and, as relay contact 11B

is now closed, a starter magnet **48** is energized to connect the supply to the motor **45**. While the bar **11D** will have moved up as relay **11** is energized, the bar **115A** is held in the closed position by the time delay switch which has been operated by manual movement of the heater **2**. The time-delay switch **17** of FIGURE 2 is shown here schematically as a block **117** and its contact bar is marked **117A**. The switch **117** is de-energized as bar **11D** rises and the contact bar **117A** breaks the circuit through magnet coil **14A**.

When the rod is beginning to feed satisfactorily, though the seam is not yet sealed by heating, the operator may lower the heater bar to seal the seam, but can still bend the rod away in the customary manner for a second or two until he is satisfied with rod quality, when he will break it off and feed it into the aperture of the radiation gauge and thence to the cut-off. The switch bar **115A** is closed when the heater bar is lowered and is subject to time-delay control before it can disengage. Before this can happen, cigarettes will be reaching the suction wheel and the diaphragm switch **110** therefore operates and its bar **110A** makes contact with the contacts shown at the right of the bar so that the eventual breaking of the contact between bar **115A** and its contacts makes no difference to the running of the machine.

When the operator wishes to stop the machine, he presses a stop button **49** which breaks the circuit through the relays **11** and **147** and the parts return to the positions shown in FIGURE 3.

If, while the machine is running, the rod breaks out, no cigarettes pass the suction wheel **5** (FIGURE 1) allowing the diaphragm switch **110** to move its contact bar **110A** away from its contacts, thus breaking the circuit to the relays **11** and **147** to stop the machine in the same manner. As the circuit through relay **11** is broken, the bar **11D** closes, completing the circuit for the time-delay switch **117**. This, subject to its time delay, closes its contact bar **117A** and the heater magnet coil **14A** is energized, raising the heater. A movement of 5 mm. is sufficient. This last time-delay switch **117** ensures that all rod made during the run-down of the machine, when the machine is stopping normally without malfunction, has the paper properly sealed. When the machine has stopped, the operator raises the heater still further, to the aforesaid extreme "up" position. The raising of the heater to the "up" positions causes the contact bar **115A** to close again so all is ready for restarting as before.

Referring now to FIGURES 4 and 5, the details of the heater structure are shown. The heater bar **2** is fixed to a casing **50**, containing electric heaters, which is pivoted at **51**. The heater can be raised manually by a handle **52** or automatically by a rod **53** which is coupled to the heater by a slotted link **54**. A spring **55** surrounds the rod **53**. At its right-hand end the rod **53** is adjustably coupled to the armature **56** of a magnet **114** by a knurled nut **70**. Said armature **56** is pivotally attached at its lower end to the magnet **114** and has an aperture having a flared portion at the upper end thereof loosely receiving the rod **53** therethrough and the flared portion is dome shaped in order to engage a corresponding dome face **71** on the knurled nut **70**. At an intermediate position along the rod **53**, one end of a pivoted lever **57** is extended between a loose collar **72** on the rod and a nut **62** for movement with the rod **53**. The lever **57** is pivoted at **58** and when it is moved sufficiently by the rod **53**, when the handle **52** is raised to extreme up position, it presses a member **59** which is part of a time-delay switch **215** and closes a switch bar, not shown, but equivalent to the bar **115A**, FIGURE 3.

From this it will be seen that if the magnet **114** becomes energized, the heater will be lifted automatically out of contact with the rod. Afterwards it can be lifted manually to the "up" position, the slotted link **54** permitting this additional movement. When the heater is swung up manually to the "up" position, the switch bar equivalent to the bar **115A**, FIGURE 3, will be closed and held by lever **57**.

As the heater is raised in this manner by the operator, the movement of link **54** relieves the tension on the rod **53** and the spring **55** can expand and operate the lever **57**, the rod **53** sliding through the hole in armature **56**. The nut **62** on the rod **53** prevents the spring **55** from operating the lever **57** to engage the time-delay switch **215** unless the heater has been raised manually to the "up" position, so as to relieve the tension on the rod.

The conditions to be met by the apparatus so far described are as follows:

(1) When the machine is stopped and empty, that is, no rod is yet formed, the heater must be in the "up" position. The contacts of the time-delay switch **15** (FIG. 1) shorting across the diaphragm switch are closed under those conditions so that the motor can be started. The machine will start and rod can be formed as soon as the heater is brought down normally to seal the rod and the heater is held down automatically by the time delay long enough for the cigarettes to flow properly past the detector.

(2) When the driving motor is stopped at the will of the operator, for example, by pressing stop button **49** (FIG. 3), the heater bar must remain in contact with the rod for about two seconds, to cover the run-down of the machine and ensure that the rod up to the cut-off is intact. Thus, upon restarting the machine there is no trouble with an inadequately sealed rod.

(3) The contacts of the diaphragm switch **10** (FIG. 1) are closed when cigarettes once more reach the suction wheel **5** so that when the contacts **15A** of the associated time-delay switch are opened, the control of the heater movement passes to the diaphragm switch contacts **10A**.

(4) When break-out occurs, the circuits to the motor **45** and the clutch **44** (FIG. 3) must open, and the time-delay switch **117** through which the magnet coil **14A** is energized, must be operated. These requirements are met by de-energizing the relay **11**. The time delay period of switch **117** is set so that the machine comes to rest just before the switch bar **117A** operates causing the magnet to pull the heater up. The operator may then raise the heater to the extreme "up" position to close the contact bar **115A** of the time-delay switch on its contacts which are connected across the contacts of the diaphragm switch bar **110A** so that the machine can be restarted when required. The contact bar **115A** short-circuits the contacts of the diaphragm switch bar **110A** for from five to ten seconds under control of the time-delay device **215** (FIG. 4).

A different embodiment shown in FIGURE 6, may be preferred over that shown in FIGURE 4.

The heater **2** is held down in contact with the rod **1** by a magnet **214** against the influence of a strong spring **60**. While the magnet **214** is energized, its armature **156** presses on a rod **153**, forcing the heater bar **2** into contact with the cigarette rod. When the magnet current ceases, the armature **156** moves and the spring **60** causes the heater to be rapidly raised to the extreme "up" position. A weak spring **61** keeps the armature **156** sufficiently in position for it to be attracted by the magnet **214**. The breaking of the magnet circuit is subjected to time delay, as before described, to ensure that cigarettes made during run-down are properly sealed. When the circuit breaks, the spring **60** presses the rod **153** against the armature **156** which in turn presses on a member **159** to close contacts of a time-delay switch **315** corresponding to the switch **15** of FIGURE 1.

The essential circuit is shown in FIGURE 7. With the machine not operating, contacts **210A** of a diaphragm switch **210** are open and a contact bar **315A** is closed across contacts **210A**. This bar **315A** is the contact bar of the time-delay switch **315**, FIGURE 6. If a button **216** is pressed, current is fed to a main relay **111** which starts a driving motor (not shown) and closes a holding

contact bar 216A. The heater is lowered as the motor is started and the rod formed before the time delay period (eight seconds, for example) of the switch 315 of FIGURE 6 runs out. Thereupon, the bar 315A disengages and contacts 210A, which close as soon as cigarettes reach the suction wheel (5 of FIG. 1), maintain the machine in operation. If break-out occurs, or the machine is deliberately stopped by pressing a stop button 249, the circuit through 111 is broken and the driving motor will come to rest. The circuit through the time delay switch 217 which is connected while relay 111 keeps the machine running, will also open to move the switch bar 217A down after a time delay of about two seconds. This cuts off the supply to the heater positioning magnet coil 314 to cause the spring 60, FIGURE 6, to swing the heater bar up. This closes the contact bar 315A, of the time-delay switch 315, FIGURE 6, and holds it closed ready for a restart.

The magnet 214 (FIG. 6) although energized all the time the machine is running, has its armature 156 very near the coil, and thus a relatively small magnet can be used. Moreover, should the power supply fail, the heater 2 is automatically lifted up.

What I claim as my invention and desire to secure by Letters Patent is:

1. In a continuous-rod cigarette-making machine driven by an electric motor to move the rod along a path and having a rod heater movable into and out of contact with the moving rod, a cut-off arranged to cut the moving rod into separate cigarettes, and a suction wheel arranged to engage cigarettes emerging from the cut-off of the machine to impart a modified further movement to them, the improvement constituting means for moving the rod heater away from the cigarette rod should cigarettes fail to emerge from the cut-off and engage the suction wheel because of malfunction of the machine and during shutdown, comprising an electro-magnet with a movable armature, means coupling the armature in operative engagement with the rod heater to move the rod heater in and out of contact with the cigarette rod, a relay having a motor control contact and an electromagnet control contact, means to start the motor and energize said electromagnet by said relay contact, a source of suction, a conduit leading from said suction source to said suction wheel, a diaphragm switch located in a second conduit communicating with the suction conduit, said switch having a set of contacts movable in response to changes in suction in said suction conduit and including means for operating the switch in two contact positions, respectively while cigarettes engage the suction wheel and while suction on the diaphragm is reduced because cigarettes fail to engage said wheel, a circuit including said movable set of contacts on the diaphragm switch for energizing said relay to thereby operate the motor and electromagnet, time-delay switching means coupled for operation by the diaphragm switch to release the electromagnet after a predetermined period, means for moving the heater away from the rod to an extended position beyond the movement afforded by said armature, and time delay switching means coupled to short circuit the contacts of the diaphragm switch and operable by movement of the heater from said extended position back to said rod to hold its contacts closed during a period permitting cigarettes to reach the suction wheel to permit restarting the machine when the diaphragm switch contacts are open whereafter its contacts open to pass control to said diaphragm switch to enable said motor to continue to run.

2. Apparatus as defined in claim 1 in which the means for moving the heater away from the rod to said extended position comprises a manually operated handle and the heater is pivoted for movement into and out of contact with the cigarette rod, and the armature operative engaging means comprises a sliding link with a slot coupled at respective ends to said armature and said rod heater to permit manual movement to said extended positions.

3. Apparatus as defined in claim 1 in which the movable rod heater is pivotable for movement into and out of contact with the cigarette rod, and said armature includes a spring coupled to move the rod heater to said extended position beyond the movement afforded by the armature automatically when the electro-magnet becomes deenergized by opening of the diaphragm switch contacts.

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