

April 17, 1951

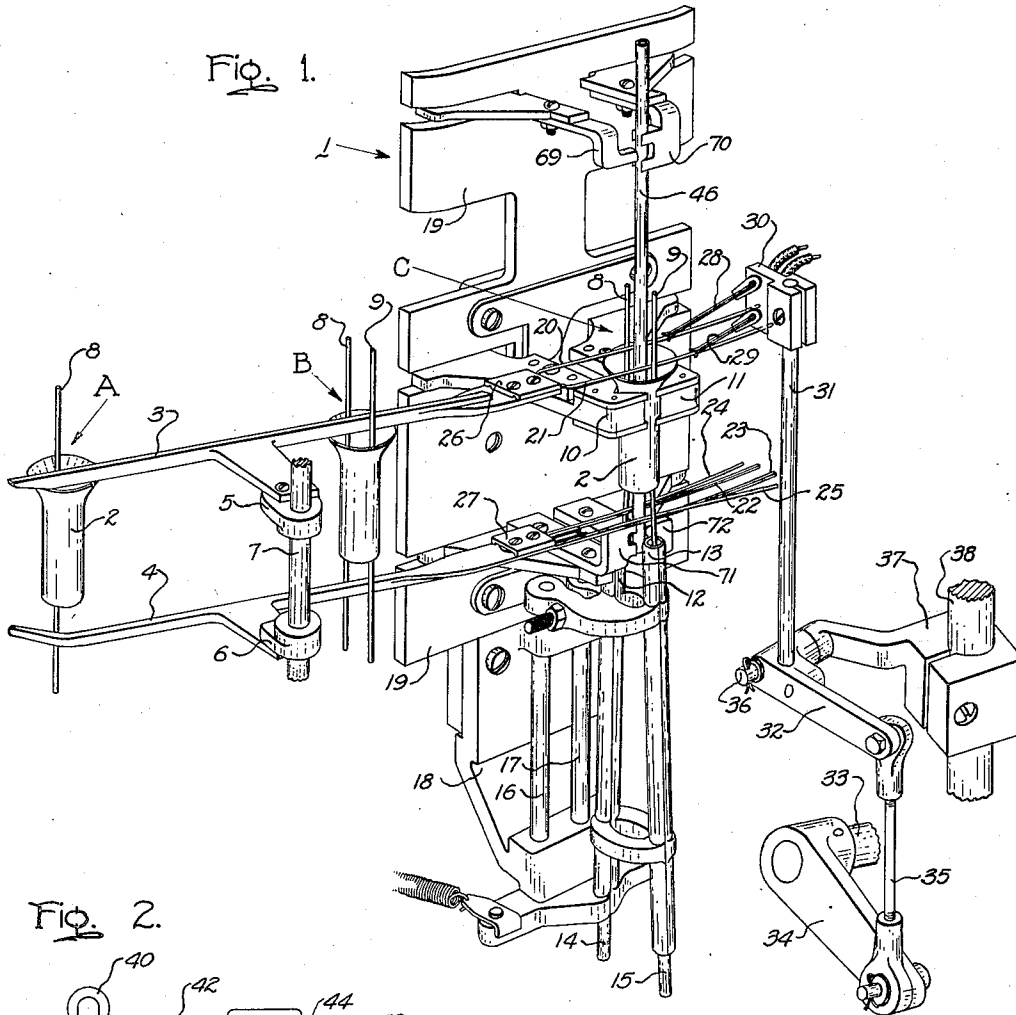
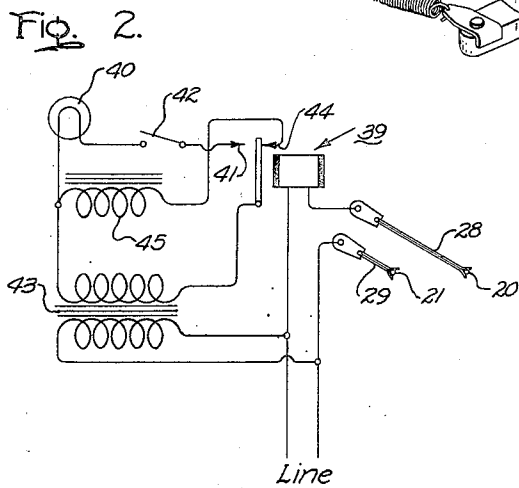
L. E. DILTS

2,549,296

LEADING-IN WIRE DETECTING APPARATUS

Filed Sept. 21, 1948

3 Sheets-Sheet 1



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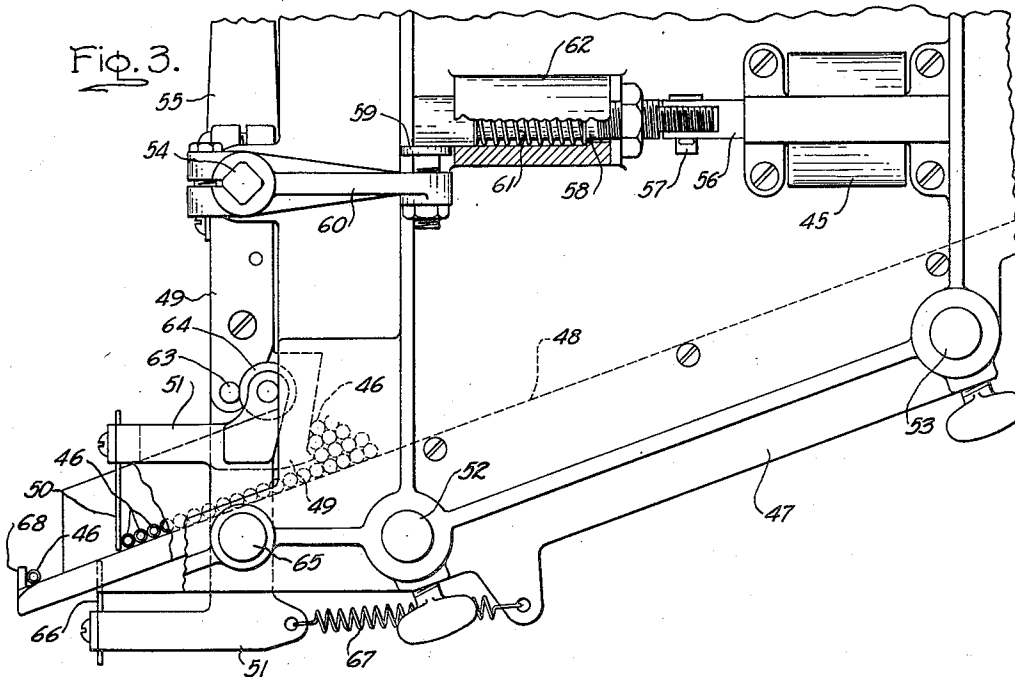
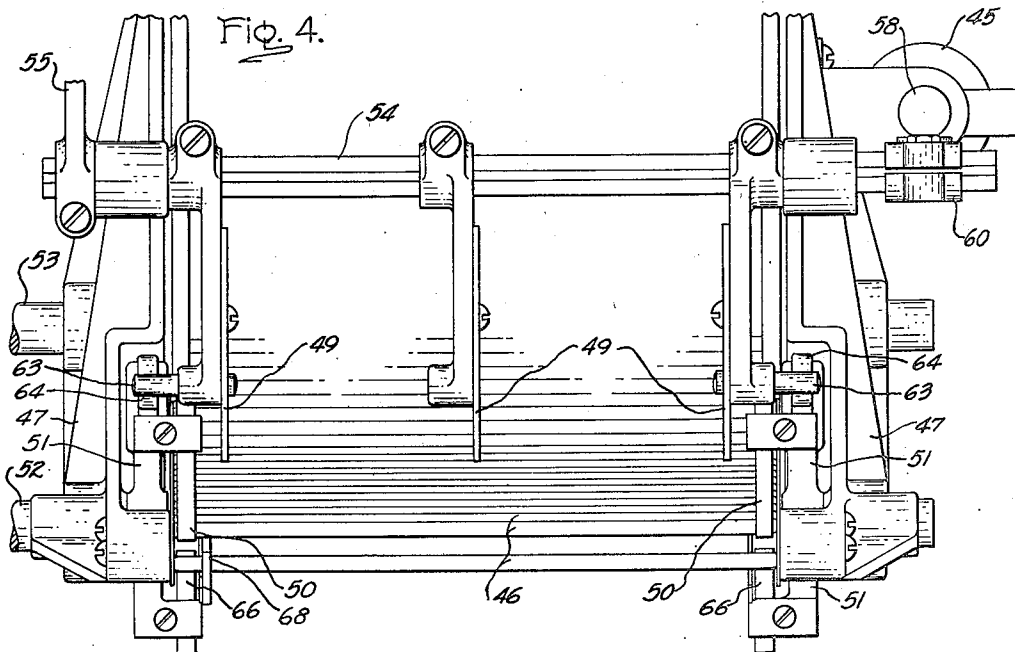
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LEADING-IN WIRE DETECTING APPARATUS

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

FIG. 5.

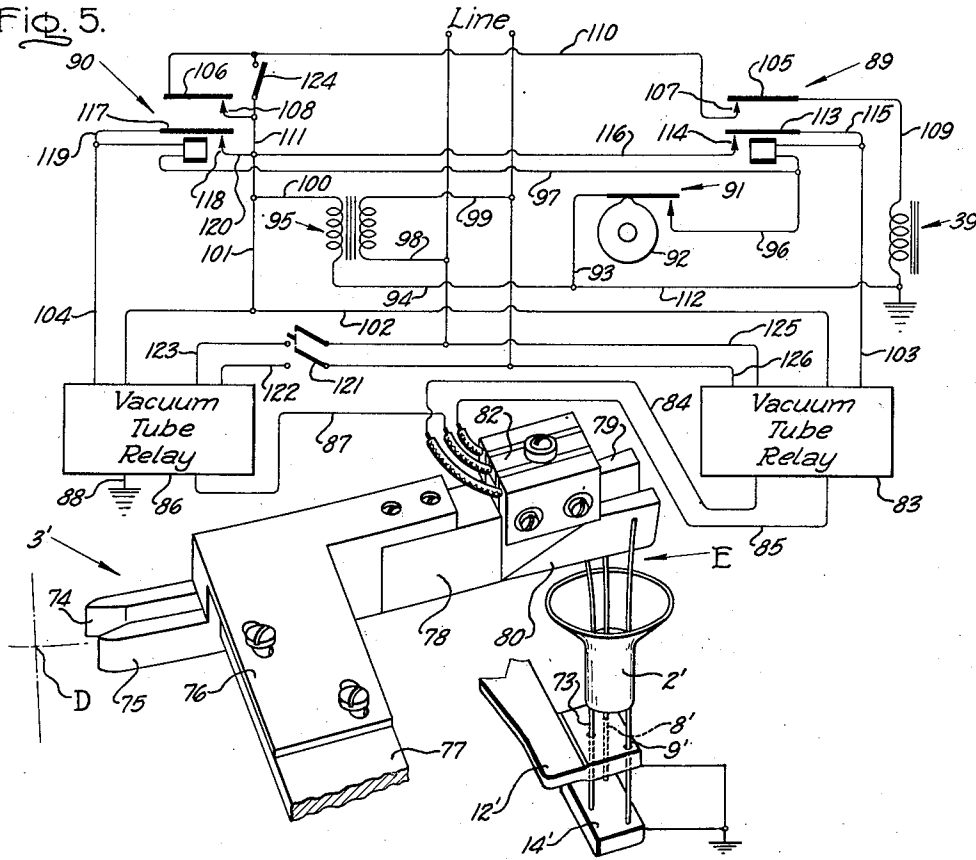


FIG. 6.

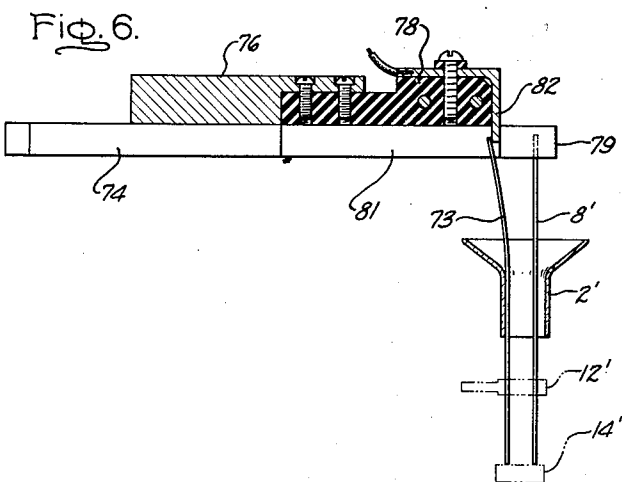
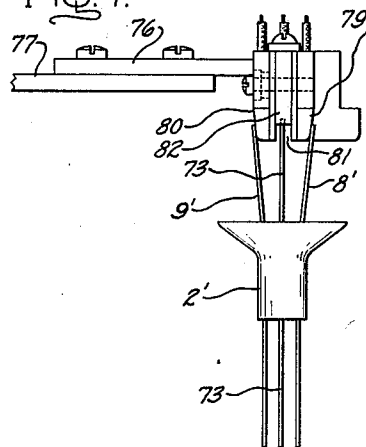


FIG. 7.



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UNITED STATES PATENT OFFICE

2,549,296

LEADING-IN WIRE DETECTING APPARATUS

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Application September 21, 1948, Serial No. 50,423

15 Claims. (Cl. 49-2)

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My invention relates to apparatus for manufacturing stems and the like for electric incandescent lamps and other electrical devices. More particularly, my invention relates to apparatus for use in combination with high-speed automatic stem-making apparatus for determining the presence or absence of leading-in wires in a movable head thereof and for effecting a control of the operation of another portion of said stem-making apparatus in accordance with said determination.

The present application is a continuation-in-part of my application Serial No. 680,955, filed July 2, 1946 and assigned to the present assignee, and now abandoned.

The stem-making functions of the usual stem-making apparatus are performed by portions of the apparatus located at a series of work stations into which work-carrying heads thereof are indexed in turn and are initiated particularly by the feeding of the leading-in wires, the exhaust tube and other stem parts which take place in that sequence. The course of travel of the heads is such that the leading-in wires are fed into tubular holders thereof at certain work stations and that subsequent movements of the heads carry them before other apparatus which feeds exhaust tubes and other lamp parts thereto, and then to still other apparatus which develops these parts into stems of the desired character. The improper functioning of any of the feeding or other apparatus results in a loss in production, manufacture of defective stems and wastage of the materials used in such stems.

One object of my invention is to provide apparatus for determining the presence or absence of leading-in wires in a movable work-carrying head of a stem machine in the course of the movement thereof through work stations. A further object of my invention is to provide leading-in wire finding apparatus of a character which can be used in combination with certain other apparatus at work stations of a stem machine, thereby permitting the more advantageous use of said stations.

A still further object of my invention is to provide apparatus for detecting leading-in wires in a work-carrying head of a stem machine, which apparatus is particularly adapted to detect as many as three of said leading-in wires. Still another object of my invention is to provide detecting apparatus of the type hereinbefore referred to which is readily converted to function properly in the detecting of different numbers of leading-in wires and effect an alarm and/or con-

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trol automatically on the basis of said findings.

The leading-in wire detecting apparatus permits the improper operation of automatic feeding apparatus to be discovered, thereby allowing the condition resulting in said improper operation to be looked into and corrected. The considerable loss of material, production, etc. resulting from the otherwise continued operation of the stem-making apparatus until improper operation is discovered is thereby avoided.

Another object of my invention is to provide apparatus operable upon the determination of the presence or absence of a leading-in wire in a movable head of a stem machine to control the operation of another portion (the exhaust tube feeding portion, for instance) of the stem machine. The control afforded by the apparatus can be introduced following the determination of the absence of any one of the leading-in wires to prevent the feeding of an exhaust tube to the head and thereby prevent the loss involved in incorporating said tube in a defective stem.

Other objects and advantages of my invention will appear from the following detailed description of species thereof and from the drawing.

In the drawing, Fig. 1 is a perspective view of leading-in wire positioning and detecting apparatus of my invention, which apparatus is located at three of the work stations about a stem machine and is shown in combination with the head of said machine occupying the latter of said work stations; Fig. 2 is a wiring diagram of the electrical elements of said apparatus; Figs. 3 and 4 are end and side elevations, respectively, of the portion of exhaust tube feeding apparatus controlled by the apparatus; Fig. 5 is a perspective view of modified leading-in wire detecting apparatus, the electrical circuit testing and control elements thereof being shown in a wiring diagram; Fig. 6 is a vertical section through the length of the guide in Fig. 5; and Fig. 7 is an end view of the last-mentioned guide.

The apparatus appearing in Fig. 1 is associated with three work stations, indicated at A, B and C, about a stem-making machine, the stations at which the leading-in wires and an exhaust tube are introduced into the stem-making machine. The leading-in wires and exhaust tube are fed into a head 1, like that shown at station C, of the stem machine during the course of its travel through these work stations in turn and are received by portions of the stem head 1 which hold them in proper spaced relation during the further stem-making operations of said machine. When the stem head 1 is advanced into station A, it al-

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ready contains a vitreous flare or stem tube 2 which is so positioned within the head 1 as to pass between the upper and lower guides 3 and 4 respectively of my apparatus. The upper and lower guides 3 and 4 are attached to the brackets 5 and 6, respectively, mounted on the stationary post 7 extending from the frame (not shown) of the stem machine and assist in keeping the leading-in wire 8 introduced at station A in its proper place in the stem head 1. The upper and lower guides 3 and 4 lie to the near side (as viewed in Fig. 1) of the stem tube 2 at station A and gradually transverse the course of travel of the stem tube 2 to the opposite side thereof at station B so as to push the leading-in wire 8 as far to that side as possible during movement of the stem head 1. A second leading-in wire 9 is introduced in the stem head 1 at station B, in this instance on the near side of the upper and lower guides 3 and 4.

The leading-in wires 8 and 9 are preferably fed into the stem head 1 by automatically operated apparatus of the type disclosed in United States Patent 2,042,520, J. Flaws, Jr., issued June 2, 1936, during the rest periods of the stem head 1 which takes an indexing course of movement through the work stations. The stem heads 1, which conform closely with those of the stem machine disclosed in United States Patent 1,655,141, J. T. Fagan et al., issued January 3, 1928, hold the stem tube 2 by means of the jaws 10 and 11, and the leading-in wires 8 and 9 which extend through said stem tube 2 by means of separate tubular holders 12 and 13. The adjustable rods 14 and 15 which extend almost the full length of the tubular holders 12 and 13 provide the base therein for positioning the leads 8 and 9 at the correct height. The tubular holders 12 and 13 are each formed by two corresponding half sections which are mounted on the rods 16 and 17 carried by the bracket 18 which, in turn, is mounted, in combination with the jaw-positioning face plate 19 of the head 1, on the frame (not shown) thereof. The half sections of the tubular holders 12 and 13 allow them to be separated from the leading-in wires 8 and 9 upon completion of the stem so as to permit the ready removal thereof from the head 1.

In the course of the movement of the stem head 1 to station C, the leading-in wires 8 and 9 first pass into engagement with widened portions of the guides 3 and 4 and then engage a section of guide 3 formed by the spreading fingers 20 and 21 and a section of guide 4 formed by the spreading fingers 22 and 23 and contact fingers 24 and 25, with the result that the leading-in wires 8 and 9 are pushed against the inner walls of the stem tube 2 and are under a constant pressure of engagement. In this position a complete electrical circuit is formed through spreading finger 20 which is insulated from guide 3, a mid-portion of leading-in wire 8, contact finger 24 which is connected to guide 4, guide 4, contact finger 25, a mid-portion of leading-in wire 9 and spreading finger 21, which circuit is tested when the stem head 1 reaches station C to determine the presence of both leading-in wires or the absence of at least one of them. The ends of the spreading fingers 20 and 21 are wrapped with an insulating tape before being attached to the guide 3 by the clamping block 26 and are, therefore, insulated therefrom, whereas the contact fingers 24 and 25 are fastened directly to guide 4 by the clamping block 27 and are therefore connected together electrically by said guide 4.

In the present instance the circuit through the

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leading-in wires 8 and 9 is tested through electrical connections made to the spreading fingers 20 and 21 by the contact brushes 28 and 29 which are mounted on the insulating block 30, and which are carried into contact therewith by movement of said block 30, the support rod 31 therefor, and the lever 32. The movement of the contact brushes 28 and 29 occurs immediately after the stem head 1 takes station C in order to allow as full utilization of the period the head 1 is located at said station C as possible and is initiated by the main driving mechanism (not shown) of the stem machine through rotation of the shaft 33 and movement of the arm 34 and link 35 which turn the lever 32 about the stationary pivot pin 36. In this particular instance, the connection to the main driving mechanism of the stem machine is indirect, the connection being made through the shaft 33, which is also the means of causing the burners (not shown) of the stem machine to be brought into operative relation to stem parts and the stem head 1 at a succeeding work station thereof. The pivot pin 36 is supported from the frame of the stem machine through the bracket 37 and the vertical post 38.

In other instances, the circuit through the leading-in wires 8 and 9 can be tested by means permanently connected to the fingers 20 and 21 of guide 3 at a position just ahead of work station C. In such instances, wires (not shown), which are connected in the electrical testing apparatus shown in Fig. 2 in the place of contact brushes 28 and 29, are attached to the ends of the fingers 20 and 21 adjacent the clamping block 26 and extend upward between the paths of movement of the wires 8 and 9 to said electrical testing apparatus. This particular manner of making electrical connections between a guide for the leading-in wires 8 and 9 corresponds to the electrical testing apparatus shown in detail in the modification of the leading-in wire finding apparatus shown in Figs. 5, 6, and 7.

In still other instances, the guide 4 can be dispensed with and the holders 12 and 13 and the associated means of the stem head 1 can be relied upon to maintain the electrical connection between the leading-in wires 8 and 9 through said holders 12 and 13.

The electrical test circuit presently completed by the contact brushes 28 and 29 is made through their wired connections to the relay 39 and the line source of low voltage electric current, as shown in the wiring diagram in Fig. 2. Normal operating conditions, wherein both leading-in wires 8 and 9 are in place in the stem head 1 and the test circuit established through them is complete, result in the armature of the relay 39 taking the position shown. Abnormal operating conditions, wherein one or both leading-in wires 8 and 9 are missing from the stem head 1 and the test circuit is incomplete, have no result in the relay 39 which allows its armature to remain in a position opposite to that shown.

The presence of both leading-in wires 8 and 9 in the stem head and the correspondingly complete condition of the test circuit indicates the proper operation of the machine and particularly the proper operation of the leading-in wire feeding mechanism hereinbefore referred to and located adjacent work stations A and B. Improper operation of the leading-in wire feeding mechanism ordinarily cannot be corrected without manual attention to said mechanism, the need of which is indicated by the lighting of the incandescent lamp 40 (Fig. 2) in one of the sup-

plemental circuits controlled by the test circuit. Should the stem head 1 be without one of the leading-in wires 8 or 9, the test circuit will be incomplete and the armature of the relay 39 will be against contact 41 and the supplemental circuit including said armature, contact 41, switch 42, indicator lamp 40 and the secondary of the transformer 43 will be complete when switch 42 is closed. The switch 42 is closed during the test interval by the main driving mechanism (not shown) of the stem machine and has a cycle of operation like that of the contact brushes 28 and 29, the stem head 1 and many other portions of the stem machine. The primary of transformer 43 is also connected to the line and provides the source of electric current of the proper characteristics for the supplemental circuit.

Should the stem head 1 be properly provided with the leading-in wires 8 and 9, the test circuit will be completed during the cycle of operation and the armature of the relay 39 will be carried against contact 44 so that the second supplemental circuit including said armature, contact 44, the solenoid 45 and the secondary of the transformer 43, will be complete. In such instances, the closing of the switch 42 during its regular cycle of operation cannot cause the indicator light 40 to be lighted since the armature of the relay 39 is in the position shown and out of engagement with the contact 41. The second supplemental circuit is used to control, through the actions of the solenoid 45, the exhaust tube feeding mechanism located adjacent station C to avoid the feeding of an exhaust tube 46, like that shown in the stem head 1 in Fig. 1, in instances where it would be added to an incomplete stem assembly. A stem head 1 holding the incorrect number of leading-in wires is allowed to continue its course of movement through the work stations of the stem machine and accordingly completes its present cycle of operation without contributing to the manufacture of a perfect stem. Feeding an exhaust tube 46 to a stem head 1 containing the incorrect number of leading-in wires 8 and 9 would result only in the wasting of said tube 46.

The feeding operations necessary to place the exhaust tube 46 in the stem head 1 in the present instance follow very closely those disclosed in United States Patent 1,655,141, J. T. Fagan et al., issued January 3, 1928, and the mechanism for said operations is actuated in a corresponding manner through a cycle completed between indexing intervals of the stem heads 1.

The exhaust tube 46 is contained with others in a hopper of such feeding mechanism and immediately after the presence of the leading-in wires 8 and 9 is ascertained by my apparatus, the tube 46 is separated from the others and transferred to the stem head 1. The control effected by the solenoid 45 is brought about through the feeding mechanism associated with the hopper 47 of the present exhaust tube feeding mechanism disclosed in Figs. 3 and 4 which supports the available supply of exhaust tubes 46 in a parallel arrangement in a pile resting on the inclined rails 48 on the opposite sides of said hopper 47. The force of gravity causes the exhaust tubes 46 to roll down the inclined rails 48 into engagement with the arms 49 which are so spaced from said rails 48 as to block all but the row of exhaust tubes 46 resting directly thereon and then to pass farther down the rails 48 to engagement with the stop bars 50 on corresponding bell cranks 51 at

opposite sides of the hopper 47. The release of exhaust tubes 46 from the hopper 47, which is mounted on the stationary support rods 52 and 53, occurs with a counterclockwise rotation (as viewed in Fig. 3) of the operating rod 54 in each cycle of operation of the feeding mechanism produced by means (not shown) actuated from the main drive apparatus of the stem machine and engaging the arm 55 and operating rod 54. The rotation of the rod 54 only occurs at times when the control portion of my apparatus indicates both leading-in wires 8 and 9 are in place in the stem head 1 by causing the solenoid 45 to shift its armature and unblock the mechanism. The solenoid 45 is mounted on the side of the hopper 47 and is connected through its armature 56 and pin 57 to the blocking rod 58 which normally takes a position over the head of the pin 59 in the arm 60 attached to the operating rod 54 because of the expansion force of spring 61 so that the arm 60 and operating rod 54 cannot move as desired. The actuation of the armature 56 of the solenoid 45 causes the blocking rod 58 to be withdrawn into the boss 62 on the side of the hopper 47, in which it is held so that the movement of the arm 60 and operating rod 54 can occur.

In operation, the operating rod 54 moves the arms 49 forward against the piled exhaust tubes 46 causing them to be agitated and to fall behind succeeding exhaust tubes 46 in the regular course of rolling down the inclined rails 48 and carries the pins 63 on the outermost arms 49 against the rollers 64 on the bell cranks 51 causing them to turn about the pivot pins 65 held by the hopper sides so that stop bars 50 are withdrawn from the path of movement of the exhaust tubes 46 and stop bars 66 are raised into said path farther therealong. The bell cranks 51 are biased by the springs 67 which also engage an ear on the hopper side and swing back to their former position (that in which they are shown in Figs. 3 and 4) as the operating rod 54 and arms 49 are immediately returned to their former position. This latter motion of the bell crank 51 introduces the stop bars 50 after the endmost exhaust tube 46 in the advancing column so as to separate it from the others and then withdraws the stop bars 66 from in front of said exhaust tube 46, allowing it to roll down the incline rails 48 to the lip 68 at the end. From this position the exhaust tube 46 is carried into the stem head 1 by transferring mechanism (not shown) which is disclosed in combination with the stem machine in United States Patent 1,655,141 hereinbefore referred to. The exhaust tube 46 takes a position within the stem tube 2 and between the spreading fingers 20 and 21, spreading fingers 22 and 23, contact fingers 24 and 25, and the two pairs of jaws 69, 70 and 71, 72 of the stem head 1 which are then closed on said exhaust tube 46, as shown, to hold it in place in the stem head 1.

The transferring mechanism immediately withdraws from operative relation to the stem 1 and the contact brushes 28 and 29 are swung back from engagement with the spreading fingers 20 and 21, thereby completing the cycle of operation of the apparatus at station C and allowing the stem head 1 to be indexed to a succeeding station in its regular course of movement. The cycle of operation of my apparatus occurs during the course of the indexing movements of the stem head 1 through the stations A, B and C about the stem machine and is repeated in the described manner in the regular course of the

advancement of other stem heads 1 of the stem machine through said stations. The operation of the leading-in wire and exhaust tube feeding mechanism also at these work stations repeats without interference from the control apparatus except as herein described.

The modification of my leading-in wire detecting apparatus appearing in Figs. 5, 6 and 7 differs from the previously described apparatus in that a shorter guide 3' is provided along the path of movement of the head (not shown) of the stem machine and in that said guide 3' is positioned so as to be wiped by upper end portions of the three leading-in wires 8', 9' and 73. The guide 3', which extends from a position adjacent station D to a position including station E, occupies such a limited space that it is located out of the normal positions of other mechanisms of the stem machine and permits the fullest use of the work stations thereof. As with the previously described modification, the function of the apparatus is to ascertain the proper operation of automatic leading-in wire feeding apparatus located at work stations taken by the head of the stem machine just prior to engagement with the detecting apparatus, and it effects a control over mechanisms of the stem machine occupying stations taken by the head following engagement with said detecting apparatus. The effect of the detecting apparatus is to cause an interruption in subsequently occurring operations of the stem machine should one or more of the three leading-in wires 8', 9' and 73 be missing from the stem head at the time it takes station E.

The proper operation of the guide 3' is dependent on the leading-in wires 8', 9' and 73 being at respective locations in the stem head so that the upper end portions thereof wipe respective portions of the guide 3'. In the present combination of apparatus the positions of the leading-in wires 8', 9' and 73 are established by the holder 12' and the rest member 14' of the stem head, the holder 12' of which is apertured to accommodate the leading-in wires 8', 9' and 73 in holes therein and fixes their relative lateral spacing whereas the rest 14' establishes their vertical position. The stem head also supports a vitreous stem tube 2' which surrounds a mid-portion of the leading-in wires 8', 9' and 73 and which is, in the course of manufacture, fused around portions thereof. The leading-in wires 8' and 9' in particular, which correspond to leading-in wires 8 and 9 shown in Fig. 1, have positions directly opposite each other adjacent the inner walls of the stem tube 2' and are somewhat separated from the third leading-in wire 73, which is located adjacent a portion of the inner wall of said stem tube 2' mid-way therebetween. Inasmuch as the leading-in wires 8' and 9' are equally spaced on either side of the center of the stem tube 2', they engage, during the initial movements of the stem head from work station D, the rounded ends of the spreading fingers 74 and 75 of the guide 3' and pass to opposite sides thereof. The leading-in wire 73, on the other hand, passes between the spreading fingers 74 and 75 and does not immediately engage any portion of the guide 3'. A further movement of the stem head 1 carries the leading-in wires 8', 9' and 73 below the angular arm 76 which extends laterally to a stationary support member 77 overhanging the outer periphery of the stem machine and which fixes the position of said guide 3'.

Still further along in the movement of the stem head, the leading-in wires 8' and 9' pass across

the block 78 of electrical insulation material comprising an intermediate section of the guide 3' and then wipe against respective metal contact fingers 79 and 80. A channel 81 in the block 78 of insulation material accommodates the upper end of the leading-in wire 73 during said movement, which is complete when station E is reached and the upper end of said leading-in wire 73 is caught behind the end of a contact 82 protruding downward into said channel 81. This manner of engagement with the leading-in wires 8', 9' and 73 provides separate electrical connections to each of said leading-in wires 8', 9' and 73 inasmuch as the contact fingers 79 and 80 and contact 82 are fastened separately to the insulating block 78. A very satisfactory connection is made to the leading-in wires in each instance in that the contact fingers 79 and 80 are flared both outwardly and upwardly so as to exert pressure against the leading-in wires 8' and 9' which bends them over the flare 2' and in that the contact 82 blocks movement of the upper end of the leading-in wire 73 during the final movement of the stem head, causing said leading-in wire 73 to be correspondingly flexed over the flare 2'. A satisfactory electrical connection is also made by the supporting parts 12' and 14' of the stem head to the lower portions of the leading-in wires 8', 9' and 73 at such times. The separate circuits formed between the contact fingers 79 and 80, and contact 82 and the stem head through the leading-in wires 8', 9' and 73, indicate by their completeness the presence of said leading-in wires 8', 9' and 73 and are tested to effect the controls already specified.

In the present combination of apparatus the test circuits through the leading-in wires 8', 9' and 73, which ascertain the presence or absence of the leading-in wires 8', 9' and 73, preferably cause operation of control relays indirectly by means of vacuum tube relays as shown associated with the apparatus in Fig. 5, but can be modified by removal of the vacuum tube relays so that the control relays are operated directly as in the combination of the electrical testing means in Fig. 2.

The electrical connections made to the leading-in wires 8', 9' and 73 in the combination of apparatus appearing in Fig. 5 provide for the test of a series circuit through leading-in wires 8' and 9' and a separate circuit through the leading-in wire 73. In this combination, the absence of either leading-in wire 8' or 9' breaks the series circuit which includes that portion of the stem head joining said leading-in wires 8' and 9' and effects a controlling influence over the vacuum tube relay 83 which is connected to the contact fingers 79 and 80 through the wires 84 and 85, respectively. The absence of leading-in wire 73, on the other hand, effects a controlling influence over the vacuum tube relay 86 which is connected through wire 87 to contact 82 and through wire 88 to the grounded frame of the stem machine, which is in effect the stem head. Both vacuum tube relays 83 and 86, which are sometimes referred to as contact amplifiers, are arranged to cause actuation of respective magnetic relays 89 or 90 at the moment control is to be effected, and through operation of said magnetic relays 89 and 90, which are arranged in series, make an energizing circuit to the control solenoid 39.

The testing function of the apparatus occurs after the stem head comes to rest at station E and is initiated by the closing movement of the switch 91, which corresponds to switch 42 in the

testing apparatus disclosed in Fig. 2, in that it is operated during a particular moment in the course of operation of the stem machine, either by the cam 92 on the main drive shaft of said machine, or by some other part thereof having the required period of operation. The switch 91 forms a master control of the source of electrical energy supplied to the magnetic relays 89 and 90, as it is connected through wires 93 and 94 to one side of the secondary of the transformer 95 and through wires 96 and 97 to the actuating coils of said magnetic relays 89 and 90, respectively. The circuits between the opposite side of the secondary of the transformer 95, the primary of which is connected through wires 98 and 99 to the main line source of electrical energy, and the actuating coils of the magnetic relays 89 and 90, is made through the wires 100, 101 and 102, the respective vacuum tube relays 83 and 86, and the respective wires 103 and 104. The vacuum tube relays 83 and 86, which have a normally open condition, are actuated by the presence of the leading-in wires 8', 9' and 73 in engagement with the contacts 79, 80 and 82 and, in the case of relay 83, complete the circuit between wires 102 and 103 to the actuating coil of magnetic relay 89, and, in the case of relay 86, complete the circuit between wires 102 and 104 to the actuating coil of magnetic relay 90. The actuation of either magnetic relay 89 or 90 causes the respective control arm 105 or 106 thereof to be moved into engagement with a cooperating stationary contact 107 or 108. However, both magnetic relays 89 and 90 must be actuated to cause the energization of the control solenoid 39, as the contact arms 105 and 106 are arranged in a series connection by the wires 109, 110, 111 and 100 to the transformer 95, the source of electrical energy. A permanent connection made by wires 112 and 94 completes the connections to the control solenoid 39 which, as shown in Figs. 3 and 4, unblocks the operating means of the exhaust tube feeding mechanism when it is energized so that the normal operations thereof can occur. As previously described, the solenoid 39 could, if required, be used to control any of the subsequently occurring operations of the stem machine.

In instances when either leading-in wire 8' or 9' is not present in the stem head, the vacuum tube relay 83 does not complete the circuit through wire 103 to the actuating coil of the magnetic relay 89 and the contact arm 105 remains out of engagement with the stationary contact 107. No current can pass through wire 109 to the control solenoid 39 under the above conditions and the armature of said control solenoid 39 remains in a position where it blocks operation of the actuating means of the exhaust tube feeding mechanism. On the other hand, when the leading-in wire 73 is not present in the stem head, the vacuum tube relay 86 does not complete the circuit through wire 104 to the actuating coil of the magnetic relay 90 and the contact arm 106 remains out of engagement with the stationary contact 108. Under these conditions, the current supply circuit through wires 110 and 111 to the magnetic relay 89 is not complete and the operation of said magnetic relay 89 has no energizing effect on the control solenoid 39 which remains in its blocking position.

The vacuum tube relays 83 and 86 are preferably those controlled by a triode valve wherein the valve is normally non-conducting and is rendered conducting by the establishment of the

continuity of a grid circuit. Such a relay, as well as others that could be used in place thereof, are again actuated if for some reason one of the electrical connections to the leading-in wires 8', 9' and 73 is momentarily broken, and could under certain circumstances cause actuation of the magnetic relays 89 and 90 and operation of the solenoid 39 during the operation cycle of the exhaust tube feeding mechanism. In the present instance this improperly timed operation cannot occur as a holding circuit is established by each of said magnetic relays 89 and 90. The holding circuit associated with the magnetic relay 89 comprises the contact arm 113 and cooperating contact 114 thereof and the wires 115, 116, 111 and 100, all of which provide for the continuous energization of the actuating coil of said relay 89 once the circuit thereto is established through the vacuum tube relay 83. The holding circuit associated with the magnetic relay 90 comprises the contact arm 117 and the cooperating contact 118 thereof and the wires 119, 120, 111 and 100.

The return of the electrical test apparatus to its initial starting position occurs when the switch 91 is actuated at the end of the operating period of the stem head at work station E and breaks the opposite current supply connection to the actuating coils of the magnetic relays 89 and 90. The apparatus is then in position to complete another cycle of operation like that described.

The leading-in wire detecting apparatus disclosed in Fig. 5 includes means which permit it to be readily adjusted, without permanent rearrangement, to function properly with the stem head when a stem having two leading-in wires corresponding to leading-in wires 8' and 9' is being manufactured. The above-referred to means consists of the switch 121 in the current supply leads 122 and 123 of the vacuum tube relay 86 and the switch 124 shunting the main control contact arm 106 and associated contact 108 of the magnetic relay 90. The switch 121 permits the current supply to be cut off from the vacuum tube relay 86 which is influenced by the leading-in wire 73 and contact 82, whereas switch 124 permits the magnetic relay 90 to be shunted so that magnetic relay 89 alone is responsible for operation of the control solenoid 39. The current supply leads 125 and 126 to the vacuum tube relay 83 and the corresponding leads 98 and 99 to the transformer 95 continue to function in the above arrangement of apparatus, thereby permitting that portion thereof associated with contact fingers 79 and 80 and leading-in wires 8' and 9' to function as previously described.

Although preferred embodiments of my invention have been disclosed, it will be understood that the invention is not to be limited to the specific construction and arrangement of parts shown nor to the particular system of connections shown, but that they may be widely modified within the spirit and scope of my invention as defined by the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination with stem-making apparatus having a movable head which is indexed to a plurality of stations and which comprises means for holding a stem tube and leading-in wire means extending longitudinally through said stem tube, apparatus for feeding an exhaust tube to said head, apparatus for determining the presence or absence of leading-in wire means in said head and for accordingly controlling the operation of

the exhaust tube feeding means comprising guide means extending along a portion of the path of movement of said head, contact means on said guide means adjacent its terminal end and engageable by said leading-in wire means, and means to electrically connect said leading-in wire means through said contact means in an electrical test circuit including means for controlling the operation of said exhaust tube feeding means in accordance with the presence or absence of leading-in wire means in said head.

2. In combination with stem-making apparatus having a movable head which is indexed to a plurality of stations and which comprises means for holding a stem tube and means for holding and making electrical connection to leading-in wire means extending longitudinally through said stem tube, apparatus for determining the presence or absence of leading-in wire means in said head comprising guide means extending along a portion of the path of movement of said head, contact means on said guide means adjacent its terminal end and engageable by said leading-in wire means, and means to electrically connect said leading-in wire means through said contact means and said head in an electrical test circuit including means for determining the continuity of said circuit.

3. In combination with stem-making apparatus having a movable head for holding a leading-in wire, apparatus for indicating the presence of the leading-in wire comprising a guide located in the path of movement of and electrically insulated from the head having a projecting contact portion adapted to momentarily catch and make an electrical connection to a portion of the leading-in wire therein, means engaging another portion of the leading-in wire, and means to electrically connect the leading-in wire through the last-mentioned means and the said contact portion in an electrical test circuit including means for determining the continuity of said circuit.

4. In combination with stem-making apparatus having a movable head for holding in spaced parallel relation a plurality of leading-in wires, apparatus for determining the presence of the leading-in wires comprising a guide located at a testing station along the path of movement of the head in a position to be engaged by portions of each of the leading-in wires, the guide having separated portions electrically insulated from each other for making an electrical connection to each of the leading-in wires during the dwell of said head at said testing station, means engaging and making an electrical connection to another portion of each of the leading-in wires at least during the dwell of said head at the testing station, and means to electrically connect said leading-in wires through the last-mentioned means and the separated portions of the guide in electrical test circuits including means for determining the continuity of the circuits therebetween by virtue of the presence of all the leading-in wires or the absence of at least one of them.

5. In combination with stem-making apparatus having a movable head for holding in spaced parallel relation a plurality of leading-in wires including a pair of outermost wires and a third wire located between said pair of wires, apparatus for determining the presence of the leading-in wires comprising a guide located along the path of movement of the head in a position to be engaged by portions of each of the leading-in wires, the guide having separated contact por-

tions electrically insulated from each other and flared outward from the path of movement so as to be wiped by and make an electrical connection to each of the outermost leading-in wires and having an intermediate contact portion electrically insulated from the other portions adapted to be engaged by a third leading-in wire located between the other leading-in wires for making an electrical connection thereto, means engaging and making an electrical connection to another portion of each of the leading-in wires, and means to electrically connect said leading-in wires through the last-mentioned means and the contact portions of the guide in electrical test circuits including means for determining the continuity of the circuits therebetween by virtue of the presence of all the leading-in wires or the absence of at least one of them.

6. In combination with stem-making apparatus having a movable head for holding in spaced relation a plurality of leading-in wires including a pair of outermost wires and a third wire located between said pair of wires, apparatus for determining the presence of the leading-in wires comprising a guide located along the path of movement of the head in a position to be engaged by portions of each of the leading-in wires, the guide having separated contact portions electrically insulated from each other and flared outward from the path of movement so as to be wiped by and make an electrical connection to each of the outermost leading-in wires and having an intermediate contact portion electrically insulated from the other portions adapted to be engaged by a third leading-in wire located between the other leading-in wires for making an electrical connection thereto, means engaging and making a common electrical connection to other portions of the leading-in wires, and an electrical test circuit having one branch including the outermost leading-in wires in series and having another branch including the third leading-in wire, said test circuit also including means for determining the continuity of the circuit by virtue of the presence of all three leading-in wires or the absence of at least one of said outermost wires or the third wire.

7. In combination with stem-making apparatus having a movable head which is indexed to a plurality of stations and which comprises means for holding a stem tube vertically and three leading-in wires extending vertically through said stem tube in spaced parallel relationship with one of said wires intermediate a pair of outermost wires, apparatus for determining the presence of the leading-in wires in said head comprising a guide extending along a portion of the path of movement of said head, said guide providing outer surfaces engaged by the upper ends of the outermost pair of said leading-in wires and terminating in contact members insulated from each other, said guide further providing a channel portion to receive the upper end of the intermediate leading-in wire and having adjacent its terminal end an intermediate contact member projecting downwardly into said channel to engage the said intermediate wire, and means to electrically connect said leading-in wires through said contact members in electrical test circuits including means for determining the continuity of the circuits.

8. In combination with stem-making apparatus having a movable head for holding a pair of leading-in wires, apparatus for indicating the presence of both or absence of at least one of the

leading-in wires in the head comprising a guide located along the path of movement of the head in a position to be located between portions of the leading-in wires and to be wiped thereby during said movement, a pair of spaced insulated conductive members constituting terminal portions of said guide and engageable by said wires, means engaging and electrically inter-connecting other portions of said leading-in wires, and means to electrically connect said leading-in wires through said conductive members in an electrical test circuit including means for determining the continuity of said circuit by virtue of the presence of both said leading-in wires or the absence of at least one of them.

9. In combination with stem-making apparatus having a movable head for holding a pair of leading-in wires, apparatus for indicating the presence or absence of the leading-in wires in the head comprising a guide located along the path of movement of the head in a position to be located between portions of the leading-in wires and to be wiped thereby during said movement, a pair of spaced insulated resilient contact fingers constituting terminal portions of said guide and engageable by said wires, means engaging and electrically inter-connecting other portions of said leading-in wires, and means to electrically connect said leading-in wires through said contact fingers in an electrical test circuit including means for determining the continuity of said circuit by virtue of the presence of both said leading-in wires or the absence of at least one of them.

10. In combination with stem-making apparatus having a movable head for holding a pair of leading-in wires, apparatus for indicating the presence or absence of the leading-in wires in the head comprising a guide located along the path of movement of the head in a position to be located between portions of the leading-in wires and to be wiped thereby during said movement, the guide having opposed portions of a section of its length insulated from the remainder for making electrical connections to said portions of the leading-in wires, a second guide located along said path in a position to be located between other portions of the leading-in wires during said movement and to be wiped by said portions and thereby make an electrical connection therebetween, and means engaging the insulated opposed portions of the first-mentioned guide for connecting said portions and both leading-in wires and the second guide in an electrical test circuit including means for determining the continuity of the test circuit and thereby the presence of both of the leading-in wires or the absence of either or both of said leading-in wires.

11. In combination with stem-making apparatus having a movable head for holding a pair of leading-in wires, apparatus for indicating the presence or absence of the leading-in wires in the head comprising a guide located along the path of movement of the head in a position to be located between portions of the leading-in wires and to be wiped thereby during said movement, the guide having opposed portions of a section of its length insulated from the remainder for making electrical connections to said portions of the leading-in wires, a second guide located along said path in a position to be located between second portions of the leading-in wires during said movement, resilient contact fingers mounted on the second guide and adapted to engage respective portions of the leading-in wires

to make an electrical connection therebetween, means engaging the insulated opposed portions of the first-mentioned guide for connecting said portions and both leading-in wires and the second guide in an electrical test circuit including means for determining the continuity of the test circuit and thereby the presence of both of the leading-in wires or the absence of either or both of said leading-in wires.

12. In combination with stem-making apparatus having a movable head for holding a pair of leading-in wires, apparatus for indicating the presence or absence of the leading-in wires in the head comprising a guide located along the path of movement of the head in a position to be located between portions of the leading-in wires and to be wiped thereby during said movement, the guide having opposed portions of a section of its length insulated from the remainder for making electrical connections to said portions of the leading-in wires, a second guide located along said path in a position to be located between other portions of the leading-in wires during said movement and to be wiped by said portions and thereby make an electrical connection therebetween, movable brushes located adjacent the insulated opposed portions of the first-mentioned guide and adapted to be brought into engagement therewith for connecting said insulated portions and portions of the leading-in wires and the second guide in a test circuit, means for moving the brushes to and from engagement with the insulated portions of the first-mentioned guide, said test circuit including means connected to the brushes for determining the continuity of the test circuit and thereby the presence of both leading-in wires or the absence of either or both of said leading-in wires.

13. In combination with stem-making apparatus having a movable head for holding a pair of leading-in wires and an exhaust tube, apparatus for controlling the feeding of an exhaust tube to the head dependent on the presence of both or absence of at least one of the leading-in wires in the head comprising a guide located along the path of movement of the head adapted to be wiped by portions of the leading-in wires in the course of said movement, a pair of spaced insulated conductive members constituting terminal portions of said guide and engageable by said wires, means engaging and electrically inter-connecting other portions of said leading-in wires, means for causing the feeding of an exhaust tube, and means to electrically connect said leading-in wires through said conductive members in an electrical test circuit including means for controlling the operation of said exhaust tube feeding means in accordance with the presence of both said leading-in wires or the absence of at least one of them.

14. In combination with stem-making apparatus having a movable head for holding a pair of leading-in wires and an exhaust tube, apparatus for controlling the feeding of an exhaust tube to the head dependent on the presence or absence of the leading-in wires in the head comprising a guide located along the path of movement of the head in a position to be located between portions of the leading-in wires and to be wiped thereby during said movement, the guide having opposed portions of a section of its length insulated from the remainder for making electrical connections to said portions of the leading-in wires, a second guide located along said path in position to be located between other portions

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of the leading-in wires during said movement, and to be wiped by said second portions and thereby make an electrical connection therebetween, means engaging the opposed insulated portions of the first-mentioned guide for connecting said portions and portions of the leading-in wires and the second guide in a test circuit, and means for causing the feeding of an exhaust tube, said test circuit including means for determining the continuity of the test circuit and thereby controlling the operation of the last-mentioned means to allow or prevent the feeding of an exhaust tube when both leading-in wires are present or at least one is absent.

15. In combination with stem-making apparatus having a movable head for holding in spaced approximately parallel relation a pair of leading-in wires and adapted to be carried to a plurality of stations, testing apparatus for determining the presence of the said wires or the absence of at least one of them, said testing apparatus being located at a testing station occupied by said head

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in its course of movement and comprising spaced contact means adapted to be engaged by portions of respective ones of said wires during the dwell of said head at said testing station, means contacting other portions of said wires to electrically connect them in series between said contact means at least during the dwell of said head at said testing station, and means electrically connecting said wires through said contact means in an electrical test circuit including means for determining the continuity of the circuit by virtue of the presence of both said wires or the absence of at least one of them.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,380,742	Flaws, Jr.	July 31, 1945