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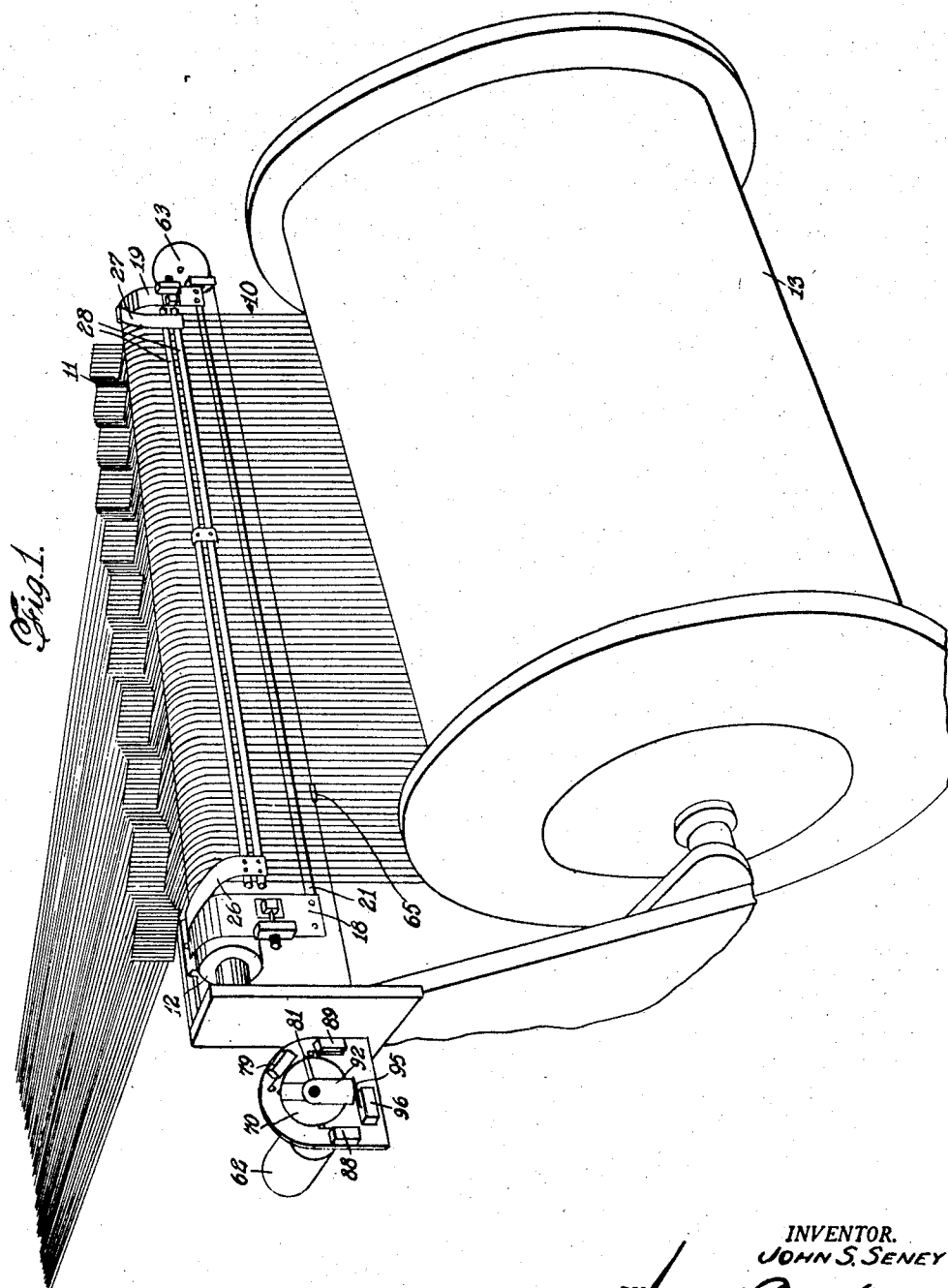
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AUTOMATIC STOP MECHANISM FOR WARPERS

Filed March 27, 1947

5 Sheets-Sheet 1



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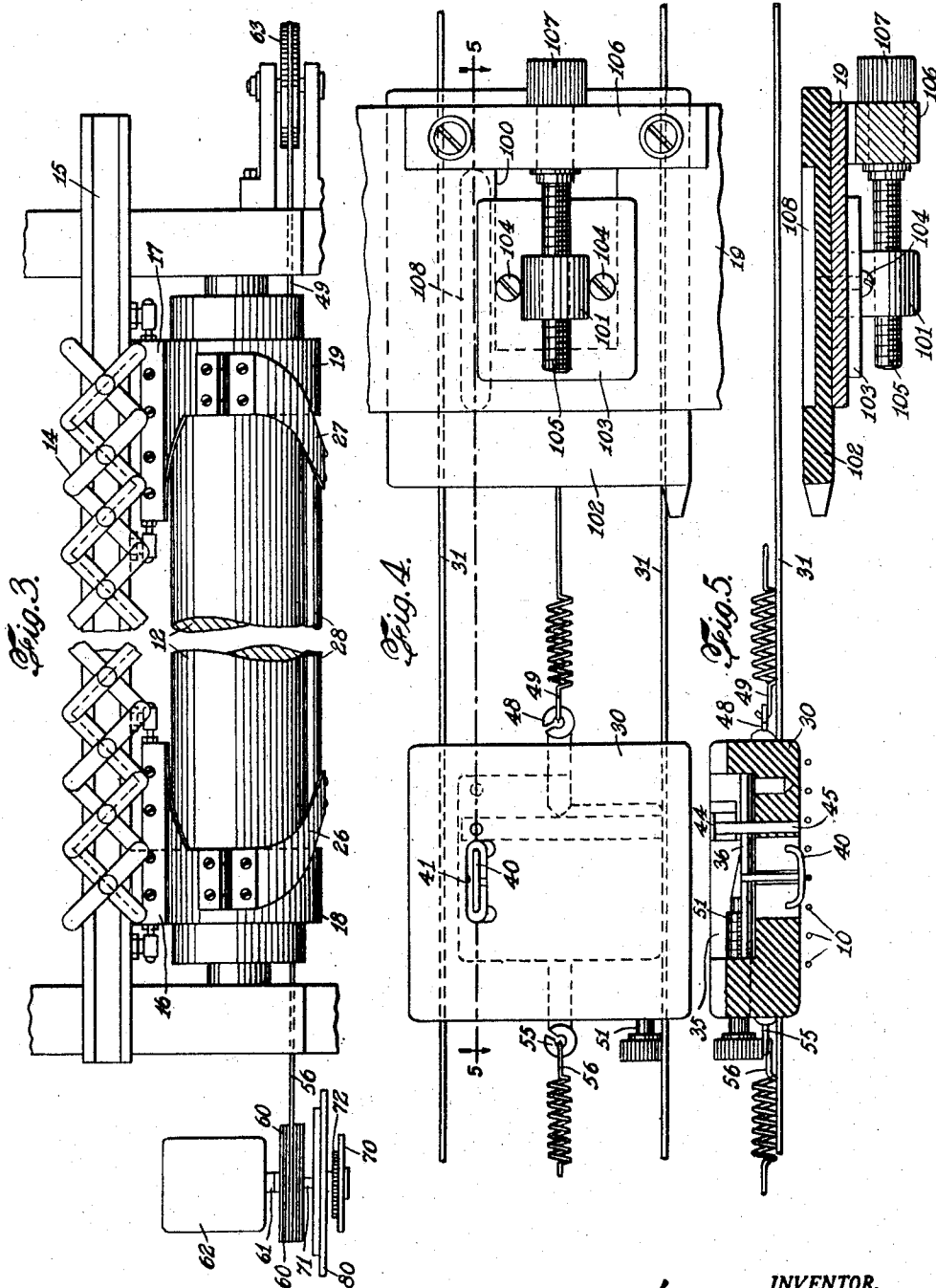
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5 Sheets-Sheet 3



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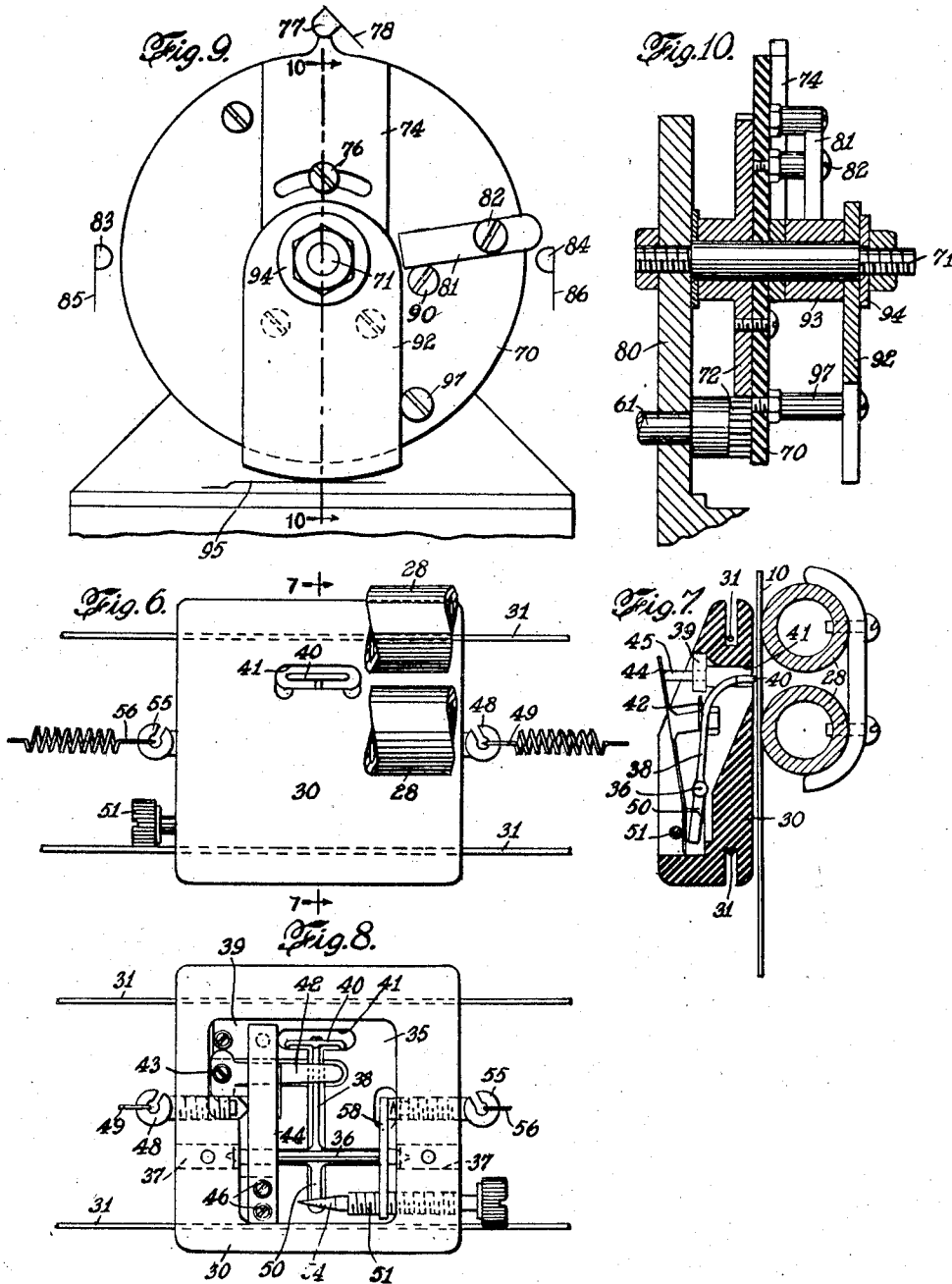
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AUTOMATIC STOP MECHANISM FOR WARPERS

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5 Sheets-Sheet 4



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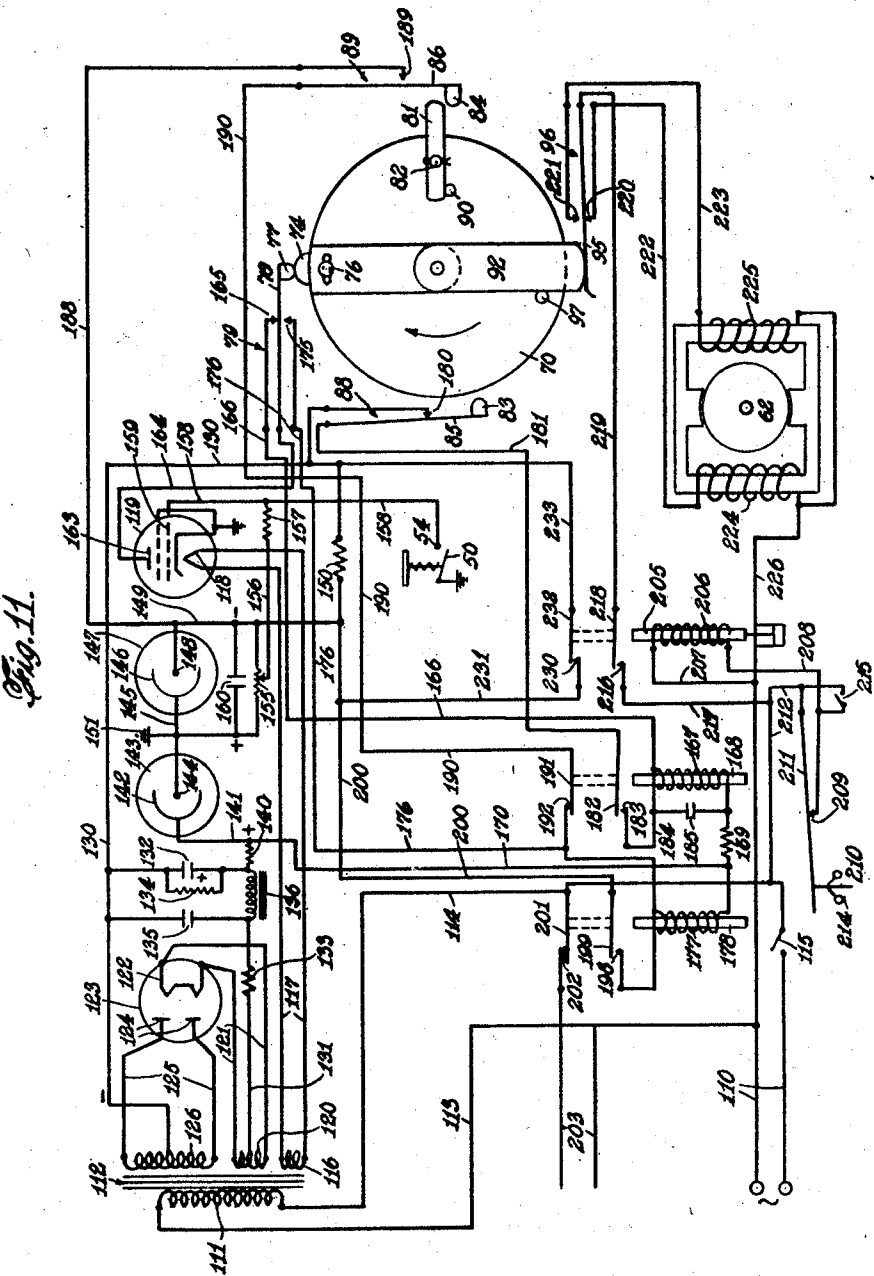
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AUTOMATIC STOP MECHANISM FOR WARPERS

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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

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AUTOMATIC STOP MECHANISM FOR
WARPERS

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Application March 27, 1947, Serial No. 737,585

10 Claims. (Cl. 28—51)

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This invention relates to warpers or the like, and more particularly to an automatic stop mechanism for stopping the warper when a thread in the warp sheet is broken or missing.

An object of the invention is to provide a device of the above type having novel and improved details of construction and features of operation.

Another object of the invention is to provide a stop mechanism of the above type having automatic check means for stopping the machine when the stop mechanism is not in proper operating condition.

Another object of the invention is to provide a stop mechanism of the above type including a traveling faller which traverses the thread sheet at regular intervals and is adapted to stop the warper when the space left by a missing thread is encountered.

Another object of the invention is to provide a traveling faller switch of the above type with check means for checking the operating condition of the stop circuit at intervals and for automatically stopping the machine if the stop circuit is not in proper operating condition.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

The invention is particularly applicable to a slasher, although it may be applied to any type of machine including a moving thread sheet consisting of a plurality of spaced, parallel, longitudinal threads. Such a machine is referred to herein as a "warper." In one embodiment, the stop mechanism comprises a faller switch including an arm having a head which is sufficiently wide to span two threads of the thread sheet but will pass through the space left by a missing thread. The faller switch is fed transversely across the thread sheet and is held open by contact with the various threads. However, the head is capable of passing through the space left by a missing thread to close the switch. Suitable control mechanism is provided for stopping the machine when this occurs.

In order to permit the faller switch to pass slightly beyond the end threads of the thread sheet without tripping a pair of end plates are provided adjacent the end threads which engage the faller switch head to hold the switch in open position when in contact therewith. In order to check the operating condition of the stop circuit, one of these plates is provided with a recess into which the head passes to close the switch when in registration therewith. This would normally

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stop the machine. However, a check circuit is provided including a cam-actuated check switch driven in synchronism with the travel of the faller switch and arranged so that at the instant the faller switch is in registration with the recess in the end plate, the stop circuit is broken and a check circuit is closed by the cam-actuated check switch. The check circuit is connected to stop the machine if the stop circuit is not operating properly. Hence, the operator may be assured at all times when the machine is running that the thread sheet is complete and that the stop circuit is in proper operating condition to stop the machine in the event of failure of any of the threads of the thread sheet.

Although the novel features which are characteristic of this invention are pointed out more particularly in the claims, the nature of the invention will be better understood by referring to the following description taken in connection with the accompanying drawings in which a specific embodiment thereof has been set forth for purposes of illustration.

In the drawings,

Figure 1 is a perspective view of a portion of a warper with a stop mechanism embodying the present invention applied thereto;

Figure 2 is a broken front elevation of a portion of a warper showing the thread sheet and the faller switch;

Figure 3 is a detail view of the thread comb and end plate support;

Figure 4 is an enlarged front elevation of the faller switch and end plate;

Figure 5 is a section taken on the line 5—5 of Figure 4;

Figure 6 is a front elevation of the faller switch;

Figure 7 is a vertical section taken on the line 7—7 of Figure 6;

Figure 8 is a rear elevation of the faller switch;

Figure 9 is a front elevation of the check cam;

Figure 10 is a transverse section taken on the line 10—10 of Figure 9; and

Figure 11 is a schematic circuit diagram of the stop and check circuits.

Referring to the drawings more in detail, the invention as shown is applied to a warper carrying a plurality of threads 10 forming a thread sheet which, as shown in Figure 1, are spaced by an adjustable comb 11, pass over a roller 12, and are individually rolled onto a beam 13. The various details of such a warper and driving means for the thread sheet are well known in the art and only so much thereof is disclosed herein

as is necessary to an understanding of the present invention.

The comb 11 is adjustably mounted for expansion or contraction in accordance with the number of ends comprising the thread sheet. For this purpose, the comb may be mounted on an expanding bracket 14 (Figure 3) which is adjustably supported on an oscillating arm 15 carrying brackets 16 and 17 which support end plates 18 and 19. The plates 18 and 19 may be adjusted along the arm 15 and are positioned beyond the end threads of the thread sheet. The plates 18 and 19 are provided with adjustable pads 20 (Figure 2) bearing against a bar 21 which is mounted on the frame of the warper to insure proper clearance for the faller switch. Brackets 26 and 27 (Figures 1, 2 and 3) are hinged to the end plates 18 and 19 and carry a pair of spaced pressure bars 28 which are adapted to rest against the front of the thread sheet for the purpose to be described. It is to be understood that the comb 11 and end plates 18 and 19 are oscillated in the usual manner by the arm 15 for causing the thread to be wound evenly on the beam 13.

In accordance with the present invention, the faller switch is mounted on a plate 30 (Figures 2 and 4-8 inclusive) which is supported and guided for travel in back of the thread sheet 10 by means of a pair of guide wires 31 which are held under tension in brackets 32 (Figure 2). Springs 33 engage the plate 30 at the ends of its travel to act as shock absorbers and to assist in reversing the movement of the plate.

Referring to Figures 4-8 inclusive, the plate 30, which is made of insulating material, is provided with an internal recess 35 in which a shaft 36 is pivoted by means of bushings 37. The shaft 36 carries an arm 38 which carries at its end a head 40 which projects through a slot 41 in the plate 30 to engage the threads 10 of the thread sheet. A contact spring 42, which is attached to the plate 30 by means of a screw 43, makes electrical contact with its arm 38. A leaf spring 44, attached to the plate 30 by screws 46, bears against the contact spring 42 to urge the arm 38 and head 40 outwardly against the threads 10. A hook 48, to which a feed wire 49 is connected, is threaded into the plate 30 and makes electrical contact with the spring 42. A screw 45, carried in the plate 30 which is mounted on plate 30 as shown in Figure 8 and also in Figure 7, bears against the spring 44 to control the tension on the faller head 40.

The shaft 36 carries a contact arm 50 which may be provided with a cap of suitable contact material, such as platinum. A contact screw 51 is mounted in the plate 30 and is provided with a contact point 54 of suitable contact material, such as platinum. A hook 55 for a feed wire 56 is mounted in the plate 30 and is electrically connected to the contact screw 51 by means of a contact strip 58.

The arrangement is such that when the head 40 falls through the slot 41, the contact arm 50 engages the contact 54 to complete an electric circuit from the wire 56, hook 55, contact strip 58, contact 54, arms 50 and 38, spring 42 and hook 48, to the wire 49. The movement of the arm 38 required to close the contact may be adjusted by means of the contact screw 51, the contact end of which is tapered for this purpose.

The guide wires 31 are positioned in back of the thread sheet so that the head 40 of the faller switch contacts the various threads 10 and is held inwardly thereby as the switch traverses the

thread sheet. The head 40 engages the threads 10 between the pressure bars 28 which impart the necessary rigidity to the thread sheet for the above purpose.

The wire 56 is wound on a drum 60 (Figures 1 and 2) which is positioned at one side of the thread sheet and is mounted on a shaft 61 driven by a motor 62 which is of the reversible type. The wire 48 passes over an insulated idler pulley 63 located at the other side of the thread sheet, and the free end thereof is likewise wound onto the drum 60. The drum 60 is provided with a helical groove to receive the wires 48 and 56, the ends of which are attached to the drum 60 to prevent slippage. The wire 56 is broken by an insulator 65 which electrically isolates the idler pulley 63. Electrical connections from the stop circuit to be controlled by the faller switch may be made to the idler pulley 63 and the drum 60.

A cam switch comprising a disc 70 (Figures 1, 2, 9, 10, 11) is mounted on a shaft 71 which is driven by gears 72 from the motor shaft 61. The gears 72 have a gear ratio such that the cam disc 70 rotates through about 350° while the faller switch makes a complete traverse of the thread sheet.

The disc 70 carries an adjustable cam actuator 74 which is adjustably attached to the disc 70 by means of an adjusting screw 76. The cam actuator 74 is adapted to engage a cam follower 77 attached to an actuating arm 78 of a double-throw switch 79 carried on a supporting plate 80. The cam actuator 74 also actuates the cam follower 83 attached to the actuating arm 85 of the switch 88.

The disc 70 also carries a cam actuator 81 pivoted by a pin 82 to the disc 70 and which is adapted to engage the cam follower 84 carried by actuating arm 88 of switch 89, also mounted on the plate 80. The actuator 81 is provided with a stop pin 90 which causes the actuator 81 to actuate the cam follower 84 when the disc 70 rotates in a clockwise direction but permits the arm 81 to pivot about the pin 82 without actuating the cam follower when the disc 70 rotates in a counterclockwise direction. The switch 89 is thus actuated only when the disc 70 rotates in a clockwise direction which corresponds to the return movement of the faller switch.

A plate 92 is journaled about the shaft 71 and is adapted to bear against an actuating arm 95 of a single pole double-throw switch 96 mounted on the plate 80. The plate 92 is held against rotation by the spring tension of the spring arm 95. A pin 97 carried by the disc 70 is adapted to engage the plate 92 as the disc 70 nears the end of its arc of rotation and alternately shifts the plate 92 onto the spring arm 95, or out of engagement therewith according to the direction of rotation of the disc 70.

The end plate 19 is provided with a slot 100 (Figures 4 and 5) through which a yoke 101 attached to a check plate 102 passes. A plate 103 is secured to the plate 102 by screws 104 which extend through the slot 100 and holds the check plate 102 for sliding adjustment on the end plate 19. The position of the check plate 102 is adjusted by means of a screw 105 extending through a bracket 106 carried by the end plate 19 and provided with a knurled adjusting knob 107. The check plate 102 is provided with an elongated recess 108 which is adapted to receive the head 40 of the faller switch and allow the faller switch to close when the head 40 registers therewith. The lateral adjustment provided by the screw 105

permits the groove 108 to be set to receive the head 40 of the faller switch when the faller switch reaches the end of its path of travel across the thread sheet.

The end plate 18 is shown as carrying a similar contact plate which engages the head 40 of the faller switch at the lefthand end of the thread sheet. The contact plate is secured to the end plate 18 in the same manner as the plate 102 above described, and is adjustable to conform for small variations in yarn sheet width, but does not contain a recess to permit the faller switch to be actuated.

Referring to the schematic circuit diagram of Figure 11, alternating current is supplied from an alternating current supply line 110 to the primary 111 of a transformer 112 through leads 113 and 114 and manual switch 115. The transformer 112 is provided with a secondary 116 which is connected by leads 117 to supply power to a heater 118 of a Thyatron tube 119. A secondary 120 of the transformer 112 is connected by leads 121 to supply power to the cathode 122 of a rectifier tube 123 having anodes 124 which are connected by leads 125 to a third secondary 126 of the transformer 112. The secondary 126 is center-tapped and is connected to a negative lead 130. The secondary 120 is center-tapped and is connected through a lead 131, resistor 133, choke 136, resistor 140 and lead 141 to the anode 142 of a voltage regulator tube 143. A filter network comprising a resistor 134 and condensers 132 and 135 is connected between the leads 130 and 131 to smooth out the voltage fluctuations.

The cathode 144 of the voltage regulator tube 143 is connected by a lead 145 to the anode 146 of a second voltage regulator tube 147. The cathode 148 of the tube 147 is connected by a lead 149 to a resistor 150 which is connected to the negative lead 130. The lead 145 is grounded at 151.

A potentiometer 155 is provided with an adjustable tap connected by a lead 156, resistor 157, and lead 158 to the control grid 159 of the Thyatron tube 119. The lead 158 is also connected to the contact 54 of the faller switch. A condenser 160 is shunted across the potentiometer 155 for smoothing out the voltage fluctuation. The potentiometer 155 is designed to supply negative biasing voltage to the grid 159 of the Thyatron tube 119 which prevents the tube 119 from operating until the potentiometer 155 is shorted by the closing of the faller switch contacts 50 and 54. When these contacts close, the negative bias is removed from the control grid 159 of the Thyatron tube 119 and the tube becomes conducting.

The tube 119 is provided with an anode 163 which is connected by a lead 164 to the arm 78 of the double-throw microswitch 79. One contact 165 of the switch 79 is connected by a lead 166 to the coil 167 of a check relay 168, the return side of which is connected through a resistor 169, return lead 170, and resistor 140, to the positive side of the condenser 132.

The second contact 175 of the switch 79 is connected by a lead 176 to the coil 177 of a stop relay 178, the return side of which is connected to the return lead 170.

The negative lead 130 is connected to a normally closed contact 180 of the switch 88, the arm 85 of which is connected by a lead 181 to a normally open contact arm 182 of the relay 168. The arm 182 is adapted to engage a contact 183 which is connected by a lead 184 to the coil 167 of the relay 168. A condenser 185 is shown as connected

across the coil 167 for improving the operation of the relay.

The cathode 148 of the voltage regulator tube 147 is also connected by a lead 188 to the normally open contact 189 of the switch 89, the arm 86 of which is connected by a lead 190 to a contact arm 191 of the relay 168, which is normally closed on a contact 192. The contact 192 is connected to the lead 176 to the coil 177 of the stop relay 178. The stop relay 178 is provided with a holding contact 198, the arm 199 of which is connected by a lead 200 to the lead 149, to the cathode 148, and through the resistor 150 to the negative lead 130. A second contact arm 201 of the stop relay 178 is connected to the lead 114. The contact 202 and the lead 113 are connected to leads 203 which supply power to the warper drive or are connected to a drive control relay.

A control relay 205 is provided with a coil 206, one side of which is connected by a lead 207 to one side of the power supply line 110, and the other side of which is connected by a lead 208 to contact 209 of a centrifugally operated switch 210, the arm 211 of which is connected by a lead 212 to the lead 114, thence through the switch 115 to the power supply line 110. The switch 210 is provided with a centrifugal operating mechanism, indicated at 214, which is connected to be actuated by the warper and is adapted to close the contact 209 when the warper is operating at full speed. A manual switch 215 is connected across the switch 210 to permit manual operation of the control relay 205.

The relay 205 is provided with a normally open contact 216 connected by a lead 217 to one side of the power supply line 110 and cooperating with a contact arm 218 which is connected by a lead 219 to the arm 95 of the double-throw switch 96. The arm 95 cooperates with contacts 220 and 221 which are connected respectively by leads 222 and 223 to control windings 224 and 225 of the motor 62. The windings 224 and 225 are connected by a return lead 226 to the current supply line 110 and are so connected that the motor 62 is reversibly operated by the selective energization of the coils 224 and 225.

The relay 205 is also provided with a normally open contact 230 which is connected by a lead 231 and lead 200 to the cathode lead 149. The contact 230 cooperates with a contact arm 232 which is connected by a lead 233 to the negative lead 130.

Operation

In the operation of this circuit, the manual switch 115 is first closed to energize the contact circuit. The warper is supplied with power through the lines 203 and the normally closed contact 202 of the stop relay 178. When the warper reaches top speed, the centrifugally operated switch 210 closes, thereby energizing the control relay 205 to close the contacts 216 and 230. The relay 205 may also be energized for test purposes by the manual switch 215 when the warper is not running. The contact 216 completes the circuit through the reversing switch 96 to the control winding 224 or 225 of the motor 62 and thereby causes the motor to operate and to drive the drum 60 for feeding the faller switch across the thread sheet in one direction or the other depending upon the position of the reversing switch 96. The motor also drives the disc 70 in a direction corresponding to the direction of feed of the faller switch. In Figure 11, the disc 70 and reversing switch 96 are positioned to start the return stroke of the faller, during

which the disc 70 will rotate in a clockwise direction. The closing of the contact 230 completes the circuit from the negative lead 130 to the cathode of the voltage regulator tube 147, thence to the voltage regulator tube 143, and through the resistor 140 to the positive side of the condenser 132. The voltage across the voltage regulator tube 147 is connected to the potentiometer 155 which furnishes an adjustable negative bias for the control grid of the Thyatron tube 119. The condenser 160 across the voltage regulator tube 147 helps to stabilize the voltage across this tube. The cathode of the Thyatron tube 119 is connected to ground. The cathode of the voltage regulator tube 143 is also grounded. The potentiometer 155 is adjusted to supply a negative bias to the control grid 159 of the tube 119 suited to block the tube. Upon the closing of the faller switch 50, the negative voltage supplied to the grid of the Thyatron tube is shorted to the grounded cathode, thus dropping the negative potential furnished by the potentiometer 155 to the same potential as the cathode. This allows the gas in the Thyatron tube to ionize and permits the flow of current from the cathode to the anode of that tube, and thence to the common contact arm 78 of the switch 79.

If the faller switch has been closed with the switch in check position at the end of its travel across the thread sheet when the head 40 of the switch is in registration with the recess 108 in the check plate 102, the disc 70 will also be in check position with the cam follower 77 of the switch 79 engaged by the cam actuator 74 on the disc 70 to close the contact 165, as shown in Figure 11. This completes the circuit from the anode lead 164, switch contact 165, line 166 to the coil 167 of the check relay 168, thereby actuating that relay and closing its contact 183 to establish a holding circuit through the line 181, and the normally closed contact 180 of the switch 88 to the negative lead 130. The holding circuit maintains the check relay 168 energized until the contact 180 is momentarily opened by the actuator 74 during the return stroke of the faller switch. Actuation of the relay 168 opens the contact 192 and breaks the energizing circuit to the coil 177 of the stop relay 178 from the line 190, normally open contact 189 of switch 89, and lead 188 to the cathode of the voltage regulator tube 147, thereby preventing the relay 178 from being actuated when the contact 189 is momentarily closed by the actuator 81 at the beginning of the return movement of the disc 70. If, however, the Thyatron control circuit had failed to actuate the relay 168, the contact 192 would have remained closed and, upon the closure of the contact 189 at the beginning of the return movement of the disc 70, the stop relay 178 would have been energized through the circuit, including contacts 189 and 192. Energization of the stop relay 178 opens the contact 202 and thereby interrupts the circuit from the supply main 110 to the warper control line 203 and stops the warper.

If the check circuit is in proper operating condition, the warper remains running and the check relay 168 remains closed until the contact 180 is opened by the actuator 74 before the faller switch and disc 70 have reached the limit of their return stroke. The disc 70 continues to rotate during the return stroke in a direction indicated as clockwise in Figure 11, until the pin 97 engages the right-hand side of the arm 92 and pushes the arm 92 off of the spring 95, there-

by changing the position of the reversing switch 96 and reversing the drive of the motor 62. The faller switch is now driven in its working stroke past the various threads of the thread sheet. During this stroke, the cam 74 is out of engagement with the cam follower 77 and the contact 175 of the switch 79 is closed. This contact sets up the circuit from the anode of the Thyatron tube 119 through the line 176 to the coil 177 of the relay 178, so that the stop relay 178 is actuated in the event that the faller switch contact 50 closes upon reaching the space left by a missing thread and removes the negative bias from the Thyatron tube 119. When the stop relay 178 is thus closed, a holding circuit is set up through its contact 198 and line 200 from the negative lead 130, which maintains the relay 178 energized until the warper has been brought to rest by opening of the relay contact 202. When the warper is brought to rest, the centrifugally operated switch 210 opens, thereby releasing the relay 205 to stop the motor 62 and open the circuit from the negative lead 130 to the voltage regulator tubes. The relay 178, however, remains energized through the resistor 150 and holds the warper control contact 202 open until the power supply to the transformer 112 is broken by opening the manual switch 115. A suitable signal light may be provided, if desired, to indicate that the warper has stopped operating.

During the checking stroke of the faller switch, the disc 70 rotates in a counterclockwise direction, as shown in Figure 11, until at the end of its stroke the pin 97 engages the arm 92 and again pushes the same onto the spring 95 to actuate the reversing switch 96. At this instant, the cam 74 engages the follower 77 to close the check circuit contact 165. During the counterclockwise rotation of the disc 70, the actuator 81 pivots about its pin 82 on the disc 70 without actuating the switch 89.

A pilot light may also be provided to indicate when the automatic stop mechanism has been manually disconnected from the warper stop circuit so as to warn the operator that manual control of the warper is necessary. It will be noted that the faller switch checks each thread of the thread sheet during its check stroke and, on its return stroke, automatically checks the operating condition of the Thyatron tube and control circuits. In the event of a missing thread or of failure of the check circuit, the warper is immediately stopped.

Although a specific embodiment of the invention has been shown for purposes of illustration, it is to be understood that the invention is capable of various uses and that changes and modifications may be made therein as will be readily apparent to a person skilled in the art. The invention is only to be limited in accordance with the scope of the following claims.

I claim:

1. An automatic control for a warper or the like having a moving thread sheet and driving means therefor, comprising a switch having an actuating head adapted to span two threads of said thread sheet but to pass through the space left by a missing or loose thread, a switch carriage carrying said switch, means mounting said carriage to traverse said thread sheet with the switch normally held open by contact of said head with the threads of said sheet, means causing said head to enter the space left by a missing or loose thread to close said switch, a stop circuit connected to be actuated by the closing of said switch

and adapted to stop the thread sheet driving means, means continuously feeding said carriage across said thread sheet in checking and return strokes, and means actuated during the return strokes to test the operative condition of said stop circuit.

2. An automatic control for a warper or the like having a moving thread sheet and driving means therefor, comprising a switch having an actuating head adapted to span two threads of said thread sheet but to pass through the space left by a missing or loose thread, a switch carriage carrying said switch, means mounting said carriage to traverse said thread sheet with the switch normally held open by contact of said head with the threads of said sheet, means causing said head to enter the space left by a missing or loose thread to close said switch, a stop circuit connected to be actuated by the closing of said switch and adapted to stop the thread sheet driving means, means continuously feeding said carriage across said thread sheet in checking and return strokes, an end plate mounted beyond the last thread of said thread sheet to engage said head and having a recess to receive said head for closing said switch at the end of said checking stroke, a cam-actuated switch synchronized with the carriage feed connected to break said stop circuit and set up a test circuit before the head enters said recess, a second cam-actuated switch actuated during the return stroke of said carriage and connected to complete said stop circuit, and means responsive to said test circuit to render said stop circuit inoperative.

3. An automatic control for a warper or the like having a moving thread sheet and driving means therefor, comprising a switch having an actuating head adapted to span two threads of said thread sheet but to pass through the space left by a missing or loose thread, a switch carriage carrying said switch, means mounting said carriage to traverse said thread sheet with the switch normally held open by contact of said head with the threads of said sheet, means causing said head to enter the space left by a missing or loose thread to close said switch, a stop circuit connected to be actuated by the closing of said switch and adapted to stop the thread sheet driving means, means continuously feeding said carriage across said thread sheet in checking and return strokes, an end plate mounted beyond the last thread of said thread sheet to engage said head and having a recess to receive said head for closing said switch at the end of said checking stroke, a cam-actuated switch synchronized with the carriage feed connected to break said stop circuit and set up a test circuit before the head enters said recess, a second cam-actuated switch actuated during the return stroke of said carriage and connected to complete said stop circuit, means responsive to said test circuit to render said stop circuit inoperative, and a third cam-actuated switch actuated during said return stroke to clear said test circuit before the next checking stroke.

4. An automatic control for a warper or the like having a moving thread sheet and driving means therefor, comprising a switch having an actuating head adapted to span two threads of said thread sheet but to pass through the space left by a missing or loose thread, a switch carriage carrying said switch, means mounting said carriage to traverse said thread sheet with the switch normally held open by contact of said head with the threads of said sheet, means causing said head to enter the space left by a missing or loose

thread to close said switch, a stop circuit including an electron discharge tube connected to be controlled by said switch, a stop relay connected to be energized by said tube and adapted to stop said thread sheet driving means, means continuously feeding said carriage across said thread sheet in checking and return strokes, means closing said switch at the end of each checking stroke, a cam-actuated switch synchronized with the feed of said carriage and connected to disconnect said tube from said stop relay and connect said tube to a check relay before the closing of said switch by said last means, a test circuit connected to actuate said stop relay, a second cam-actuated switch connected to set up said test circuit during said return stroke, and means actuated by said check relay to break said test circuit.

5. An automatic control for a warper or the like having a moving thread sheet and driving means therefor, comprising a switch having an actuating head adapted to span two threads of said thread sheet but to pass through the space left by a missing or loose thread, a switch carriage carrying said switch, means mounting said carriage to traverse said thread sheet with the switch normally held open by contact of said head with the threads of said sheet, means causing said head to enter the space left by a missing or loose thread to close said switch, a stop circuit including an electron discharge tube connected to be controlled by said switch, a stop relay connected to be energized by said tube and adapted to stop said thread sheet driving means, means continuously feeding said carriage across said thread sheet in checking and return strokes, means closing said switch at the end of each checking stroke, a cam-actuated switch synchronized with the feed of said carriage and connected to disconnect said tube from said stop relay and connect said tube to a check relay before the closing of said switch by said last means, a test circuit connected to actuate said stop relay, a second cam-actuated switch connected to set up said test circuit during said return stroke, means actuated by said check relay to break said test circuit, and a third cam actuated switch connected to deenergize said check relay before the next checking stroke.

6. An automatic control for a warper or the like having a moving thread sheet and driving means therefor, comprising a switch having an actuating head adapted to span two threads of said thread sheet but to pass through the space left by a missing or loose thread, a switch carriage carrying said switch, means mounting said carriage to traverse said thread sheet with the switch normally held open by contact of said head with the threads of said sheet, means causing said head to enter the space left by a missing or loose thread to close said switch, a stop circuit connected to be actuated by the closing of said switch and adapted to stop the thread sheet driving means, an endless cable connected to drive said carriage, a drum carrying said cable, a reversible motor connected to drive said drum for causing said carriage to traverse said thread sheet, a reversing switch for said motor, and means actuated at the ends of each traverse of said carriage to actuate said reversing switch.

7. An automatic control for a warper or the like having a moving thread sheet and driving means therefor, comprising a switch having an actuating head adapted to span two threads of said thread sheet but to pass through the space left by a missing or loose thread, a switch carriage carrying said switch, means mounting said

carriage to traverse said thread sheet with the switch normally held open by contact of said head with the threads of said sheet, means causing said head to enter the space left by a missing or loose thread to close said switch, a stop circuit connected to be actuated by the closing of said switch and adapted to stop the thread sheet driving means, an endless cable connected to drive said carriage, a drum carrying said cable, a reversible motor connected to drive said drum for causing said carriage to traverse said thread sheet, a reversing switch for said motor, and cam-actuated means driven in synchronism with the feed of said carriage to actuate said reversing switch at the ends of each traverse of said carriage.

8. An automatic control for a warper or the like having a moving thread sheet and driving means therefor, comprising a switch having an actuating head adapted to span two threads of said thread sheet but to pass through the space left by a missing or loose thread, a switch carriage carrying said switch, means mounting said carriage to traverse said thread sheet with the switch normally held open by contact of said head with the threads of said sheet, means causing said head to enter the space left by a missing or loose thread to close said switch, a stop circuit including an electron discharge tube connected to be controlled by said switch, a stop relay connected to be energized by said tube and adapted to stop the thread sheet driving means, means continuously feeding said carriage across said thread sheet in checking and return strokes, means closing said switch at the end of each checking stroke, a cam-actuated switch synchronized with the feed of said carriage and connected to disconnect said tube from said stop relay and connect said tube to a check relay before the closing of said switch by said last means, a test circuit connected to actuate said stop relay, a second cam-actuated switch connected to set up said test circuit during said return stroke, means actuated by said check relay to break said test circuit, a third cam-actuated switch connected to deenergize said check relay before the next checking stroke, and switch means responsive to the stopping of said warper to stop said feed means and deenergize said tube.

9. An automatic control for a warper or the like having a moving thread sheet and driving means

therefor, comprising a member having an actuating head adapted to span two threads of said thread sheet but to pass through the space left by a missing or loose thread, a carriage carrying said member, means mounting said carriage to traverse said thread sheet with the member normally held retracted by contact of said head with the threads of said sheet, means causing said head to advance into the space left by a missing or loose thread, stop means connected to be actuated by the advance of said member and adapted to stop the thread sheet driving means, means continuously feeding said carriage across said thread sheet in checking and return strokes, an end plate mounted beyond the last thread of said thread sheet to engage said head and having a recess to receive said head for checking the mechanism at the end of said checking stroke, and means adjusting the position of said end plate to conform to the width of the thread sheet.

10. An automatic control for a warper or the like having a moving thread sheet and driving means therefor, comprising a contact member having an actuating head adapted to span two threads of said thread sheet but to pass through the space left by a missing or loose thread, a carriage carrying said member, means mounting said carriage to traverse said thread sheet with the member normally held retracted by contact of said head with the threads of said sheet, means causing said head to advance into the space left by a missing or loose thread, stop means actuated by the advance of said member and adapted to stop the thread sheet driving means, means continuously feeding said carriage across said thread sheet in checking and return strokes, and means actuated during the return strokes to test the operative condition of said stop means.

JOHN S. SENEY.

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Certificate of Correction

Patent No. 2,450,996.

October 12, 1948.

JOHN S. SENEY

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 8, line 30, for "wrapper" read *warper*; column 12, line 21, for "automatic" read *automatic*;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of January, A. D. 1949.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

Certificate of Correction

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[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.