April 21, 1964 L. C. NICKELL ETAL 3,129,484

SEAM JUMPER CONTROL FOR CLOTH SHEARS

Filed May 15, 1962 4 Sheets-Sheet 1

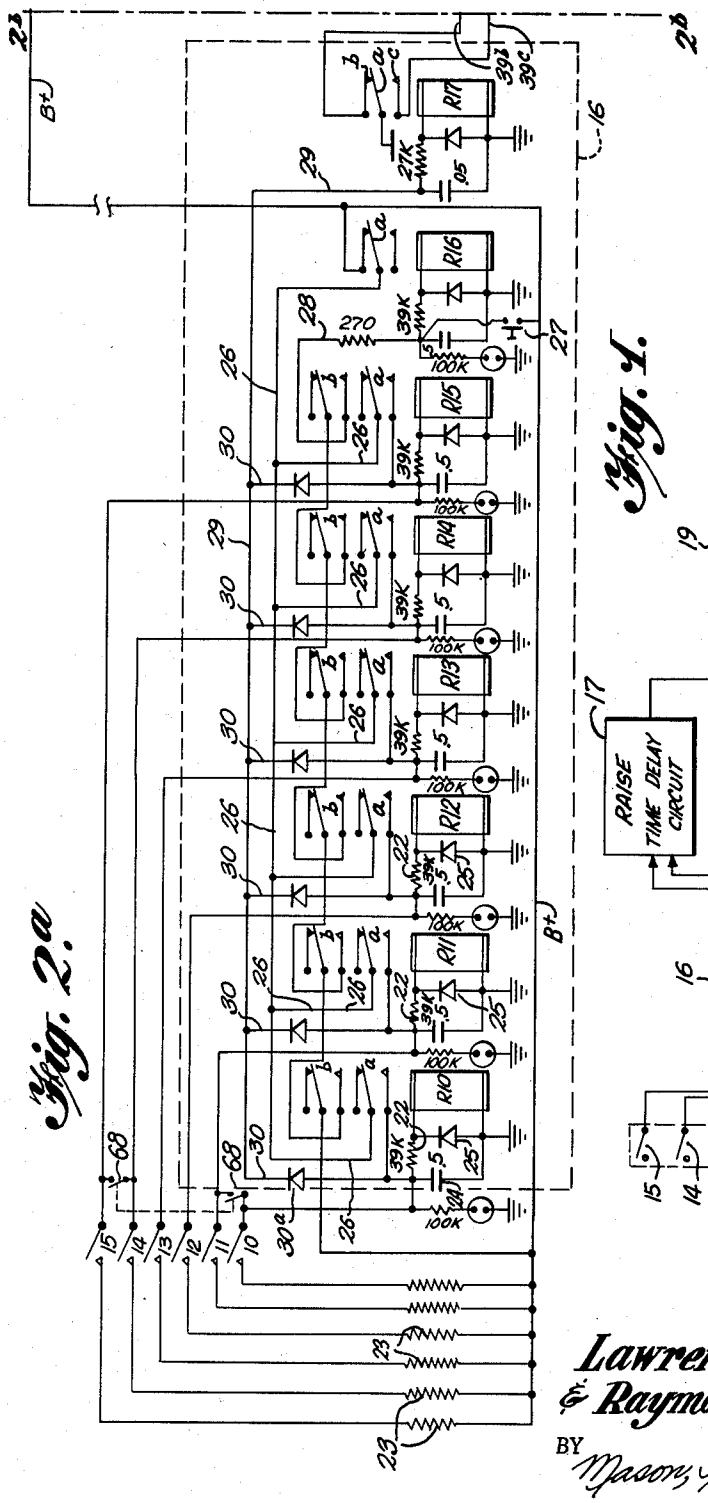


Fig. 1.

Fig. 2a.

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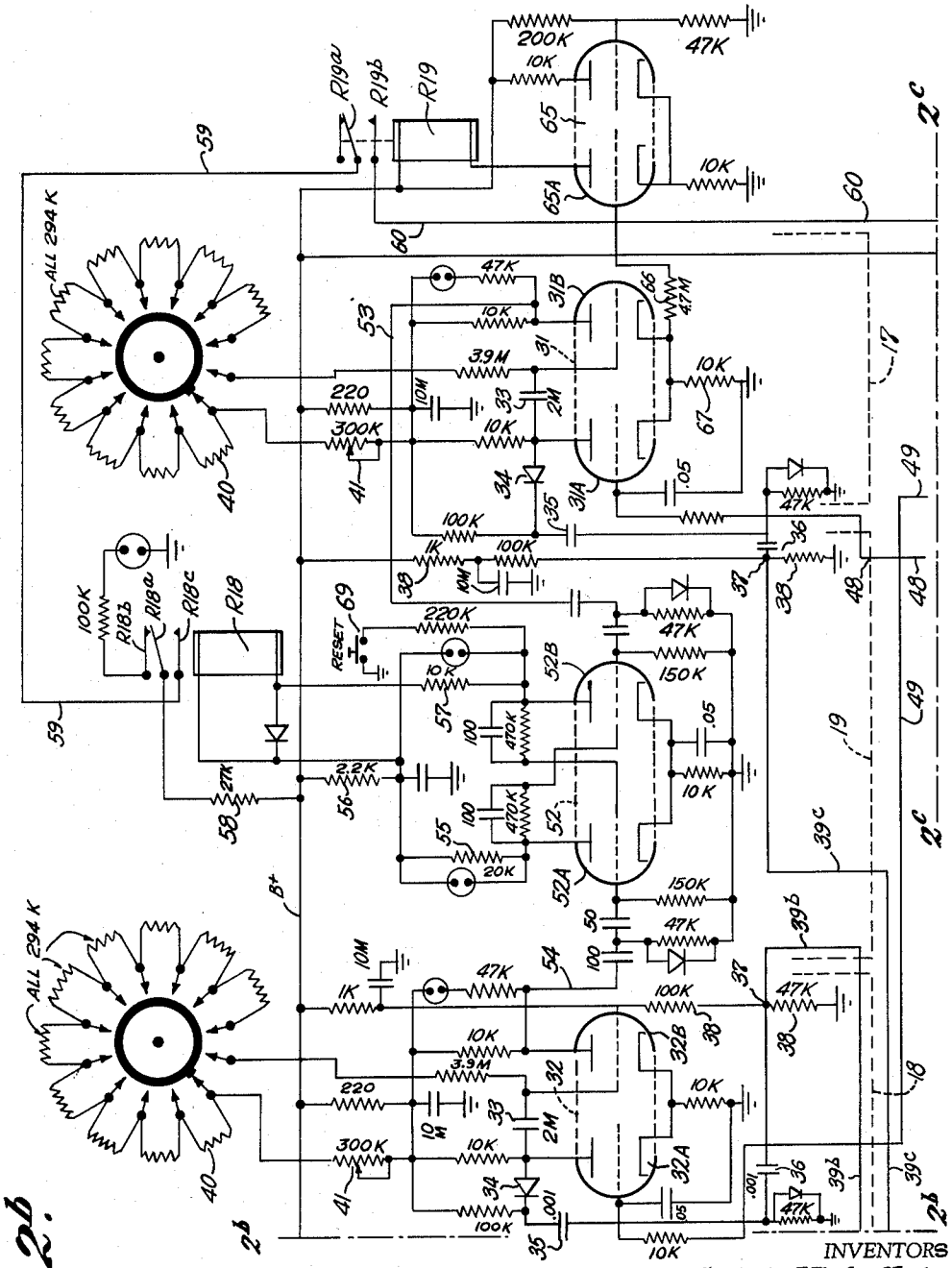


Fig. 2b.

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SEAM JUMPER CONTROL FOR CLOTH SHEARS

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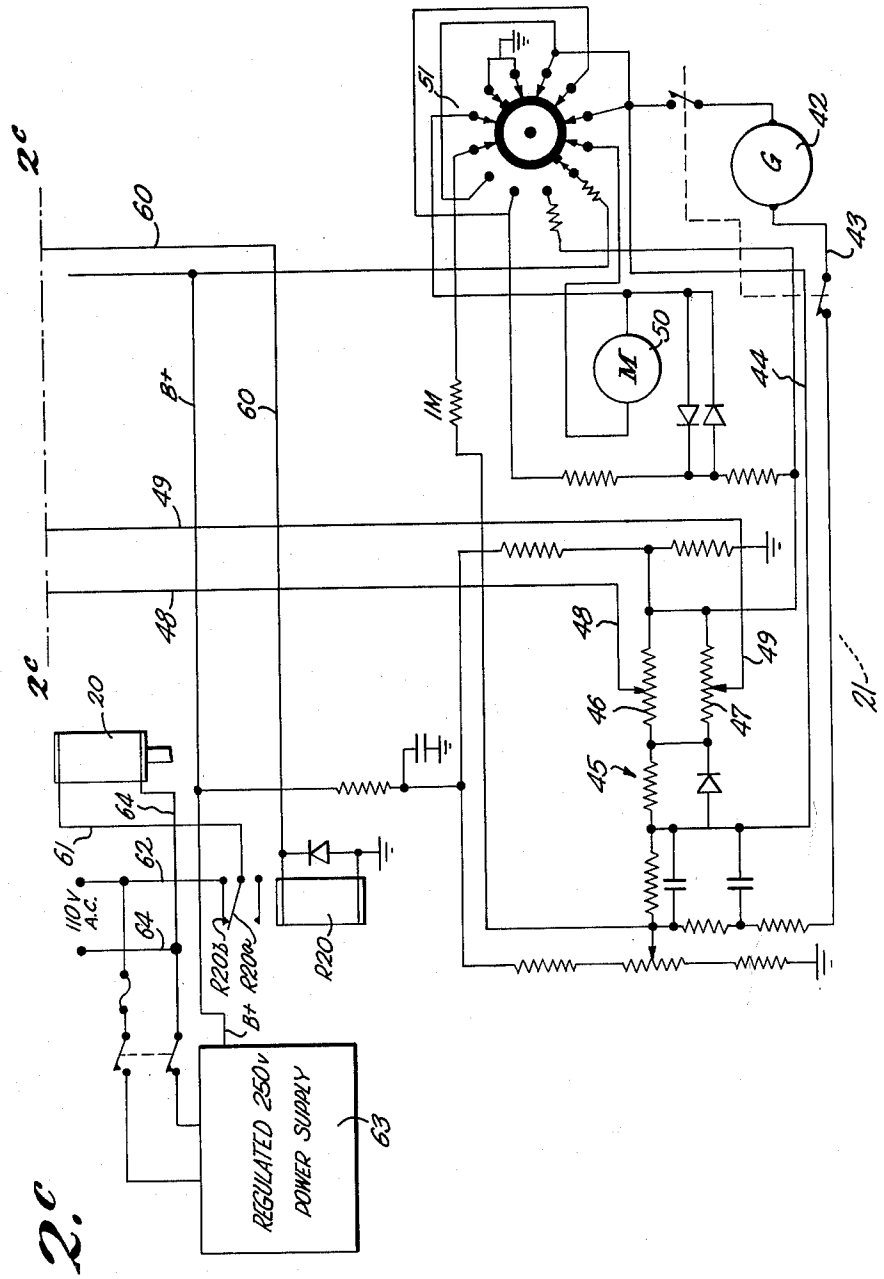


Fig. 2c

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SEAM JUMPER CONTROL FOR CLOTH SHEARS

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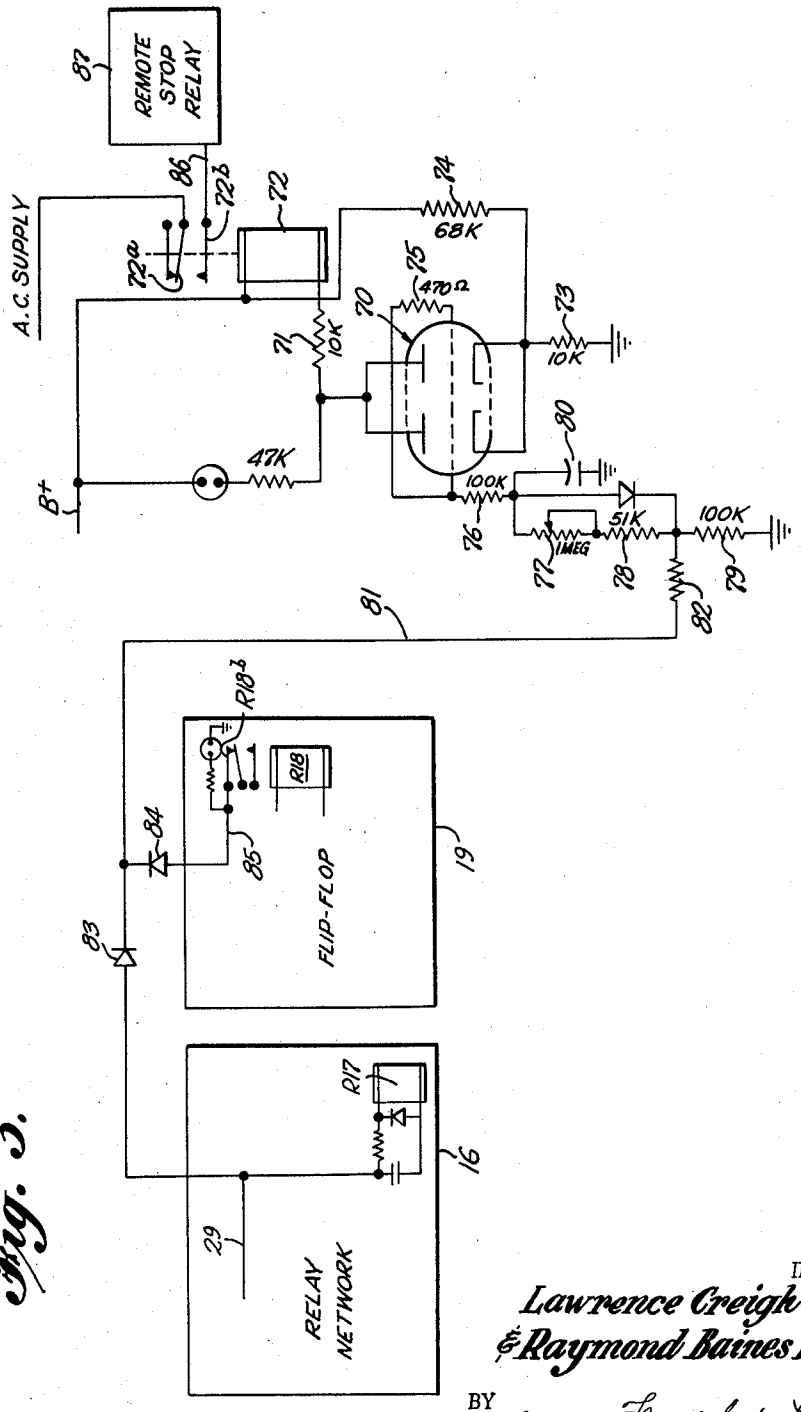


Fig. 3.

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SEAM JUMPER CONTROL FOR CLOTH SHEARS

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Filed May 15, 1962, Ser. No. 194,851
12 Claims. (Cl. 26—17)

The present invention relates in general to seam jumper apparatus for textile mill finishing machines and the like, and more particularly to apparatus for elevating and lowering rotary knives of cloth shearing machines used in cloth finishing upon detection of seams in the cloth.

In textile mills, long strips of cloth are sewed together at the ends before being fed into finishing machines. The cloth is then put through a shearing machine to crop or shear the nap or surplus materail on the surface of the cloth. The shearing machines have one or more rotary knives which cut surplus material from the surface of the cloth. In order to prevent damage to the knives, it is necessary for them to be raised when a seam comes through the machine. It is the normal practice to raise the knives manually. It is the purpose of the present invention to raise and lower the knives automatically in response to detection of a seam in the cloth. This will eliminate damaged knives caused by the operator failing to see the seam. It will save considerable material because it will allow shorter knife raising periods. Faster operation of the machines will be possible due to the lack of physical limitations imposed by even a skilled operator.

An object of the present invention is the provision of novel apparatus for raising and lowering the knives of textile mill finishing machines responsive to passage of a seam through the shearing zone characterized by simplicity of construction and maintenance and reliability of operation.

Another object of the present invention is the provision of novel apparatus for raising the knives of textile mill finishing machines in response to passage of a seam into a detection zone regardless of whether the seam is straight or distorted and for lowering the knives promptly upon passage of the seam from the knife shearing zone.

Another object of the present invention is the provision of apparatus of the character described in the preceding paragraph wherein means are provided for automatically varying a delay interval between detection of a seam and raising or lowering of the knives in accordance with variations in cloth speed.

Other objects, advantages and capabilities of the present invention will become apparent from the following detail description, taken in conjunction with the accompanying drawings illustrating one preferred embodiment of the invention.

In the drawings:

FIGURE 1 is a block diagram of seam jumping apparatus embodying the present invention;

FIGURES 2*a*, 2*b* and 2*c* constitute a schematic diagram of an exemplary circuit for the seam jumping apparatus disclosing respectively the relay network, the delay and flip-flop stages, and the tachometer generator components of the circuit; and

FIGURE 3 is a schematic diagram of a master time delay stop unit which may be employed with the seam jumping apparatus.

The present invention is designed for use with textile mill finishing machines having one or more rotary knives supported so that they can be raised and lowered relative to the surface of the cloth, one example of such a finishing machine being the machine commonly known

in the trade as a cloth shear. It will be appreciated, however, that the present invention is useful in other machines or applications, such as for example in cloth calendaring and like devices wherein movement of an element or component in response to approach of a seam or thickened region is desired. The general arrangement of the seam detecting and knife control system of the present invention is illustrated in the block diagram of FIGURE 1, and includes a plurality of precision snap action switches, six being provided in the exemplary embodiment herein described identified by the reference characters **10** to **15** mounted on a suitable supporting beam disposed across and above the path of movement of the cloth at a detecting station spaced a short distance in advance of the cutting station occupied by the knife or knives. The snap action switches **10** to **15** are arranged along a rectilinear axis extending transversely of the direction of cloth movement at substantially uniform increments so that the outermost snap action switches **10** and **15** are located close to the lateral margin of the widest cloth to be processed by the cloth shear, and all of the snap action switches are so spaced from the normal plane of cloth movement that normally no contact is made with the cloth. However, at the seams, the material is somewhat thicker due to the thread used in making the seam. The microswitches are positioned and adjusted so as to be closed by contact with the seam when the seam passes under them. Several switches spaced transversely of the path of cloth travel must be used to effect accurate detection of seams that are not straight, particularly where wide material is being finished. While six snap action switches are shown in this illustrated embodiment, it will be apparent that a larger or smaller number of switches may be used depending upon the requirements of the particular installation and particularly the width of cloth to be processed.

The switches **10** to **15** are connected to a relay network **16**, which supplies triggering voltages to a raise time delay circuit **17** and a lower time delay circuit **18**, which in turn control triggering of a flip-flop circuit **19** controlling a relay or series of relays which regulate energization and de-energization of a knife solenoid or solenoids **20** corresponding to the number of knives present. Closure of the first snap action switch encountered by the seam, for example the snap action switch **12**, causes the relay network **16** to generate a pulse which actuates the raise time delay circuit **17**. A delayed pulse from the raise time delay circuit **17** triggers the flip-flop circuit **19** which causes a series of relays to energize the knife solenoid **20** to lift the knife out of operative position relative to the cloth. After all switches **10** to **15**, with certain exceptions hereinafter noted, have been actuated and returned to their normal positions by the seam passing under them, another pulse is generated by the relay network **16**. This pulse actuates the lower time delay circuit **18** to trigger this circuit, de-energizing the knife solenoid **20** and lowering the knife, again to operative position relative to the cloth. If several knives are used, all will be raised and lowered simultaneously by the associated solenoids. A tachometer generator unit, indicated generally at **21**, may be coupled to a rotary component such as the cloth drive roller of the shearing machine to continuously produce voltages related to the speed of the machine or the speed of cloth travel for varying the delay periods of the raise and lower time delay circuits **17** and **18** to compensate for variations in machine speed.

Referring now to FIGURES 2*a*, *b* and *c* illustrating an exemplary circuit for the seam jumping apparatus of the present invention, the relay network **16** may include a series of multi-contact relays R**10** to R**15** associated respectively with the snap action switches **10** to **15** and

each having two sets of contacts *a* and *b* including a movable contact arm and normally open and normally closed stationary contacts. The coils of the relays R10 to R15 are respectively coupled to the snap action switches 10 to 15 to be energized upon closure of their associated snap action switches, one end of each relay coil being connected through a resistor 22 and its associated snap action switch and one of the set of resistors 23 to a B+ supply voltage, for example a regulated 250 volt supply. A capacitor 24 and unidirectional diode 25 are coupled in circuit with each relay coil in the manner illustrated in the drawing to secure positive relay closure. The movable contact arm of one set of the contacts "*a*" of the relays R10 to R15 is connected in parallel with the corresponding contact arm of each of the relays through lead 26 to the movable contact arm of the set of contacts "*a*" of a latching relay R16, the normally closed stationary contact of the set of contacts R16*a* being connected to the B+ supply. The normally open stationary contact of the contact set "*a*" of each relay R10 to R15 is connected through the resistor 22 to its associated relay coil so that, upon energization of any of the relays R10 to R15 by closure of their associated snap action switches, the relay will be locked in energized position by engagement of the contact arm of contact set "*a*" with the normally open stationary contact of that set through lead 26 and the contact set "*a*" of relay R16 as long as relay R16 remains de-energized.

The movable contact arm of the contact set "*b*" of relay R10 is connected to the B+ supply and the movable contact arms and normally open stationary contacts of the contact sets "*b*" of each of the other relays R11 to R15 are connected in series circuit relation with the normally open stationary contact of the contact set R10*b* and through lead 28 with the coil of relay R16 to energize the relay R16 and open the supply circuit through its contact R16*a* to the locking contacts "*a*" of the relays R10 to R15 when all of the relays R10 to R15 have been energized. By this arrangement, each of the relays R10 to R15 will be individually energized and locked in energized position upon closure of their associated snap action switches 10 to 15, and when all of the relays R10 to R15 have been energized and their associated switches 10 to 15 have reopened, energization of the relay R16 will break the self-locking supply to the relays R10 to R15 causing them to fall back to de-energized condition.

Also, a mercury wetted relay R17 having its coil connected through lead 29 and parallel branch leads 30, each having a diode 30*a* therein, to the normally opened stationary contact of the contact set "*a*" of each relay R10 to R15, is energized immediately upon energization of any one of the relays R10 to R15 responsive to closure of their associated switches 10 to 15. The mercury relay R17 is used to eliminate contact bounce, and includes a grounded movable contact arm R17*a*, a normally closed stationary contact or contacts R17*b* connected to the lower time delay circuit 18, and a normally open stationary contact or contacts R17*c* connected to the raise time delay circuit 17.

The raise time delay circuit 17 and lower time delay circuit 18 are similar, each being coupled as a one-shot multivibrator to be triggered by a negative pulse produced by closing of the normally open contact R17*c* or of the normally closed contact R17*b* of the relay R17 to generate an output pulse for triggering the flip-flop 19 after a selected delay interval. The delay circuits 17 and 18 include duo-triodes 31 and 32 respectively having normally conducting sections 31B, 32B and normally non-conducting sections 31A and 32A. The grids of the normally conducting sections 31B, 32B are connected through capacitors 33, intercoupling the grids of the B sections with the plates of the A sections, diodes 34 and capacitors 35, 36 to junction point 37 of a voltage divider 38 to which lead 39*c* or 39*b* from the relay contacts R17*c* and R17*b* respectively is connected. The grids of the normally conducting section 31B and 32B are also coupled through variable resistance switches 40 and vernier potentiometers 41 to the B+ supply for varying the resistance in the charging circuit of capacitor 33 to control the time delay period between triggering of the sections 31B, 32B into non-conduction and return of the sections of tubes 31, 32 to their normal states.

The bias on the grids of the normally non-conducting sections 31A, 32A of the time delay multivibrators may be automatically regulated in accordance with the cloth speed, for example by monitoring the speed of the cloth drive roller with the tachometer generator unit 21. The tachometer generator unit 21 is of generally conventional construction and includes a D.C. generator 42 whose shaft is coupled, for example, to the drive roller of the cloth shear, the output leads 43, 44 from the D.C. generator 42 being coupled across a section of a voltage divider network 45 including parallel potentiometers 46, 47 whose wiper arms are connected through leads 48, 49 and suitable resistors to the control grids of time delay multivibrator sections 31A, 32A. For example, the wiper arms of potentiometers 46, 47 may be normally set to a 50 volt position and the leads 43, 44 are coupled to the divider network 45 at positions so that the voltage at the wiper arms of potentiometers 46, 47 changes in direction and extent due to variations in speed of generator 42 to automatically decrease the delay time of circuits 17 and 18 by altering the bias on sections 31A, 32A when the drive roller and D.C. generator speed up, and the voltage on leads 43, 44 increases, and to change the delay time in the opposite direction upon decrease in cloth roller and D.C. generator speed. The resistance adjustments in the divider network 45 and the meter circuit 50 and meter switch 51 are provided to permit accurate setting and calibration of the divider network 45, so as to vary the delay times of the multivibrator circuits 17, 18 the proper amount to compensate for variations in the speed of cloth travel. Such adjustment of the raise and lower delay times is necessary because the snap action switches 10–15 are physically located about one foot ahead of the shearing knife or knives and the raising and lowering of the knives must be accurately timed relative to closure and opening of the snap action switches to actuate the knives when the seams arrive at the knife positions.

It will be appreciated that the control grids of the A sections of tubes 31 and 32 may be connected to suitable sources of adjustable D.C. voltage to manually regulate the bias on the same and the delay time instead of using the above-described tachometer generator unit 21.

The flip-flop circuit 19 includes a duo-triode 52 having two sections 52A and 52B intercoupled as a multivibrator, the control grid of the right-hand section 52B being coupled through capacitors and a lead 53 to the plate of the normally conducting section 31B of the raise time delay circuit 17 and the control grid of the left-hand section 52A being similarly coupled through lead 54 to the plate of the normally conducting section 32B of the lower time delay circuit 18. The plate of flip-flop section 52A is connected through resistor 55 and common plate load resistor 56 to B+ and the plate of flip-flop section 52B is coupled through resistor 57 and the coil of relay R18 to the lower end of the common plate load resistor 56 so that the relay R18 will be energized during the period that the flip-flop section 52B conducts.

The movable contact arm R18*a* is connected through resistor 58 to B+ and its normally closed stationary contact R18*b* may either be an inactive contact or may be connected through a suitable indicator lamp as shown to indicate the state of this relay. The normally open stationary contact R18*c* serves to complete a circuit to regulate the supply to the knife solenoid 20 governing the position of the shearing knife or knives, and in the particular embodiment herein shown is connected through lead 59 to the movable contact arm R19*a* of a fail-safe relay R19, the normally open stationary contact R19*b* of

which is connected through lead **60** to one end of the coil of relay **R20**, the other end of which is connected to ground.

The relay **R20** serves as the relay for controlling the voltage supply to the knife solenoid **20**, the movable contact **R20***a* being connected through lead **61** to a terminal of the knife solenoid **20** and the normally closed stationary contact **R20***b* being connected through lead **62** to one terminal of an A.C. voltage source providing sufficient power for the knife solenoid coil **20**, such for example as a 110 volt A.C. source connected to the power supply **63** for the seam jumper control circuit. The power supply **63** being in this illustrative example a conventional power supply providing a 250 volt requlated B+ output. The other end of the solenoid **20** is connected through lead **64** to the other terminal of the A.C. source.

The coil of the fail-safe relay **R19** is connected to the plate of the section **65A** of the duo-triode **65** forming the fail-safe stage. The grid or the fail-safe tube section **65A** is coupled through resistor **66** to the top of the common cathode resistor **67** of the raise time delay tube **31**, so that the fail-safe tube section **65A** continuously conducts when either of the sections of the raise time delay tube **31** are conducting.

The values of the circuit elements of the illustrative example described above are indicated in the drawings and the duo-triodes **31**, **32**, **52** and **65** may all be 6201 tubes in this preferred example.

In the operation of the above-described circuit, during the normal operation of the cloth shear when seams or thickened portions of the cloth are not in the region of the sensing station occupied by the switches **10** to **15**, the right-hand sections **31B**, **32B** and **52B** of the raise, lower time delay circuits **17** and **18** and of the flip-flop circuit **19** are normally conducting, the lefthand section **65A** of the fail-safe tube **65** is normally conducting, relays **R10** to **R17** are normally in a de-energized state, and relays **R17** and **R19** are energized. Conduction in the right-hand section of tube section **52B** is initially insured by depressing reset switch **69** connected to ground and through a resistor to the plate of section **52B**, to mechanically fire section **52B** and close contacts, **R18***a* and **R18***c* of relay **R18**. This applies B+ voltage through the contacts *a* and *c* of relay **R18** and the closed contacts of **R19** to the coil of **R20**. Energizing relay **R20** draws the contact arm **R20***a* away from the stationary contact **R20***b*, breaking the A.C. circuit through lead **62** to the solenoid **20**. This reset switch **69** is only used in first turning on the seam jumper and getting the shear into operation, as the shear blade must be lowered into shearing position before the cloth is started rolling through the shear. Thus the shearing knife or knives are in the active cloth shearing position, either by virtue of resilient biasing means or gravitational bias on the knife solenoid plunger. When a seam or thickened cloth portion arrives at the sensing station and momentarily closes any of the snap action switches **10** to **15**, for example the switch **10**, the associated relay coil **R10** is energized, making the circuit through the movable contact arm **R10***a* and associated normally open stationary contact from the B+ supply through the normally closed contacts **R16***a* to the coil of relay **R10**, latching the relay **R10** in energized condition. The making of the circuit between the movable contact arm and normally open stationary contact of the contact set **R10***a* also applies B+ voltage through the lead **30**, diode **30A** and lead **29** to the coil of the relay **R17** energizing this relay. Energization of relay **R17** places the grounded movable contact arm **R17***a* in engagement with the stationary contact **R17***c* connected through the lead **39***c*, and applying a negative pulse to the grid of the normally conducting section **31B** of the raise time delay tube **31**. After a suitable interval determined by the resistance interposed in the charging circuit of the capacitor **33** by the setting of the variable resistance switch **40** and vernier potentiometer **41**, the capacitor **33** charges to a sufficient level to raise the potential of the grid of section **31B** above cut-off and returning the section **31B** to a conducting state. The negative going plate voltage waveform produced when the delay multivibrator section **31B** returns to a conducting state is applied through the lead **53** to the grid of the normally conducting section **52B** of flip-flop **52**, terminating conduction in this section. The termination of conduction in flip-flop section **52B** terminates current flow through the coil of relay **R18**, de-energizing this relay, and opening the B+ supply formerly maintained through the movable contact arm **R18***a* and stationary contact **R18***c*. The shifting of the contact arm **R18***a* out of engagement with stationary contact **R18***c* interrupts the B+ supply to the coil of relay **R20**, de-energizing this relay, and permitting return of the relay arm **R20***a* into engagement with the stationary contact **R20***b* to complete the supply circuit from the 110 volt line and lead **62** to lead **61** and knife solenoid **20**, thereby energizing the knife solenoid **20** and raising the knife or knives to a position spaced above the plane of cloth travel wherein the seam may pass freely beneath the knife or knives. When all of the switches **10** to **15** have been momentarily closed, by passage of the seam through the sensing station, and their associated relays **R10** to **R15** have all been energized, the relay **R16** is energized through the series circuit established by closure of all of the relay contacts **R10***b* to **R15***b* when no switch **10** to **15** is still closed, breaking the B+ supply circuit to the line **26** and self-latching contacts **R10***a* to **R15***a* by movement of the contact arm of **R16***a* out of engagement with its associated normally closed stationary contact. This de-energizing of the relays **R10** to **R15** breaks the B+ supply through lead **29** to the coil of relay **R17**, de-energizing relay **R17** and shifting its grounded contact arm **R17***a* into engagement with stationary contact **R17***b* which is applied through **39***b* to the voltage divider **38** and generates a negative pulse which is applied through diode **34** and capacitor **33** to the grid of normally conducting section **32***b* of the lower delay multivibrator. Conduction ceases in the lower delay multivibrator section **32B** for the delay period established by the setting of the variable resistance switch **40** and vernier potentiometer **41** in the charging path of the capacitor **33**, and the delay multivibrator **32** then switches back to its normal state, the negative going voltage waveform at the plate of section **32B** being applied through lead **54** to the grid of the flip-flop section **52A** which is now conducting. This negative pulse produced at the end of the delay period triggers the flip-flop **52** back to its normal state, re-establishing conduction in the section **52B** and current flow through the coil of relay **R18**. The making of the contact arm **R18***a* with the normally opening stationary contact **R18***c* reapplies B+ voltage to the coil of relay **R20**, energizing this relay and breaking the 110 volt supply through the lead **61** to the knife solenoid **20**.

When the tachometer generator and bias control circuitry are used, if the speed of the cloth drive roller in the cloth shear machine increases, the voltage produced by the D.C. generator **42** in the tachometer generator unit **21** and applied through the leads **43**, **44** to the voltage divider network **45** increases, the bias voltage applied through the leads **48**, **49** from the wiper arms of the potentiometers **46**, **47** varies the bias on the grids of the sections **31A** and **32A** of the time delay multivibrator tubes **31** and **32**, varying the delay period of these viltivibrators. Reduction in the speed of the cloth drive roller and accordingly of the D.C. generator **42** varies the bias on the grids of delay multivibrator sections **31A** and **32A** in the opposite sense to increase the delay time, so that the tachometer generator unit **21** serves to alter the bias on the time delay multivibrators in such a way as to compensate for variations in cloth speed.

Also, the fail-safe stage **65** serves to protect the knife

in the event the raise time delay multivibrator tube 31 becomes defective. If the raise delay multivibrator tube 31 fails to conduct in either section, or encounters a substantial reduction in cathode current, the bias voltage on fail-safe tube section 65A applied through resistor 66 reduces to a point either cutting off conduction through section 65A or so lowering the rate of conduction that the relay R19 opens, whereby the contact arm R19*a* interrupts the B+ supply through line 60 to the relay R20. Thus the relay R20 becomes de-energized, permitting the contact arm R20*a* to re-establish contact with stationary contact R20*b* and completes the 110 volt supply circuit through leads 62 and 61 to the knife solenoid 20 to lift the knife or knives to their elevated inactive position.

In order to make above-described unit having six snap action switches 10 to 15 operative for either wide or narrow cloth, the microswitches are spaced at suitable intervals transversely of the cloth feed path so as to extend over substantially the full width of the widest cloth to be encountered. The leads from the endmost switches 10 and 15, to the relays R10, R15, however, are interconnected by normally open manual switches 68 with the leads from the next adjacent switches 11, 14, to their respective relays. These selector switches 68, when closed, cause the relay coils R10 and R15, as well as relays R11 and R14, to be energized when switches 11 and 14 are closed, thus establishing the conditions for proper operation of the seam jumper control circuitry even when narrow cloth is being used which is of insufficient width to activate the end-most switches 10 and 15. The selector switches 68, therefore, are maintained in open condition for wide cloth and are closed for narrow cloth.

To permit manual resetting of the relays R10 to R15 if one of the snap action switches 10 to 15 should fail to close and energize its associated relay R10–R15, a normally open manual relay reset switch 27 is provided, for example, between the B+ supply lead and the junction between the resistor 22 and capacitor 24 associated with the coil of relay R16. Thus, if the operator notes that the knife solenoid 20 fails to lower the knife promptly after passage of a seam beneath the snap action switches 10–15, he can actuate the reset switch 27 which applies B+ to the coil of relay R16 and thus open the B+ supply to the self-locking contacts *a* of the relays R10–R15 to initiate the shearing knife lowering cycle.

If desired, a master time delay stop unit may be provided. Such a master time delay stop unit is illustrated in FIGURE 3 in conjunction with the stages of FIGURES 2*a*–2*c* with which it is to be associated, and comprises a duo-triode delay tube 70 having the plates thereof connected through a load resistor 71 and the coil of a relay 72 to the B+ supply source, and the cathodes thereof connected together through the cathode load resistor 73 to ground and through resistor 74 to the B+ supply sourse to normally bias the delay tube to a non-conducting state. The grid of the right-hand section of delay tube 70 is connected through resistor 75 to the grid of the left-hand section, which in turn is connected through resistor 76, delay potentiometer 77 and resistors 78 and 79 to ground. A capacitor 80 is connected between ground and the bottom of resistor 76. A lead 81 having a resistor 82 therein is connected from a point between resistors 78 and 79 to lead 29. A junction diode 83 is provided in the lead 81 near its connection with the lead 29 and a diode 84 is provided in a lead 85 connected between the lead 81 and the normally closed stationary contact R18*b* of relay R18. The movable contact arm 72*a* of relay 72 is connected to an A.C. power source and the normally open stationary contact 72*b* is connected through lead 86 to a remote stop relay 87 for stopping operation of the shearing machine. With this master time delay stop unit, B+ voltage is applied through diode 83 and lead 81 to the top of the resistor 79 when any one of the relays R10–R15 is energized by its associated snap action switch and B+ voltage is applied to the lead 29. Since the voltage across a capacitor cannot change instantaneously, this positive potential applied to the top of the resistor 79 is not immediately applied to the grids of the delay tube 70, but is progressively applied to the grids of this tube as the capacitor 80 progressively charges with the time constant regulated by the adjustment of the delay potentiometer 77. This charging delay period is set to trigger the delay tube 70 into conduction if the B+ voltage on the lead 81, applied either through diode 83 when any one of the relays R10–R15 is in energized condition or through diode 84 when the relay R18 is in deenergized condition, is not taken off of this lead 81 for a selected time interval which is slightly longer than the period B+ appears on the lead 81 in normal operation of the apparatus. Thus, if the shearing knife is elevated in response to the energization of one of the relays R10–R15 upon passage of a seam through one of the snap action switch stations and the relays R10–R15 are not subsequently deenergized as by energization of relay R16 or actuation of the manual relay reset switch 27 an approximately normal delay interval thereafter to effect lowering of the shearing knife, the master time delay stop unit will effect energization of the remote stop relay 87 through delayed firing of the delay tube 70.

While preferred exemplary embodiments of the present invention have been particularly shown and described, it is apparent that various modifications may be made therein within the spirit and scope of the invention, and it is desired, therefore, that only such limitations be placed on the invention as are set forth in the appended claims.

What is claimed is:

1. In a cloth shear of the type having means for propelling and guiding a seamed web of cloth, shearing means at a shearing zone in the path of travel of the cloth normally urged to a cloth shearing position, and shearing-suspending means for positioning the shearing means to suspend shearing action upon activation thereof; means for detecting the approach of a seam to the shearing zone and controlling said shearing-suspending means in timed relation thereto comprising a plurality of seam detecting elements aligned transversely of the cloth web at laterally spaced locations in the path of travel at a sensing zone spaced from the shearing zone to be momentarily actuated responsive to passage of a seam, a plurality of detector relays each connected to one of the seam detecting elements to be energized upon actuation of their associated seam detecting elements, a bistable multivibrator circuit having first and second stable states, means responsive to said first stable state for activating said shearing-suspending means to suspend shearing during the period of said first stable state, first and second time delay stages each including a one-shot multivibrator responsive to triggering signals to assume an unstable state and operative to automatically switch to a stable state a time delay interval following such triggering signals, means responsive to energization of any one of said detector relays for triggering the first time delay multivibrator to said unstable state, means for shifting said bistable multivibrator to said first stable state to activate said shearing-suspending means responsive to switching of said first time delay multivibrator to its stable state, means responsive to energization of all said detector relays and return of said seam detecting elements to non-actuated condition for triggering said second time delay multivibrator to its unstable state, means for shifting said bistable multivibrator to said second stable state responsive to switching of said second time delay multivibrator to its stable state, and adjustable resistance means for each of said time delay multivibrators for regulating the time interval between triggering thereof to their unstable states and switching to their stable states.

2. In a cloth shear of the type having means for propel-

ling and guiding a seamed web of cloth, shearing means at a shearing zone in the path of travel of the cloth normally urged to a cloth shearing position, and shearing-suspending means for positioning the shearing means to suspend shearing action upon activation thereof; means for detecting the approach of a seam to the shearing zone and controlling said shearing-suspending means in timed relation thereto comprising a plurality of seam detecting switches aligned transversely of the cloth web at laterally spaced locations in the path of travel at a sensing zone spaced from the shearing zone to be momentarily actuated by passage of a seam through said sensing zone, a plurality of detector relays each connected to one of the seam detecting switches to be energized upon actuation of their associated switches, a bistable multivibrator circuit having a normally conducting first section and a normally nonconducting second section, a shearing control relay responsive to conduction and nonconduction of said first section to assume first and second distinctive conditions respectively, means responsive to the second condition of said shearing control relay to activate said shearing-suspending means to suspend shearing during the period said shearing control relay is in said second condition, first and second time delay stages each including a one-shot multivibrator responsive to triggering signals to assume an unstable state and variable time constant circuit means automatically switching the same to a normal stable state a time delay interval following application of triggering signals thereto, means responsive to energization of any one of said detector relays for triggering the first time delay multivibrator to said unstable state, means coupling said first section of said bistable multivibrator to said first time delay multivibrator to be triggered to non-conducting state and dispose said shearing control relay in said second condition responsive to switching of said first time delay multivibrator to its stable state, means responsive to energization of all said detector relays and return of said seam detecting switches to non-actuated condition for triggering said second time delay multivibrator to its unstable state, means coupling said second section of said bistable multivibrator to said second time delay multivibrator for returning said first section of the bistable multivibrator to conducting state responsive to switching of said second time delay multivibrator to its stable state, the variable time constant circuit means of each of said time delay multivibrators including manually adjustable variable resistance means for regulating the time interval between triggering of said time delay multivibrator to their unstable states and return to their stable states.

3. In a cloth shear of the type having means for propelling and guiding a seamed web of cloth, shearing means at a shearing zone in the path of travel of the cloth normally urged to a cloth shearing position, and shearing-suspending means for positioning the shearing means to suspend shearing action upon activation thereof; means for detecting the approach of a seam to the shearing zone and controlling said shearing-suspending means in timed relation thereto comprising a plurality of seam detecting elements aligned transversely of the cloth web at laterally spaced locations in the path of travel at a sensing zone spaced from the shearing zone to be momentarily actuated by passage of a seam through said sensing zone, a plurality of detector relays each connected to one of the seam detecting elements to be energized upon actuation of their associated seam detecting elements, a bistable multivibrator circuit having first and second stable states, means responsive to said first stable state for activating said shearing-suspending means to suspend shearing during the period of said first stable state, first and second time delay stages each including a one-shot multivibrator responsive to triggering signals to assume an unstable state and operative to automatically switch to a stable state a time delay interval following such triggering signals, means responsive to energization of any one of said detector relays for triggering the first time delay multivibrator to said unstable state, means for shifting said bistable multivibrator to said first stable state to activate said shearing-suspending means responsive to switching of said first time delay multivibrator to its stable state, means responsive to energization of all said detector relays and return of said seam detecting elements to non-actuated condition for triggering said second time delay multivibrator to its unstable state, means for shifting said bistable multivibrator to said second stable state responsive to switching of said second time delay multivibrator to its stable state, and adjustable resistance means for each of said time delay multivibrators for regulating the time interval between triggering thereof to their unstable states and switching to their stable states, tachometer generator means responsive to the speed of the cloth travel through the cloth shear for producing variable biasing voltages bearing a preselected relation to the speed of cloth travel, and means continuously applying the biasing voltages produced by said generator means to said time delay multivibrators for automatically varying the delay interval between triggering thereof to their unstable states and switching to their stable states to compensate for variations in speed of cloth travel.

4. In a cloth shear of the type having means for propelling and guiding a seamed web of cloth, shearing means at a shearing zone in the path of travel of the cloth normally urged to a cloth shearing position, and shearing-suspending means for positioning the shearing means to suspend shearing action upon activation thereof; means for detecting the approach of a seam to the shearing zone and controlling said shearing-suspending means in timed relation thereto comprising a plurality of seam detecting switches aligned transversely of the cloth web at laterally spaced locations in the path of travel at a sensing zone spaced from the shearing zone to be momentarily actuated by contact with a seam, a plurality of detector relays each connected to one of the seam detecting switches to be energized upon actuation of their associated switches, a bistable multivibrator circuit having a normally conducting first section and a normally non-conducting second section, a shearing control relay responsive to conduction and non-conduction of said first section to assume first and second distinctive conditions respectively, means responsive to the second condition of said shearing control relay to activate said shearing-suspending means to suspend shearing during the period said shearing control relay is in said second condition, first and second time delay stages each including a one-shot multivibrator responsive to triggering signals to assume an unstable state and variable time constant circuit means automatically switching the same to a normal stable state a time delay interval following application of triggering signals thereto, means responsive to energization of any one of said detector relays for triggering the first time delay multivibrator to said unstable state, means coupling said first section of said bistable multivibrator to said first time delay multivibrator to be triggered to non-conducting state and dispose said shearing control relay in said second condition responsive to switching of said first time delay multivibrator to its stable state, means responsive to energization of all said detector relays and return of said seam detecting switches to non-actuated condition for triggering said second time delay multivibrator to its unstable state, means coupling said second section of said bistable multivibrator to said second time delay multivibrator for returning said first section of the bistable multivibrator to conducting state responsive to switching of said second time delay multivibrator to its stable state, the variable time constant circuit means of each of said time delay multivibrators including manually adjustable variable resistance means for regulating the time interval between triggering of said time delay multivibrators to their unstable states and return to their stable states, tachometer generator means responsive to the speed of the cloth travel through the cloth shear for producing variable biasing voltages

bearing a preselected relation to the speed of cloth travel, and means continuously applying the biasing voltages produced by said generator means to said time delay multivibrators for automatically varying the delay interval between triggering thereof to their unstable states and switching to their stable states to compensate for variations in speed of cloth travel.

5. In a cloth shear of the type having means including a cloth drive roller for propelling and guiding a seamed web of cloth, shearing means at a shearing zone in the path of travel of the cloth normally urged to a cloth shearing position, and shearing-suspending means for positioning the shearing means to suspend shearing action upon activation thereof; means for detecting the approach of a seam to the shearing zone and controlling said shearing-suspending means in timed relation thereto comprising a plurality of seam detecting elements aligned transversely of the cloth web at laterally spaced locations in the path of travel at a sensing zone spaced from the shearing zone to be momentarily actuated by contact with a seam, a plurality of detector relays each connected to one of the seam detecting elements to be energized upon actuation of their associated seam detecting elements, a bistable multivibrator circuit having first and second stable states, means responsive to said first stable state for activating said shearing-suspending means to suspend shearing during the period of said first stable state, raise and lower time delay stages each including a one-shot multivibrator having first and second sections and a normal stable state wherein said first and second sections are in conduction and non-conduction respectively, each of the time delay multivibrators being responsive to triggering signals to assume a reverse unstable state and including a resistance-capacitance circuit intercoupling the sections thereof for switching the multivibrator to said stable state a delay interval following application of triggering signals thereto, means intercoupling said first section of the raise time delay multivibrator with said detector relays for triggering the raise time delay multivibrator to said unstable state responsive to energization of any one of said detector relays, means for shifting said bistable multivibrator to said first stable state to activate said shearing-suspending means responsive to switching of said raise time delay multivibrator to its stable state, means intercoupling said first section of the lower time delay multivibrator with said detector relays for triggering said lower time delay multivibrator to its unstable state responsive to energization of all said detector relays and return of the seam detecting elements to non-actuated condition, means for shifting said bistable multivibrator to said second stable state responsive to switching of said lower time delay multivibrator to its stable state, and adjustable resistance means in said resistance-capacitance circuit of each of said time delay multivibrators for varying the time constant of the resistance-capacitance circuit to adjust the delay interval of the associated time delay multivibrator to correspond substantially to the travel time of the cloth from said sensing zone to said shearing zone for a selected cloth speed.

6. In a cloth shear of the type having means including a cloth drive roller for propelling and guiding a seamed web of cloth, shearing means at a shearing zone in the path of travel of the cloth normally urged to a cloth shearing position, and shearing-suspending means for positioning the shearing means to suspend shearing action upon activation thereof; means for detecting the approach of a seam to the shearing zone and controlling said shearing suspending means in timed relation thereto comprising a plurality of seam detecting elements aligned transversely of the cloth web at laterally spaced locations in the path of travel at a sensing zone spaced from the shearing zone to be momentarily actuated by contact with a seam, a plurality of detector relays each connected to one of the seam detecting elements to be energized upon actuation of their associated seam detecting elements, a bistable multivibrator circuit having first and second stable states, means responsive to said first stable state for activating said shearing-suspending means to suspend shearing during the period of said first stable state, raise and lower time delay stages each including a one-shot multivibrator having first and second sections and a normal stable state wherein said first and second sections are in conduction and non-conduction respectively, each of the time delay multivibrators being responsive to triggering signals to assume a reverse unstable state and including a resistance-capacitance circuit intercoupling the sections thereof for switching the multivibrator to said stable state a delay interval following application of triggering signals thereto, means intercoupling said first section of the raise time delay multivibrator with said detector relays for triggering the raise time delay multivibrator to said unstable state responsive to energization of any one of said detector relays, means for shifting said bistable multivibrator to said first stable state to activate said shearing-suspending means responsive to switching of said raise time delay multivibrator to its stable state, means intercoupling said first section of the lower time delay multivibrator with said detector relays for triggering said lower time delay multivibrator to its unstable state responsive to energization of all said detector relays and return of the seam detecting elements to non-actuated condition, means for shifitng said bistable multivibrator to said second stable state responsive to switching of said lower time delay multivibrator to its stable state, and adjustable resistance means in said resistance-capacitance circuit of each of said time delay multivibrators for varying the time constant of the resistance-capacitance circuit to adjust the delay interval of the associated time delay multivibrator to correspond substantially to the travel time of the cloth from said sensing zone to said shearing zone for a selected cloth speed, and tachometer generator means including voltage divider network means intercoupled across a substantially constant D.C. voltage source, means adjustably coupling the second section of each of said raise and lower time delay vibrators to said voltage divider network means to supply a selected biasing voltage thereto, and a D.C. voltage generator intercoupled with said cloth drive roller to superimpose voltages on at least a part of said voltage divider network means to vary the biasing voltage applied to the second sections of said time delay multi-vibrators for varying the delay intervals thereof in compensating relation to variations in speed of cloth travel.

7. In a cloth shear, the combination recited in claim 1 wherein said plurality of seam detecting elements are spaced substantially uniformly transversely of the path of cloth travel such that the endmost seam detector elements lie in a zone between the lateral edges of the widest cloth to be processed in the cloth shear and the lateral edges of a narrower web of cloth to be processed, the inwardly adjacent seam detector elements being positioned in the path of cloth travel inwardly of the lateral edges of said narrower web of cloth, and manual switch means for selectively intercoupling the detector relays connected to said endmost seam detector elements with said inwardly adjacent seam detector elements when said narrower web of cloth is being procesesd to cause all of said detector relays to be energized when a cloth seam of the narrower web of cloth has actuated said inwardly adjacent seam detecting elements and the seam detecting elements therebetween.

8. In a cloth shear, the combination recited in claim 2 wherein said plurality of seam detecting switches are spaced substantially uniformly transversely of the path of cloth travel such that the endmost seam detector switches lie in a zone between the lateral edges of the widest cloth to be processed in the cloth shear and the lateral edges of a narrower web of cloth to be procesesd, the inwardly adjacent seam detector switches being positioned in the path of cloth travel inwardly of the lateral edges of said

narrower web of cloth, and manual switch means for selectively intercoupling the detector relays connected to said endmost seam detector switches with said inwardly adjacent seam detector switches when said narrower web of cloth is being processed to cause all of said detector relays to be energized when a cloth seam of the narrower web of cloth has actuated said inwardly adjacent seam detecting switches and the seam detecting switches therebetween.

9. In a cloth shear, the combination recited in claim 2 wherein relay means responsive to conduction in said first time delay multivibrator is interposed between said shearing control relay and said shearing-suspending means to prevent said shearing control relay from activating the shearing-suspending means to initiate shearing when said first time delay multivibrator fails to conduct at substantially normal level.

10. In a cloth shear, the combination recited in claim 4 wherein relay means responsive to conduction in said first time delay multivibrator is interposed between said shearing control relay and said shearing-suspending means to prevent said shearing control relay from activating the shearing-suspending means to initiate shearing when said first time delay multivibrator fails to conduct at substantially normal level.

11. In a cloth shear, the combination recited in claim 1, including a stop relay for the cloth shear, a normally non-conducting discharge device connected to said stop relay for energizing the stop relay to stop operation of the cloth shear upon triggering of said discharge device into conduction, and an adjustable time delay input circuit for said discharge device responsive to activating signals signifying energization of any of said detector relays and to activating signals signifying that said bistable multivibrator is in said first stable state to trigger said discharge device into conduction upon persistence of said activating signals for a selected time interval following initiation of said activating signals.

12. In a cloth shear, the combination recited in claim 3, including a stop relay for the cloth shear, a normally non-conducting discharge device connected to said stop relay for energizing the stop relay to stop operation of the cloth shear upon triggering of said discharge device into conduction, and an adjustable time delay input circuit for said discharge device responsive to activating signals signifying energization of any of said detector relays and to activating signals signifying that said bistable multivibrator is in said first stable state to trigger said discharge device into conduction upon persistence of said activating signals for a selected time interval following initiation of said activating signals.

References Cited in the file of this patent

UNITED STATES PATENTS

2,393,159 Hadley ---------- Jan. 15, 1946