

June 12, 1951

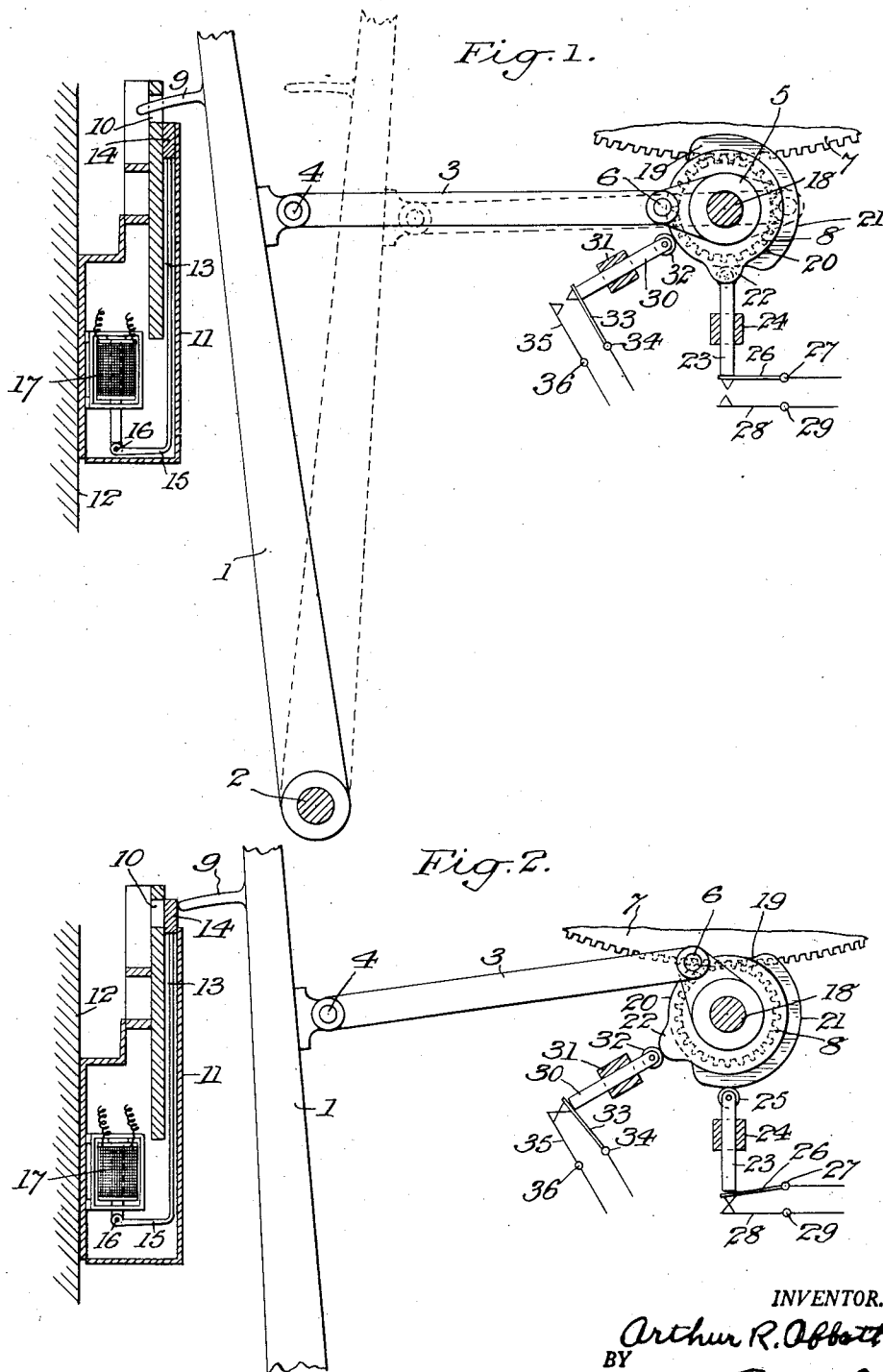
A. R. ABBOTT

2,556,785

ELECTROMAGNETIC SHUTTLE PROTECTOR SYSTEM FOR LOOMS

Filed June 2, 1948

3 Sheets-Sheet 1



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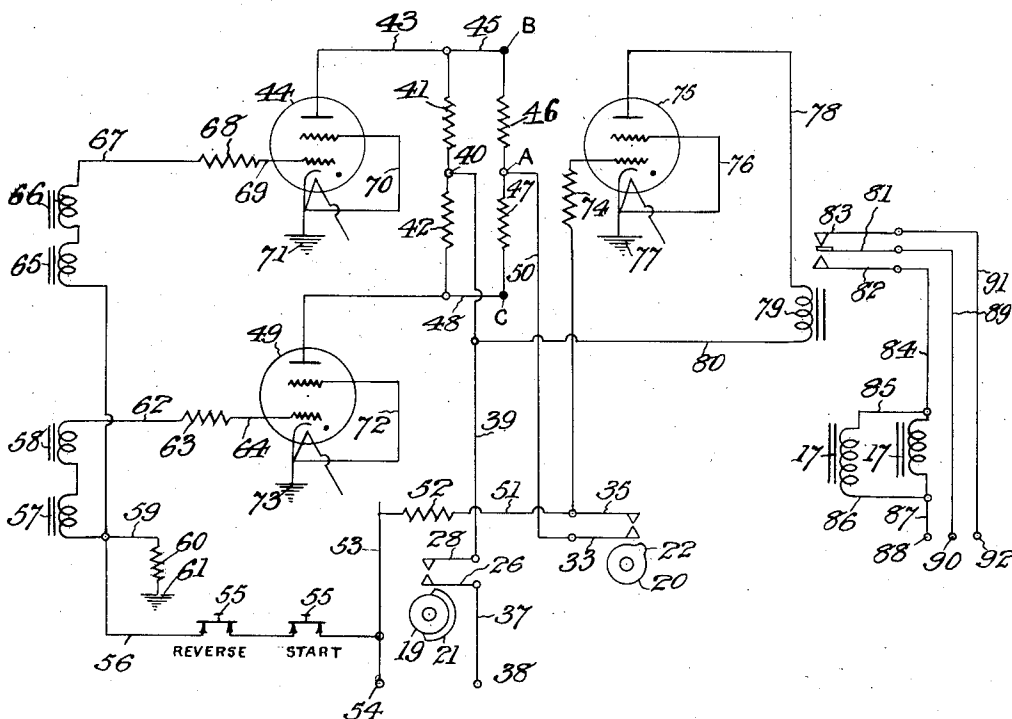
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ELECTROMAGNETIC SHUTTLE PROTECTOR SYSTEM FOR LOOMS

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Fig. 3.



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ELECTROMAGNETIC SHUTTLE PROTECTOR SYSTEM FOR LOOMS

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3 Sheets-Sheet 3

Fig. 4.

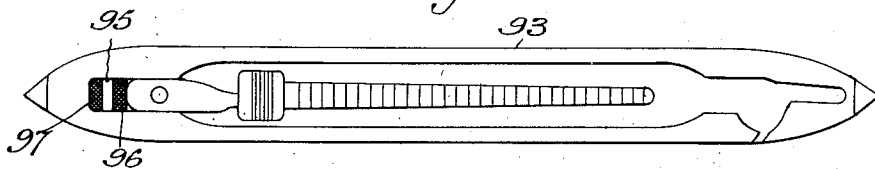


Fig. 5.

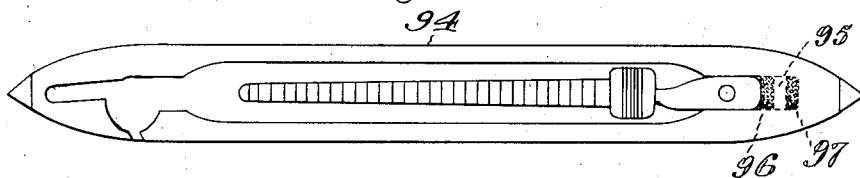


Fig. 6.

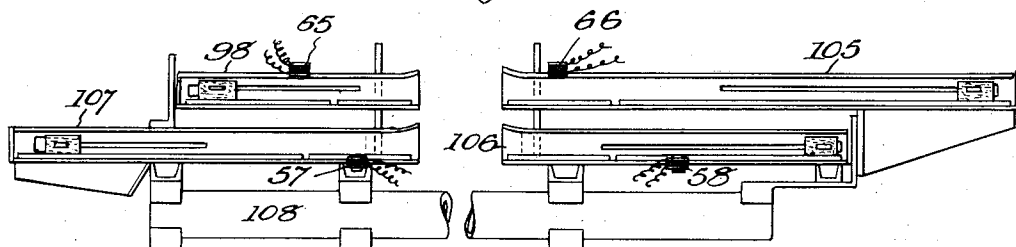


Fig. 7.

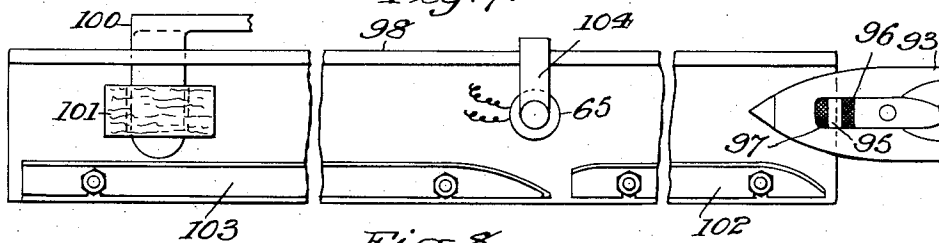
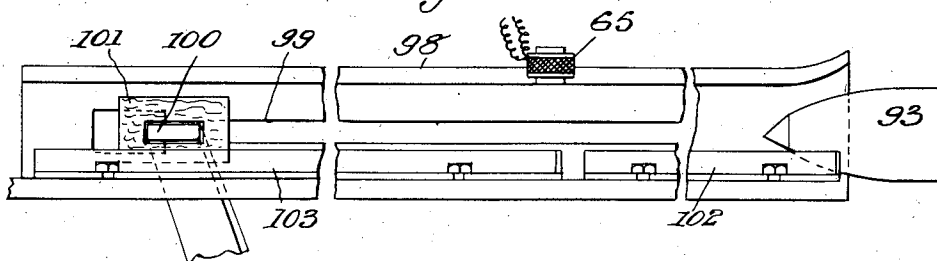


Fig. 8.



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ELECTROMAGNETIC SHUTTLE PROTECTOR
SYSTEM FOR LOOMSArthur R. Abbott, Shelton, Conn., assignor to
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Application June 2, 1948, Serial No. 30,663

20 Claims. (Cl. 139-341)

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This invention relates to looms and, more particularly, to electro-magnetically actuated means for preventing injury to a shuttle and/or the yarn being woven in case of failure of the shuttle properly to traverse the sheds and enter its box, and has for an object to provide a construction and arrangement in which such a shuttle failure will automatically bring into operation electronic control means that will stop the loom and actuate mechanism which obstructs the forward motion of the lay so as to prevent injury to the shuttle and/or yarn.

Another object is to provide such a system which simplifies loom construction by eliminating the usual movable daggers and mechanism for lifting them on each forward stroke of the lay while the loom is operating correctly.

Another object is to provide such a system in which the parts are normally set to stop the loom at the termination of each shuttle flight and in which such action is prevented by a magnetic element carried by the shuttle or shuttles which becomes effective upon proper entry of each shuttle into its box.

Another object is to provide such a system which operates without the necessity of the employment of high voltages in connection with the shuttle boxes, thus minimizing the danger of injury through fire.

Another object is to provide such a system in which the fitting of the magnetic element in the shuttle does not call for change in general construction, form or size of the shuttle.

Another object is to provide such a system in which is adapted to be applied to looms of standard and approved types without the requirement of any substantial change in their construction or mode of operation.

A further object is to provide certain improvements in the form, construction and arrangement of the parts whereby the above named and other objects inherent in the invention may be effectively attained.

A practical embodiment of the invention is shown in the accompanying drawings, in which:

Fig. 1 represents, partly diagrammatically, a side elevation, partly in section, of a loom lay leg and associated parts; the leg and its actuating pitman being shown in two positions in full and broken lines;

Fig. 2 represents, a similar view showing in detail certain of the parts in position different from those of Fig. 1;

Fig. 3 represents a diagrammatic layout of the electronic control and certain operative mechan-

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ical parts associated therewith, adapted to be used in connection with a double shuttle pile or plush loom;

Fig. 4 represents a top plan view of an upper shuttle for a double shuttle loom equipped with the above mentioned magnetic element.

Fig. 5 represents a similar view of a lower shuttle;

Fig. 6 represents a broken front elevation of of the shuttle boxes of a double shuttle loom mounted on the lay, with the front elements of the boxes removed;

Fig. 7 represents a broken top plan view of a shuttle box and associated picking mechanism; the box being shown as equipped with an electric element for cooperating with the magnetic element carried by the shuttle, and a portion of a shuttle being shown as entering the box; and

Fig. 8 represents a side elevation of the parts shown in Fig. 7.

It has been common practice in loom construction to provide means for stopping the loom in the event a shuttle fails properly to enter its box, in order to prevent injury to the shuttle and/or yarn being woven through the striking of the former by the lay. This means has usually included one or more movable daggers carried by the lay in position to contact one or more blocks fixed to the loom frame, which contact serves to stop the loom by what is commonly referred to as a "bang off." To avoid this stoppage while the loom is operating satisfactorily and the shuttles are properly entering their boxes, mechanism, generally including bell cranks and rods, has been associated with the back of one or more shuttle boxes, which mechanism lifts the dagger or daggers on each forward or beat-up stroke of the lay when the shuttles are properly entering their boxes. It will be clear that the arrangement just described necessarily entails a certain amount of complication in loom structure and need for additional power in operation as well as increasing the probability of failure or faulty operation due to the increase in number of moving parts. The present invention is calculated to overcome these existing disadvantages by eliminating the necessity for movable daggers and mechanism for moving them, whereby there is obtained a substantial advance in loom construction and operation, including the hereinabove recited objects of this invention.

Referring to the accompanying drawings, one of the lay legs is denoted by 1 and it is mounted as usual on a rock shaft 2 which has journals (not shown) in the lower part of the loom frame

and is arranged to be oscillated by a pitman 3, which is pinned to the lay leg at 4 and to a crank 5 at 6, which crank is rotated by a motor gear 7 that meshes with a gear 8 which is fixed to the crank.

Fastened to and projecting laterally from the forward side of the leg is a fixed dagger 9 that is positioned to enter an opening or window 10, which is formed in a small dagger stop casing 11 that is secured in any suitable manner, as by bolts (not shown), to an adjacent side member 12 of the loom frame.

The construction of the said casing and its movable elements are set forth in detail and claimed in a pending application filed by Francis J. Sullivan and myself on June 2, 1948, under Serial Number 30,544, now Patent No. 2,499,887, and hence the same will be described herein only to the extent necessary for an understanding of the present invention. The casing is preferably rectangular in cross section and provided across its front portion with a slideway 13 in which is mounted a slidable shutter 14 that is of such size as to be fitted to close the window 10 (see Fig. 2). A depending tail piece 15 is secured to the lower part of the shutter and also, as indicated at 16, to the core of a solenoid 17, which latter is suitably mounted in the lower part of the casing 11. When the solenoid 17 is not energized, the shutter and its tail piece will drop to the position shown in Fig. 1, which leaves the window 10 open, but when the solenoid is energized it will lift the shutter as shown in Fig. 2, causing the latter to close the window 10 and obstruct the passage of the dagger 9 there-through. If desired, the slideway 13 may be provided with one or more stops (not shown) in position to be contacted by the lower part of the shutter 14 when it is in the position shown in Fig. 1 in order to prevent its further downward movement. In practice the construction just described is provided at each side of the loom.

The crank shaft of the loom is denoted by 18, and to it are fixed, as by pins or keys, two cams, one of which is marked 19 and the other 20; cam 19 being provided with a raised portion 21, which extends about half way round the cam, and cam 20 being provided with a radially projecting nose 22. A switch actuator 23 is slidably mounted in a bearing 24 that is fixed in the loom frame in any suitable manner in line with the raised portion 21 of cam 19, and the end of the said actuator extending toward the said cam carries a cam roller 25 which is arranged to travel on the said raised portion 21. A spring switch contact 26 has one end fixed at 27 in a suitable part of the loom frame or a support carried thereby and the said spring switch is normally urged against the actuator 23 so as to hold the cam roller 25 in contact with cam 19. A second switch contact 28, which is preferably stationary, has one end similarly fixed at 29, and the said contact 28 is in position to be closed with contact 26 when the latter is moved toward it.

Another switch actuator 30 is slidably mounted in a bearing 31 which is arranged in the loom frame in line with cam 20, and the end of the actuator extending toward the cam carries a roller 32 that is designed to travel on the periphery of the said cam. Another spring switch contact 33 has one end fixed at 34 in a suitable part of the loom frame or an element carried thereby and the said contact is normally urged against actuator 30 so as to hold roller 32 against

cam 20. A further switch contact 35, which is preferably stationary, like contact 28, has one end mounted at 36 in any suitable way in the loom frame or part carried thereby, and is in position to mate with contact 33.

Turning now to the diagrammatic layout of Fig. 3, switch contact 26, which is governed by cam 19, is connected by wire 37 with a source of direct electric current 38, which may be of a strength of two hundred volts; while contact 28 is connected by a wire 39 at 40 with a pair of resistors 41, 42, each of which may have a capacity of twenty-five thousand ohms. Resistor 41 is connected by a wire 43 with the plate of an electron tube 44, which is illustrated as a shield-grid thyratron tetrode with indirectly heated cathode, and by a wire 45 with a pair of resistors 46, 47, each of which may be of six hundred thousand ohms capacity. Resistor 47 is, in turn, connected by a wire 48 with one end of resistor 42 and with the plate of second electron tube 49 which is similar in type to tube 44.

Resistors 46 and 47 are connected by a wire 50 with switch contact 33 that is governed by cam 20; while contact 35, which mates with contact 33, is connected by a wire 51 with a resistor 52 that may be of one hundred thousand ohms capacity and is, in turn, connected by wire 53 with a source of bias supply 54 that may be of fifteen volts strength. The said source of bias supply is connected through a pair of in series normally closed push button switches 55, 55, one of which is labeled "star" and the other "reverse," with a wire 56 that leads to one end of the pick-up coil 57 of the iron core type that may be of four thousand ohms capacity and is mounted in the lower left hand shuttle box. Said coil has its other end connected with a similar coil 58 that is mounted in the lower right hand shuttle box. Coil 57 is also connected by a wire 59 with a resistor 60 that may be of one million ohms capacity and is grounded at 61; while coil 58 is connected by wire 62 with a resistor 63 that may be of one hundred thousand ohms capacity and is, in turn, connected by a wire 64 with the control grid of tube 49. Wire 56 also extends to a pick-up coil 65 that is carried by the upper left hand shuttle box and is connected with another coil 66, which is carried by the upper right hand shuttle box, said coils 65 and 66 being similar to coils 57 and 58, and coil 66 being connected by wire 67 with a resistor 68 which may be of one hundred thousand ohms capacity and is connected by a wire 69 with the control grid of tube 44. The shield grid of tube 44 is connected by a wire 70 with ground at 71, and the shield grid of tube 49 is connected by a wire 72 with ground at 73.

Switch contact 35 is also connected through resistor 74, which may be of one hundred thousand ohms capacity, with the control grid of an electron tube 75, which is illustrated as of a type similar to tubes 44 and 49; while the shield grid of the said tube is connected by a wire 76 with ground at 77. A wire 78 extends from the plate of tube 75 to relay 79, which is also connected by a wire 80 with wire 39.

Associated with the relay 79 is a control switch 81 that cooperates with contacts 82 and 83; and contact 82 is connected by wires 84, 85, with two solenoids 86, 87, which are located in casings 88, as described in connection with the showing of Figs. 1 and 2; said solenoids being in turn connected by wires 86, 87, with one terminal 89, of a source of alternating electric current that may be of two hundred twenty volts strength. Switch

81 is connected by a wire 89 with the other terminal 90 of the said current source, while contact 83 is connected by a wire 91 with the motor holding coil indicated at 92.

Figs. 4 to 8 of the drawings show the shuttle 5 and shuttle box arrangement whereby the activity of the pick-up coils 57, 58, 65 and 66 is governed by the proper entry of the shuttles into their boxes or their failure to do so.

An upper shuttle is denoted generally by 93 and a lower shuttle by 94. They may be of any standard or approved form or type, except that a magnet 95, having a north pole 96 and a south pole 97, is suitably fixed in each shuttle; the one in the upper shuttle being exposed at the top and the one in the lower shuttle being exposed at the bottom thereof, as indicated by dotted lines in Fig. 5, with the axes of their poles substantially parallel with the longitudinal axes of the shuttles.

A shuttle box, which may be of any appropriate construction, is marked 98 and has the usual slot 99 in its back wall within which the picker stick 100 carrying the picker 101 reciprocates, as well as an adjustable shuttle guide 102 and an adjustable shuttle brake 103. As previously mentioned in describing the showing of Fig. 3, each shuttle box is provided with a pick-up coil and, for present purposes, it may be assumed that the shuttle box shown in Figs. 7 and 8 is the one positioned at the upper left hand side of the loom, so that its coil is denoted by 65, which was the reference numeral applied to the coil carried by the said box in the disclosure of Fig. 3. The said coil 65 is mounted in a bracket 104 that is suitably fastened to the top of the back of the shuttle box; the coil being at such a height as to permit the shuttle and picker to pass thereunder with a small clearance and the location of the coil with respect to the width of the box being such that it will be substantially in vertical alignment with the magnet 95 carried by the shuttle when the shuttle enters the box, so that the passage of the magnet carried by the shuttle beneath the coil, with the poles of the magnet successively coming into reactive range therewith, will generate an electric pulse of substantial strength and activate the coil to cause it to function as will be hereinafter described. It will be understood, of course, that a loom of the double shuttle or pile type will have four shuttle boxes provided with coils like the one just described, as has been indicated in the description of the showing of Fig. 3 and as is shown in Fig. 6, and that there will be two shuttles provided with magnets like the one just described, as shown in Figs. 4 and 5, one alternately entering the two lower boxes and the other alternately entering the two upper boxes; while in the case of a single shuttle loom there will be two such shuttle boxes and one such shuttle.

Referring now to the operation of this invention, the switch composed of the contacts 26 and 28, which is governed by cam 19 and is supplied from a source of direct current 38 of two hundred volts strength, is timed to close immediately after picker stick 100 has started shuttle 93 on its flight and while the lay mechanism is at the end of its rearward stroke, as shown in broken lines in Fig. 1. If the loom shuttles are operating correctly so as properly to enter their boxes, the passage of their magnets past the box coils will generate sharp positive electric pulses in the latter which will overcome the negative grid bias that is being fed through the coils from the source 54. This will fire tubes 44 and 49 and cause a drop in their plate potentials from plus two hun-

dred volts, derived from current source 38, to approximately plus 10 volts, with a corresponding voltage existing at the junction A of wire 50 with resistors 46 and 47, at the junction B of wire 45 with resistor 46 and at the junction C of wire 48 with resistor 47. The switch composed of the contacts 33 and 35, which is governed by cam 20, is timed to close when the lay mechanism is on its forward stroke and the fixed dagger 9, and its mate at the opposite side of the loom, are a short distance (e.g. about one inch) from the window 10 in casing 11 and its mate at the opposite side of the loom. This closing of switch contacts 33, 35, will connect junction A with the control grid of tube 75, which is fed by the bias supply from source 54 through one hundred thousand ohms resistor 74 and, as junction A has at that time a plus ten volts potential which is fed to it through the six hundred thousand ohms resistors 46 and 47, the connection of A to the control grid of tube 75 will reduce the grid bias of the said tube to minus ten volts, which is not sufficient to fire the said tube that requires a minus four volts potential to fire it. Consequently, the relay 79 will not be energized by tube 75; the control switch 81 associated therewith will remain closed with contact 83 so that the motor will continue in operation; the solenoids 17, 17 will not be energized, and the shutter 14, and its mate at the opposite side of the loom, will not be elevated to close the window 10 and its mate at the opposite side of the loom so that the dagger 9, and its mate at the opposite side of the loom, can freely enter the said windows, thus permitting a full forward stroke of the lay mechanism. At the moment the lay mechanism reaches the limit of its forward stroke, cams 19 and 20 permit their switch contacts to open, and the tubes 44, 49 and 75, together with the circuits and elements associated therewith, are reset to the condition which existed before switch 26, 28, was closed by cam 19, as mentioned at the outset of this description of the operation.

Suppose, now, that both shuttles fail properly to enter their boxes. In this condition the pick-up coils carried by the boxes will not receive electric pulses due to the passage of the shuttle magnets thereby and the tubes 44 and 49 will not be fired as heretofore described in connection with the proper entry of both shuttles into their boxes. Consequently, junctions A, B and C will remain at a potential of plus two hundred volts, which is sufficient to overcome the minus fifteen volts bias supply being fed to tube 75 from source 54 when contact is made between said junctions A, B and C and tube 75 by the closing of switch contacts 33, 35. This will fire tube 75, energize relay 79, move switch 81 from contact 83 to contact 82; thus opening the holding motor contact coil circuit to stop the motor, and energize solenoids 17, 17, which elevate shutter 14 and its mate to close the window 10 and its mate, arrest forward movement of the dagger 9 and its mate by contact with the shutters and thus prevent the lay from completing its forward movement and injuring the faulty shuttles and/or the yarn being woven.

The same result will obtain if either shuttle fails properly to enter its box, because the failure of a shuttle to energize coil 65 or 66 will leave tube 44 unfired and junction A will have a potential of plus ninety-five volts, junction B plus ten volts and junction C plus two hundred volts. As plus ninety-five volts at junction A is sufficient to overcome the minus fifteen volts grid bias of

tube 75, the latter will be fired with the effect already described. Likewise, the failure of a shuttle to energize coil 57 or 58 will leave tube 49 unfired and junction A will have a potential of plus ninety-five volts, junction B plus two hundred volts and junction C plus ten volts; with the potential at junction A again operating in the same way.

It should be noted that, as is well understood by those skilled in this industry and as is illustrated in Fig. 6, which shows four shuttle boxes 98, 105, 106 and 107, carried by lay 108, one shuttle box of a pair on the same level is generally much longer than the opposite one so that, when upper shuttle 93 is sent on its return flight from box 98, it will enter the longer box 105 at the opposite side of the loom and its magnet 95 will pass under the coil 66 carried by the longer box to energize said coil in spite of the fact that the magnet is mounted at the end of the shuttle which is last to enter said longer box. This is further assured by mounting the coil 66 near the inner end of box 105. The same is true with respect to the lower boxes 106, 107, except that the positions of the long and short boxes are reversed and the coils 57 and 58 are mounted at the bottom of the boxes so that the shuttle 94 with its magnet 95 exposed on its under surface rides over the said coils to energize them.

The push button switches 55, 55, are provided for the purpose of re-starting the loom and re-setting the control system following a stoppage due to shuttle failure. The switch marked "start" is connected in any well known or approved manner (not shown) to the current supply for the loom motor so that, when its button is pressed, three phase power is applied to cause the loom to be driven in the forward or normal direction; while the switch marked "reverse" is so connected to the said current supply that, when its button is pressed, two phases are interchanged and the motor is reversed to drive the loom backwardly. Additionally, the pressing of the button of either switch 55 will cause tubes 44 and 49 to fire by cutting off their bias supply from source 54. As the shuttles are motionless at the beginning of loom operation, they will not energize the shuttle box coils and there would be an immediate stoppage of the loom following its start. This is prevented by the functioning of the "start" switch 55 which cuts off the bias supply to tubes 44 and 49. A similar situation arises following loom stoppage or "bang off" due to shuttle failure as hereinbefore described; and this situation is remedied by pressing the button of "reverse" switch 55 which has the same effect on the system as pressing the button of "start" switch 55. Furthermore, the operation of either switch 55 will open switch 26, 28 and extinguish tube 75 by cutting the current from source 38; thereby deenergizing relay 79 and solenoids 17, 17, which permits the shutter to drop and allows full lay motion. Thus the operator, by manipulating the switches 55, 55, can assure proper starting and re-starting of the loom and proper setting and re-setting of the control system.

From the foregoing description it will be seen that the invention accomplishes the objects hereinabove recited, as well as others inherent in it; and that it is applicable to standard and well known types of looms without requiring any fundamental change in the construction or arrangement of their parts although permitting simplification by the elimination of certain auxiliary parts, especially those related to actuation of movable daggers. It will also be evident that

the invention is susceptible to variations in its embodiment and that changes may be resorted to in the form, construction, material and arrangement of the parts without departing from the spirit or scope of the invention. Hence, I do not intend to be limited to details herein shown or described except as they may be included in the claims or be required by disclosures of the prior art.

What I claim is:

1. A loom comprising, a frame, a shuttle box at each side thereof, a picking mechanism for driving a shuttle to and from the boxes, lay mechanism, and electronic means for stopping the loom and arresting the lay mechanism when the lay has partly completed a forward stroke, said electronic means being controlled by cooperative electric and magnetic elements.

2. A loom comprising, a frame, a shuttle box at each side thereof, picking mechanism for driving a shuttle to and from the boxes, lay mechanism, and electronic means for stopping the loom and arresting the lay mechanism when the lay has partly completed a forward stroke, said electronic means being controlled by cooperative electric and magnetic elements carried by the shuttle boxes and the shuttle operating in connection therewith.

3. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including an element carried by a shuttle box and an element carried by a shuttle, one of said elements being electric and the other magnetic, the one being subject to energization when in proximity to the other.

4. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including an element carried by a shuttle box and an element carried by a shuttle, one of said elements being electric and the other magnetic, said electric element being subject to energization when in proximity to said magnetic element.

5. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including an electric element carried by a shuttle box and a magnetic element carried by a shuttle, said electric element being subject to energization by said magnetic element when the shuttle enters the box.

6. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including a pick-up coil carried by a shuttle box and a magnet carried by a shuttle, said coil being subject to energization by said magnet when the shuttle enters the box.

7. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including a pick-up coil carried by a shuttle box and a magnet carried by a shuttle with the axes of the poles of the magnet substantially parallel to the longitudinal axis of the shuttle, said coil being subject to energization by said magnet when the poles of the latter sequentially pass the coil as the shuttle enters the box.

8. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including an element carried by a shuttle box and an element carried by a shuttle, one of said elements

being electric and the other magnetic, the one being subject to energization when in proximity to the other, an electric motor for operating the loom, a control switch for the motor current, a movable lay arresting device, and an electronic system arranged to activate said control switch and arresting device, said system being governed by the said element which is subject to energization.

9. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including an element carried by a shuttle box and an element carried by a shuttle, one of said elements being electric and the other magnetic, the one being subject to energization when in proximity to the other, an electric motor for operating the loom, a control switch for the motor current, a movable lay arresting device, and an electronic system arranged to activate said control switch and arresting device, said system being governed by the said electric element.

10. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including an electric element carried by a shuttle box and a magnetic element carried by a shuttle, said electric element being subject to energization by said magnetic element when the shuttle enters the box, an electric motor for operating the loom, a control switch for the motor current, a movable lay arresting device, and an electronic system arranged to activate said control switch and arresting device, said system being governed by the energization of said electric element.

11. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including an element carried by a shuttle box and an element carried by a shuttle, one of said elements being electric and the other magnetic, the one being subject to energization when in proximity to the other, an electric motor for operating the loom, a control switch for the motor current, a movable lay arresting device, and an electronic system arranged to activate said control switch and arresting device, said system embodying an electron tube in operative association with the shuttle box and arranged to be fired when said element that is subject to energization is energized.

12. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including an element carried by a shuttle box and an element carried by a shuttle, one of said elements being electric and the other magnetic, the one being subject to energization when in proximity to the other, an electric motor for operating the loom, a control switch for the motor current, a movable lay arresting device, and an electronic system arranged to activate said control switch and arresting device, said system embodying an electron tube in operative association with the shuttle box and arranged to be fired when said element that is subject to energization is energized, and an additional electron tube in operative association with said control switch and arresting device, said additional tube being arranged to be fired when the other tube fails to be fired.

13. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including a kind of element carried by each shuttle box and another kind of element carried by the

shuttle which operates in and out of the boxes, one kind of said elements being electric and the other kind magnetic, the one kind being subject to energization when in proximity to the other, an electric motor for operating the loom, a control switch for the motor current, a movable lay arresting device, and an electronic system arranged to activate said control switch and arresting device, said system embodying an electron tube in operative association with each shuttle box and arranged to be fired when a said element that is subject to energization is energized, and an additional electron tube in operative association with said control switch and arresting device, said additional tube being arranged to be fired when either of the other tubes fails to be fired.

14. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including an electric element carried by each shuttle box and a magnetic element carried by the shuttle which operates in and out of the boxes, each said electric element being subject to energization by said magnetic element when the shuttle enters its box, an electric motor for operating the loom, a control switch for the motor current, a movable lay arresting device, and an electronic system arranged to activate said control switch and arresting device, said system embodying an electron tube in operative association with each said electric element carried by the shuttle boxes and arranged to be fired when said electric element is energized, and an additional electron tube in operative association with said control switch and arresting device, said additional tube being arranged to be fired when either of the other tubes fails to be fired.

15. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including a pick-up coil carried by each shuttle box and a magnet carried by the shuttle which operates in and out of the boxes, each said coil being subject to energization by said magnet when the shuttle enters its box, an electric motor for operating the loom, a control switch for the motor current, a movable lay arresting device, and an electronic system arranged to activate said control switch and arresting device, said system embodying an electron tube in operative association with each said coil carried by the shuttle boxes and arranged to be fired when said coil is energized, and an additional electron tube in operative association with said control switch and arresting device, said additional tube being arranged to be fired when either of the other tubes fails to be fired.

16. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including an element carried by a shuttle box and an element carried by a shuttle, one of said elements being electric and the other magnetic, the one being subject to energization when in proximity to the other, an electric motor for operating the loom, a control switch for the motor current, a movable lay arresting device, and an electronic system arranged to activate said control switch and arresting device, said system embodying an electron tube in operative association with the shuttle box and arranged to be fired when said element that is subject to energization is energized, an additional electron tube in operative association with said control

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switch and arresting device, said additional tube being arranged to be fired when the other tube fails to be fired, and means for resetting the said system following loom stoppage by extinguishing said additional tube and firing said first named tube.

17. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including a kind of element carried by each shuttle box and another kind of element carried by the shuttle which operates in and out of the boxes, one kind of said elements being electric and the other kind magnetic, the one kind being subject to energization when in proximity to the other, an electric motor for operating the loom, a control switch for the motor current, a movable lay arresting device, and an electronic system arranged to activate said control switch and arresting device, said system embodying an electron tube in operative association with each shuttle box and arranged to be fired when a said element that is subject to energization is energized, an additional electron tube in operative association with said control switch and arresting device, said additional tube being arranged to be fired when either of the other tubes fails to be fired, and means for resetting the said system following loom stoppage by extinguishing said additional tube and firing said first named tubes.

18. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including an electric element carried by each shuttle box and a magnetic element carried by the shuttle which operates in and out of the boxes, each said electric element being subject to energization by said magnetic element when the shuttle enters its box, an electric motor for operating the loom, a control switch for the motor current, a movable lay arresting device, and an electronic system arranged to activate said control switch and arresting device, said system embodying an electron tube in operative association with each said electric element carried by the shuttle boxes and arranged to be fired when said electric element is energized, an additional electron tube in operative association with

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said control switch and arresting device, said additional tube being arranged to be fired when either of the other tubes fails to be fired, and means for resetting the said system following loom stoppage by extinguishing said additional tube and firing said first named tubes.

19. In a loom, means for stopping the loom and arresting the forward lay motion when a shuttle fails properly to enter its box, said means including a pick-up coil carried by each shuttle box and a magnet carried by the shuttle which operates in and out of the boxes, each said coil being subject to energization by said magnet when the shuttle enters its box, an electric motor for operating the loom, a control switch for the motor current, a movable lay arresting device, and an electronic system arranged to activate said control switch and arresting device, said system embodying an electron tube in operative association with each said coil carried by the shuttle boxes and arranged to be fired when said coil is energized, an additional electron tube in operative association with said control switch and arresting device, said additional tube being arranged to be fired when either of the other tubes fails to be fired, and means for resetting the said system following loom stoppage by extinguishing said additional tube and firing said first named tubes.

20. In a loom lay and shuttle therefor for a loom dependent for continued operation upon impressing an electric impulse on an electronic circuit, an electric impulse generating unit carried by the lay and magnetic means carried by the shuttle effective when passing said unit to generate an electric impulse.

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