

W. S. MORSE.

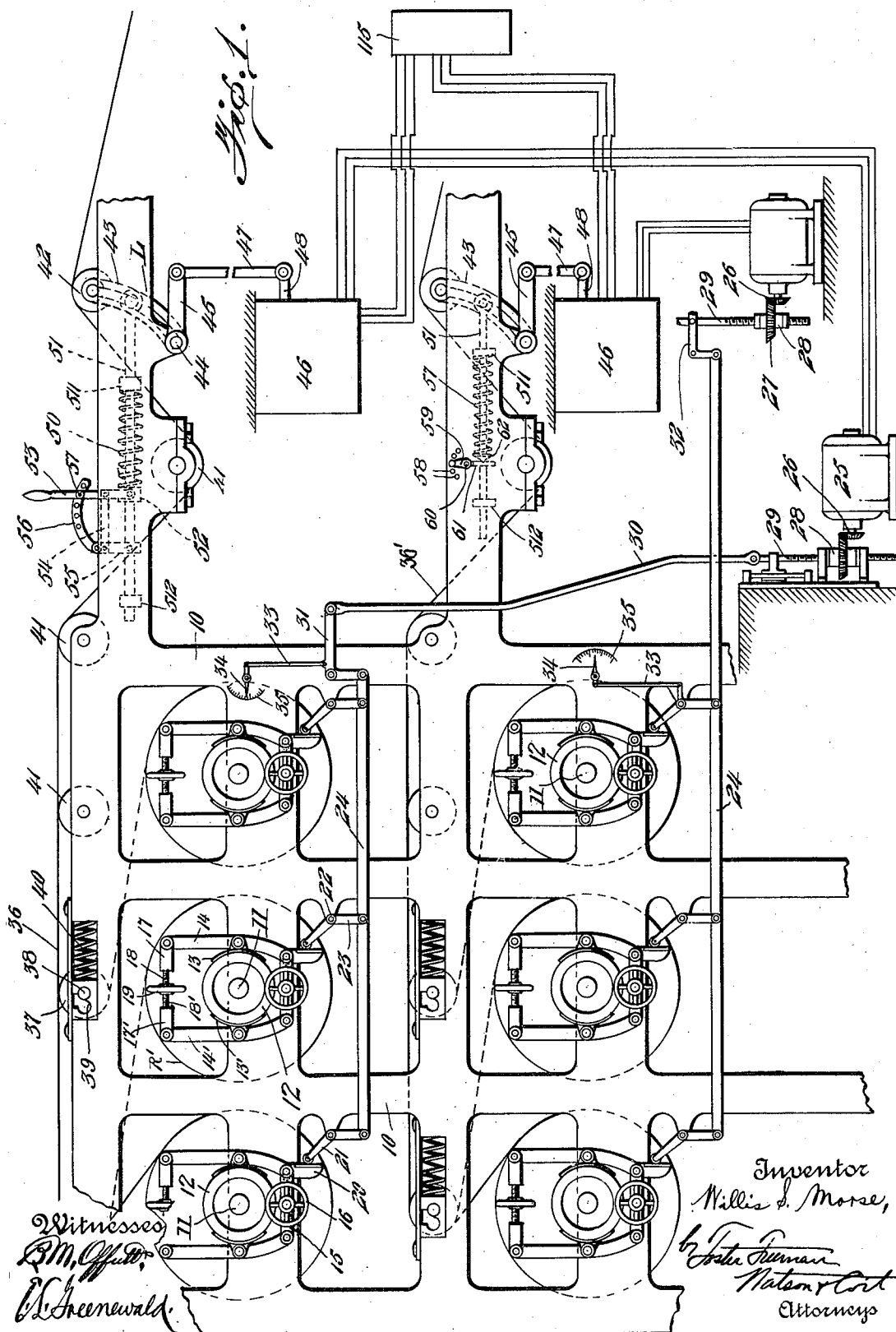
TENSION REGULATING MECHANISM FOR PRINTING PRESSES AND THE LIKE.

APPLICATION FILED JAN. 12, 1914.

1,170,840.

Patented Feb. 8, 1916.

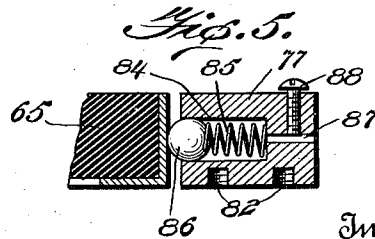
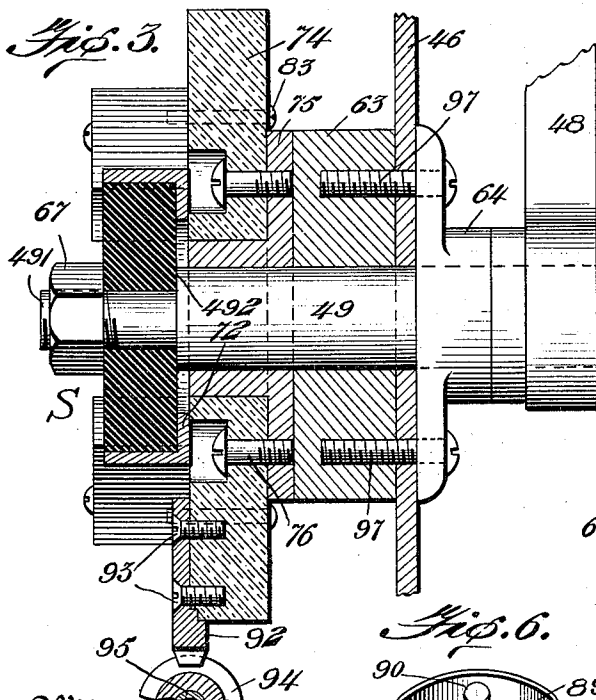
3 SHEETS—SHEET 1.



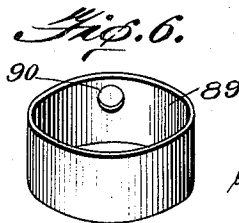
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3 SHEETS—SHEET 2.



Witnesses
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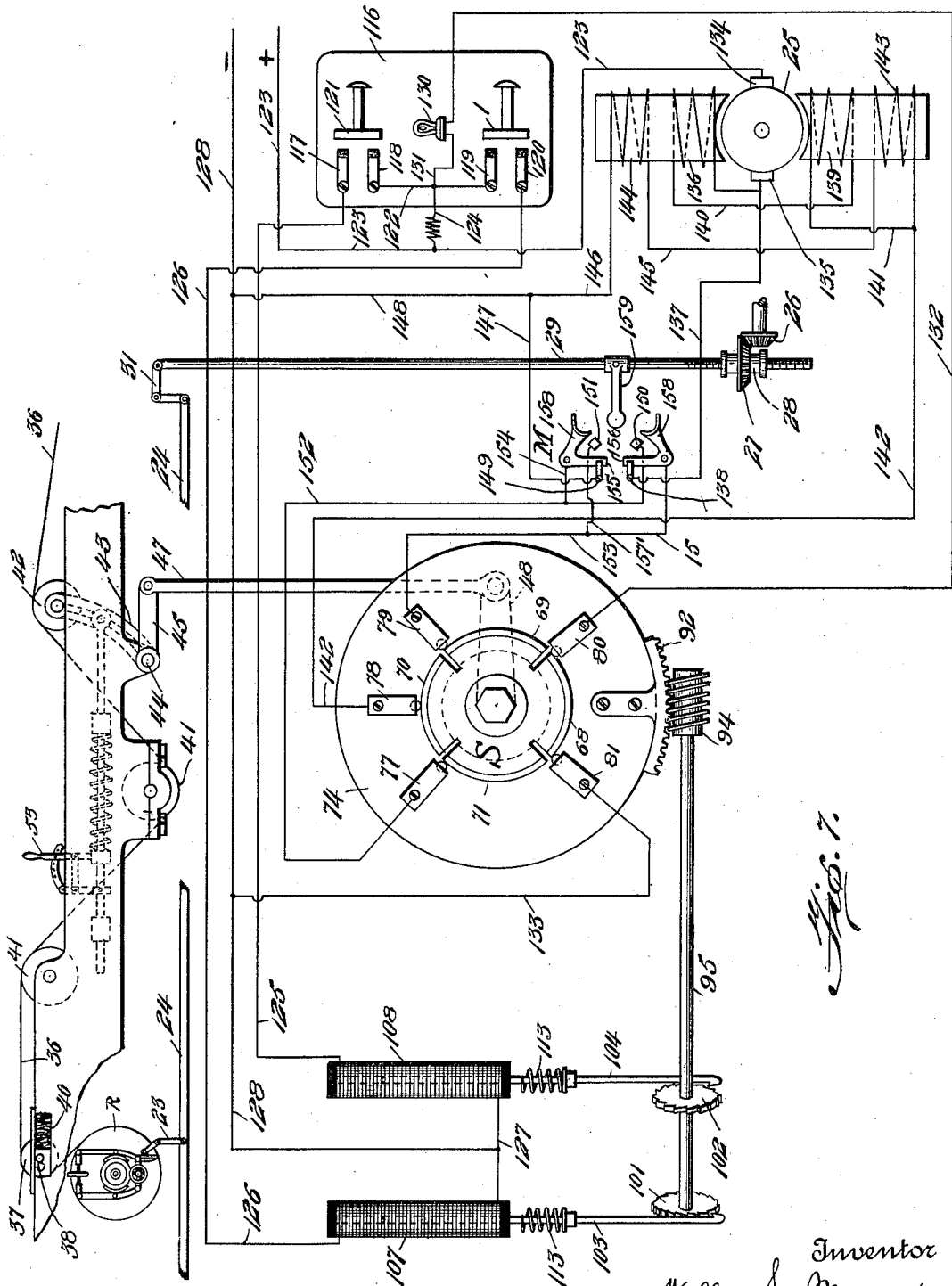


Fig. 7.

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UNITED STATES PATENT OFFICE.

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TENSION-REGULATING MECHANISM FOR PRINTING-PRESSES AND THE LIKE.

1,170,840.

Specification of Letters Patent.

Patented Feb. 8, 1916.

Application filed January 12, 1914. Serial No. 811,695.

To all whom it may concern:

Be it known that I, WILLIS S. MORSE, a citizen of the United States, residing at Philadelphia, Pennsylvania, have invented certain new and useful Improvements in Tension-Regulating Mechanism for Printing-Presses and the like, of which the following is a specification.

This invention relates to improvements in printing presses, and more particularly to mechanism for automatically regulating the tension on a paper web as it is delivered to the printing couples or other mechanisms associated with the press.

One of the objects of the invention is to provide an efficient mechanism which will positively and automatically regulate the tension of the web and effect the necessary changes of the retarding force exerted on the roll of paper from which the web is fed, thereby maintaining a predetermined tension on the web.

In carrying out the invention a single mechanism has been devised which is associated with a series of shafts carrying rolls of paper so that the said mechanism may in succession automatically regulate the tension of the web delivered from each of the series of rolls.

It is to be understood that one tension regulating mechanism operates on only one web at a time and it may be applied to a single roll and later when the roll has been exhausted and replaced by a full roll, the mechanism is adapted to control the web delivered from the new roll. However, in order to reduce the interval of time necessary to renew the roll of paper, it is more recent practice to support a series of rolls of paper in suitable bearings at one end of the press before the run is started. Then when the paper on one roll becomes nearly exhausted, it requires a much smaller interval of time to splice the end of the new roll of paper to the end of the old web than it does to remove the roll shaft which carries the nearly exhausted roll, replace the same with a full roll and perform the beforementioned splicing operation. The tension of the web delivered by the active roll is continuously regulated until the roll becomes nearly exhausted whereupon the press

is stopped and the tension control disassociated and connected to one of the formerly inactive rolls by a simple manual operation to be described. Should the web break while the press is running, the mechanism which operates in response to changes in the web tension acts as a safety device and immediately sets the brake on the web supply roll to stop the latter and prevent further unwinding of the paper.

A further object of the invention is to provide a mechanism for simultaneously regulating the tension of webs supplied from rolls on separate decks of the press and so arrange the mechanism that it may be automatically controlled by the tension of the paper webs and additionally subject to control from any desirable position about the press. Both the automatic and additional manual control are preferably electrically effected. In order that the operator at the forward or delivery end of the press may have complete charge of varying the tension to relieve conditions not taken care of by the automatic regulating mechanism, a suitable device is mounted at the delivery end of the press so that by a simple operation, for instance, by the depression of a button, he may vary the retarding force exerted on the paper roll shaft. By means of the herein described novel electric switch, a part of which operates in response to the variations in the tension of the web and a part of which operates in response to the operation of said device or depression of said button, it is possible to effect the operation of the electric motor driving means associated with the tension regulating mechanism.

The above and other objects and novel features of the invention will be apparent from the following description, taken in connection with the drawings, in which,—

Figure 1 is a side elevation of so much of a printing press as is necessary to show the application of my invention thereto, certain features of the invention being diagrammatically indicated; Fig. 2 is a front elevation of the box containing the electric switch or motor controller, the cover being removed to show the arrangement of the devices on the interior of the box; Fig. 3 is a vertical cross section along the line 3—3 of Fig. 2,

showing parts of the rear of the box in side elevation; Fig. 4 is a perspective view of the bridging device or switch member of the controller; Fig. 5 is a sectional view of a terminal block used on the motor controller, showing the arrangement of the steel ball contacts therein, and also showing part of the switch member in contact with said ball. Fig. 6 is a perspective view of a device for assembling the spring supported steel ball contacts in the terminal blocks, and Fig. 7 is a view showing parts of the press, and diagrammatically indicating the electric motor, circuit switches, etc., associated with the tension regulating mechanism.

Referring to the drawing, 10 designates the frame of a double deck printing press; however, it is to be understood that the invention herein described may be applied to a press comprising any desired number of decks and any number of paper roll supporting shafts mounted thereon. To illustrate the invention, I have shown a series of three rolls mounted in suitable bearings on the upper deck and a similar number on the lower deck. Each of the roll spindles or shafts 11 carries a roll of paper R, and, as shown, the shafts 11 with their associated brake or retarding devices are substantially similar in construction, so it will only be necessary to describe one of them.

Fixed to the end of the shaft 11 in any suitable manner is a grooved brake wheel 12. The face of the brake wheel 12 may be of any other desirable shape. A pair of brake shoes 13, 13' are provided with faces to fit the groove in the brake wheel 12 and are pivotally supported on diametrically opposite sides of said wheel by means of the levers 14, 14'. Each of the said levers has one arm pivotally connected to a bar 15, pivoted on the spindle 16, which latter is mounted in the frame 10. The tubular members 17, 17' are pivotally connected to the other arms of the levers 14, 14', respectively. The said tubular members 17, 17' are interiorly threaded to receive the right and left hand threads respectively, on the screws 18, 18' fixed to the opposite sides of the hand wheel 19, so that when the parts are assembled and the hand wheel 19 is rotated in one direction, the ends of the levers will be drawn together and exert a greater braking effect, while if the hand wheel is rotated in the opposite direction the retarding force will be decreased.

The end of the bar 15 which is connected to the lever 14 is slotted to receive a connecting pin or pivot so that this end of the lever is free to move a limited extent relatively to said bar. The said lever 14 is extended downward beyond its pivotal connection to the bar 15 to form a heel or abutment 20. The arm 21 of a lever pivoted on the frame 10 is mounted so that it may en-

gage the heel 20 and cause the lever 14 to swing about its pivotal connection with the tubular member 17 as a fulcrum for the purpose of varying the pressure of the brake shoes on the grooved wheel 12.

To vary the tension of the web fed from the separate rolls each one of the brake mechanisms includes a bell crank lever pivoted on the frame at 22, the arm 21 comprising one of the members of the bell crank lever, while the arm 23 comprises the other member. The arms 21 on a single deck are pivotally connected together by a common link 24 so that any one of the brake mechanisms against which the arms 21 engage, may be operated by an electric motor 25. An electric motor 25 separate from the press motor is provided for actuating each of the links 24. An electric motor is used because it is more convenient, but it is to be understood that any other suitable driving means may be substituted therefor.

Each motor is preferably mounted in the pit below the press, and the shaft of the motor carries a beveled pinion 26 which meshes with a suitably supported beveled gear 27 having an internally threaded hub 28 to receive the threaded portion of the rod 29. It will be apparent that the rotation of the motor shaft which drives the gear 27 will cause the rod 29 to move in one direction or the other, that is, raising or lowering the same, depending upon the direction or rotation of the motor. The raising or lowering of the rod 29 serves to increase or decrease the retarding force applied to the brake mechanism, the rod 29 being connected to the link 24 by suitable levers and rods—as shown. The rod 29, driven by the motor for the upper deck is connected by means of a link 30 and lever 31 to the link 24, whereas the rod 29, driven by the motor for the lower deck is connected directly to the link 24 by a lever 32.

In order that the pressman may know at a glance that the tension regulating mechanism is operating properly, an indicating device is provided for each of the decks, that is, for each one of the separate controlling mechanisms. The indicating mechanism comprises a rod 33 connected to a part of the linkage which actuates the braking mechanism. For the upper deck the link 33 has one end thereof connected to the lever 31, and its other end is pivotally connected to one end of a pointer 34 pivoted on the frame and movable over a dial 35 also on the frame. The rod 33 on the lower deck is connected to one of the pivoted levers for operating the brake mechanism, and also has pivotally attached thereto the pointer 34 movable over the dial 35 on the frame. It will be understood that the indicating device may be connected to any suitable part of the mechanism which regulates the ten-

sion and will show at a glance what braking force is being applied to the brake shoes. The web 36 drawn from an active roll passes around the compensating roll 37, the shaft 38 of which is mounted in a bearing 39 on each side of the frame, the bearings 39 being each supported by a spring 40 so that the roll may yield in either end in the direction the web is moving. Beyond the compensating roll 37, the web passes over a series of guide rolls 41 which are rotatably supported in the opposite sides of the frame 10. The web 36 from the series of rolls on the upper deck feeds to one set of printing couples, whereas the web 36' feeds to a separate set, both operating simultaneously and finally feeding to a common cutting and folding mechanism from which they are delivered in single newspapers, as is well known.

Beyond the compensating roll 37 and guide rollers 41, and just before the web reaches the printing couples, it also passes over a roller 42, rotatably supported in the ends of the arms 43 of double armed or bell crank levers L pivoted in bearings 44 at opposite sides of the frame. The roller 42 which bears against the paper web is so supported that it is sensitive and will move in response to variations in the tension of the web, causing the arms 45 of the bell crank lever L to operate the governing devices in the box 46 which control the operation of the electric motor 25. The levers L are so connected as to move together and are held in a predetermined position by means of a spiral spring 50 which surrounds the rod 51, which latter is pivotally connected to the arm 43 of one of the bell crank levers. The rod 51 is supported in the guides 511 and 512 on a side member of the frame, the spring 50 bearing against the guide member 511, while the other end of the spring is held in adjusted position by means of a slidable collar 52 which is pivotally supported at the end of a handle 53. The adjustment of the collar 52 along the rod 51 is effected by means of the handle 53 which is pivotally supported in a bar 54 pivoted on the arm 55 which latter is rigidly keyed to the rod 51. The outer end of the arm 55 carries a pivoted member 56 which has a series of holes drilled there-through to receive the end of a spring pin 57 carried by the bar 53. It will thus be obvious that a suitable adjustment of the spring may readily be effected while the press is in operation, it simply being necessary to withdraw the pin 57 from one of the holes and move the handle 53 about its pivot on the bar 54 to another notch in the member 56, the latter extending through a slot in the handle 53 whereby the handle may be locked to any adjustable position.

In the spring adjusting device described

above, the entire adjusting leverage is supported on the rod 51. On the deck below a slightly different form of spring adjusting device is shown where a series of holes 58 is drilled in an arc in the frame 10 and a lever arm 59 connected to a rock shaft 60 extending through the frame carries a bar 61 at its inner end. The rod 51 pivoted to the arm 43 extends through the guide 512, as on the deck above, and a spring 57 encircles the said rod and bears at one end against the collar 511 on the rod. The other end of the spring bears against a collar 62 which is loose on the rod 51 and is movable along the rod to any one of a series of adjusted positions by means of the arm 61 which engages the collar and fits around the rod 51.

The arm 45 of the lever L is connected to the control device within the box 46 by means of a link 47 which latter is pivotally connected to said arm 45. The other end of the link 47 is pivoted to a crank arm 48 keyed to a stub shaft 49 which extends through an opening in the rear wall of the box 46. Concentric brass bearing blocks 63 and 64, secured at the inside and outside of the opening in the rear wall of the box 46 serve to form a suitable bearing for the stub shaft 49, which is provided with a reduced and threaded section 491 at its outer end to carry the switch member S of the motor controller.

As shown in Figs. 2 to 5 inclusive the switch member S comprises a fiber disk 65 which has a central opening 66 to fit the reduced end 491, and when secured in place the fiber disk abuts against the shoulder 492 formed at the juncture of the shaft 49 and reduced portion 491. A nut 67 fits the threaded portion of the reduced section 491 and secures the disk 65 to the shaft 49 so that it will move therewith. The fiber disk 65 is provided with a series of bridging members 68, 69, 70 and 71 in the form of a rim on the periphery of the disk. The rim is applied as a continuous piece and is provided with an inwardly projecting flange 72 which receives the securing screws 73 by means of which the rim is secured to the disk 65. After the rim has been applied to the disk the same is formed into four equal separate bridging members by means of saw cuts 74 extending through the rim and disk at the edge, and which cuts are filled with sheets of mica or other suitable insulating material so as to completely insulate the four bridging members from one another. The device, as shown in perspective in Fig. 4, forms a four part switch which is inexpensive to make and may be readily turned down when the parts are worn or renewed when necessary, it being merely necessary to remove the nut 67 and draw the switch member off the stub shaft.

Between the bearing block 63 and the

switch member S there is a slate disk or plate 74 which is loosely supported on the stub shaft 49. A flanged hub member 75 fits the shaft and forms a bearing for the slate base 74 which is concentrically secured to the flange of the hub 75 by means of the screws 76. A series of five terminal blocks 77, 78, 79, 80 and 81 are secured to the outer faces of the base 74, and their inner faces are mounted on the circumference of a circle which is somewhat greater in diameter than the diameter of the switch member S. The terminal blocks are of a novel construction and are substantially similar to one another, the terminal block 77 being shown in detail in Fig. 5. Each terminal block has threaded recesses 82 to receive the ends of screws 83 by means of which the blocks are rigidly attached to the slate base 74. Opening at the inner face of the block there is a cavity 84, the bottom of which forms a seat for the spiral spring 85, the mouth of the cavity being closed by a steel contact ball 86 which is sustained by the spring 85, the latter bearing against the inner side of the ball and tending to force the same out of the cavity. The inner faces of the blocks being mounted on the circumference of a circle which is of slightly greater diameter than the switch S, the balls will be held in a slightly projected position and in contact with the switch members or bridging parts on the switch S. There is an opening 87 at the rear of the terminal block to receive a circuit wire, the latter being secured to the block by means of a binding screw 88. As the ball 86 engages the walls of the cavity and the spring 85 also rests against the ball and the bottom of the cavity, there is a suitable electrical connection between the contact ball and the block.

In order to readily assemble the balls in the cavities of the terminal blocks, the novel device shown in perspective in Fig. 6 has been provided. It comprises a cylindrical shell 89, provided with a single opening 90 in its side walls and positioned so as to register with the mouth of each of the cavities when the shell is fitted against the face of the slate base 74 and between the terminal blocks thereon. The shell 89 is of slightly smaller diameter than the circle upon which the blocks are mounted and of a greater diameter than the switch member S. When inserting the balls in the cavities 84, the opening 90 in the side wall of the shell 89 is brought into register with the mouth of the cavity, and the spring 85 is inserted through the opening 90. Then the ball is passed into the cavity and pressed back so that the shell 89 may be rotated until the opening 90 comes into register with the mouth of the cavity in the next block. The spring and ball are inserted into this cavity and pressed so as to allow the move-

ment of the shell until its opening registers with the mouth of the next cavity. This operation is repeated until the springs and the contact balls supported thereon are fitted into all of the cavities. The switch member is then passed into the shell and secured to the shaft 49, the flanged end of the switch member being placed innermost. The shell 89 may then be withdrawn, whereupon the balls in the cavities will be released so that they may bear against the switch elements on the switch member.

The terminal blocks are arranged on the slate base in such a relation to the switch member S or vice versa the switch member S is so positioned with relation to the terminal blocks that when the tension of the web is at a predetermined amount, the lever systems and the motor operating the tension or take-off devices are idle or inoperative. In such a position, the ball mounted on the contact block 78 bears on the switch member 70, but is not in electrical connection with either of the contact balls 77 or 79. The contact balls on the blocks 77 and 79 rest at or near the edge of the switch members 71 and 69 respectively, so that the movement of the base 74 in a clock-wise direction will move the blocks relatively to the commutator so that the blocks 78 and 79 will be electrically connected by the switch element 70, whereas a movement of the base 74 in the opposite direction electrically connects the blocks 78 and 77. The movement of the slate base 74 in either direction thus effects connections to operate the motor in one direction or another, whereas a reverse movement of the switch member S by the movable member which bears against the web will effect the same connections and produce the same results.

The terminal blocks 80 and 81 are normally electrically connected by the switch member 68, the ball contacts of the said blocks bearing on the switch elements 68 at or near its opposite ends so that any movement in either direction immediately breaks the circuit between the blocks 80 and 81.

The base 74 which carries the terminal blocks may, of course, be supported so that it will be stationary at all times, but so far as the operation of the motor by the movable member bearing against the web is concerned, its function will be complete and the motor will remain stationary or run in one direction or another, depending entirely upon the tension of the web. However, under certain conditions it is desirable to provide means whereby the motor may be caused to rotate in one direction or another, independently of the variations in the tension of the web. In order to carry out this feature of the invention, a novel mechanism has been provided for holding the slate base

74 stationary or moving it in either direction about the shaft 49 on which it is loosely pivoted.

A short curved rack 92 is secured to the rim of the slate base 74 by means of screws 93 which pass through an arm integral with the rack. A worm 94 keyed to the spindle 95 meshes with the teeth of the rack 92, and when the spindle 95 is turned in either direction, the slate base 74 is caused to rotate about the shaft 49. The shaft 95 is mounted in two suitable bearings 96 and 97 secured to the bottom wall of the metal box 46, the worm 94 abutting at one end against the bearing 97 and limiting the movement of the shaft in one direction. The endwise movement of the shaft is yieldingly limited in the opposite direction by means of a collar 98 secured to the shaft 95, and a spring 99 bearing against the said collar 98 and against a fiber disk 100 loosely mounted on the shaft 95 and yieldingly held against the face of the bearing 97.

Two ratchet wheels 101 and 102 are connected to rotate with the spindle 95, and are mounted at opposite sides of the bearing 96. The teeth of the ratchet wheels are directed in opposite directions to one another. A pair of plunger rods 103 and 104 are forked at their lower ends to fit over the shaft and the ratchet wheels thereon. Pawls 105 and 106 are pivotally mounted in the forked portions of the plunger rods 103 and 104, respectively, and are held in contact with the toothed faces of the ratchet wheels by means of springs, not shown. A pair of solenoids 107 and 108 are mounted in saddles 109 secured to the rear wall of the casing 46, and a yoke 110 fits over the solenoids and by means of the thumb nut 111 fitting on the screw 112, the two solenoids are held in the saddles and may be loosened as desired to adjust the position of the plunger rods 103 and 104 which they operate. The plunger rods are each surrounded by a spring 113 which at one end bears against a shoulder 114, and the opposite ends thereof engage the lower ends of the solenoids to return the plungers to operative position after they have been actuated.

In order that the operator in charge of the press may at any time vary the tension on the paper web from his position in front of the press as he may find to be advisable from his examination of the condition of the printed matter turned out by the press, an electric control box 115 containing push buttons or other suitable switches is located at the front or delivery end of the press. In the diagrammatic showing in Fig. 7, a base 116 of insulating material mounted in the box 115 supports the contacts 117, 118, 119, and 120 of a switch device for controlling the operation of the solenoids 107 and 108. A pair of switch plates 121 and 122 are

adapted to close the circuit between the pairs of contacts 117, 118, 119, and 120, respectively, on depression of the buttons attached to the said switch plates. The contacts 118 and 119 are connected together by the wire 122, which latter is connected to the positive branch 123 of the line by means of the wire 124. The switch contacts 117 and 120 are connected to the solenoids 108 and 107 respectively, by the conductors 125 and 126, respectively. The other ends of the solenoids are connected together by the wire 127 to which the negative branch 128 of the line is connected. It will thus be seen that on depressing the switch plate 121 the solenoid 108 will be energized, while a depression of the switch plate 122 will energize the solenoid 107. The buttons by means of which the switch plates are operated are so constructed as to open immediately after they are operated. It will be clear that the operation of the solenoid 107 will rotate the ratchet wheel 101 in a clock-wise direction, whereas the operation of the solenoid 108 will rotate the ratchet wheels in a counter clock-wise direction, looking at the ratchet wheel shown in Fig. 7. It is preferable, in order to get the slight adjustments desired that the pawl move the ratchet but one step at a time, which movement will be transmitted to the worm 94 and to the rack 92 on the base 74. This gives the operator a selection of a wide range of adjustments, as every depression of the buttons which operate the switch plates 121 or 122 will then step the ratchet but one step, but it is to be understood the parts may be adjusted so as to rotate the shaft the equivalent of more than one step.

In order to indicate the neutral position of the apparatus to the operator at the front of the press, a signal, such as the lamp 130, is mounted in the box 115 and on the base 116. One terminal of the lamp is connected to the positive branch of the line by the wire 131, while the other terminal of the lamp is connected to the terminal block 80 by the wire 132. The terminal block 81 is connected to the negative branch of the line by the wire 133, and the circuit of the lamp is completed by the switch element 68 on the fiber disk 65. The lamp will be lighted only while the condition of the apparatus is as indicated in Fig. 2 or in the diagram shown in Fig. 7. When either the base 74 carrying the terminal block is moved by the operator by means of the solenoid control, or when the switch member is automatically moved by the movable member bearing against the web, the lamp 130 will go out, indicating that the parts are not in neutral position. When the base 74 is moved by the solenoid control it, of course, also changes the position of the terminal blocks 77, 78 and 79, which causes the motor to operate.

since, if in Fig. 7, the base 74 is rotated clock-wise the two terminal blocks 77 and 78 will be electrically connected, whereas, if the base 74 is rotated in the opposite direction the contact blocks 79 and 78 will be connected together. These connections cause the motor to rotate in opposite directions.

The motor 25, which operates the gearing 26 and 27 and the rod 29 to increase or diminish the retarding force applied to the paper roll is of a special construction. The fields thereof are so wound as to normally oppose one another and thus neutralize each other and prevent the operation of the motor. As shown in Fig. 7, one of the brushes 134 is connected directly to the positive branch 123 of the line, and the other brush 135 is connected to a field coil 136, and by means of the wire 137 is also connected to a jaw 138 of the limit switch M. The other terminal of the field coil 136 is connected to the field coil 139 by the wire 140. By means of the wire 141, the field coil 139 is connected to the wire 142 which leads to the terminal block 78 and to the field coil 143. The field coil 143 is connected to the field coil 144 by means of the wire 145, and a wire 146 leads from the other terminal of the field coil 144 to the wires 147 and 148, which respectively lead to the jaw 149 of the limit switch M and to the negative branch 128 of the line. As indicated, the pair of field coils 136 and 144 set up fields of opposite polarity, and the coils 139 and 143 are also adapted to set up fields of opposite polarity so that when the control device is neutral and in the predetermined position, the coils will neutralize each other and the motor will remain stationary, but with the armature and fields energized.

The limit switch M is arranged so as to open circuits under predetermined conditions, and thereafter close a second circuit in order to first stop the operation of the electric motor and then start the motor in a reverse direction so as to restore it to a position for starting in the opposite direction. The switch comprises a suitable insulating base not shown, on which are mounted the switch contacts 150 and 151, the former being connected to the terminal block 77 by means of the wire 152, whereas the latter is connected to the terminal block 79 by means of the wire 153. The wire 152 is also connected by the wire 154 to a pivoted switch blade 155, whereas the wire 153 is similarly connected to a pivoted switch blade 156 by means of the wire 157. Each of the switch blades 155 and 156 has a forked arm 158 rigidly connected thereto, and an operating member in the form of a reciprocal arm 159 carried by some part of the motor, such as the rod 29 has a head so constructed as to engage the forked end of the arms 158 under certain conditions of

operation, and operate the switch. Supposing, for example, that the rod 29 is moving upwardly to apply a retarding force to the brake, the arm 159 will be carried therewith, and as it engages the forked end of the upper arm 158 it will turn the blade 155 about its pivot and out of engagement with the jaw 149 into engagement with the contact 151. This movement breaks the circuit and makes another circuit to run the motor in the reverse direction. A movement of the rod 29 in the opposite direction to take off retarding force similarly operates the forked lever 158 and the switch blade 156 rigidly connected thereto, thus opening the circuit at this extremity of the movement and making contact between the blade 156 and the contact 150 to reverse the motor so that the same will be in a condition to again start. It will be noted that the forked ends of the levers 158 are so arranged that the head on the end of the arm 159 will fit therein, and before the head leaves the jaws the arm must return the blades 155 or 156, as the case may be, into engagement with the jaws 149 or 138. The movement of the blades 155 and 156 into connection with the contacts 151 and 150 is caused by the motor drifting the slight distance necessary to swing the blade this distance. In case the motor has too much inertia, a brake may be constructed to be applied to the gearing or other operating parts of the motor when the current has been cut off.

The operation of the mechanism is briefly as follows: Rolls of paper having been supported in the bearings in the sides of the frame 10, it is preferable to start with the last roll on the deck, that is, the roll nearest the end of the press. In such an arrangement, as the rolls are exhausted, and while the last roll at the right is being run off, the two exhausted rolls may be replaced, thereby running five rolls of paper off a single deck and requiring in all less than a minute's stoppage of the press for the connection of the exhausted and new rolls. The web is threaded through the press, passing first over the compensating roll 37, then over the idle rolls 41, and just before it reaches the printing couples it passes over the roll on the movable member L. The compensating roll, mounted as heretofore described, is subject to vibrations, and its object is to compensate for the variations in the tension of the paper web just as it is delivered from the supply roll. The sensitive member L which operates the automatic tension mechanism is mounted some distance beyond the compensating roll and guide rolls 41 which are in one sense the equivalent of the compensating roll. Said member preferably bears against the web just before the sheet passes to the printing couples. The principal inequalities are taken up by

the compensating roll, such inequalities being due to the departure of the supply roll from a true cylindrical form, and also due to the variations in the amount of web actually delivered by the roll in successive intervals of time, which causes the compensating roll to vibrate with greater or less rapidity and in a most uneven manner. Instead of having the action of the tension regulating means depend on the movement of the compensating roll, it depends entirely upon the tension of the web just before it goes to the impression cylinders, the compensating roll having already cured the irregularities of the supply roll to some extent. Consequently, it is important to position the sensitive member of the regulating mechanism at some point beyond the compensating roll, and preferably just before the sheet is delivered to the printing couples. When it is desired to start the operation of the automatic tension controller, the tension of the clamp or breaking mechanism is initially adjusted so that more retardation is effected than is necessary. This is done by drawing the members 17 and 17' up as tightly as possible by means of the hand wheel 19. Consequently, the tension control device is immediately brought into service to move it from its released position, or where it was left when the web was broken for splicing.

Should the web break while the press is running, the web supply roll, due to its momentum or velocity, will feed off a great length of paper before it will slow down and stop of its own accord, when free to turn, making as many as 600 revolutions before stopping. The roll member which responds to changes in the tension of the web acts as a safety device in this respect and immediately moves to a position to set the brake on the supply roll shaft, thus simultaneously stopping the supply roll with the breaking of the web and preventing the unwinding of the web. Such a position, as above noted, would follow the complete release of the tension on the web, causing the movable roll 42 and the levers and links connected therewith to rotate the switch element 70 so as to connect the terminal blocks 77 and 78, causing the operation of the motor to apply additional retarding force to move until it takes the slack in the web. The circuit completed by the switch member 70 to operate the motor is as follows: positive branch of the line 123, brush 134, armature of the motor 25, brush 135, field coil 136, field coil 139, wires 141 and 142, terminal blocks 78, switch element 70, terminal blocks 77, wires 152 and 154, switch blade 155, wires 147 and 148 to the negative branch 128 of the line. The field coils 136 and 139 set up a flux to operate the motor 25, causing it to rotate the gears 26, 27, hub 28, and move the rod 29 upwardly. The

movement of the rod 29 upwardly will continue until the tension applied to the web by the increase in retarding effect will force the movable member bearing against the web to cause the switch element 70 to move out of contact with the terminal block 77, and thus restore the balanced condition, due to the following connections: positive branch 123 of the line, brush 134, armature of the motor 25, brush 135, field coils 136, wire 140, field wire 139, wire 141, field coil 143, wire 145, field wire 144, wires 146 and 148 to the negative branch 128 of the line.

The opposing fields set up by the pairs of field coils, hereinbefore described, causes the motor to remain idle as long as the switch member 70 remains in neutral position. If, as before stated, the web is broken or the press is stopped or the web becomes unduly slack, the movement of the rod 29 will continue upwardly and carry the arm 159 into engagement with the forked arm 158, moving the knife 155 about its pivot from engagement with the jaw 149 and into engagement with the contact 151. This causes a reversal of the motor, as it will be seen that the contact 151 is connected to the knife 156, whereas the contact 150 is electrically connected with the knife 155 and the movement of the contact 155 into engagement with the contact 151 amounts to reversing the direction of the current, and the current now takes the following path: positive branch of the line 123, brush 134, armature of the motor 25, brush 135, wire 137, jaw 138, switch blade 156, wire 157', contact 151, switch blade 155, wires 154 and 152, terminal block 77, switch member 70, terminal block 78, wire 142, field coil 143, wire 145, field coil 144, wires 146 and 148 to the negative branch 128 of the line. Thus, the movement of the rod 29 is limited, and injury to any part of the apparatus is prevented. The reversal of the motor simply moves the rod 29 downward slightly and moves the switch blade 155 out of connection with the contact 151 and to a position between the contact 151 and the jaw 149. Then, when the press is started again sufficient tension is manually applied on the clamp so that it will cause the movable member 43 and its leverage connections to rotate the switch member 70 to make electrical connection between the terminal blocks 78 and 79, causing the motor to move rod 29 and arm 159 downwardly and close the blade 155 into the jaw 149. The pivoted blade 156 being normally in the position shown in Fig. 7, the regulation of the tension will go on as hereinbefore described. Should the operator in charge consider it of the buttons attached to the switch plates 121 and 122, thereby operating the solenoids 108 or 107, as the case may be, to move the plate 74 and change the position at which

the motor is actuated by the movable member which bears against the web. A third advisable to change the normal position of the pivoted or movable member 42, it is merely necessary to depress one or the other adjustment is provided for by the manual variation of the tension of the spring which yieldingly holds the movable member in contact with the web.

10 It will be apparent from the foregoing description that an electrically operated automatic tension regulating means has been provided which is operated by a sensitive and movable member bearing against the web and depending entirely on the tension of the latter. In addition, mechanism has been provided whereby the adjustment of the automatic tension regulating means may be effected while the press is running. The motor connections are so arranged that they will not cause injurious sparking when starting, stopping or reversing. The box 115 which carries buttons controlling the motor governing devices of a plurality of decks is located at a convenient position at the front or delivery end of the press so that the operator in charge may readily change the position of the devices as desired. By such arrangement, the automatic control device is completely under the control of the operator, and may be adjusted while the press is operating.

As it will be apparent that numerous modifications may be made in the construction without departing from the spirit of the invention, it is not intended to limit the invention to the exact details as shown and described.

What is claimed is:—

40 1. In a printing press or the like, the combination of a series of shafts adapted to support rolls of material which successively supply a web to the same devices operating thereon, mechanism for retarding or permitting the acceleration of rotation of each of said shafts, and means responsive to the variations in the tension of said web for causing the operation of said mechanism.

50 2. In a printing press, the combination of a series of shafts adapted to support rolls of paper which successively and continuously supply a web to the same set of printing couples, mechanism for retarding or permitting the acceleration of rotation of each of said shafts, and means interposed between the said mechanism and the web and operating in response to variations in the tension of said web to cause the operation of said mechanism and the retardation or acceleration of said shafts.

3. In a web tension regulating mechanism for printing presses or the like, the combination of a series of shafts adapted to carry rolls of material which successively

and continuously supply a web to the same devices, mechanism for retarding or permitting the acceleration of each of said shafts when the roll of material supported thereby is feeding, and means common to said series of shafts and interposed between the said mechanism and the web for causing the operation of said mechanism to retard or permit acceleration of the shaft carrying the feeding roll as the tension of the web supply therefrom rises above or falls below normal.

4. In a web tension regulating mechanism for printing presses and the like, the combination of a series of shafts adapted to support rolls of paper which successively supply a web to the same set of printing couples or like devices, of breaking means operative on said shafts for retarding or permitting the acceleration of rotation of each of the web supply roll shafts, a driving mechanism associated with the braking means, and means responsive to the variations in the tension of the web for causing the operation of the braking means by the driving mechanism when the tension of the web falls below or rises above normal.

5. In a web tension regulating mechanism for a printing press or the like, the combination of a series of shafts adapted to support rolls of paper, a braking device associated with each of said shafts and adapted to retard or permit the acceleration of rotation of the same, driving means associated with each of said braking devices, a member movable in response to variations in the tension of said web, and a device rendered operable by said movable member when the tension of the web is above or below normal, said device when operative causing the actuation of the braking devices by the driving means to retard or permit the increase of the acceleration of the supply roll shaft.

6. In a web tension regulating mechanism for printing presses and the like, the combination of a series of shafts adapted to support rolls of paper which successively supply a web to the same set of printing couples, a braking device associated with each of said roll shafts for retarding or permitting the acceleration of rotation of each of said shafts, a single driving means for operating the braking device associated with any one of said rolls, means for controlling the operation of the braking device by said driving means, a member bearing against the web and responsive to changes in the tension thereof, said member having a part which is in neutral position when the web is at proper working tension and movable with said member in response to variations in the tension of the web to operate the controlling means and cause the operation of one of said braking devices by the driving means.

7. In a web tension regulating mechanism

for printing presses and the like, the combination of groups of shafts adapted to support rolls of material and simultaneously feed webs therefrom to separate printing
 5 couples or the like, mechanism individual to each group of shafts for retarding or permitting the acceleration of the rotation thereof, and means responsive to the variations in the tensions of said webs for causing
 10 the operation of each retarding and accelerating mechanism.

8. In a web tension regulating device for printing presses and the like, the combination of groups of shafts adapted to support
 15 rolls of material to successively supply separate webs, mechanism for retarding or permitting the acceleration of rotation of each shaft of said groups of shafts, and means responsive to the variations in the tensions
 20 of said webs for causing the operation of said mechanism.

9. In a web tension regulating mechanism for printing presses and the like, the combination of groups of shafts adapted to support
 25 rolls of paper which successively supply webs to the printing devices, means for retarding or permitting the acceleration of rotation of each of the shafts, means for actuating said retarding or accelerating means,
 30 and a mechanism associated with each group of shafts and responsive to the variations in the tension of the web fed from the group of shafts with which it is associated, said
 35 mechanism causing the operation of the retarding or accelerating means by the actuating means.

10. In a web tension regulating mechanism for printing presses or the like, the combination of groups of shafts mounted
 40 on separate decks and adapted to support rolls of paper which successively and continuously supply a web from each of the said decks, mechanism for retarding or permitting the acceleration of rotation of each of
 45 the shafts when a web is supplied from the roll thereon, driving means associated with said retarding or accelerating mechanism, and means responsive to the variations in the tension of the webs for causing the operation
 50 of said retarding and accelerating mechanism by the driving means when the tensions of the webs are above or below normal.

11. In a web tension regulating mechanism for printing presses and the like, the combination of groups of shafts arranged to support rolls of paper, each group having an active roll, each of said active rolls being
 55 arranged to supply a web to a separate printing device, breaking means associated with each of said shafts for retarding or permitting the acceleration of rotation of the shafts as the roll on any shaft is rendered active to feed a web, driving means
 60 associated with each of said groups and the

braking means for the roll shafts, and means responsive to variations in the tensions of said webs for causing the operation of the
 braking means of an active roll shaft in any
 70 of the groups by the driving means associated therewith when the tension of the web supplied from the said active roll is above or below normal.

12. In a web tension regulating mechanism for printing presses and the like, the combination of a series of shafts adapted to support rolls of paper which supply a web to the same device, a braking mechanism co-
 75 operating with each roll shaft to retard or permit the acceleration of rotation thereof, a common driving mechanism for the series
 80 of braking means, means whereby any one of said braking devices may be rendered active and subject to the control of the driving mechanism, and means responsive to variations
 85 in the tension of the web for causing the operation of the active braking means by the driving means when the tension of the web rises above or falls below normal.

13. In a web tension regulating mechanism for printing presses, the combination of a group of shafts adapted to support
 90 rolls of paper which supply a web to the same device on the press, a brake structure on each of the roll shafts, a brake clamp or
 95 shoe operative on each brake structure, driving mechanism associated with the group of brake devices, means for rendering any one of the brake devices operative by the driving mechanism, and means responsive to the
 100 variations in the tension of the web for causing the operation of one of said brake devices by the driving mechanism.

14. In a web tension regulating mechanism for printing presses, the combination
 105 of a group of shafts adapted to support rolls of paper which supply a web to the same device of the press, a brake structure on each of said shafts, a brake shoe on each of said brake structures, levers adapted to
 110 operate said brake shoes, a common link associated with said levers, driving mechanism connected to said link, and means responsive to variations in the tension of the web for causing said driving mechanism to
 115 operate the link and brake devices associated therewith.

15. In a web tension regulating mechanism for printing presses and the like having a web supply roll shaft, the combination of
 120 braking mechanism for the roll shaft, driving mechanism associated with the brake mechanism and independent of the web supply roll shaft, means for controlling the operation of said brake mechanism by said
 125 driving means, mechanism responsive to the variations in the tension of said web for causing the driving mechanism to operate the brake mechanism, and means associated with said brake mechanism and driving
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mechanism for indicating the extent of operation of the same.

16. In a tension controlling mechanism for printing presses and the like, the combination of a web supply roll shaft, brake mechanism associated therewith for retarding or permitting the acceleration of the roll shaft, driving mechanism associated with the brake mechanism, and means adapted to automatically control the operation of the brake mechanism by the driving mechanism, said means comprising a member adapted to be acted upon by the web and adjustable to a predetermined tension, a device adapted to be actuated by said member and adapted to cause the operation of said brake mechanism by said driving mechanism when the tension of the web is above or below a predetermined value, and adjusting means separate from the automatic controlling means, said adjusting means having a control handle located at a point near said member for changing the predetermined or adjusted value of tension at which said member is set.

17. In a web tension controlling mechanism for printing presses, the combination of a shaft adapted to support a roll of paper from which a web is supplied, a brake mechanism operative on the roll shaft, driving means associated with the brake mechanism, means for controlling the operation of the brake mechanism by the driving means, means responsive to the tension of the web for operating said controlling means when the web tension is above or below normal, and means for independently varying the relative position of the responsive means and controlling means so as to change the tension at which the brake mechanism is actuated by the driving means.

18. In a tension regulating mechanism for printing presses and the like, the combination of a shaft adapted to support a roll of paper from which the web is supplied, means for retarding or permitting the acceleration of the roll shaft, driving means associated with said retarding or accelerating means, means for controlling the operation of the retarding and accelerating means by the driving means, means responsive to the tension of the web for operating said controlling means to cause the operation of the retarding and accelerating means by the driving means, and means for independently adjusting the controlling means.

19. In a tension regulating mechanism for printing presses and the like, the combination of a shaft adapted to support a roll of paper from which the web is supplied, means for retarding or permitting the acceleration of the roll shaft, driving means associated with said retarding or accelerating means, means for controlling the operation of the retarding and accelerating

means by the driving means, means responsive to the tension of the web for operating said controlling means to cause the operation of the retarding and accelerating means by the driving means, means for independently varying the adjustment of said controlling means, and means for limiting the extent of operation of said retarding and accelerating means by said driving means.

20. In a tension regulating mechanism for printing presses and the like, the combination of a shaft adapted to support a roll of paper from which the web is supplied, means for retarding or permitting the acceleration of the roll shaft, driving means associated with said retarding or accelerating means, a member for controlling the operation of the retarding or accelerating means, a device responsive to the tension of the web for operating the controlling member and causing the operation of the retarding and accelerating means by the driving means, a member movable with said device, one of said members being adjustable relatively to the other and independently of said device so as to change the value of the tension at which the retarding and accelerating means is operated by the driving means.

21. In a tension regulating mechanism for printing presses and the like, the combination of a shaft adapted to support a roll of paper from which a web is supplied, means for retarding or permitting the acceleration of said roll shaft, a motor associated with said retarding and accelerating means, a member for controlling the operation of said retarding and accelerating means by said motor, and a member for automatically operating said controlling member in response to web tension changes to cause the operation of said retarding and accelerating means by said motor, and electrically operated means for changing the relative position of said members to alter the tension at which said automatic means causes the motor to operate the retarding and accelerating means.

22. In a tension regulating mechanism for printing presses and the like, the combination of a shaft adapted to support a roll of paper from which a web is supplied, brake mechanism for retarding or permitting the acceleration of the roll shaft, an electric motor operatively connected to the brake mechanism, means for controlling the operation of said brake mechanism by said motor, said controlling means comprising two relatively movable parts, one of which carries a switch member and the other carries switch contacts, a member connected to one of said parts and automatically responsive to web tension changes and adapted to effect electrical connections between said relatively movable parts of the controller to cause the

motor to operate the brake mechanism as the tension of the web varies from normal, and means for effecting a relative adjustment between the parts of said controlling means.

23. In a tension regulating mechanism for printing presses and the like, the combination of a shaft adapted to support a roll of paper from which a web is supplied, brake mechanism for retarding or permitting the acceleration of the roll shaft, an electric motor connected to the brake mechanism and adapted to operate the same, means for controlling the operation of the brake mechanism by the motor comprising two independently movable parts, one of said parts carrying switch contacts and the other part carrying a switch member adapted to connect the contacts, a member movable in response to changes in the tension of the web, said member being connected to one of the parts of said controlling means and adapted to cause the connection between contacts on the other member to operate said brake mechanism by the motor, electrically operable means for changing the relative adjusted position of said parts of the controlling means, and means for limiting the operation of said brake mechanism by the motor.

24. In a tension regulating mechanism for printing presses and the like, the combination of a shaft adapted to support a roll of paper from which a web is supplied, brake mechanism for retarding or permitting the acceleration of the roll shaft, an electric motor connected to the brake mechanism and adapted to operate the same, means for controlling the operation of the brake mechanism by the motor comprising two independently movable parts, one of said parts carrying switch contacts and the other part carrying a switch member adapted to connect the contacts and operate said motor in one direction or the other, a movable member connected to one of said parts and arranged to cause the operation of the electric motor in one direction or the other in response to web tension changes, electrically operated means for changing the relative adjusted position of the said parts of the controlling device, means for limiting the extent of operation of the brake mechanism by the motor, and means for indicating when the web is working at substantially a predetermined tension.

25. In a tension regulating means for printing presses and the like, the combination of a shaft adapted to support a roll of paper from which a web is supplied, a brake mechanism for retarding or permitting the acceleration of the roll shaft, a driving mechanism associated with the brake mechanism, means for controlling the operation of the brake mechanism by the driving

mechanism, means responsive to variations in the tension of the web for operating said controlling means to cause the operation of the brake mechanism by the driving mechanism, said responsive means and controlling means being inactive or neutral when said web is at proper working tension, and means operated by the connections between the driving mechanism and brake mechanism for indicating when the web is at proper working tension and for indicating when the tension is above and below normal.

26. In a tension regulating mechanism for printing presses and the like, the combination of a shaft adapted to support a roll of paper from which the web is supplied, brake mechanism for retarding or permitting the acceleration of the roll shaft, a motor associated with the brake mechanism, means for controlling the operation of the brake mechanism by the motor and comprising two members, one of which carries a plurality of switch contacts and the other of which carries switch members adapted to connect the switch contacts, a member responsive to variations in the tension of the web operatively connected to said switch member and adapted when operated to cause said motor to rotate in one direction or the other and apply or take off pressure on the roll shaft when the tension of the web rises above or falls below a predetermined value, and means accessible from the delivery end of the press for changing the adjustment of the controlling device so as to vary the tension at which the web is supplied to the printing mechanism.

27. In a tension regulating mechanism for printing presses, the combination of a shaft adapted to support a roll of paper from which a web is supplied, brake mechanism operated on said shaft and adapted to retard or permit the acceleration of the same, an electric motor for operating said brake mechanism, means controlling the operation of said brake mechanism by said motor comprising a pair of independently movable members, one of said members carrying a plurality of contacts, and the other member carrying a switching device adapted to make and break the circuit between the contacts, a member connected to the switching device and adapted to operate the same in response to web tension changes, an electrically operated pawl and ratchet mechanism for changing the relative position of said members comprising the controlling device, and means for limiting the operation of said braking mechanism by said motor.

28. In a tension regulating mechanism for printing presses and the like, the combination of a shaft adapted to support a roll of paper from which a web is supplied, brake mechanism for retarding or permitting the acceleration of the roll shaft, an electric

motor for operating said brake mechanism, means for controlling the operation of the brake mechanism by the motor and comprising two relatively movable members, one of
 5 said members carrying switch contacts connected to the electric motor and the other member carrying a switching device adapted to connect certain of said contacts, means responsive to variations in the tension of the
 10 web for operating said switching device to connect certain of said contacts in response to variations in the tension of the web above or below normal to operate the electric motor and actuate said brake mechanism.

29. In a tension regulating mechanism for printing presses and the like, the combination of a shaft adapted to support a roll of paper from which a web is supplied, brake mechanism for retarding or permitting the
 20 acceleration of the roll shaft, an electric motor for operating the brake mechanism, means for controlling the operation of the brake mechanism by the electric motor comprising a member carrying three terminals
 25 connected to the electric motor, a switch member permanently connected to one of said terminals and adapted to connect the same with either of the other two, said members being relatively rotatable, and
 30 means movable in response to web tension changes for operating said switch member to cause the motor to operate in one direction or the other and actuate said brake mechanism.

30. In a tension regulating mechanism for printing presses and the like, the combination of a shaft adapted to support a roll of paper from which a web is supplied, brake mechanism for retarding or permitting the
 40 acceleration of the roll shaft, an electric motor for operating the brake mechanism, means for controlling the operation of the brake mechanism by the motor, said means comprising two relatively movable members
 45 one of said members carrying a group of three contacts adapted to be electrically connected to said motor and a pair of contacts separate from said first mentioned contacts, a switching device associated with said contacts
 50 and having a part permanently associated with a contact of one of said groups of contacts and adapted to be connected to either of the other of said group of contacts, said switching device also having a part
 55 adapted to electrically connect and disconnect said pair of contacts, means responsive to web tension changes for operating said switching device, said responsive means being at neutral position when the web is at
 60 working tension, said permanently connected contact being disconnected from either of its associated contacts and the pair of contacts being connected together while said responsive means is neutral, a signal in circuit
 65 with said pair of contacts, and means at

the signal for changing the relative position of said parts of the controlling device so as to change the working tension of the web.

31. In a tension regulating mechanism for printing presses and the like, the combination of a shaft adapted to support a roll of
 70 paper from which a web is supplied, means for retarding or permitting the acceleration of the roll shaft, driving means associated with said retarding or accelerating means
 75 for operating the same, means for controlling the operation of the retarding and accelerating means by the driving means, a movable member bearing against the web and adapted to operate the controlling means
 80 and cause the driving means to operate the retarding or accelerating means in response to web tension changes, and means for adjusting said member comprising a rod pivotally connected to said member, a spring
 85 surrounding said rod, and a collar slidably mounted on said rod and forming a bearing for one end of said spring, said collar being slidable along the rod and adjustable in a series of positions to vary the tension of the
 90 spring and thereby change the pressure exerted by said movable member against the paper web.

32. In a tension regulating mechanism for printing presses and the like, the combination of a shaft adapted to support a roll of
 95 paper from which a web is supplied, means for retarding or permitting the acceleration of the roll shaft, driving means associated with said retarding or accelerating means
 100 for operating the same, means for controlling the operation of the retarding and accelerating means by the driving means, a movable member bearing against the web and adapted to operate the controlling means
 105 and cause the driving means to operate the retarding or accelerating means in response to web tension changes, and means for adjusting the pressure of said movable member against the paper web comprising a rod pivoted to the movable member, guiding means
 110 for the rod, a spring surrounding the rod and bearing at one end against the guiding means, a loose collar on the rod against which the other end of the spring bears, a
 115 notched member, an arm adapted to engage the collar and having a part fitting in the said notches to adjust the collar in any one of a series of positions.

33. In a tension regulating mechanism for
 120 printing presses and the like, the combination of a shaft adapted to support a roll of paper from which a web is supplied, means for retarding or permitting the acceleration of the roll shaft, driving means associated
 125 with said retarding or accelerating means for operating the same, means for controlling the operation of the retarding and accelerating means by the driving means, a movable member bearing against the web and adapted to
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operate the controlling means and cause the driving means to operate the retarding or accelerating means in response to web tension changes, and means for adjusting the pressure of said movable member against the paper web comprising, a rod pivoted to the member, guiding means for the rod, a spring surrounding the rod, a loose collar on the rod forming a bearing for one end of the spring, a pivotally mounted lever having one arm in engagement with said collar, a member having a series of recesses, and a spring pin on the other arm of the lever for engaging the said recesses and locking the lever in any one of a series of adjusted positions.

34. In a device of the class described, the

combination of a switch member and a contact carrying member supported for relative movement, a source of current, a motor connected with one of said members and the source of current, and automatic means, responsive to variations in the tension of a web of material, for rotating said members relatively to one another to effect connections to cause the operation of the motor.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIS S. MORSE.

Witnesses:

GERTRUDE M. STUCKER,

EUGENE L. GREENAWALD.