

**Sept. 4, 1934.**

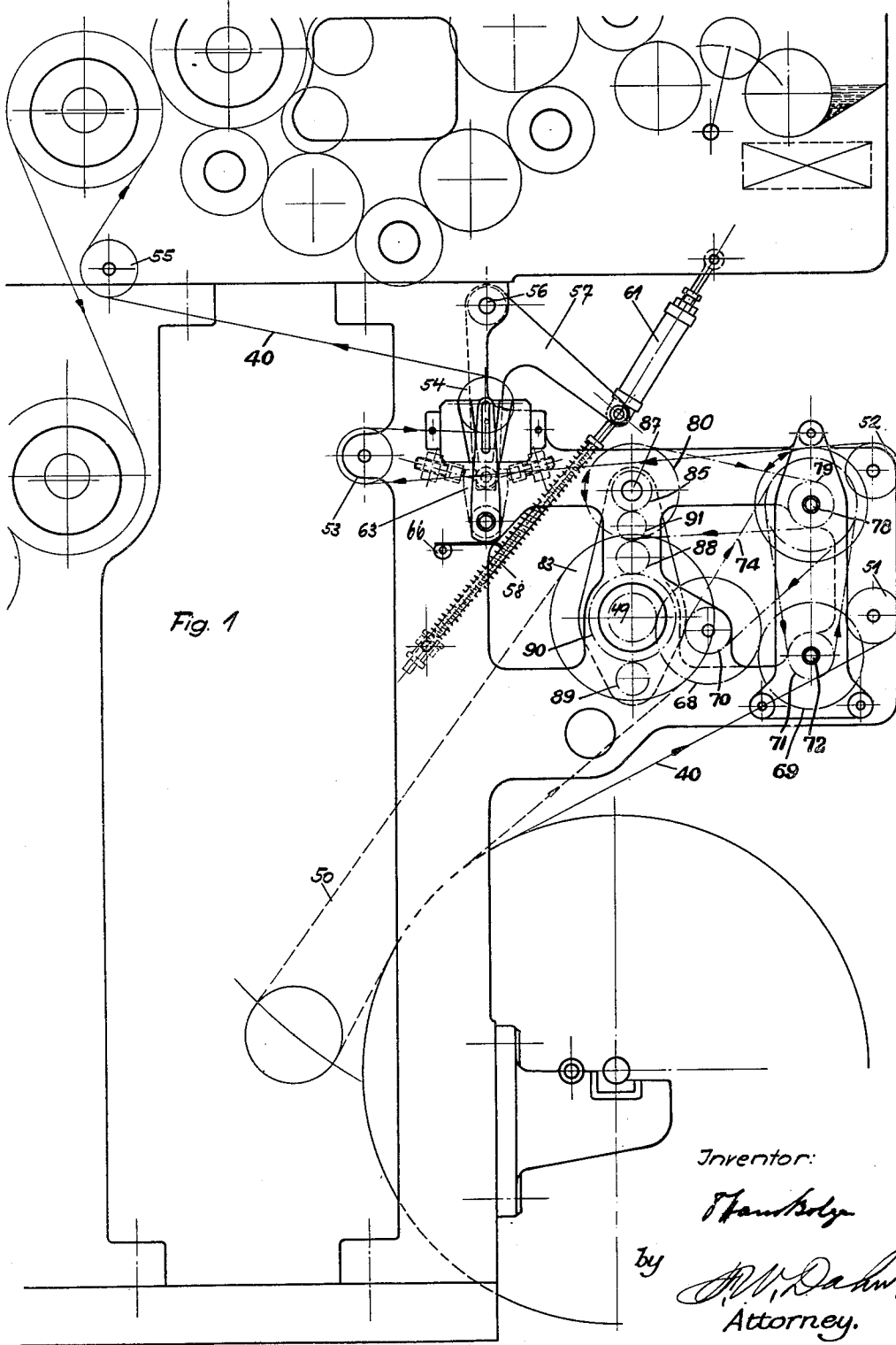
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H. BOLZA  
 DEVICE FOR AUTOMATICALLY REGULATING THE TENSION  
 OF THE WEB IN ROTARY PRINTING MACHINES  
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4 Sheets-Sheet 1



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4 Sheets-Sheet 2

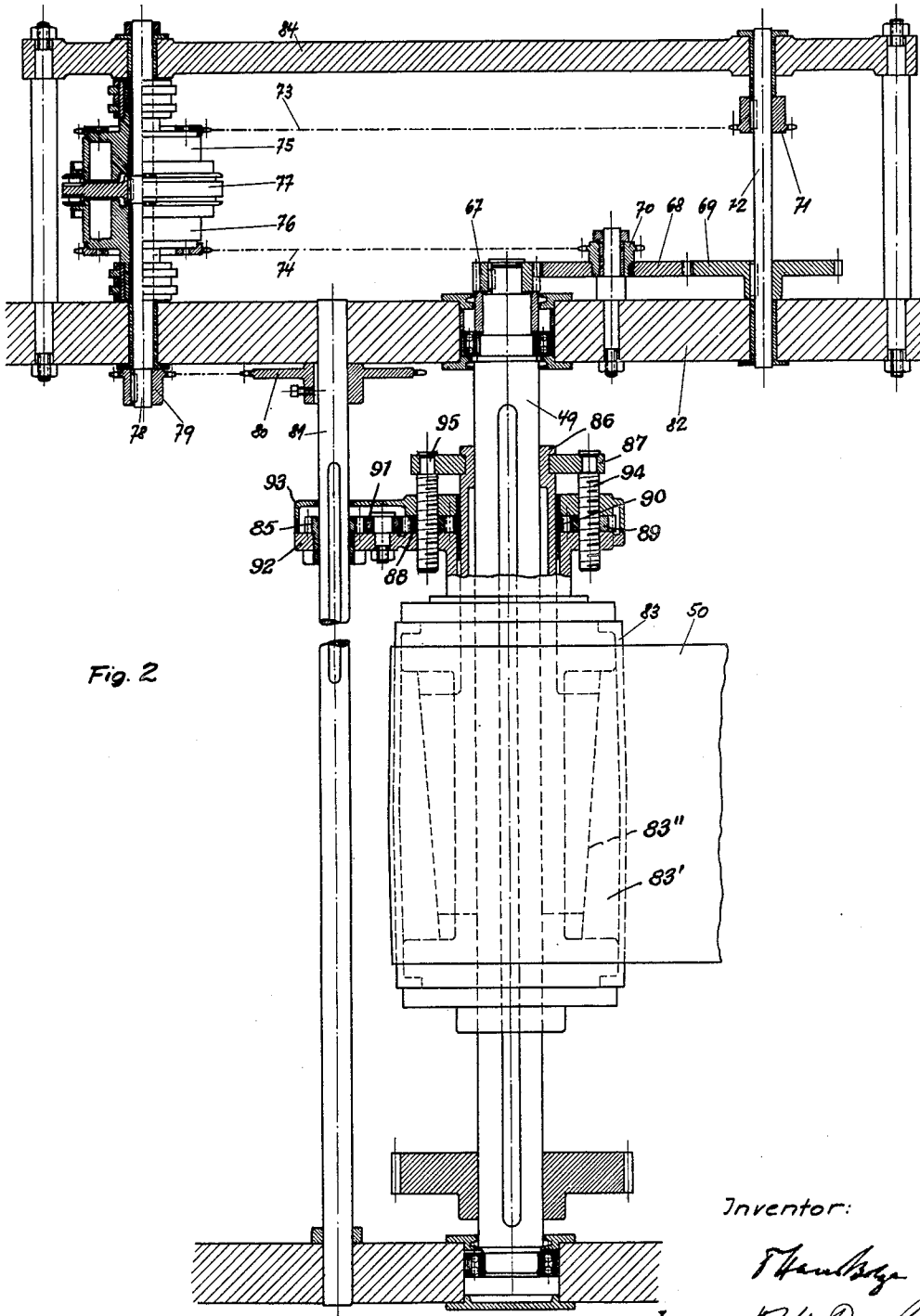


Fig. 2

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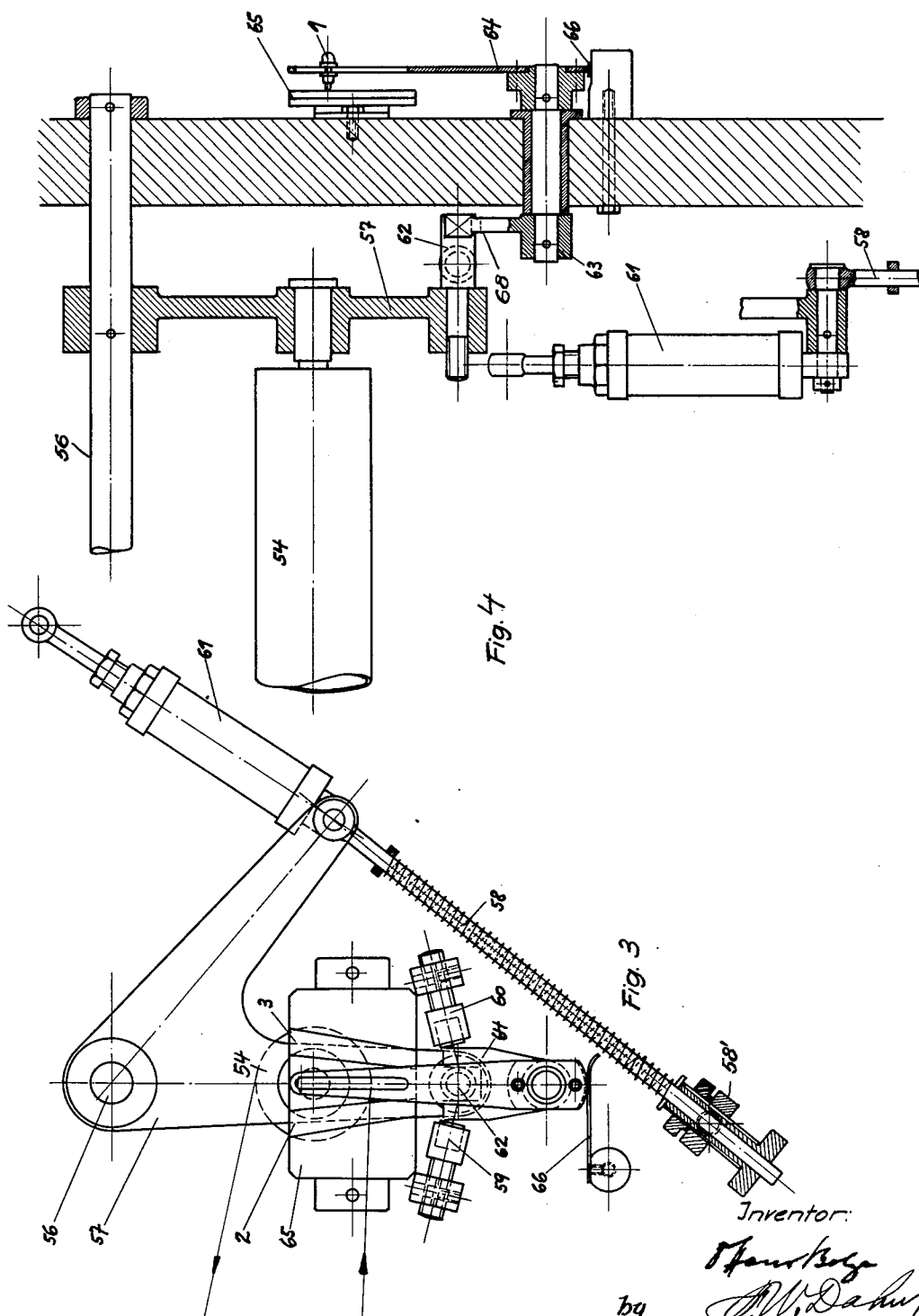
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4 Sheets-Sheet 3



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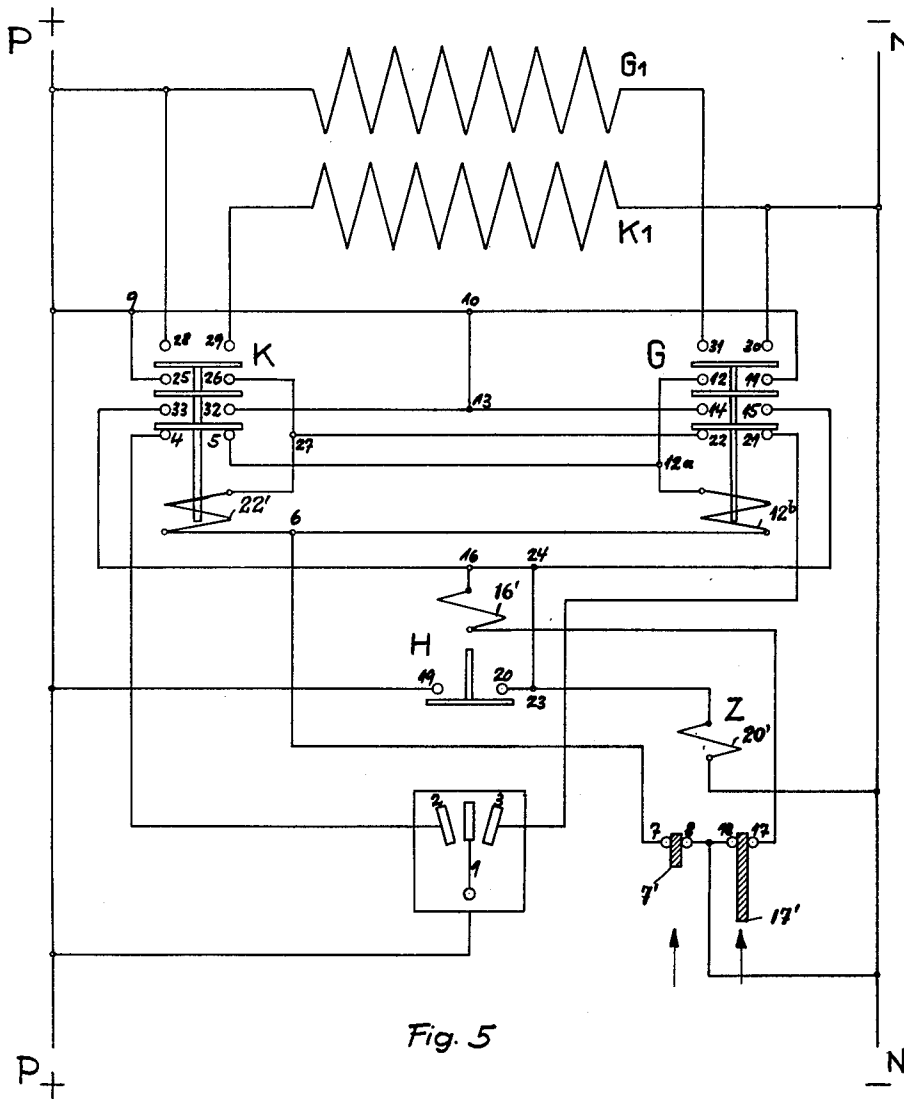
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DEVICE FOR AUTOMATICALLY REGULATING THE TENSION  
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4 Sheets-Sheet 4



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## UNITED STATES PATENT OFFICE

1,972,676

## DEVICE FOR AUTOMATICALLY REGULATING THE TENSION OF THE WEB IN ROTARY PRINTING MACHINES

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19 Claims. (Cl. 242—75)

It is known, that in order to regulate the tension of the web in web rotary machines, the web must be guided over a roller lodged in movable bearings, the action of which sets the paper roll brake more strongly or less strongly in motion.

On account of the fact that the web easily breaks when, running at a high speed, the web itself is used as a means of traction for unwinding the slightly braked supply roll, it has, in the case of high speed rotary machines, long since been so arranged that the paper roll is driven by an endless belt acting upon the circumference of the paper roll.

In the latter unwinding process the paper roll can no longer be braked by the aforementioned tension regulation as then the purpose of the special driving device would be frustrated.

The invention concerns a process which, in a simple manner, makes possible also for this method of unwinding, the automatic regulation of the tension of the paper. It aims at making the speed of the unwinding dependent on the paper tension, in such a manner that the tension of the paper affects a pendulously suspended roller, the swinging of which influences the circumferential velocity of the driving belt pulley.

In the drawings an example is given how the tension regulator, according to the invention, might be designed. The different figures show:

Fig. 1, a part of a printing machine with a side view of a tension regulator adapted to it.

Fig. 2, a front view of the same device, partly in section and partly in side elevation.

Fig. 3, an enlarged side elevation of the suspended swinging roller and associated parts.

Fig. 4, a front elevation (partly in section) of parts shown in Fig. 3.

Fig. 5, the wiring diagram.

The web 40, driven by the endless belt 50 engaging the periphery of the supply roll, runs over the paper guiding rollers 51, 52, 53, 54, 55, to the printing cylinders. By the guiding of the paper over the three rollers 53, 54, 55, these form a loop and the traction of the paper acts upon the swinging roller 54, which is rotatably supported by arms of two bent levers 57 (only one of which is shown) said levers being suspended from a shaft 56 as a fulcrum. Spring rods 58 slidable in guides 58' on the frame act upon the other arms of the levers 57 and work in opposition to the tension of the paper strip. By the suitable adjustment of the spring tension the roller 54 is left in the central position

Fig. 1 and Fig. 3, so long as the printing cylinders require exactly so much paper as the belt 50 supplies. But upon an alteration in the conditions, that is to say, suppose for example that the printing cylinders require more paper than the belt 50 supplies, then the traction of the paper overcomes the spring tension and the roller 54 swings towards the roller 55. The extent of the deflection in either direction must, as has been proved by experience be very shortly arrested and is limited by the respective stoppers 59 and 60. In order to insure a certain smooth or rhythmic working of the suspended roller, and to reduce the extent of the deflections of the roller 54 to a suitable measure, an oil brake or dashpot 61—which is familiar for other purposes—is used, which acts upon the same arm as the spring rod 58, and which is fastened to the frame of the machine. The effect of the brake may easily be increased or diminished by regulating the flow of oil in the dashpot in well known manner.

Lever 57 bears a pin 62 extending between forks 63 of a rock-lever and the deflection of the roller 54 operates by means of the bolt 62, to rock the fork-lever 63 and thereby the slotted arm 64 fixed to the pivot of the fork-lever to the right or the left. The fork-lever is insulated and bears the contact pin 1, which is adjustable along the slot of said arm. The contact pin serves to close the circuits between a diverging contact 66 and the contact strips 2 and 3 respectively which are fitted on the common insulating slab 65. The contact strips may be parallel but preferably they diverge toward one end or the other in order that the idle zone through which the contact 1 may oscillate ineffectively can be varied more extensively according to the particular circumstances connected with the operation of a given machine. In order to transmit only the large deflection of the roller 54 to the magnet coupling and in order to completely cancel the effect of the smaller deflection, the distance between the contact strips 2 and 3 is purposely kept rather large.

The device for regulating the driving belt pulley 83 is to be seen in Figs. 1 and 2.

On the extension of the driving-belt-pulley-spindle 49 is placed, on the outer side of the machine frame 82 the gear 67, which, by the gear 68, sprocket 70 and chain 74 operates on the left half 76, and by the connecting gears 68, 69, spindle 72, sprocket 71, and chain 73, operates on the right half 75, of the reversible magnetic coupling. The two coupling halves 75 and 76 are loosely

mounted on the spindle 78 and constantly revolve to right and left respectively. Between the two coupling halves, strongly bolted to the spindle 78, is the pulley 77, which is clutched to one or the other of the clutch members 75, 76 by switching in the right or left magnet winding thus causing pulley 77 and spindle 78 to rotate in one or the other direction. The spindle 78 is journaled in the transom 84 and in machine frame 82 and has on an extension at the innerside of the machine frame a sprocket 79 geared to the sprocket 80 fixed to the adjusting spindle 81 which may be driven at constant speed by a gear 39 secured thereto.

The spindle 81 is thus turned either clockwise or counterclockwise for adjustably varying the diameter of expansible pulley 83 by means of the gear 85 splined to the spindle. The different cylindrical mantle portions 83' of the expansible pulley 83 are moved radially inward or outward by means of dove-tailed guiding pieces or the like, arranged on spindle 49 and provided with inclined faces at 83'' for coacting with inclined faces on the mantle portions in well known manner. They have on one side a kind of nave 86 on which a disk 87 is loosely mounted. Disk 87 is fixed against axial movement and spindle 49 with nave 86 may rotate in the non-rotating disk 87. In this disk 87 two screw-threaded bolts 94 and 95 lie at opposite sides of spindle 49 and they carry intermediate gears 88, 89 which are internally threaded. These gears 88, 89 mesh with a ring gear 90 which likewise is loose on nave 86, so that by the drive of gear 88 which is operated from gear 85 through pinion 91 in the one or the other direction, gear 89 also turns. The whole system of gears 85, 91, 88, 90, 89 being ensured against axial shifting by means of the stationary disks 92, 93, the threaded bolts 94, 95 are shifted axially by means of the internally threaded gears 88, 89 which are threaded to the bolt, moving thereby the nave 86 axially in the one or the other direction and thus changing the diameter of the belt pulley 83.

Fig. 5 shows the wiring diagram of the electrical parts of the device.

When contact 1 engages with contact 2, a circuit is closed from P through contacts 1, 2, contacts 4, 5 of remote switch K, through the coil 12b of the remote switch G through conductor 6 and contacts 7 and 8 to N. The switch G is raised and is retained in this position by the circuit through P 9, 10, 11, 12, 12a, coil 12b, conductor 6 and contacts 7 and 8 to N. The magnetic winding G1 of the clutch member 76 receives current over contacts 30 and 31, and the clutch now drives the pulley 77 and thereby expands the driving belt pulley 83. At the same time the auxiliary switch H is closed by energizing the circuit through P 9, 10, 13, 14, 15, 16, coil 16', 17, 18 N, which closes the circuit P 19, 20, coil 20', of the time switch Z, to line N. Even if the contacts 1 and 3 should have been connected in the meantime the remote switch K cannot be raised because no flow of current is possible, when the switch G is raised, between the contacts 21 and 22.

After having been raised the auxiliary switch H is retained in this position by the circuit P 19, 20, 23, 24, 16, coil 16', 17, 18, N.

The time switch Z now moves the two contact pieces 7' and 17' in the direction indicated by the arrows. After an adjustable time of a few seconds the contacts 7 and 8 of the time switch Z will be interrupted whereby the coil of the re-

mote switch G is rendered currentless. Switch G drops and thereby interrupts the magnet winding G1 which stops the expansion of the driving belt pulley towards its maximum diameter. In order to allow the expanding process time to take effect, and thereby to insure a certain quietness in the working of the system the switch K should not be immediately raised after the dropping of the switch G, in case that meanwhile contact 1 itself should have been connected to contact 3. This is also prevented because the contacts 7 and 8 remain unconnected so long as the time switch Z is in operation. Only when, after the disconnection of the contacts 17 and 18 of the time switch Z, the auxiliary switch H becomes dead, drops, and thereby, owing to the opening of the contacts 19 and 20 of H switches off the time switch, are the contacts 7 and 8, by the dropping of the contact pieces 7' and 17' of the time switch Z, again bridged over.

If contact 1 is still connected with contact 2 it shows that the expanding of the pulley has not been sufficient. The switch G is again raised and again expands the pulley to a certain amount, which is determined by the length of the contact blocks of the time switch.

But should in the meantime contact 1 be connected to contact 3, then the current flows from P over 1, 3, 21, 22, through the coil 22' of remote switch K over 6, 7, 8, to N. The switch K closes and is held in this position by the circuit through P, 9, 25, 26, 27, the coil 22' of the switch K 6, 7, 8, N. The switch K switches on the auxiliary switch H over P 9, 10, 13, 32, 33, 16, coil 16', 17, 18, N which supplies a current through circuit P, 19, 20 N to the time switch Z. Now the driving belt pulley is decreased towards the smallest diameter so long as the circuit remains closed through the contacts 7 and 8, analogous to the previously explained switching process with switch G and magnet winding G1.

Having thus fully described my said invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination, a paper supply roll, a driving belt for said roll, means for driving the belt including an expansible pulley, a floating roller engaging a bight in the paper passing off said roll, means controlled by the tension of the paper through said roller for varying the diameter of the pulley, comprising, a contact movable with said roller, fixed contacts engageable by said movable contact, oppositely rotating magnetic clutch members in circuit with said fixed contacts, and a driven magnetic clutch member having geared connection with means for varying the diameter of said expansible pulley, said rotating clutch members being respectively energized by engagement of the floating contact with one or other of said fixed contacts.

2. In combination, a paper supply roll, a driving belt for said roll, means for driving the belt including an expansible pulley, a floating roller engaging a bight in the paper passing off said roll, means controlled by the tension of the paper through said roller for varying the diameter of the pulley, comprising, a contact movable with said roller, two fixed contacts engageable by said movable contact, oppositely rotating magnetic clutch members in circuit with said two fixed contacts, a driven magnetic clutch member having geared connection with means for varying the diameter of said expansible pulley, said rotating clutch members being respectively energized by engagement of the floating contact with one or

other of said fixed contacts, and a dash pot for damping the movements of said roller.

3. In combination, a paper supply roll, a driving belt for said roll, means for driving the belt including an expansible pulley, a floating roller engaging a bight in the paper passing off said roll, means controlled by the tension of the paper through said roller for varying the diameter of the pulley, comprising, a contact movable with said roller, two fixed contacts engageable by said movable contact, oppositely rotating magnetic clutch members in circuit with said fixed contacts, a driven magnetic clutch member having geared connection with means for varying the diameter of said expansible pulley, said rotating clutch members being respectively energized by engagement of the floating contact with one or other of said two fixed contacts, a dash pot for damping the movements of said roller, and stops for limiting the movements of said roller in opposite directions.

4. In combination, a paper supply roll, a driving belt for said roll, means for driving the belt including an expansible pulley, a floating roller engaging a bight in the paper passing off said roll, means controlled by the tension of the paper through said roller for varying the diameter of the pulley, comprising, a contact movable with said roller, fixed contacts engageable by said movable contact, oppositely rotating magnetic clutch members in circuit with said fixed contacts, a driven magnetic clutch member having geared connection with means for varying the diameter of said expansible pulley, said rotating clutch members being respectively energized by engagement of the floating contact with one or other of said fixed contacts, and a dash pot for damping the movements of said roller, said circuits having an auxiliary switch and a time switch interconnected therewith for regulating the coupling of said magnetic clutch.

5. In combination, a supply roll, a driving belt for said roll, a pulley for driving the belt, a floating roller engaging a bight in the material passing off said roll and movable in accordance with variations of tension of said material, means controlled by the movements of the roller for varying the diameter of the pulley, comprising a pivotal support for said roller, resilient means opposing the movement of said roller under increasing tension of the paper, a contact movable with the roller, and fixed contacts at opposite sides of the neutral position of said movable contact, said movable contact being adjustable toward or from the axis of said pivotal support and said fixed contacts being elongated for engagement by said movable contact in any of its positions.

6. In combination, a supply roll, a driving belt for said roll, a pulley for driving the belt, a floating roller engaging a bight in the material passing off said roll and movable in accordance with variations of tension of said material, means controlled by the movements of the roller for varying the diameter of the pulley, comprising a pivotal support for said roller, resilient means opposing the movement of said roller under increasing tension of the paper, a contact movable with the roller, and two fixed contacts at opposite sides of the neutral position of said movable contact said movable contact being adjustable toward or from the axis of said pivotal support and said fixed contacts consisting of oppositely inclined strips varying in distance from each other at different distances from said axis to vary the

arc of ineffective movement of the movable contact.

7. In combination, a supply roll, means for driving the same including an expansible pulley and a belt passing over said pulley, a roller engaging in a bight of material fed off said roll, a pivotal support for said roller, means for expanding said pulley including an electric circuit, means for contracting said pulley including an electric circuit, a contact movable with said roller, contacts in the respective circuits for engagement by said movable contact in accordance with the tension of said material, and delay means for retarding the time between operation of the expanding means and the contracting means respectively for said pulley including an auxiliary switch and a time switch interconnected with said circuits.

8. In combination, a supply roll, means for driving the same including an expansible pulley and a belt passing over said pulley, a roller engaging in a bight of material fed off said roll, a pivotal support for said roller, means for varying the diameter of said pulley including a shaft, a magnetic clutch member fixed to said shaft, oppositely rotating magnetic clutch members adjacent to said first-named clutch member, circuits for energizing the respective second-named clutch members, a contact movable in accordance with the movements of said roller, contacts in said clutch circuits engageable by said movable contact, and delay means for increasing the time between engagement of said first-named clutch member with the respective rotating clutch members.

9. In combination, a supply roll, means for driving the same including an expansible pulley and a belt passing over said pulley, a roller engaging in a bight of material fed off said roll, a pivotal support for said roller, means for varying the diameter of said pulley including a shaft, a magnetic clutch member fixed to said shaft, oppositely rotating magnetic clutch members adjacent to said first-named clutch member, circuits for energizing the respective second-named clutch members, a contact movable in accordance with the movements of said roller, contacts in said clutch circuits engageable by said movable contact, and delay means for increasing the time between engagement of said first-named clutch member with the respective rotating clutch members, said delay means including a time switch and an auxiliary switch.

10. In a driving mechanism for paper rolls of printing machines and the like having a web tension controller, the combination of a paper supply roll, a driving belt in peripheral contact with said roll, an expansible pulley for driving the belt, a resiliently pivoted lever, a roller on said lever engaging a bight in the material passing off said roll and movable in accordance with variations in the tension of said material, electrical means controlled by the position of said roller for varying the speed of the belt by automatically varying the diameter of said pulley, a dash pot for damping the movements of said roller, and adjustable stops for limiting the movements of said roller in opposite directions.

11. In a driving mechanism for paper rollers of printing machines or the like having a web tension controller, the combination of a paper supply roll, a driving belt in contact with said roll, an expansible pulley for driving the belt, a lever, a roller carried by said lever said roller engaging a bight in the material passing off from

said roll and movable in accordance with variations in the tension of said material, resilient means opposing the movement of the lever under increasing tension of the paper, electrical means controlled by the position of said roller for varying the speed of the belt by automatically varying the diameter of said pulley, said means including fixed contacts and a contact movable with said roller, a dash pot for damping the movements of said roller, adjustable stops for limiting the movements of said roller in opposite directions, the relative positions of the stops and the fixed contacts being so arranged that said electrical means is inoperative when the paper is torn and the said resiliently pivoted lever is consequently pressed by the spring against one of the adjustable stops.

12. A driving mechanism for paper rolls of printing machines and the like including in combination a paper supply roll, a driving belt in contact with the said roll, an expansible pulley for driving the belt, a resiliently pivoted lever, a roller on the lever engaging a bight in the material passing off said roll and movable in accordance with variations in the tension of said material, a relatively short rock arm having pin and slot connection with said lever, a relatively long rock arm pivoted coaxially with said short rock arm, a contact on said long rock arm, two fixed contacts adapted to be engaged by said movable contact, connections operable by the closing of a circuit through the respective fixed contacts for increasing or decreasing the size of said pulley, a dash pot for damping the movements of said roller, and stops for limiting the movements of said short rock arm in opposite directions, one of said stops being positioned so as to permit the movable contact to be forced past the circuit closing position by said spring upon failure of the paper.

13. In combination, a supply roll for paper or the like, a belt engaging a substantial arc of the periphery of the roll, means for driving the belt comprising an expansible pulley, a roller engaging a bight in the material fed from said roll, a pivoted support for said roller, electrically operated means for increasing and decreasing the diameter of the pulley, a movable contact actuated by said roller, and fixed contacts coacting with

said movable contact to control the operation of said electrically operated means.

14. A device as in claim 13, including delay means in circuit with said electrically operated means whereby changes in diameter of the pulley are limited in extent and can take place only after elapsed times.

15. A device as in claim 13, including connections between said roller and said movable contact whereby the movement of the contact is multiplied relatively to that of the roller, means for damping the movements of the roller, and stops for limiting movements of the roller substantially beyond the circuit closing positions of the movable contact.

16. A device as in claim 13, including means for stopping the movement of the roller after the movable contact has passed beyond circuit-closing position upon failure of the paper.

17. In combination, a supply roll, a belt engaging a substantial part of the periphery of said roll, an expansible pulley for driving said belt, electrically operated means controlled by the tension of the material passing off the roll for varying the diameter of said pulley, and means for causing the changes in diameter of the pulley to take place by spaced increments.

18. In combination, a supply roll, a belt engaging a substantial part of the periphery of said roll, an expansible pulley for driving said belt, electrically operated means controlled by the tension of the material passing off the roll for varying the diameter of said pulley, and means to break the circuit of said electrically operated means upon failure of the material on the roll.

19. In combination, a supply roll, a belt engaging a substantial part of the periphery of said roll, an expansible pulley for driving said belt, electrically operated means controlled by the tension of the material passing off the roll for varying the diameter of said pulley, said means including a movable contact, fixed contacts at opposite sides of the median position of the movable contact said contacts being in circuit with said electrically operated means, and means for varying the arc of ineffective movement of said movable contact.

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