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AUTOMATIC SPEED CONTROLLING DEVICE

Filed Feb. 6, 1922

2 Sheets-Sheet 1

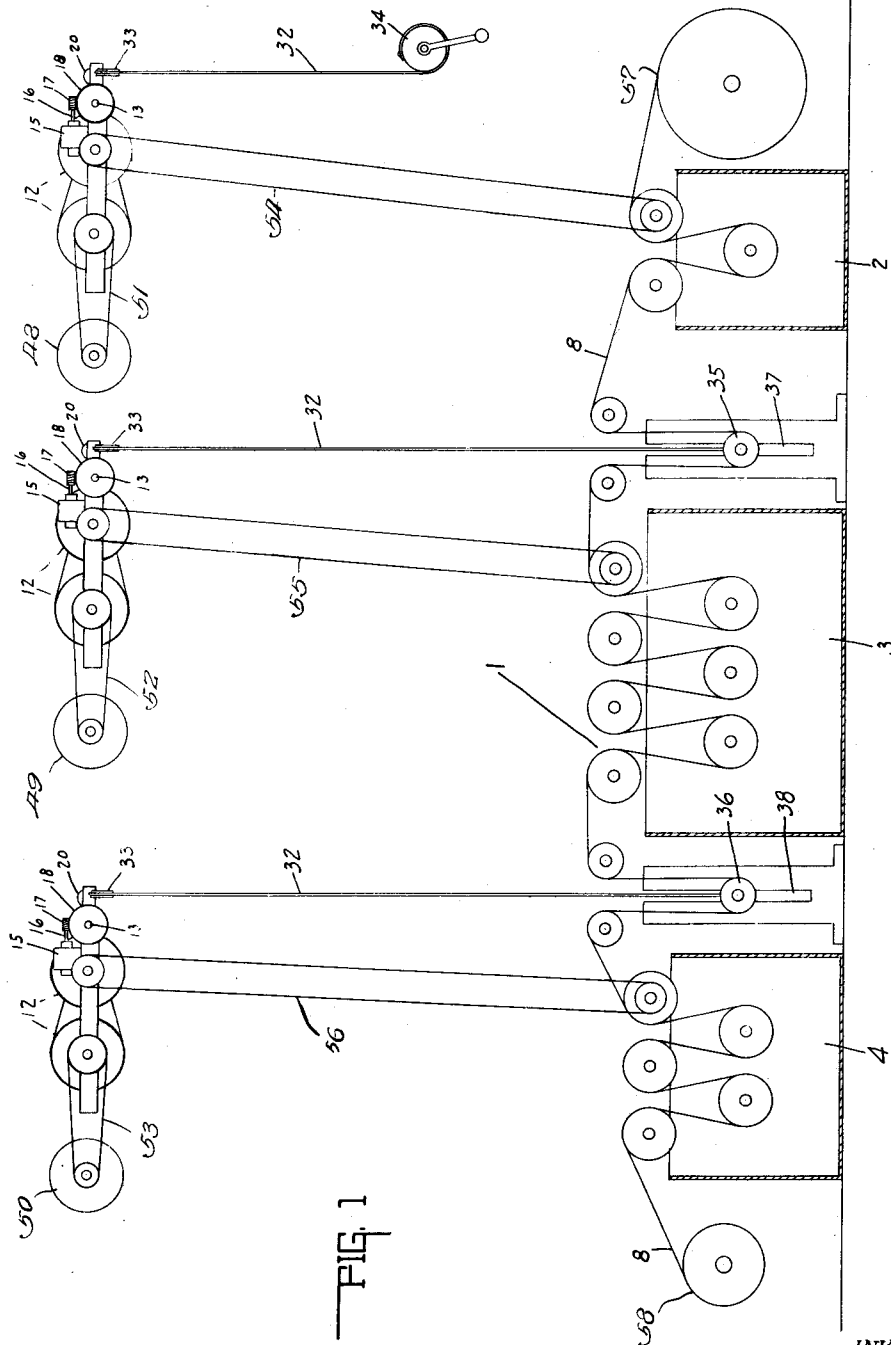


FIG. 1

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2 Sheets-Sheet 2

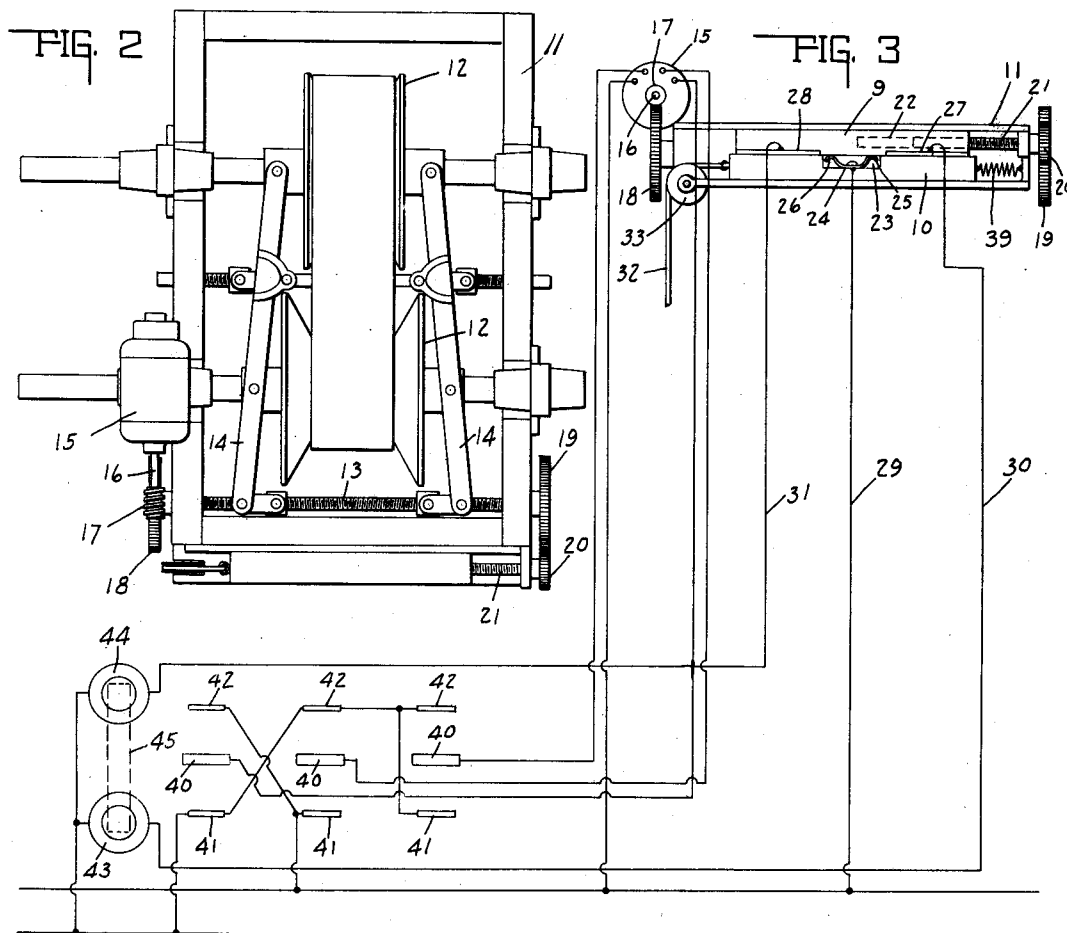


FIG. 4

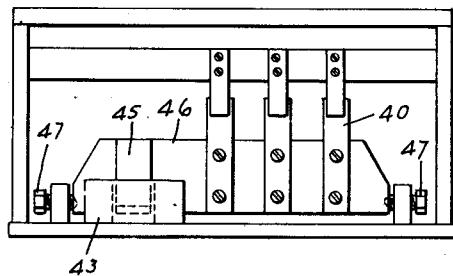
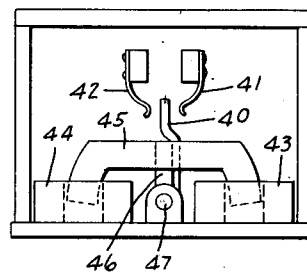


FIG. 5



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## UNITED STATES PATENT OFFICE.

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### AUTOMATIC SPEED-CONTROLLING DEVICE.

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This invention relates to automatic speed controlling devices and is designed primarily for use in connection with variable speed transmission mechanisms, the present construction being adapted preferably for controlling the various units of a cloth treating machine, although it will be understood that it will work equally as well with all classes of machinery having units requiring the change of speed for causing the units to operate in absolute harmony.

In treating cloth, it frequently occurs that the fiber of the cloth will be caused to contract or shrink in passing through one unit while at a subsequent unit the treatment will result in the expansion of the cloth or fiber, consequently the speed at which the operating parts of the different units is driven must necessarily be varied, and the prime feature of the present invention is the provision of means in connection with the variable speed gears for constantly changing and unifying the speed at which the different units are driven, depending upon the condition of the material as it is passing through the various units.

A further feature of the invention is the provision of means operated by the material being treated for controlling the movement of the automatic speed changing control.

A further feature of the invention is in so constructing the speed changing mechanism that the motor employed for operating the same may be reversed or driven in either direction.

And a further feature of the invention is in so constructing the speed controlling parts for the variable speed mechanism that the shifting of the parts of the variable speed mechanism for changing the speed thereof will automatically and intermittently break the circuit to the motor employed for driving the speed controlling mechanism.

Other objects and advantages will be hereinafter more fully set forth and pointed out in the accompanying specification.

In the accompanying drawings,

Figure 1 is a diagrammatic view of a machine having a plurality of units and individual variable speed mechanisms for driving the separate units,

Figure 2 is a top plan view of a variable speed mechanism showing the automatic control thereon,

Figure 3 is a detail end elevation of the frame of the transmission mechanism with the automatic speed controlling device attached thereto, showing parts thereof by diagram,

Figure 4 is a side elevation of a magnetically controlled switch, and

Figure 5 is an end elevation thereof.

Referring to the drawings, 1 indicates a machine for treating cloth or similar fabric, which in the present instance is divided into units 2, 3 and 4, which are driven from variable speed mechanisms 5, 6 and 7 respectively, and in devices of this class it frequently occurs that the strip of fabric 8, during the treatment in the unit number 2, will contract, while the same fabric when passing through the unit number 3 will expand, consequently it is necessary to drive the variable speed mechanism 5 at a different speed from that at which the variable speed mechanism 6 is driven, and in some instances it is also necessary to operate the variable speed mechanism 7 at a still different speed from the other two mechanisms, and it also frequently occurs that the ratios of speed will change at irregular intervals thereby requiring that the speed changing mechanism be intermittently operated for practically instantly compensating for the variations in the speed of travel of the different sections of the fabric.

In accomplishing these various results, means are provided for automatically and independently changing and controlling the speed of travel of the different variable speed mechanisms, consisting preferably of a pair of blocks 9 and 10, preferably of insulating material, which blocks are slidably mounted on the end bar of a frame 11, such as is used for carrying variable speed transmission cones 12, said blocks being slidably mounted on the frame and movable independently of each other. Extending transversely through the frame 11 is the usual form of threaded shaft 13 to which are connected levers 14 for controlling the sets of cones 12, and through the medium of which the speed of the variable speed shaft of the transmission mechanism is increased or decreased. Mounted upon the frame 11 is a motor 15, to the shaft 16 of which is attached a worm gear 17, said worm meshing with a worm gear 18 on one end of the shaft 13, while at the opposite end of said shaft is a gear 19 which meshes with a pinion 20 con-

5 nected to one end of an adjusting screw 21, the threaded end of said screw entering a threaded socket 22 which extends longitudinally of the block 9, consequently when the shaft 13 is operated to change the positions of the pairs of cones 12, the screw 21 will be rotated for moving the block 9 lengthwise. The block 10 is provided with a recess 23 in which is located a contact 24, the ends of the contact being bent upwardly and curved to form contact fingers 25 and 26 respectively, and these fingers are adapted to engage respectively with contact plates 27 and 28 on the under face of the block 9. The plates 27 and 28 are so positioned that the contact fingers may remain out of contact with both of the plates, but when the block 10 is moved longitudinally in either direction one of the fingers of the contact 24 will be brought into engagement with one or the other of the contact plates 27 or 28 thereby closing a circuit through a wire 29, connected with the contact 24, and through a wire 30 connected with the contact plate 27, or a wire 31 connected with the contact plate 28, the closing of a circuit causing the motor 15 to drive the worm 17, the direction of travel of the motor and worm depending upon whether the circuit is closed through the wire 30 or 31.

30 Any suitable means may be employed for moving the block 10 lengthwise, but in the present instance a cable 32 is connected with one end of the block 10 and extended over a sheave 33 so as to properly guide the cable, and as shown in Figure 1 of the drawings, the cable associated with the block on the variable speed mechanism 5 is connected with a hand operated drum 34, so that the speed of this particular unit may be manually operated while the cables connected with the blocks on the variable speed mechanisms 6 and 7 are arranged for automatic operation. These latter cables are connected with idlers 35 and 36 which are located, respectively, between the units 2 and 3 and 3 and 4, the idlers being rotatably mounted and vertically adjustable in guides 37 and 38 respectively, and as the strip of fabric passes below these idlers, and in fact supports the idlers, the contraction or expansion of the fabric will control the positions of the idlers and determine the positions of the blocks 10 attached to the cables connected with said idlers, consequently the speed of the transmission mechanisms 6 and 7 will be automatically controlled.

55 The cables 32 move the blocks 10 in one direction only, and the cables exert an endwise pull on the blocks 10 only in the event of an expansion of the fabric or through the manual operation of the drum 34, consequently other means must be provided for moving the blocks 10 in the opposite direction. In this instance a spring 39 is connected to the opposite end of the block 10 from that to which the cable 32 is connected, the opposite end of the spring

being connected to a part of the frame in which the block 10 is mounted, consequently as the tension on the cables 32 is released the springs 39 will move the blocks 10 in the opposite direction, and if the cables are sufficiently slackened will move the fingers 25 into engagement with the plates 27 and close the circuit through the wires 29 and 30, thereby energizing the motor 15 and setting up rotation of the adjusting screw 21, the direction of travel of the motor causing the block 9 to move to the right. This movement will continue until the block 10 stops its movement and the block 9 continues to move a sufficient distance to break connection between the plate 27 and finger 25. The block 10 may be made of such a length that in the event the cable 32 should break, the spring 39 will practically instantly move the contact 24 entirely past the plate 27, the movement of the block 10 being so rapid that the operation of the motor will be very slight. The direction of travel of the motor 15 is controlled through the medium of switch tongues 40 and contact plates 41 and 42, the plates 41 and 42 being placed at opposite sides of the switch tongues so that the tongues may be swung in opposite directions for successively making contacts with the plates.

The movement of the switch tongues 40 is controlled by magnets 43 and 44 with which co-operates a common armature 45, said armature being connected to an insulating block 46 to which the switch tongues 40 are also connected, the block 46 having pivots 47 at its ends so arranged that the block will rock on the pivots and move the switch tongues into engagement with either the plates 41 or 42. One end of the armature 45 is associated with the magnet 43, while the opposite end thereof is associated with the magnet 44, consequently when a circuit is formed through the wire 29, finger 25, contact plate 27 and wire 30, the end of the armature 45 co-operating with the magnet 43 will be energized and drawn downwardly, thereby swinging the switch tongues 40 into engagement with contact plates 41, while should the circuit be formed through the wire 29, finger 26, contact plate 28 and wire 31, the magnet 44 will be energized and the end of the armature co-operating therewith moved downwardly thereby swinging the switch tongues in the opposite direction and into engagement with the plates 42, this movement reversing the rotation of the motor 15 and causing the adjusting screw 21 to move the block 9 in the opposite direction from that previously described. When both magnets are de-energized the tongues 40 will automatically move to a neutral position between the contact plates 41 and 42.

Power may be supplied to the variable speed transmission devices 5, 6 and 7 from any suitable source such as a motor, line shaft,

counter shaft or the like through the medium of belts, chains gearing, etc. In the illustration embodiment of the invention shown in the drawings power is supplied by electric  
 5 motors 48, 49 and 50 to the respective variable speed transmission devices 5, 6 and 7 through the medium of belts 51, 52 and 53. The power is transmitted from the variable speed transmission devices to units 2, 3 and  
 10 4 by means of belts 54, 55 and 56 as here shown, but any other suitable means may be used. The fabric or other material being treated is indicated as being unwound from a roll 57 and rewound on a roll 58.

15 In operation, after the drum 34 has been operated manually for regulating the speed of the mechanism 5, any expansion of the fabric passing below the idlers 35 or 36 will cause said idlers to descend and move the respective block 10, to which the idler is attached endwise, thereby moving the finger  
 20 26 into engagement with the plate 28, whereupon a circuit will be formed through the wires 29 and 31 and the magnet 44 being thus energized, will swing the tongues 40 into engagement with the plates 42, and as this circuit is closed, the motor 15 will be energized and driven so long as the contact finger 26 is in engagement with the contact plate 28, and  
 25 this registration will continue so long as the idler continues to descend. As soon, however, as the idler has reached the limit of its downward movement, the endwise movement of the block 10 will cease but the operation  
 30 of the motor will continue to move the block 9 lengthwise until the plate 28 is moved out of engagement with the contact finger 26, this operation of the motor also operating the shaft 13 for changing the speed of the variable speed mechanism, the change in speed  
 35 being such as to regulate the operation of the particular unit to which the variable speed mechanism is connected until another change occurs in the fabric. Should the fabric begin to contract or shorten, the idlers  
 40 will be elevated and the tension removed from the cables connected to the blocks 10, whereupon the springs 39 will move the blocks lengthwise in the opposite direction a sufficient distance to form a circuit through the  
 45 finger 25 and contact plate 27, thereby moving the switch tongues 40 into engagement with the plates 41 and causing the motor to operate in reverse movement, this operation  
 50 continuing until the block 10 has been moved to a neutral point and the contact 27 moved out of engagement with the finger 25. It will thus be seen that the fluctuating movement of the idlers 35 and 36 will automatically  
 55 control the rate of speed of the variable speed mechanisms 6 and 7, and it will likewise be seen that the operation of the shaft 13 for regulating the speed of the cones 12 will act to break the circuit between the contact plates  
 60 27 and 28 and the contact 24.

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

1. The combination with an adjusting shaft of a variable speed transmission mechanism and an electrically driven motor for  
 70 operating said shaft, of a pair of slidably mounted co-operating blocks, a pair of contact plates on one of said blocks, a contact mounted on the other block and having fin-  
 75 gers for engagement with said plates, automatic means for moving the contact carrying block endwise, and means controlled by the operation of said shaft for moving the plate carrying block lengthwise in opposite direc-  
 80 tions.

2. The combination with a speed changing means for variable speed mechanism, and means for operating said speed changing  
 85 means, of a pair of slidably mounted blocks, contact plates in separated relation on one of said blocks, a contact on the opposite block having fingers for engagement with the plates of the other block, means controlled by the  
 90 operation of said speed changing means for moving the plate containing block lengthwise, and means for automatically moving the contact carrying block lengthwise for engaging the fingers of the contact thereon with one or the other of said plates.  
 95

3. The combination with a variable speed transmission mechanism, of means for changing the position of parts of said transmission mechanism, and means for utilizing the movement of the parts of the transmission mechanism for stopping operation of the position  
 100 changing means, substantially as set forth.

4. Gearing comprising a lever, a speed-varying element operated thereby, means for operating the lever including an electric  
 105 switch, and means for automatically breaking the circuit at said switch after a predetermined movement of the lever, substantially as set forth.

5. Gearing comprising a lever, a speed-varying element operated thereby, means for operating the lever including an electric  
 110 switch having relatively movable parts, means controlled by material in a driven machine for moving one of said parts of the switch to close a circuit for causing operation of the lever, and means in connection with the lever-operating means for moving another of said parts of the switch to break the circuit, substantially as set forth.  
 120

6. In combination, a driven machine, and gearing for driving the same including power-operated shiftable speed varying means, a circuit-closer for setting the shiftable means in motion when the circuit is closed, means  
 125 under control of the material in the machine for closing the circuit, and means for breaking the circuit after a predetermined movement of the shiftable means, substantially as set forth.

7. In combination, a driven machine, and gearing for driving the same including power-operated shiftable speed varying means, a circuit-closer for setting the shiftable means in motion when closed said circuit-closer having relatively movable parts, means for moving one of said parts to an extent controlled by the condition of the material being operated on, and means controlled by the movement of said shiftable means for re-establishing the relation of said movable parts of the circuit-closer to break the circuit, substantially as set forth.

8. In a machine operating on web material, driving gearing, speed-varying means therefor including a shifting element, means for moving the shiftable element including a circuit-closer having a plurality of movable parts, means for moving one of said parts a distance proportional to variations in the tension of the material thereby closing the circuit, and connections from the shiftable element for causing another element of the circuit-closer to follow the first and thus break the circuit after a movement corresponding to such variations of tension, substantially as set forth.

9. A machine for operating on continuous strip material comprising a shiftable speed-varying element, means to move the same including a circuit-closer having two relatively slidable parts, means for imparting movement to one such part in proportion to variations of tension in the material being operated on, and means operating in synchronism with said shiftable element for giving another part a follow-up movement whereby the circuit is broken after a travel of the latter part proportioned to said variations of tension, substantially as set forth.

10. The combination of a pair of expandible pulleys, a belt extending thereover, a pair of levers for adjusting the pulleys in opposite senses, a screw to adjust the levers simultaneously, an electric motor operating the screw, a switch in the motor circuit having two movable parts, means controlled by variations of condition in the material being operated on for moving one part in either of two opposite directions, and gearing connected to said screw for giving the other part of the circuit-closer a follow-up movement whereby the circuit is broken after a travel proportioned to such variation in condition, substantially as set forth.

11. The combination of speed varying mechanism, adjusting means therefor, an electric motor, gearing connecting the motor to the adjusting means, automatic means for closing the motor circuit, and means controlled by the adjusting means for breaking the motor circuit, substantially as set forth.

12. The combination of speed varying mechanism, adjusting means therefor, an

electric motor, gearing connecting the motor to the adjusting means, automatic means for closing the motor circuit, electrical means for determining the direction of rotation of the motor, and means controlled by the adjusting means for breaking the motor circuit, substantially as set forth.

13. The combination of driving mechanism, means for varying the speed of the same, a shiftable element, an electric motor for shifting the same, means under control of the material being operated on for starting the motor, and means operated by the shiftable element for stopping the same, substantially as set forth.

14. In combination, two machines arranged to operate on the same material in series, a variable-speed mechanism through which one of said two machines is driven, power-operated means for operating said variable speed mechanism to vary the relative speeds of said two machines, and means for controlling said power-operated means jointly by the accumulation of material between the two machines and by the position of said power-operated means.

15. In combination, two machines arranged to operate on the same material in series, a variable-speed mechanism through which one of said two machines is driven, power-operated means for operating said variable-speed mechanism to vary the relative speeds of said two machines, control means for controlling the supply of power to said power-operated means, and means for governing said control means by the accumulation of material between the two machines.

16. In combination, two machines arranged to operate on the same material in series, a variable-speed mechanism through which one of said two machines is driven, power-operated means for operating said variable-speed mechanism to vary the relative speeds of said two machines, control means for controlling the supply of power to said power-operated means, and means for governing said control means jointly by the accumulation of material between the two machines and by the position of said power-operated means.

17. In combination, two machines arranged to operate on the same material in series, a variable-speed mechanism through which one of said two machines is driven, power-operated means for operating said variable-speed mechanism to vary the relative speeds of said two machines, control means for controlling the supply of power to said power-operated means, said control means comprising two movable members, and means for moving one of said movable members in accordance with the accumulation of material between the two machines and for moving the other of said two members by the movements of said power-operated means.

18. In combination, two machines arranged

to operate on the same material in series, a variable-speed mechanism through which one of said two machines is driven, power-operated means for operating said variable-speed mechanism to vary the relative speeds of said two machines, control means for controlling the supply of power to said power-operated means, said control means comprising two relatively movable members, and means for producing a relative movement of said two members by the accumulation of material between the two machines and for producing the reverse relative movement of said two members by the movement of said power-operated means which is produced in response to the first-named relative movement.

19. In combination, two machines operating on the same strip of material in series, said strip being arranged in a bight between the two machines, a control member arranged to be carried in said bight and to be movable by the lengthening and shortening of the bight, a variable-speed mechanism through which one of said two machines is driven, and means for controlling said variable-speed mechanism jointly by the vertical movements of said control members and by the condition of said variable-speed mechanism.

20. The mechanism set forth in claim 14, in which the material operated on by the machines travels in a strip from one of the machines to the other in combination with means for forming a bight in the intermediate section of the strip between the two machines, a control member hung in said bight and movable transversely of its axis by the lengthening and shortening of the bight, and means operated by said movements of said control member for producing the control in response to the accumulation of material between the two machines.

21. The mechanism set forth in claim 15, in which the material operated on by the machines travels in a strip from one of the machines to the other in combination with means for forming a bight in the intermediate section of the strip between the two machines, a control member hung in said bight and movable transversely of its axis by the lengthening and shortening of the bight, and means operated by said movements of said control member for producing the control in response to the accumulation of material between the two machines.

22. The mechanism set forth in claim 16, in which the material operated on by the machines travels in a strip from one of the machines to the other in combination with means for forming a bight in the intermediate section of the strip between the two machines, a control member hung in said bight and movable transversely of its axis by the lengthening and shortening of the bight, and means operated by said movements of said control member for producing the control in response

to the accumulation of material between the two machines.

23. The mechanism set forth in claim 17, in which the material operated on by the machines travels in a strip from one of the machines to the other in combination with means for forming a bight in the intermediate section of the strip between the two machines, a control member hung in said bight and movable transversely of its axis by the lengthening and shortening of the bight, and means operated by said movements of said control member for producing the control in response to the accumulation of material between the two machines.

24. The mechanism set forth in claim 18, in which the material operated on by the machines travels in a strip from one of the machines to the other in combination with means for forming a bight in the intermediate section of the strip between the two machines, a control member hung in said bight and movable transversely of its axis by the lengthening and shortening of the bight, and means operated by said movements of said control member for producing the control in response to the accumulation of material between the two machines.

25. In combination, two machines operating on the same strip of material in series, said strip being arranged in a bight between the two machines, a control member arranged to be carried in said bight and to be movable by the lengthening and shortening of the bight, a variable-speed mechanism through which one of said two machines is driven, means for controlling said variable-speed mechanism by the movements of said control member, the material operated on by the machines traveling in a strip from one of the machines to the other, in combination with means for forming a bight in the intermediate section of the strip between the two machines; a control member hung in said bight and movable transversely of its axis by the lengthening and shortening of the bight, and means operated by said movements of said control member for producing the control in response to the accumulation of material between the two machines.

26. In combination, two machines operating on the same strip of material in series, said strip being arranged in a bight between the two machines, a control member arranged to be carried in said bight and to be movable by the lengthening and shortening of the bight, a variable-speed mechanism through which one of said two machines is driven, means for controlling said variable-speed mechanism jointly by the vertical movements of said control members and by the condition of said variable-speed mechanism, the material operated on by the machine traveling in a strip from one of the machines to the other, in combination with means for forming a bight in

the intermediate section of the strip between the two machines, a control member hung in said bight and movable transversely of its axis by the lengthening and shortening of the bight, and means operated by said movements of said control member for producing the control in response to the accumulation of material between the two machines.

27. In combination, two machines, arranged to operate on the same material in series, a variable-speed mechanism through which one of said two machines is driven, power-operated means for operating said variable-speed mechanism to vary the relative speeds of said two machines, control means for controlling the supply of power to said power-operated means, said control means comprising two movable members, and means for moving one of said movable members in one direction or the other according as the accumulation of material between the two machines increases or decreases, respectively, and for subsequently moving the other member in the same direction to restore the normal relation between said two members by the operation of said power-operated means.

28. In combination, two machines arranged to operate on the same material in series, a variable-speed mechanism through which one of said two machines is driven, power-operated means for operating said variable-speed mechanism to vary the relative speeds of said two machines, control means for controlling the supply of power to said power-operated means, said control means comprising two movable members, and means for moving one of said movable members in one direction or the other according as the accumulation of material between the two machines increases or decreases, respectively, and for subsequently moving the other member in the same direction to restore the normal relation between said two members.

29. In combination, a power-operated device, control means therefor, said control means comprising two movable members, and means for moving one of said movable members in one direction or the other in accordance with variations in a determining quantity and for subsequently moving the other member in the same direction to restore the normal relation between said two members.

30. In combination, a power-operated device, control means therefor, said control means comprising two movable members, and means for moving one of said movable members in one direction or the other in accordance with variations in a determining quantity and for subsequently moving the other member in the same direction to restore the normal relation between said two members by the operation of said power-operated device.

31. The combination with a variable speed

transmission mechanism and a machine driven thereby, said machine having a work-controlled part, of a speed changing mechanism, means actuated by said work-controlled part for operating the speed changing mechanism, and means for reversing the direction of movement of said speed changing mechanism at any point in the travel of the work-controlled part, substantially as set forth.

32. Means for treating fabric to successive operations in a continuous manner, which consists in the combination of a plurality of different fabric treating machines through which the fabric passes in succession with separate power means for mechanically driving each of the fabric treating machines at a normal predetermined speed suitable for said machines, separate means intermediate of the separate power means and the respective fabric treating machines for varying the speed of the latter, by reason of which the speed of any of the fabric treating machines may be increased or decreased, and automatic means controlled by the looseness of the fabric in passing from one fabric treating machine to the next of said machines in succession for automatically controlling the speed varying means for the machine upon which the fabric is received, whereby the speed of said machine is increased or decreased as the case may be in accordance with the increase or decrease in the looseness of the fabric in passing from one machine to the machine next in succession and whose speed is to be automatically controlled, wherein the separate means for driving each of the fabric treating machines through which the fabric passes consists of a constant speed motor.

33. Means for treating a fabric to successive operations in a continuous manner which consists in the combination of a plurality of different machines through which the fabric passes in succession, separate constant speed means for driving each of the machines, interposed speed varying means between each of the constant speed means and the respective machines driven thereby whereby the speeds of said machines may be independently varied without affecting the constant speed means, manually controlled means for regulating the interposed speed varying means of one of the machines, and automatic means controlled by the looseness of the fabric in passing from the manually controlled machine to the next machine of the series for adjusting the interposed speed varying means thereof whereby the speed of said machine is automatically increased or decreased as the case may be in accordance with the increase or decrease of the looseness of the fabric in passing from the preceding or manually controlled machine to the machine the speed of which is to be automatically controlled.

34. Means for driving and controlling the speed of a machine of a "range" which consists of a driving shaft and a driven shaft, variable speed transmitting devices between the two shafts, a constant speed motor for operating the driving shaft at a constant speed, power transmitting means from the driven shaft to the machine whose speed is to be automatically controlled, mechanical means for increasing or decreasing the speed of the driven shaft, a controlling electric motor for operating the mechanical means, a source of electric energy for operating the control motor, and an electric switch for putting the control motor in and out of action and reversing its direction of rotation controlled by the extent of slack in the textile material passing to the machine of the "range" whose speed is to be controlled.
35. Means for treating a fabric to successive operations in a continuous manner which consists in the combination of a plurality of different machines through which the fabric passes in succession, separate constant speed means for driving each of the machines, interposed speed varying means between each of the constant speed means and the respective machines driven thereby whereby the speeds of said machines may be independently varied without affecting the constant speed means, manually controlled means for regulating the interposed speed varying means of one of the machines, and automatic means controlled by the looseness of the fabric in passing from the manually controlled machine to the next machine of the series for adjusting the interposed speed varying means thereof whereby the speed of said machine is automatically increased or decreased as the case may be in accordance with the increase or decrease of the looseness of the fabric in passing from the preceding or manually controlled machine to the machine the speed of which is to be automatically controlled, substantially as set forth.
36. Means for treating fabric to successive operations in a continuous manner, which consists in the combination of a plurality of different fabric treating machines through which the fabric passes in succession with separate power means for mechanically driving each of the fabric treating machines at a normal predetermined speed suitable for said machines, separate means intermediate of the separate power means and the respective fabric treating machines for varying the speed of the latter by reason of which the speed of the fabric treating machines may be relatively increased or decreased, and automatic means controlled by the looseness of the fabric in passing from one fabric treating machine to the next of said machines in succession for automatically controlling the speed varying means for the machine upon which the fabric is received whereby the speed of said machine is increased or decreased as the case may be in accordance with the increase or decrease in the looseness of the fabric in passing from one fabric treating machine to the next of said machines in succession for automatically controlling the speed of the latter by reason of which the speed of the fabric treating machines may be relatively increased or decreased, and automatic means controlled by the looseness of the fabric in passing from one fabric treating machine to the next of said machines in succession for automatically controlling the speed varying means for the machine upon which the fabric is received whereby the speed of said machine is increased or decreased as the case may be in accordance with the increase or decrease in the looseness of the fabric in passing from one machine to the machine next in succession and whose speed is to be automatically controlled, substantially as set forth.
37. Means for treating fabric to successive operations in a continuous manner, which consists in the combination of a plurality of different fabric treating machines through which the fabric passes in succession with separate power means for mechanically driving each of the fabric treating machines at a normal predetermined speed suitable for said machines, separate means intermediate of the separate power means and the respective fabric treating machines for varying the speed of the latter by reason of which the speed of the fabric treating machines may be relatively increased or decreased, and automatic means controlled by the looseness of the fabric in passing from one fabric treating machine to the next of said machines in succession for automatically controlling the speed varying means for the machine upon which the fabric is received, whereby the speed of said machine is increased or decreased as the case may be in accordance with the increase or decrease in the looseness of the fabric in passing from one machine to the machine next in succession and whose speed is to be automatically controlled, the separate power means for driving each of the fabric treating machines through which the fabric passes consisting of a constant speed motor, substantially as set forth.
38. Means for driving and controlling the speed of a machine of a "range" which consists of a driving shaft and a driven shaft, variable speed transmitting devices between the two shafts, a constant speed motor for operating the driving shaft at a constant speed, power transmitting means from the driven shaft to the machine whose speed is to be automatically controlled, mechanical means for increasing or decreasing the speed of the driven shaft, a controlling electric motor for operating the mechanical means, a source of electric energy for operating the control motor, and an electric switch for putting the control motor in and out of action and reversing its direction of rotation controlled by the extent of slack in the textile material passing to the machine of the "range" whose speed is to be controlled, substantially as set forth.
39. The combination of a variable speed transmission mechanism and a machine driven thereby, a traveling work-controlled part actuated by the work to be treated in said machine, an electrically actuated speed changing mechanism, means actuated by said work-controlled part for controlling the operation of the electrically actuated speed

changing mechanism, and means for reversing the direction of movement of said speed changing mechanism by the work-controlled part at any point when the direction of its travel is reversed, substantially as set forth.

40. The combination with a variable speed power means and a machine driven thereby, a traveling work-controlled part actuated by the work to be treated in said machine, a speed changing means for said variable power means actuated by said work-controlled part for controlling the speed of the power means, and means for reversing the direction of movement of the speed changing means by the work controlled part at any point when the direction of its travel is reversed, substantially as set forth.

41. In combination, two machines operating on the same strip of material in series, said strip being arranged in a bight between the two machines, a control member arranged to be carried in said bight and to be movable by the lengthening and shortening of

the bight, a variable-speed mechanism through which one of said two machines is driven, constant speed means for operating the variable speed mechanism, means for controlling said variable-speed mechanism by the movements of said control member, the material operated on by the machines traveling in a strip from one of the machines to the other, in combination with means for forming a bight in the intermediate section of the strip between the two machines, a control member hung in said bight and movable transversely of its axis by the lengthening and shortening of the bight, and means operated by said movements of said control member for producing the control in response to the accumulation of material between the two machines, substantially as set forth.

In witness whereof, I have hereunto set my hand at Indianapolis, Indiana, this 3rd day of February, A. D. nineteen hundred and twenty-two.

DARCY E. LEWELLEN.