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A. W. KUZINSKI

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TENTERING MACHINE SPEED CONTROL

Filed March 9, 1945

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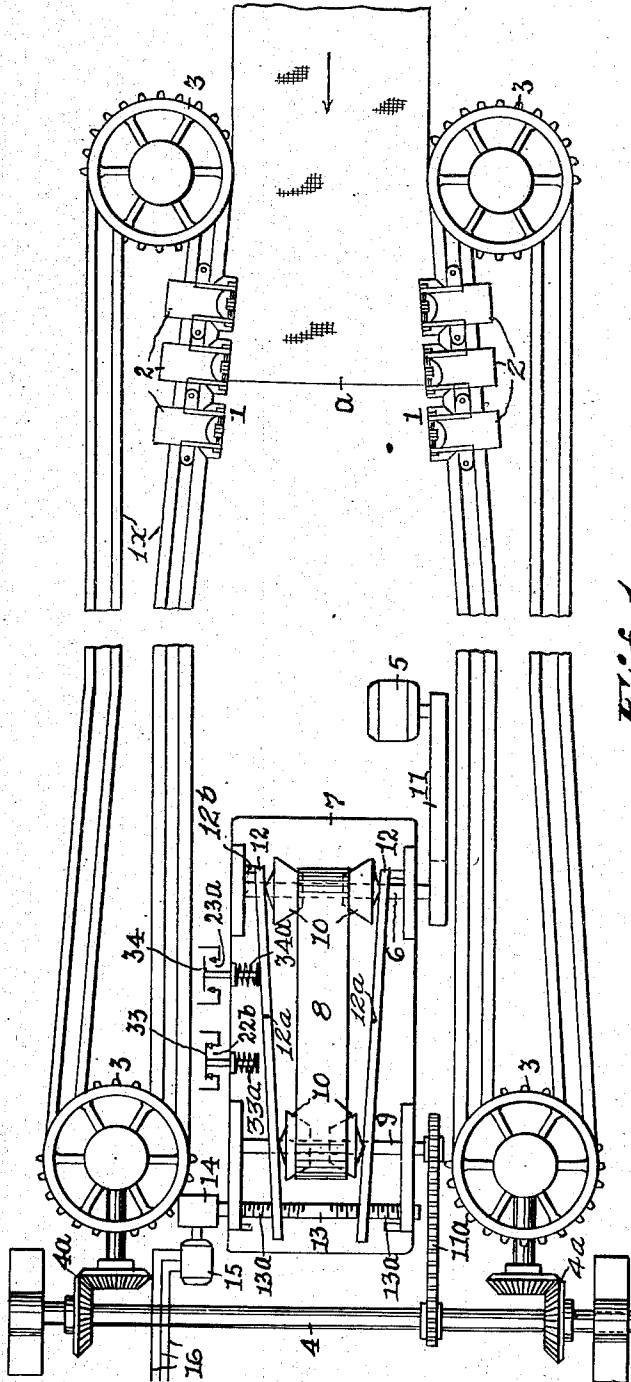


Fig. 1.

INVENTOR,
Adolph W. Kuzinski,
BY
John W. Howard
ATTORNEY.

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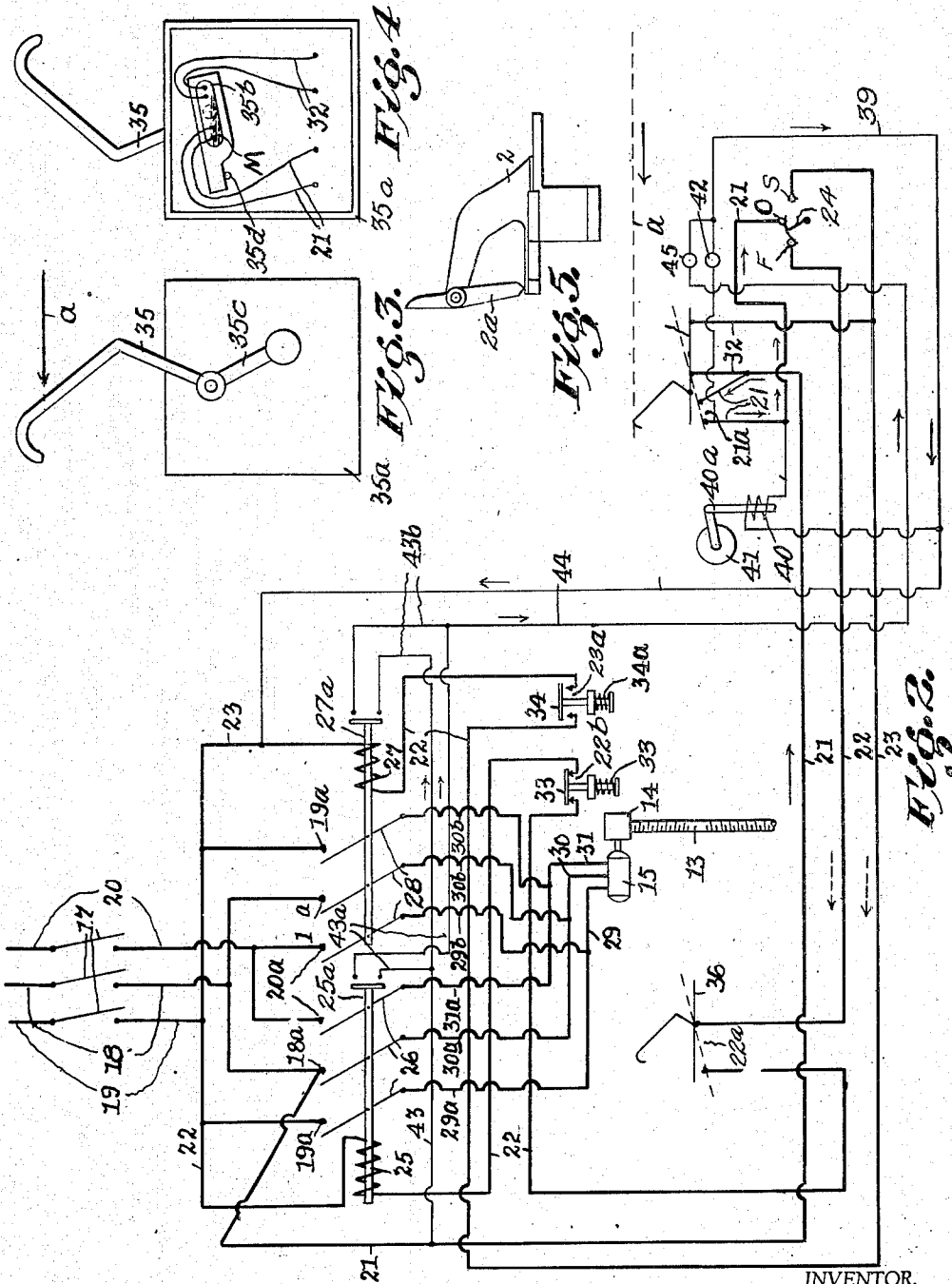
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BY

INVENTOR,
Adolph W. Kuzinski,
John W. Kuzinski,
ATTORNEY

UNITED STATES PATENT OFFICE

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TENTERING MACHINE SPEED CONTROL

Adolph W. Kuzinski, Passaic, N. J.

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5 Claims. (Cl. 26—57)

This invention relates to machines for simultaneously advancing and transversely stretching sheet material, as in a known machine for tentering a fabric, and particularly in the case where in the normal operation of the machine successive lengths of the material are made to undergo the operation with a little interruption and delay as possible, and (as in the case of a tentering machine) the speed of the machine has to be slowed down when a length or piece enters, in order to insure proper incorporation of the same in the control of the machine, and speeded up when such length is about to leave the machine, in order in such case to permit the length to be formed into a roll, which latter is usually a manual operation. With respect to such normal operation the slow speed, once started for the delivery of a length, is maintained for the entering of the succeeding length—that is to say, the high speed and slow speeds alternate, usually without interruption of either, unless, of course, some unforeseen circumstance necessitates such interruption.

Heretofore the speed-control for such normal operation has been accomplished manually, with a considerable expense of labor and time. According to this invention such speed-control is effected automatically. Further, if the operation is to be abnormal, or the machine operated at slow speed, the invention provides for driving the machine only at slow speed. Again, as will appear, the operator can, when the system has been set for normal operation, determine the speed above the minimum, or slow, at which the machine is driven, which speed will continue until the particular piece then being treated is about to leave the machine. The invention also provides for certain signal devices for indicating to the operator during the normal operation certain conditions incident to such operation and also for automatic steaming of the material being treated when such material, as in the case of a tentering machine, is a fabric.

In the drawings:

Fig. 1 is a generally diagrammatic view, in plan, of a tentering machine and a variable-speed drive therefor;

Fig. 2 is a diagram of the electrical system controlling the drive;

Figs. 3 and 4 are front and rear elevations, respectively, of the main control switch; and

Fig. 5 is a side elevation of a conventional tentering clip.

Sufficient of a conventional well-known tentering machine is shown in Fig. 1 for the present purpose, to wit, as including two endless chains 1 (only partially shown in Fig. 1) of clips 2 equipped with pivoted jaws 2a (Fig. 5) so as to grip the cloth *a* to be tented at its margins each chain being guided by rails 1x and extending

around a pair of sprocket-wheels 3 to be driven in the direction to cause the chain to advance the cloth as per the arrow shown in Fig. 1, as from a shaft 4 itself to be driven at differential speeds from any type of master motor 5 through a drive, in this example being what is known as a Reeves drive and including a variable-speed transmission comprising parts 10—8—6—10—9 constructed as follows: A shaft 6, journaled in the structure 7, through a belt 8 drives a shaft 9, each such shaft having splined thereto a pair of pulleys 10 directly engaged by the belt. When the pulleys on shaft 6 are moved apart and those on shaft 9 are moved together shaft 9 is rotated at a slower speed than when this relation of the pulleys of the two pairs is reversed; as appearing in Fig. 1 the speed of shaft 9 would be slow. A belt-and-pulley connection 11 transmits rotation from the master motor to shaft 6, and a sprocket-and-chain connection 11a transmits rotation from shaft 9 to shaft 4, which through gearing 4a drives the chains. Levers 12, each fulcrumed in structure 7 at 12a between its ends and having its motion limited, as at 12b in each direction, effect the setting of the pulleys of either pair toward and those of the other pair from each other when said levers are moved by a rotary reversible element here formed as a screw 13 connected with levers 12 so as to rotate in unison therewith, as by having reverse threadings 13a in threaded engagement with the respective levers. The screw is rotated, through gearing in a gear-box 14, by the rotary driven member of a three-phase electric reversible motor 15 having the conductors 16.

The electrical energy for driving motor 15 in either direction is derived from the source provided by one of three service lines 18—19—20 when a master switch 17 (Fig. 2) is closed; each of which lines is forked to provide a pair of terminals 18a, 19a and 20a, all six terminals being here arranged as shown or so that they are aligned and one from each pair goes to form one group and the others another group.

A main power line 21 extends from one terminal, as 18a, in one group to a terminal O and has a break 21a therein to be closed as will appear. Two branch main return lines 22 and 23 respectively have terminals F and S on opposite sides of terminal O. At 24 is a control switch movable to close the break between either O—F or O—S. Branch line 22 extends from terminal F to one of the forked portions other than the one having either terminal 18a, as here a forked portion having a terminal 19a, and has a primary break at 22a and a secondary break 22b and contains a magnetic solenoid as a coil 25 whose core or armature 25a forms with pivoted blades 26 a known circuit-closer. Branch line 23 extends from terminal S also to one of the

forked portions other than the one having either terminal 18a, or here to a forked portion having a terminal 19a, and has a break therein at 23a and a solenoid coil 27 whose core or armature 27a forms with pivoted blades 28 a known circuit-closer. (When in the appended claims I refer to the breaks 22a and 22b and coil 25 of line 22, or the break 23a and the coil 27 of line 23, as "arranged in succession" I mean in the order here stated.) A subsidiary power line 30 leads to motor 15 and two subsidiary return lines 29—31 lead from motor 15, and branch lines 30a—29a—31a respectively connect said three lines with the circuit-closer blades 26, while branch-lines 30b—29b—31b respectively connect said three lines with circuit-closer blades 28. Line 21 has near the break 21a a by-pass line 32 extending to line 23 and having a break which, when closed by a circuit-closer 35 (as will appear) while break 21a remains open, causes the current to by-pass terminals O—F or O—S. (It is to be understood that, in any way not shown, the armatures 25a—27a are normally held retracted or, as shown, in the state in which the blades 26—28 are in open position.)

When in the said normal operation a piece of cloth *a* enters the machine it is to move first at a slow rate (to insure effective gripping thereof by the chain clips first approached); it is then to move at normal or fast rates; and finally, as its travel through the machine is about to terminate, to move at a slow rate to permit winding of the cloth into a rolled mass, usually controlled by hand. (As already noted, with respect to a succession of lengths of cloth to be treated, the machine alternately is driven slow and fast, the slow speed being for the delivery of one piece and for the entry of the next succeeding piece.) Hence there are opposed to the ends of one lever 12 two circuit-closers 33 and 34 (normally held in closing position by springs 33a—34a) for closing the breaks at 22b and 23a. In the position of such lever as shown in Fig. 1 circuit-closer 33 is closed and circuit-closer 34 open; in its reverse position circuit-closer 33 will be opened and circuit-closer 34 closed. With break 22b closed by circuit-closer 33 complete closing of circuit 21—22 will cause motor 15 to set the Reeves drive from the position shown, or now for high-speed driving; with break 23a closed by circuit-closer 34, complete closing of circuit 21—23 will cause motor 15 to set back the Reeves drive or for slow speed driving.

In Fig. 2 is shown diagrammatically a lever 35 having an upstanding arm 35a in the path of the entering cloth *a* and forming a circuit-closer active either to close the break at 21a and open the break in branch line 32, or vice versa, when the lever is respectively depressed by the cloth or left free by it to rise, as by gravity and as shown in a particular form of such circuit-closer to be described. This circuit-closer adjoins the input (right-hand) end of the machine, and near the output end is a somewhat similar circuit-closer 36 for closing the break at 22a.

In respect to the normal operation (in which, according to the appendant claims, the control switch is assumed to maintain closed the break between O and F) it will facilitate an understanding thereof to note as follows: First, when the transmission of the variable-speed drive is moved in one direction one of the breaks 22b—23a is closed and the other opened and when the transmission is moved reversely there is a vice versa opening and closing of these breaks; in short,

with the circuit also otherwise closed, the next succeeding movement of the transmission from the position in Fig. 1 will cause the speed to increase from slow toward maximum, opening break 22b and ultimately closing break 23a and the return movement will involve reduction of the speed to slow, opening break 23a and closing break 22b. Secondly, that the closing of either of such breaks causes rotation of the reversible rotary means 13—14—15 in one direction for shifting said transmission to the position for slow-speed driving and in the reverse direction to the position for high-speed driving, i. e., thereupon respectively to energize the coil 25 or 27, and so cause the respective circuit-closers formed by armature 25a or 27a to connect the motor 15 through lines 29—30—31 and their branches with the energy source. Finally, that the circuit-closers 35 and 36 respectively cooperate, as will appear, with the circuit-closers 33 and 34 for the breaks 22b and 23a for the energizing of the coils.

Now assume that the cloth is entering the machine at a slow rate, to wit, as will appear at the end of this description of the operation, because the piece of cloth last treated left circuit-closer 35 in the full-line position of Fig. 1, with the break in by-pass line 32 closed and break 21a and also break 22a open. The entering piece will depress circuit-closer 35, opening the break in line 32 and closing the break at 21a. Notwithstanding break 21a is now closed, until the piece closes break 22a the circuit via the main power line 21 and main return line 22 will be open, though closed at 22b. But when the piece, while maintaining circuit-closer 35 in said position, also causes circuit-closer 36 to close the break at 22a coil 25 will be energized and its armature 25a moved to connect lines 29—30—31 via their branches with the energy source for the shifting of the transmission of the variable-speed drive to the high-speed position. This will continue until the trailing end of the piece frees circuit-closer 35, thus to open the break at 21a and close the break in by-pass line 32. When the by-pass line is thus closed the circuit is via the main power line, such by-pass line and the main return line 23 and, since the break 23a was left closed by the preceding movement of the transmission, the coil 27 will now be energized and its armature moved to connect lines 29—30—31 via their branch-lines with the energy source for driving motor 15 reversely and hence returning the transmission to its initial position. When the next piece enters, circuit-closer 35 being still in the position in which it was left by the preceding piece, or as per the full-line showing, it will continue at slow speed until it depresses, first, that circuit-closer and thereupon circuit-closer 36.

Further, having moved the control switch to close the break between O and F, as soon as the breaks at 21a and 22a are closed by the cloth and while the transmission is undergoing movement from its slow or minimum speed position toward its maximum speed position, the operator can check such movement and cause the normal speed of the machine to remain at any speed above such minimum speed. Thus, suppose the maximum speed to be 50 yards per minute and the selected speed is to be 25 yards per minute. While the transmission is undergoing movement toward its maximum-speed position the operator, when the 25-yards-per-minute normal speed is attained (determined by some speed indicator or the operator's judgment), can shift

the control switch to contact only at O thus de-energizing the coils and permitting their armatures to retract to interrupt the connections of the circuit with the energy source. By slow speed, I therefore mean the minimum speed, and by high speed any speed between such minimum and maximum speed attainable by the transmission.

Again, the operator, with the system operating at normal speed can shift the control switch to close the break between O and S and reduce the speed to slow.

The circuit so far referred to is shown by heavy lines. Desirably there are other circuit lines, shown light, for accessory expedients, as will now appear:

A return line 37 extends to branch line 23 relatively aft of solenoid 27 and to it from line 21 extend branch-lines 38 and 39. Branch line 38 contains a solenoid 40 having its core 40a connected to a diagrammatically shown steam-valve 41 for permitting, when opened, discharge of steam to the cloth. Branch-line 39 contains a signal 42, as a green light. When the circuit via 21—22 is closed at 21a solenoid 40 and signal 42 are energized, so that the cloth is steamed and the operator is informed that the break between O and F is closed for normal operation.

From line 21 extends a line 43 having a branch-line 43a, with a break therein to be closed by solenoid core 25a, and a branch-line 43b, with a break therein to be closed by solenoid core 27a, both such branch-lines extending to a return line 44 which is connected to branch-line 39 relatively aft of signal 42 and contains a signal 45, as a red light. Such signal, when energized, indicates that the speed has been increased to high, i. e., that, both of the breaks at 21a and 22a being now closed, motor 15 has been energized to cause the Reeves drive transmission to shift to high-speed driving position.

Circuit-closer 35 is shown (Figs. 3 and 4) as pivoted on a horizontal axis in a box 35a and as including a transparent tube 35b containing mercury M and being normally held in the position shown by the weight of a depending arm 35c and resting against a stop 35d. In the normal state of said circuit closer (Fig. 4) the break 21a (Fig. 2) in line 21 is closed by the mercury; when it is depressed by the cloth a the break in the branch-line 32 will be closed by the mercury. When either such break is closed by such circuit closer the other is of course allowed to open. The equipment including circuit-closer 36 may be the same as that shown in Figs. 4 and 5 excepting that such circuit-closer is adapted to close only one break. Such equipment may be in any way supported in fixed relation to the path of the cloth, not here shown but as on the frame of the tentering machine.

In the appended claims I treat the main power line and main return lines as normally joined or connected here by the switch 24 being in closing relation to F and O, or as shown, to wit—for what I have termed the "normal operation."

Having thus fully described my invention what I claim is:

1. The combination, with a machine for simultaneously lengthwise advancing and transversely stretching sheet material, a master motor, and a drive for said machine operatively interposed between the same and the motor and including a

variable-speed transmission movable alternately to two positions in one of which said transmission drives said machine at low speed and in the other at high speed, of means to form, with an electric energy source, an electric circuit, said means including a main power line having a break therein and a pair of main return lines one of which has, arranged in succession from said main power line, a primary break, a secondary break and a magnetic coil, and the other of which has, arranged in succession from said main power line, a break and a magnetic coil, said main power line having, between the break therein and the juncture of the said main return lines therewith, a bypass line extending to the second-named main return line and having a break, a reversible rotary means, including a three-phase electric motor having its driven member operatively connected with said transmission, for moving the latter to one or the other of its said positions when such reversible rotary means is respectively rotated in one direction or the other, a subsidiary power line extending to said electric motor and having a pair of branches to be connected to said main power line, two subsidiary return lines extending from the latter motor and each having a pair of branches to be connected to at least one main return line, means, including armatures for the respective coils, movable by the latter to electrically connect said subsidiary line branches with the main power line and the branches of the subsidiary return lines with at least one main return line, independent means respectively to close said secondary break in the first-named main return line and the break in the second-named main return line, said independent means being normally urged into closing relation to the latter breaks but arranged to be displaced by said transmission alternately out of said relation on movement of the transmission alternately in one direction and the other, a circuit-closer normally urged into closing relation to the break in said by-pass line but arranged to be moved by the advancing material into closing relation to the break in the main power line, and a circuit-closer, aft of the last-named circuit-closer relatively to the advance of said material, normally urged out of but movable by the advancing material into closing relation to said primary break in the first-named return line.

2. The combination set forth in claim 1 characterized by the same also including means to interrupt said circuit anterior to the breaks in said main return lines.

3. The combination set forth in claim 1 characterized by the same also including means to switch the current flowing from the main power line to the second-named main return line.

4. The combination set forth in claim 1 characterized by the same also including a line itself including a signal and extending from said main power line, relatively aft of the break therein, to one main return line, relatively aft of the coil in the latter line.

5. The combination set forth in claim 1 characterized by the same also including, with a line itself including a magnetic coil and extending from said main power line, relatively aft of the break therein, to one main return line, relatively aft of such coil, a steam-discharge valve, and an armature movable by such coil and controlling said valve.

ADOLPH W. KUZINSKI.