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G. Z. GOWIN

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APPARATUS FOR SPREADING AND GUIDING A FABRIC WEB

Original Filed Feb. 28, 1962

3 Sheets-Sheet 1

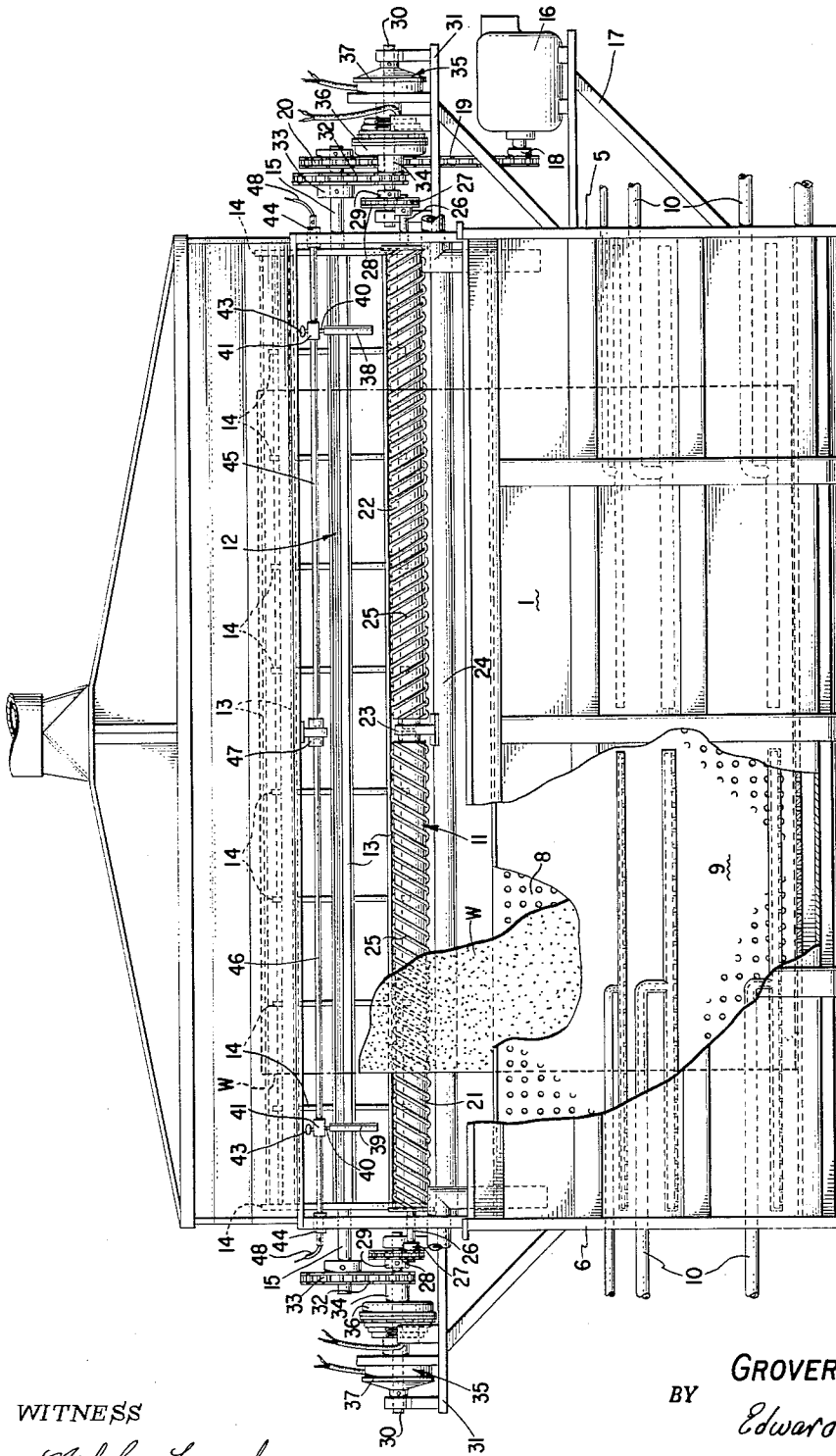


Fig. 1.

WITNESS

Nicholas Georgak

BY

INVENTOR.
GROVER Z. GOWIN

Edward L. Bell

ATTORNEY

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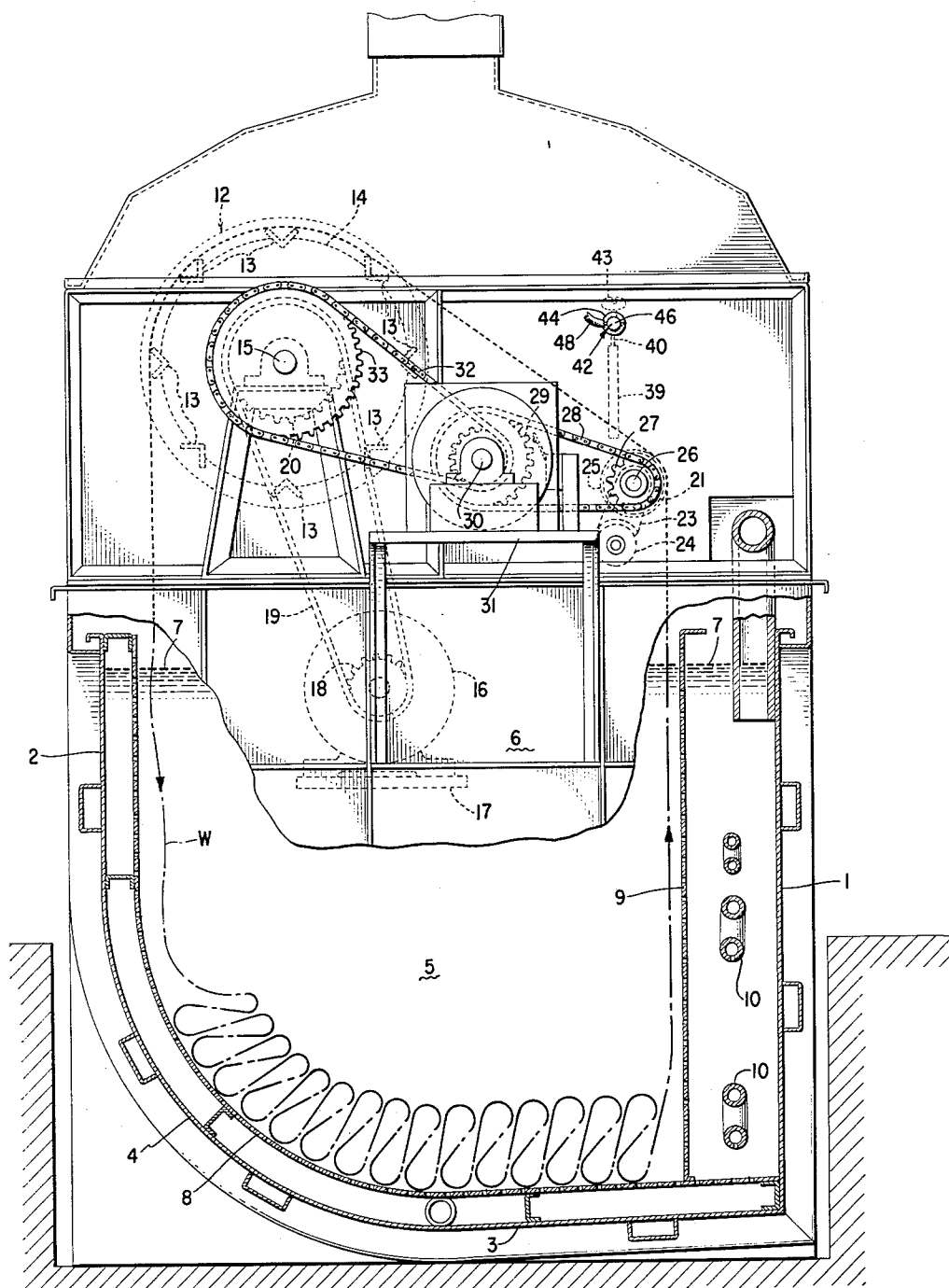


Fig. 2.

WITNESS

Nicholas Leozgah

INVENTOR

GROVER Z. GOWIN

BY *Edward d Bell*

ATTORNEY

April 5, 1966

G. Z. GOWIN

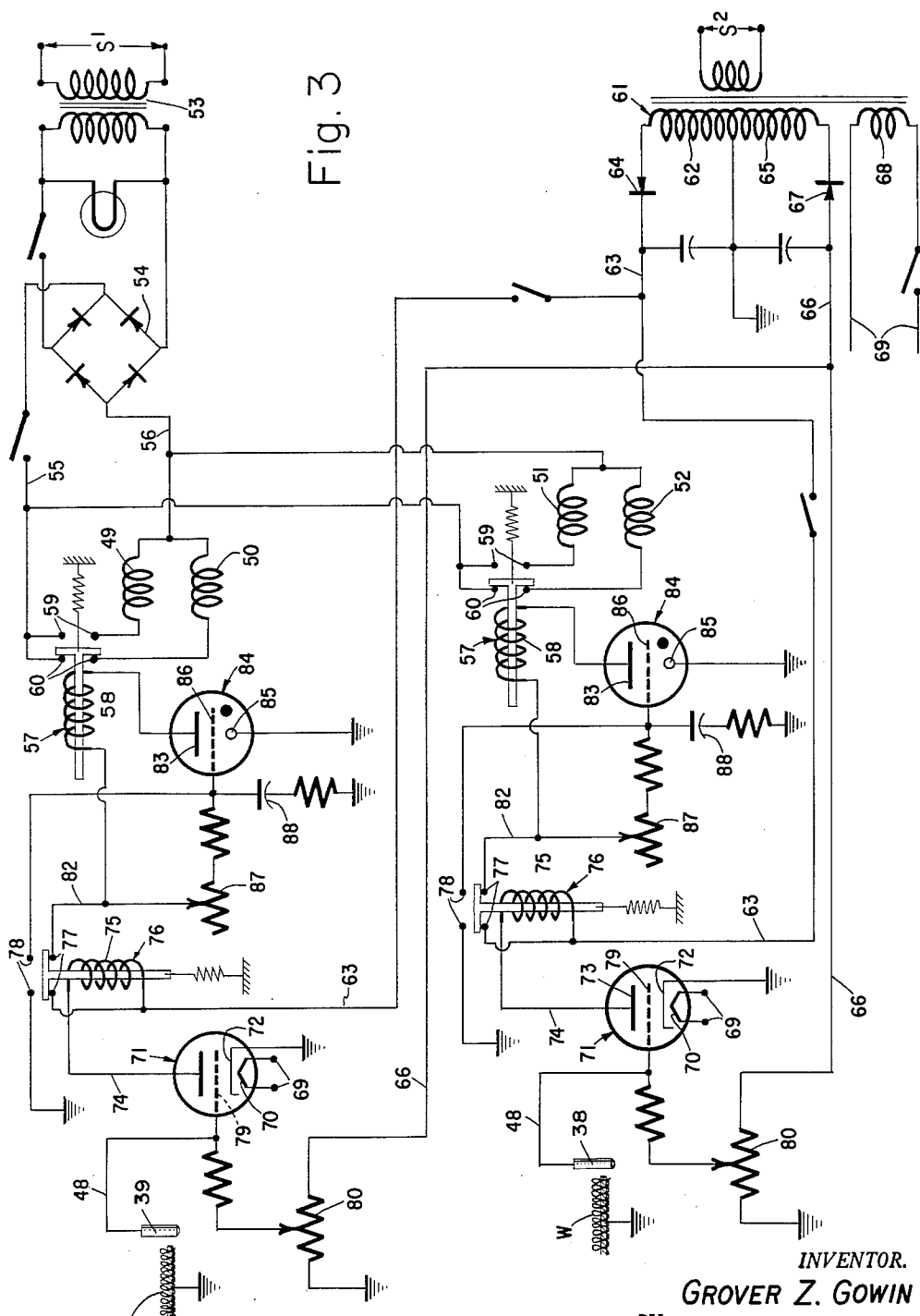
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Fig. 3



WITNESS

Nicholas Leszczak

BY

GROVER Z. GOWIN

Edward L. Bell

ATTORNEY

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APPARATUS FOR SPREADING AND GUIDING A FABRIC WEB

Grover Z. Gowin, Tunnel Hill, Ga., assignor to The
Singer Company, New York, N.Y., a corporation of
New Jersey

Continuation of application Ser. No. 176,268, Feb. 28,
1962. This application Jan. 29, 1965, Ser. No. 432,061
10 Claims. (Cl. 68—177)

This application is a continuation of my prior appli-
cation Serial No. 176,268, filed February 28, 1962, and
now abandoned.

This invention relates to apparatus for spreading and
guiding a web of fabric, e.g., a carpet, and more particu-
larly, to an apparatus for maintaining a fabric web pass-
ing over the same in a spread or "open-width" condition
and in a centered condition.

In many operations, for example in open-width dyeing
of carpet, in which a continuous length of carpet is im-
mersed into and withdrawn from the dyeing solution,
means are provided for keeping the carpet spread and
for keeping it centered with respect to the driving roller.
Equipment now in use for this operation has the dis-
advantages that they introduce distortion into the fabric
and are not sufficiently fast-acting to maintain the web
centered at all times. Present equipment has a further
disadvantage when used with tufted fabrics, i.e., in dy-
ing tufted carpet, it has been found that loops are pulled
from the fabric by the action of the spreader rolls thereon.

In accordance with the above, it is an object of this
invention to provide an apparatus for controlling a fabric
web, which apparatus is fast-acting to maintain the web
in centered condition and which will control the web
without introducing distortions into the web and, in use
with a tufted fabric, without pulling loops from the web.

Having in mind the above and other objects that will
be evident from an understanding of this disclosure, the
invention comprises the devices, combinations and ar-
rangements of parts as illustrated in the presently pre-
ferred embodiment of the invention which is hereinafter
set forth in such detail as to enable those skilled in the
art readily to understand the function, operation, con-
struction and advantages of it when read in conjunction
with the accompanying drawings in which:

FIG. 1 is a front elevational view of a dyeing machine
embodying the present invention, parts of the machine
being partly broken away.

FIG. 2 is an end elevational view of the dyeing ma-
chine of FIG. 1 with parts broken away and in section.

FIG. 3 is an electrical diagram of the controls for the
web spreading and guiding means of the machine of
FIG. 1.

With reference to the drawings, there is illustrated a
dyeing machine having an outer shell including a front
wall 1, a rear wall 2, a bottom wall 3 that is continuous
with the rear wall 2 and is connected to it by a smooth
curve or corner 4, and end walls 5 and 6, all defining
a dye kettle that is adapted to be filled with a dye solu-
tion to the level as indicated at 7. Within the dye kettle
there is provided a perforated false bottom 8 that is
coextensive with the rear wall 2, bottom wall 3 and
corner 4, and a vertical baffle 9 that is coextensive with
the front wall 1. Steam is introduced into the dye kettle
in the space between the front wall 1 and baffle 9 by
a plurality of steam lines 10.

The fabric web W is withdrawn from the dyeing solu-

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tion upwardly along the baffle 9, over the guiding and
spreading mechanism 11, over the drive roller 12, and
is then reimmersed in the dyeing solution along the false
bottom 8.

The drive roller 12 consists of a plurality of transverse
bars 13, spaced angularly about a plurality of circular
supports 14 that are in turn mounted on a drive shaft
15 journaled in the side walls 5 and 6. Preferably, the
bars 13 are angle irons secured to the supports 14 at the
angles with the free edges of the web extending out-
wardly for engaging the fabric. Rotation is imparted to
the drive roller 12 by a motor 16 mounted on a bracket
17 carried by the end wall 5 and having a sprocket 18
connected by a belt 19 to a sprocket 20 on the drive
shaft 15.

The guiding and spreading mechanism 11 comprises
a pair of axially aligned rollers 21 and 22 arranged in
end-to-end relation on an axis parallel to the axis of the
drive roller 12. The rollers 21 and 22 are journaled at
their remote ends in the end walls 5 and 6 and at their
adjacent ends in a bearing bracket 23 carried by a sup-
port tube 24 that is secured at its ends to the end walls
5 and 6. The rollers 21 and 22 are thus journaled inde-
pendently for rotation. Formed upon the peripheral
surface of each of the rollers 21 and 22 is a spiral 25
which may be formed by a small diameter rod wound
spirally on and secured to the periphery thereof, the
spirals on the rollers being oppositely directed and being
designed to progress from the adjacent ends of the rollers
outwardly toward the remote ends thereof upon forward
rotation of the rollers, that is, rotation in a direction in
which the rollers at the point of contact with the fabric
advance relative to the web, which is counterclockwise
in FIG. 2.

Each of the rollers 21 and 22 is driven independently
in the forward direction and for this purpose has a re-
duced end 26 that extends through the respective end
wall 5 or 6 and has thereon a sprocket 27 that is con-
nected by a chain 28 to a sprocket 29 on a shaft 30
journaled in a bracket 31 mounted on the respective end
wall. Each of the shafts 30 are driven from the shaft
15 by a chain 32 extending between a sprocket 33 on
the shaft 15 and a sprocket 34 journaled on the shaft
30. Also mounted on each of the shafts 30 and adapted
selectively to couple the shaft 30 to the sprocket 33 or
to brake the same, is an electrically-actuated clutch-brake
mechanism 35 including a clutch unit 36 and a brake
unit 37.

With each of the rollers 21 and 22 selectively driven
as above noted or braked and with the spirals 25 arranged
as noted, the action upon the web W by the spirals 25
can be made to work the web outwardly from the center
thereof to provide a spreading action and at the same
time the action of one of the spirals can be selectively
reversed so that the action of both of the spirals will be
in the same direction to provide a quick and easy center-
ing action. This result is obtained by reversing the direc-
tion of the relative motion between the web and the spiral.
When the rollers are driven, they are traveling faster than
the web so that the relative motion between the web and
the spiral at the point of contact is in what is termed the
forward direction. The spirals 25 are arranged to urge
the web outwardly from the center thereof upon relative
motion in the forward direction. When the relative mo-
tion of the web and the spirals is reversed—that is, when
the web is traveling faster than the spirals, the web is
urged in the opposite direction or inwardly toward the

center thereof. The centering action is obtained by reversing the direction of the relative motion of one of the rollers 21 or 22 with respect to the web, while continuing to drive the other of the rollers, so that both of the spirals 25 urge the web in the same direction. The means for reversing the relative motion between the web and the spirals—the reversing means set forth in the appended claims, is the brake unit 37. The force or effect applied to the web by the spiral 25 when the spiral is moving slower than the web is a function of the speed of the relative motion between the web and the spiral, and assuming a constant speed of the web, the maximum effect would be when the respective roller is stopped.

While the rollers 21 and 22 are in the preferred embodiment driven during the spreading action and selectively braked during the centering action, it will be apparent that these actions could be reversed.

The sensing mechanism for controlling the rollers 21 and 22 in response to the lateral wanderings of the fabric comprises a pair of sensing elements 38 and 39 adapted to engage the opposite edges of the fabric. The sensing elements 38 and 39 are each suspended by a wire 40 from a collar 41 slidably mounted on a rod 42 and adapted to be secured in adjusted position thereon by a thumbscrew 43. The rod 42 is arranged transversely of the machine on an axis parallel to the axis of the rollers, and is mounted in the end walls 5 and 6 and electrically insulated therefrom by bushings 44. The rod 42 is formed in two parts 45 and 46 electrically insulated from each other by a sleeve 47 and each of which is connected at the end thereof to a lead 48. The sensing elements 38 and 39 are electrically conductive and are electrically connected through the wires 40, collars 41 and parts 45 and 46 of the rod 42 to one of the leads 48. As more fully explained hereinafter, the frame of the machine is grounded and the clutch-brake mechanisms 35 are controlled by engagement of the sensing elements 38 and 39 with the edges of the fabric which acts to connect the sensing elements to ground through the fabric and the dyeing solution.

With reference to FIG. 3, there is illustrated schematically the electrical control circuit of the machine. The clutch-brake mechanism 35 associated with the left hand roller 21 includes a coil 49 for operating the brake unit 37 thereof, and a coil 50 for operating the clutch unit 36. Similarly, there is provided coils 51 and 52 for operating respectively the brake and clutch units 37 and 36 of the clutch-brake mechanism 35 associated with the right hand roller 22.

Since the circuits for the coils 49 and 50 on the one hand and the coils 51 and 52 on the other hand are identical, common reference numerals are used in both circuits, only one of which is hereinafter described. It is understood that the description of the one circuit is equally applicable to the other.

Electrical power for operating the brake coils 49 and 51 and the clutch coils 50 and 52 is supplied by an alternating current source S1 through a transformer 53, rectifier 54 and leads 55 and 56. The application of power to the coils is controlled by a relay 57 having a coil 58, a pair of contacts 59 which, when closed, energize the brake coil 49 or 51, and a pair of contacts 60, which, when closed, energize the clutch coil 50 or 52. When the coil 58 is energized, the clutch contacts 60 are closed and the brake contacts 59 are open. The opposite occurs when the coil 58 is deenergized.

The energization of the relay 57 is controlled by the engagement of the sensing element 38 or 39 with the fabric through a control circuit supplied with power from an alternating current source S2 through a transformer 61. The transformer 61 has a first secondary coil 62 that applies positive voltage to a line 63 through a rectifier 64 and a second secondary coil 65 that applies a negative voltage to a line 66 through a rectifier 67. The transformer 61 also has a third secondary coil 68 which through leads 69 energizes the filament 70 of a triode

amplifier 71. The cathode 72 of the amplifier 71 is grounded while the anode 73 is connected by a lead 74 to the coil 75 of a relay 76, the opposite side of which coil is connected to the lead 63. The relay 76 includes two pairs of contacts 77 and 78. When the coil 75 is sufficiently deenergized, the contacts 77 are closed and the contacts 78 are open, and when it is energized, the contacts 77 are open and the contacts 78 are closed. The amplifier 71 controls the energization of the coil 75.

Negative voltage is applied to the grid 79 of the amplifier 71 by the lead 66. When the sensing element 38 or 39 contacts the fabric W, which is grounded through the dyeing solution and frame of the machine, the grid 79 is grounded through lead 48, thus permitting the amplifier 71 to conduct and thereby energize the coil 75 to actuate the relay 76. The sensitivity of the device is adjusted by means of an adjustable resistor 80, one side of which is grounded, thereby varying the negative biasing voltage on the grid 79. Normally, the grid voltage will be adjusted so that the amplifier 71 will be conducting but will not be conducting sufficiently to actuate the relay 76.

The coil 58 of the relay 57 is connected at one side to the line 63 through a lead 82 and the contacts 77 of the relay 76, and at the other side is connected to the anode 83 of a gas triode 84, the cathode 85 of which is connected to ground. The grid 86 of the triode 84 is connected to the lead 82 through an adjustable resistor 87 and is also connected to ground through the contacts 78 of the relay 76 and to one side of a capacitor 88 the other side of which is connected to ground. The purpose is this circuit is to obtain a time delay in the energization of the coil 58 after the contacts 77 have closed. When the contacts 77 are closed, the charging of the capacitor 88 delays the application of the full voltage of line 63 on the grid 86, thus delaying the time at which the triode 84 will conduct. The amount of the delay is variable by adjustment of the resistor 87. When the contacts 78 are closed, the capacitor 88 is discharged, thus resetting the time delay circuit.

The operation of the present device is as follows: Normally, the fabric W will be out of engagement with the sensing elements, 38 and 39. Thus, negative voltage from the lead 66 will be applied to the grid 79 of the amplifier 71 and the amplifier 71 will be biased so that it will not be conducting sufficiently to energize the coil 75 of the relay 76. In this condition, the contacts 77 are closed and the contacts 78 open. With the contacts 77 closed, power from the lead 63 is applied to the coil 58 of the relay 57 and the clutch contacts 60 thereof will be closed while the brake contacts 59 are open. With the clutch contacts 60 closed, the clutch coil 50 or 52 is energized and the rollers 21 and 22 will be rotated continuously to spread the fabric.

As the fabric wanders from the centered condition relative to the rollers 21 and 22, it will engage one or the other of the sensing elements 38 and 39. The grid 79 of the respective amplifier 71 is thus grounded through the fabric, permitting the amplifier 71 to conduct sufficiently to energize the coil 75 of the relay 76, thus opening the contacts 77 and closing contacts 78. When the contacts 77 open, the coil 58 of the respective relay 57 is deenergized to open the clutch contacts 60 and to close the brake contacts 59. The respective one of the rollers 21 and 22 is thus stopped and the continued rotation of the other one thereof, together with the reversed effect of that one, quickly moves the fabric back toward the centered condition, that is, away from the engaged sensing element 38 or 39. To avoid "hunting," the relay 57 is energized through the time delay circuit with the result that the clutch contacts 60 will not be closed immediately as soon as the fabric disengages the sensing element 38 or 39, but will remain open with the brake contacts 59 closed for a time thereafter so that the fabric is moved fully back to the centered position on the rollers 21 and 22.

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Numerous alterations of the structure herein disclosed will suggest themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to a preferred embodiment of my invention which is for purposes of illustration only and not to be construed as a limitation of the invention. All such modifications which do not depart from the spirit of the invention are intended to be included within the scope of the appended claims.

Having thus set forth the nature of this invention, what I claim herein is:

1. Apparatus for spreading and guiding a web of material comprising a pair of axially aligned rollers adapted to receive the web transversely and in a centered condition thereon, said rollers having oppositely directed spirals on the peripheral surfaces thereof and each of said spirals being arranged to urge the web outwardly of the roller upon relative motion in one direction between the web and the roller and to urge the web inwardly of the roller upon relative motion in the other direction between the web and the roller, actuating means for each of said rollers for effecting relative motion between the roller and the web in the one direction in which the spirals on both of said rollers urge the web outwardly, reversing means for each of said rollers for effecting relative motion between the roller and the web in the other direction, and control means responsive to the web for controlling the actuating means and the reversing means to effect relative motion between the web and the rollers in the one direction in which both of the rollers urge the web outwardly to provide a spreading action thereon and selectively to effect relative motion in the opposite direction of one of the rollers when the web wanders into the same whereby both of said rollers will urge the web in the same direction to provide for centering thereof.

2. Apparatus for spreading and guiding a web of materials comprising a pair of axially aligned rollers adapted to receive the web transversely and in a centered condition thereon, means for moving the web longitudinally relative to said rollers, means for mounting said rollers independently for rotation, drive means for such of said rollers for imparting forward rotation thereto to effect relative motion between the roller and the web in a direction to advance the roller relative to the web where the same are in contact, reversing means for each of said rollers for effecting relative motion between the roller and the web in the opposite direction, said rollers having oppositely directed spirals on the peripheral surfaces thereof and arranged to move the web outwardly in both directions from the center of the rollers upon forward rotation of said rollers relative to the web, a pair of sensing elements for engaging the opposite longitudinal edges of the web, control means for each of said drive means and for said reversing means and responsive to the engagement and disengagement of one of said sensing elements and the web for controlling the operation of both of said drive means and both of said reversing means to provide for continuous forward rotation of said rollers relative to the web when the web is in centered condition and to stop the drive means and to actuate the reversing means of one of said rollers when the web wanders from the centered condition in the direction toward that roller and to stop the drive means and to actuate the reversing means of the other of said rollers when the web wanders in the other direction.

3. Apparatus for spreading and guiding a web of material, comprising a pair of axially aligned rollers adapted to receive the web transversely and in a centered condition thereon and having oppositely directed spirals on the peripheral surfaces thereof, means for mounting said rollers independently for rotation, drive means for imparting rotation to each of said rollers relative to the web, brake means for each of said rollers, sensing means responsive to the position of the web laterally of said rollers,

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and control means for each of said rollers, each of said control means being responsive to said sensing means for controlling the operation of the respective drive means and simultaneously setting the respective brake means when the drive means is deenergized and releasing said brake means when the drive means is energized.

4. Apparatus for spreading and guiding a web of material, comprising a pair of axially aligned rollers adapted to receive the web transversely and in a centered condition thereon and having oppositely directed spirals on the peripheral surfaces thereof, means for mounting said rollers independently for rotation, drive means for each of said rollers and including clutch means for selectively coupling and uncoupling said drive means with respect to the respective roller, brake means for each of said rollers, a pair of sensing elements for engaging the opposite longitudinal edges of the web, and control means for each of said rollers, each of said control means being responsive to the engagement and disengagement of one of said sensing elements and the web upon the wandering of the web from the centered condition for actuating said clutch and brake means to uncouple said drive means from the respective roller and to set said brake means and, through a time-delay, for actuating said clutch and brake means to couple said drive means to the respective roller and to release said brake means.

5. Apparatus as set forth in claim 4 in which said clutch and brake means are electrically actuated.

6. Apparatus as set forth in claim 5 in which each of said control means comprises a relay for controlling the application of power to said clutch and brake means including switching means for energizing and deenergizing said relay, time delay means, and means for electrically connecting said sensing element and said time delay means for actuating said switching means in response to the engagement and disengagement of said sensing element and the web.

7. Apparatus as set forth in claim 6 in which said switching means comprises an electrically biased element and a bias circuit for biasing the same, and said time delay means comprises a capacitor in the bias circuit of said electrically biased element.

8. Apparatus as set forth in claim 7 in which said means for connecting said sensing element and time delay means comprises a second relay and a second electrically-biased element, and said sensing element acts to control the bias of said second electrically-biased element.

9. Apparatus as set forth in claim 8 in which said sensing element controls the bias on said second electrically-biased element by grounding the same through the web upon engagement of the sensing element and the web, and there is provided a parallel circuit for grounding said bias and including an adjustable resistance to adjust the sensitivity of said sensing element.

10. In a dyeing machine for an endless web of carpet or the like and having a dye container, a drive reel for removing and depositing the carpet in said dye container, a pair of axially aligned rollers disposed transversely of the web between said drive reel and said dye container and having oppositely directed spirals on the peripheral surfaces thereof, means for mounting said rollers independently for rotation, drive means for imparting rotation to each of said rollers, brake means for each of said rollers, a pair of sensing elements for engaging the opposite longitudinal edges of the web, and control means for each of said rollers, each of said control means being responsive to the engagement and disengagement of one of said sensing elements and the web for actuating said drive means and said brake means to provide for continuous rotation of said rollers when the web is centered relative to said sensing elements during normal operation and to stop the drive means and to set the brake means associated with one of said rollers when the respective sensing element engages the web, thereby spreading the

web and aligning it in a centered condition relative to said rollers.

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5 WALTER A. SCHEEL, *Primary Examiner.*
WILLIAM I. PRICE, *Assistant Examiner.*