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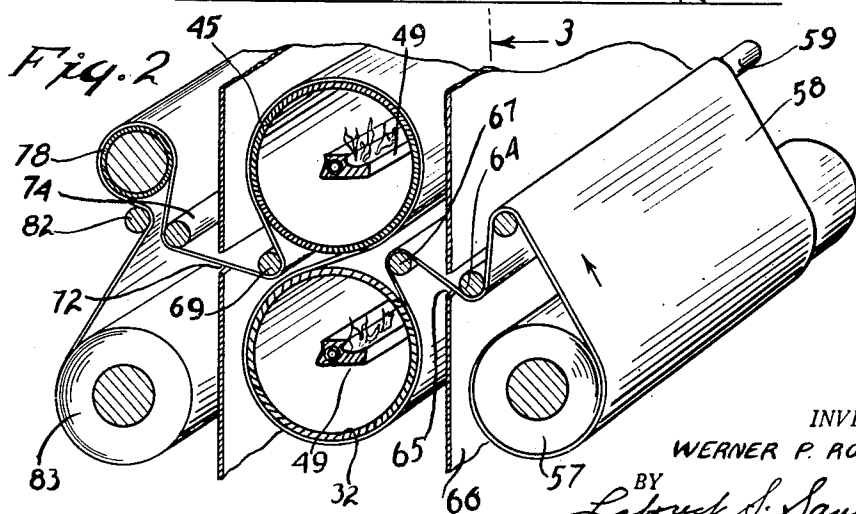
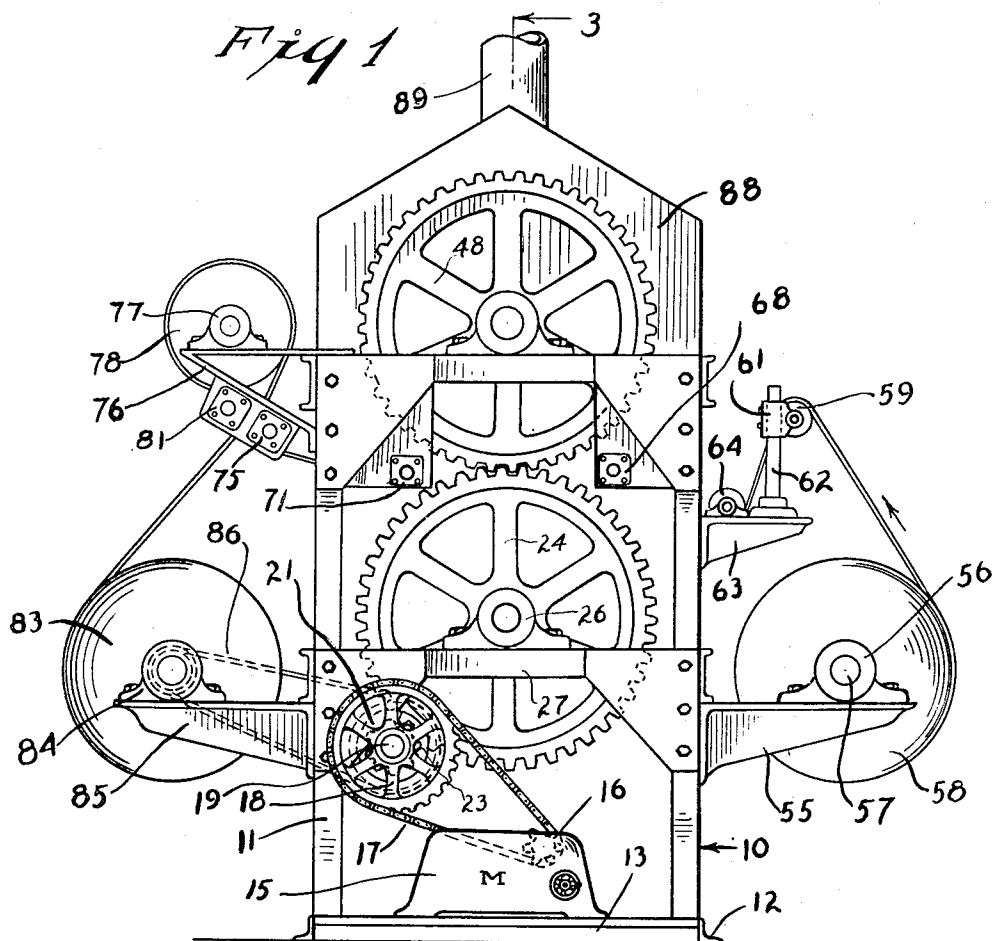
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2,599,486

HEAT TREATING MACHINE FOR TEXTILE MATERIAL

Filed Jan. 13, 1950

3 Sheets-Sheet 1



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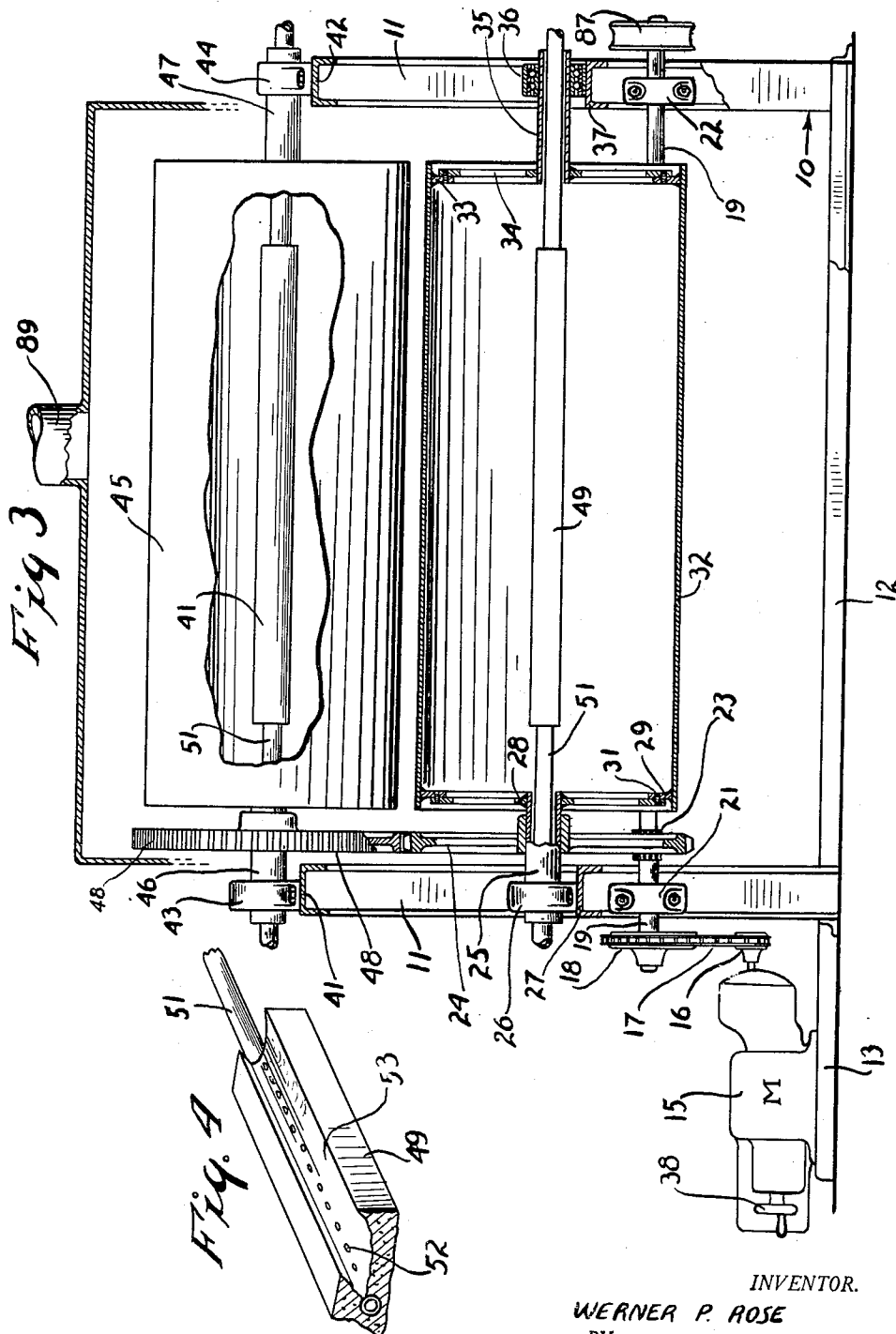
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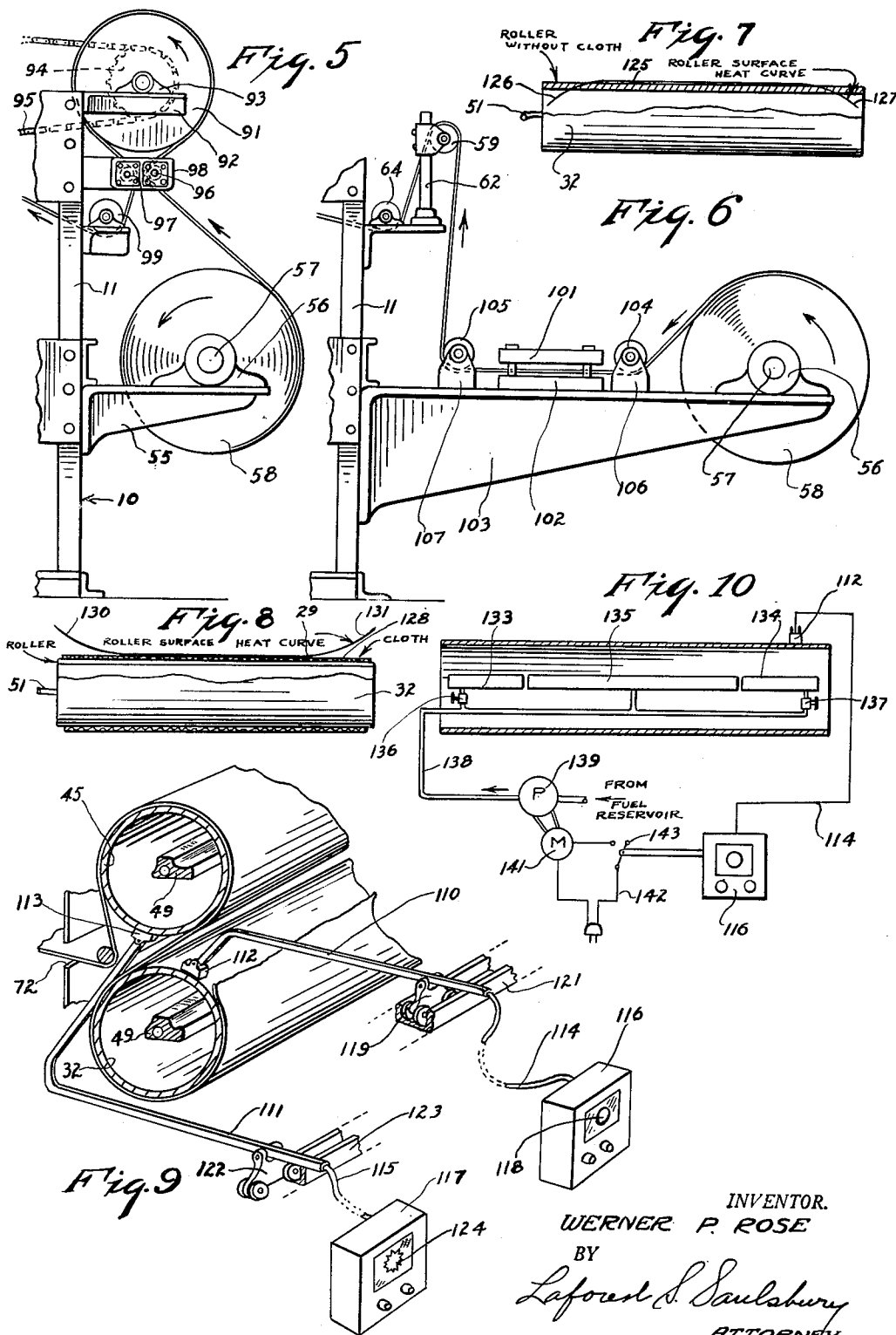
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HEAT TREATING MACHINE FOR TEXTILE MATERIAL

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3 Sheets-Sheet 3



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HEAT-TREATING MACHINE FOR TEXTILE MATERIAL

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7 Claims. (Cl. 26—1)

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This invention relates to heat treating machines for textile materials and more particularly to a nylon setting machine.

Woven fabrics having fibers of synthetic materials have to be heat treated or set in order for them to have the desired characteristics of being easy to handle, to drape well, resilient and to give them dimensional stability. In order to provide these characteristics, it is necessary that the fabric be heat treated by the pressing of the same upon a heated surface which is uniformly heated and maintained, except for minor variations not important to the contemplated operation, at a temperature of the order of 450° Fahrenheit for some fabrics, 600° Fahrenheit for other fabrics and in some cases 1000° Fahrenheit, for a treating of from three to twenty seconds, depending upon the type of fabric being treated. This temperature is kept below the fusion point of the synthetic material. Heretofore, machines for the treating of this fabric have utilized liquid or circulated air for the heating of a series of small diameter rollers with which the fabric has contacted and this liquid or air has had to have been heated and pumped or blown into and out of the rotating drums through multiple duct work and nozzles to heat the same. Also, liquid has been confined in double shell drums with safety valves subject to failure and explosion. By so confining this type of liquid which must be used, they may break down in their chemical composition resulting in the release of highly harmful and deleterious gases and liquids. The liquids which have had to be used to reach the unusually high temperatures are also highly fugacious necessitating the use of all welded piping since threaded fittings cannot practically be made tight enough to confine the liquid. This entails expensive equipment for the use of liquids. Such a procedure has required a great deal of auxiliary equipment such as pumps, blowers, baffles, duct work, nozzles, piping, storage reservoirs and heating equipment and liquids which are costly in order to be utilized for the high range of temperatures which are necessary for the treating of synthetic fabric.

It is accordingly an object of the present invention to provide a hot roll machine for treating synthetic fabrics which will not require the use of liquid externally heated or conveyed air with the incumbent equipment necessary to heat, handle and store the liquid or air and wherein the rolls themselves can be heated by direct action or infra red radiant heat upon the internal surfaces thereof and wherein the rolls which are

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heated can be mounted under a simple hood to remove gases and produces of combustion and wherein the fabric being treated will be confined upon substantially the entire surface of the hot roll whereby to give maximum treatment from the roll and to keep the number of rolls within the machine to a bare minimum.

It is another object of the present invention to provide a machine for treating synthetic fabrics which have treating rolls with sectionalized infrared radiant heaters within them and means responsive to the temperature of the exterior heating surface of the rolls for controlling the operation of the heater and for maintaining the proper temperature of the surfaces.

It is another object of the present invention to provide a hot roll machine for treating synthetic fabrics wherein simple and adequate means is associated with the machine for preheating the fabric before engaging with the radiantly heated hot rolls, and thereafter for cooling the hot treat fabric upon leaving the hot treating rolls.

Other objects of the present invention are to provide a hot roll machine for treating synthetic fabrics, such as nylon and similar synthetics, which is of simple construction, inexpensive to manufacture, capable of handling large volumes of the fabric, compact and well hooded, has a minimum number of rolls, provides for the keeping of the fabric free from wrinkles, temperature controlled, has little heat loss, and efficient in operation.

For other objects and for a better understanding of the invention, reference may be had to the following detailed description taken in connection with the accompanying drawing, in which:

Fig. 1 is an end elevational view of the nylon setting machine embodying the features of the present invention.

Fig. 2 is a fragmentary perspective view of the interior and exterior rolls and showing the path of movement of the fabric through the machine.

Fig. 3 is a vertical sectional view taken on line 3—3 of Fig. 1.

Fig. 4 is a fragmentary perspective view of one of the infrared radiant heating elements.

Fig. 5 is a fragmentary side elevational view of the machine frame modified to provide for an external preheating roll, said roll being supplied with hot water or steam to effect the heating thereof.

Fig. 6 is a fragmentary end elevational view of the machine frame modified and supporting

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an electric preheating means for the fabric entering the machine.

Fig. 7 is a diagrammatic view of one of the main treating rolls and showing the temperature curve for the treating surface prior to the receiving of the fabric.

Fig. 8 is a diagrammatic view of one of the treating rolls showing the temperature curve for the roll surface when the fabric or cloth has been extended thereover.

Fig. 9 is a fragmentary perspective view of the main heating rolls and of a temperature-responsive mechanism serving to indicate the temperature of the treating surface at any position along the length thereof, the engaging elements with the roll surfaces being adjustable along the length thereof.

Fig. 10 is a diagrammatic view of the sectionalized radiant heating arrangement for the rolls, the fuel supply means and the temperature responsive device for controlling the operation of the same.

Referring now to the figures, 10 represents a vertical frame structure formed of angle iron posts 11 disposed at four corners and retained in spaced relationship by angle iron tie members 12 welded to the lower ends of the posts. Extending laterally from one end of the frame structure is a base 13 for supporting a combined electric motor and gear reduction unit 15 having an output drive pinion 16 for driving a chain 17 extended over a sprocket 18. This sprocket 18 is supported on the end of a shaft 19 journaled in bearing brackets 21 and 22 extending inwardly from posts 11 at one side of the frame. This shaft 19 extends throughout the full length of the frame.

On the shaft 19 is a pinion gear 23 which meshes with a large driving gear 24 fixed to a sleeve 25 that is journaled in a bearing bracket 26 lying on a transverse supporting frame member 27. This sleeve 25 has a perforated disc 28 secured to the same. To the outer periphery of this disc there is connected an inwardly extending flange 29 by screws 31, extending inwardly from a welded steel tubing 32 providing the lower one of the main heat treating rolls. At the opposite end of the tubing is an inwardly extending flange 33 connected to a perforated plate 34 which is in turn welded to a sleeve projection 35 journaled in a ball bearing unit 36 carried on a transverse frame member 37 at the opposite end of the machine and extending between vertical posts 11 of the frame structure located at that end of the frame. Accordingly, by means of the pinion 23 and large gear 24, the treating roll 32 will be driven. It is intended that this roll be driven to have a peripheral treating surface speed of between fifteen and forty-five yards per minute depending upon the setting of the gear portion of the unit 15 as effected by an adjusting wheel 38 thereof, Fig. 3.

Lying above the respective transverse supporting members 27 and 37 are respectively transverse supporting members 41 and 42 for supporting respectively ball bearing units 43 and 44. Above the roll 32 is another main heat treating roll 45 of similar construction and supported through the sleeves 46 and 47 in the respective bearing units 43 and 44. A large gear 48 meshes with the large gear 24 so that the treating roll 45 will be driven in the reverse direction from the roll 32.

One of the important features of this invention is the infrared radiant heating apparatus

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provided for these rolls 32 and 45 which are maintained in a hot constant temperature condition. Within each of these rolls is a radiant heat delivering element 49 connected by pipes 51 to a fuel supply source, not shown. These pipes 51 extend through the sleeves supporting the respective rolls. Each pipe 51 has a series of holes 52, Fig. 4, through which the fuel is extended to project flames onto a curved top radiating surface 53 of the heating element. A temperature-responsive device, to be described, is applied to the rolls for the purpose of controlling the fuel supply to maintain a constant temperature of the treating surface. This heating element has the capacity to heat by radiation the roll to a temperature of the order of 450° Fahrenheit or to a greater temperature depending upon the nature of the fabric to be treated. The necessary temperature will be maintained without material variance by automatic thermostatic controls which increase or decrease the intensity and volume and pressure of the flame.

The treating rolls 32 and 45 are arranged in vertical alignment with the roll 45 disposed above the roll 32. Extending from one side of the machine are brackets 55 having bearings 56 mounted thereon. In these bearings are journaled a shaft 57 which carries a supply roll 58 of the woven synthetic fabric to be treated. These fabric rolls run to seven feet in length and the fabric material thereof is fed upwardly over a small roller 59 extending the width of the machine and supported upon adjustable brackets 61 carried upon pedestals 62 supported on frame brackets 63 projecting outwardly from the side of the machine frame above the brackets 55.

Also upon the brackets 63 there is supported a roll-type expander 64 for spreading the cloth and removing any wrinkles from the same, Fig. 2. From this expander 64, the material in smooth condition, extends through a slot 65 in a hood 66 inwardly and over a small guide roll 67 lying in close proximity to the hot rolls 32 and 45 and in space between them so that a substantial wrapping of the fabric about the hot treating roll 32 is effected. The fabric thence passes under the hot treating roll 32 and upwardly and transversely across the top thereof to provide the initial heat treatment of the fabric upon one side face thereof. By having the guide roll 67 located well within the space between the rolls 32 and 45, substantially the entire surface of the roll will be covered with the fabric. The guide roll 67 is supported in bearing elements 68 carried respectively upon the opposite ends of the machine frame 10.

As the fabric crosses over the top of the roll 32, it is passed onto the upper hot roll 45 and the reverse side of the fabric is brought into contact with the radiantly heated surface thereof for the treatment of the fabric from that side thereof. The fabric passes over the roll 45 and downwardly and inwardly and under an idler roll 69 at the opposite side of the machine and journaled in bearings 71 disposed respectively at the opposite ends of the machine frame. From this roll 68 the fabric extends outwardly through a slot 72 in hood 66 and over another idler roll 74 journaled in bearings 75 depending from brackets 76 mounted on the machine frame. The brackets 76 have bearings 77 which support a cooling roll 78. Cooling medium, such as water, is passed through this roller 78 to effectively cool the fabric and to establish the set therein.

Also on the brackets 76 are bearings 81 which

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support an idler roll 82 beneath the cooling roll 78 downwardly from which the fabric passes to a treated fabric collecting roll 83 journaled in bearings 84 carried respectively upon brackets 85 on machine frame 10.

This fabric collecting roll 83 is driven by a pulley belt 86 extending from a pulley 87 on the shaft 19 which carries the main driving pinion 23 and is thus driven from the unit 15. The pulley 87 is located at the opposite end of the machine from which the driving pinion gear 23 is located.

In Fig. 5, there is shown a modified form of the machine wherein a pre-heating roll 91 is connected to the machine frame 10 above the fabric supply roll 58. This roll 91 is similar to the roll 78 which cools the fabric and can be provided in any well known manner to receive a supply of steam under pressure. It has been found that steam supplied at fifteen pounds pressure will heat the roll to 230° Fahrenheit which is sufficient to adequately preheat the fabric material before engagement with the radiant heat treating roll 32.

Brackets 92 having bearings 93 respectively and disposed at the opposite ends of the machine frame serve to rotatably support the preheating roll 91. This roll 91 can be driven through a sprocket 94 connected thereto by chain 95 which may drivingly connect the sprocket 94 with a driving sprocket, not shown. Small guide rolls 96 and 97 are provided on brackets 93 for guiding the fabric to and from the preheating roll 91. From the small roll 96 the fabric passes under roll 99 and into the machine frame for treatment upon rolls 32 and 45. Because the fabric is preheated, the surface temperature on the roll 32 can be better maintained at constant temperature and with less variation thereof.

As shown in Fig. 6, the fabric can be preheated in a different manner as by the passing of this fabric between electrically heated plates 101 and 102 carried on long brackets 103 extending from the opposite ends of the machine frame. These same brackets 103 support bearings 56 and fabric supply roll 58. The fabric material is maintained in proper spaced relationship while being passed between heating elements 101 and 102 by small rolls 104 and 105 journaled in bearings 106 and 107 respectively carried on the brackets 103. The fabric material passes upwardly from the small roll 105 to the adjustable roll 59 on pedestal 62 and thence under roll 64 for passage into the machine frame.

In order to keep the heating elements at the proper temperature, arms 110 and 111 are respectively extended toward rolls 32 and 45 to have their respective temperature responsive shoes 112 and 113 engage the surfaces of the rolls. These elements 112 and 113 are respectively wired through respective cables 114 and 115 with temperature control units 116 and 117, Fig. 9. These control units will give graph indications 118 as the projections and their shoes are moved longitudinally along the surface of the roll being tested. The projection 110 is supported on a roller carriage 119 that runs through channel 121. The projection 111 is supported on carriage 122 that runs in channel 123. The graph, indicated at 118 and showing a smooth circle on the control unit 116, indicates an even temperature condition along the roll. A jagged graph circle 124 in the control unit 117 means that there is an uneven heat condition throughout the extent of the roll 45.

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The temperature curve for a treating roll free of the fabric or cloth will generally appear as indicated at 125 in Fig. 7. There is a constant height for the curve throughout the major extent of the same, but the ends of the curve will droop, as indicated at 126 and 127, because of the dissipation of the heat into the end structures of the roll. In other words, the intermediate portions of the roll will be kept at a constant temperature. If a narrow width fabric is to be treated, this can be easily done as the fabric will extend over only the intermediate portion of the roll where the temperature is the same throughout the extent of the portion.

It was found, however, that upon a wide fabric being extended over the roll, as indicated at 128, in Fig. 8, that this fabric conducted the heat from the intermediate portion of the roll faster than the end structures thereof could dissipate the same so that a heat curve 129 with upturned ends 130 and 131 resulted. The wide fabric would thus be unevenly treated.

To overcome this situation, there is provided a sectionalized heater arrangement, as shown in Fig. 10, wherein end sections 133 and 134 can be separately controlled and independently of the main burner 135. Throttle valves are provided with the burner units 133 and 134, as indicated respectively at 136 and 137. A supply line 139 supplies fuel to these burners under a predetermined pressure as provided by a pump 139 operated by motor 141. An electric supply circuit for the motor 141 is indicated at 142 and is opened and closed by a switch 143 that is connected and operated by thermal control unit 116.

It should now be apparent that there has been provided a machine for treating synthetic fabrics which does not require the use of special liquids which have to be externally heated and conveyed to the treating rolls or conveyed air with the incumbent equipment necessary to heat, handle and store the liquid or air and wherein the rolls themselves can be heated by the direct action of radiant burners disposed within the rolls and directing radiant heat upon the internal surfaces of the rolls whereby the external surfaces of the rolls are brought to a high temperature required for the heat treatment of the fabric and wherein but a simple hood is required for the few fumes which may result from the treating operation. By the use of radiant burner elements, heat is supplied directly to the heat treating surfaces of the rolls, heat losses are kept to a minimum and a machine which consumes little factory space is had. The construction of the machine is simple and the cost of synthetic fabric treating machines has been greatly reduced.

It should also be apparent that the fabric is drawn through the machine with continuous motion depending upon the adjustment of the unit 15 by its adjusting wheel 38 and that the passage of the fabric over the heating rolls 32 and 45 is likened to a figure eight and that maximum engagement of the fabric with each of these rollers 32 and 45 is effected. The fabric is immediately cooled by the cooling roll 78. The fabric will have been shrunk in width in some cases about ten percent of the original width and the length of the material on the receiving roll 83 will be less than its original length on the supply 58.

While various changes may be made in the detail construction, it shall be understood that

such changes shall be within the spirit and scope of the present invention as defined by the appended claims.

What is claimed is:

1. In a synthetic fabric setting machine, a vertically extending frame, a first treating roll journaled on the frame, an infrared radiant heating element extending through the roll to radiantly heat the roll and its heat treating surface thereof, a second heat treating roll journaled on the frame above the first heat treating roll, an infrared radiant heating element extending through the second heat treating roll to radiantly heat the same, said heat treating rolls being thereby so arranged as to receive a synthetic fabric in such a manner as to first treat one side of the fabric with the first roll and the opposite side of the fabric with the second heat treating roll, means for driving said rolls, means responsive to the temperature of the treating surfaces of the respective rolls for controlling the operation of the respective heating elements whereby to maintain a controlled constant temperature of the respective roll treating surfaces, means for delivering fabric over the rolls and for collecting the treated fabric at the opposite side thereof, said means for driving said rolls comprising an adjustable motor gear unit having variable speeds, large gears secured to the respective heat treating rolls and meshed with one another, a shaft journaled on said frame, means operatively connected between said shaft and said motor gear unit for driving the shaft, and a pinion gear on said shaft drivingly connected to one of the gears of the heat treating roll.

2. In a synthetic fabric setting machine, a vertically extending frame, a first treating roll journaled on the frame, a radiant heating element extending through the roll to heat its treating surface, a second heat treating roll journaled to the frame above the first heat treating roll, a radiant heating element extending through the second heat treating roll to heat its treating surface, said heat treating rolls being thereby so arranged as to receive a synthetic fabric in such a manner as to first treat one side of the fabric with the first roll and the opposite side of the fabric with the second heat treating roll, means for driving said rolls and means for delivering fabric over the rolls and for collecting the treated fabric at the opposite side thereof, and said fabric delivering and collecting means comprising vertically spaced brackets on the opposite sides of the frame, a fabric roll journaled upon brackets on the one side of the frame, a small idler roll supported on the brackets on the same side of the frame, a fabric spreading roll journaled on the bracket having the idler roll, a second idler roll lying within the frame and between the two heat treating rolls for the delivery of the fabric to the lower heat treating roll, an idler roll in the frame at the opposite side of the heat treating rolls for receiving the fabric from the upper heat treating roll, idler rolls on upper brackets at the opposite side of the frame and a fabric collecting roll on the lower bracket for finally collecting the heat treated fabric.

3. In a synthetic fabric setting machine, a vertically extending frame, a first treating roll journaled on the frame, a radiant heating element extending through the roll to heat the same, a second heat treating roll connected to the frame above the first heat treating roll, a radiant heating element extending through the second heat

treating roll to heat the same, said heat treating rolls being thereby so arranged as to receive a synthetic fabric in such a manner as to first treat one side of the fabric with the first roll and the opposite side of the fabric with the second heat treating roll, means for driving said rolls and means for delivering fabric over the rolls and for collecting the treated fabric at the opposite side thereof, and said means for delivering and receiving the fabric including a cooling roll, means for journalling said roll upon the outside of the frame, said cooling roll being adapted to receive a cooling fluid internally thereof.

4. In a synthetic fabric setting machine, a vertically extending frame, a first treating roll journaled on the frame, a radiant heating element extending through the roll to heat the same, a second heat treating roll connected to the frame above the first heat treating roll, a radiant heating element extending through the second heat treating roll to heat the same, said heat treating rolls being thereby so arranged as to receive a synthetic fabric in such a manner as to first treat one side of the fabric with the first roll and the opposite side of the fabric with the second heat treating roll, means for driving said rolls and means for delivering fabric over the rolls and for collecting the treated fabric at the opposite side thereof, and said means for driving said rolls including an adjustable motor gear unit having variable speeds, large gears secured to the respective heat treating rolls and meshed with one another, a shaft journaled on said frame, means operatively connected between said shaft and said motor gear unit for driving the shaft, a pinion gear on said shaft drivingly connected to one of the gears of the heat treating roll, and said means for delivering and collecting the fabric including a shaft, a collecting roll upon said shaft, and drive means extending from the shaft drivingly connected with the heat treating rolls whereby to drive the fabric collecting roll.

5. In a synthetic fabric treating machine, a vertically extending frame, a large hollow treating roll journaled on said frame and adapted to receive fabric to be treated, infrared radiant intermediate and end heating elements disposed within the hollow treating roll, fuel supply means for the heating elements, throttle valves associated with each of the end burner elements whereby the end heating elements may be independently regulated, and means responsive to the temperature of the treating surface of the treating roll for controlling the supply of fuel to the fuel supply pipe and to the heating elements.

6. In a synthetic fabric treating machine, a frame, a large hollow treating roll journaled on said frame and adapted to receive the fabric to be treated, an infrared radiant heating element extending through said roll to radiantly heat its roll treating surface, means on the frame for delivering fabric to the roll and for collecting the treated fabric, means for driving said roll and said fabric delivering and collecting means, means responsive to the temperature of the heated roll surface for controlling the operation of the heating element to maintain a controlled constant temperature of the roll treating surface, and said temperature responsive means including a heat responsive element engageable with the treating surface of the treating roll, a supporting member for the surface engaging element and means for connecting the supporting

member to the frame of the machine for adjustment longitudinally thereof and lengthwise of the treating roll whereby the temperature of the roll at different locations throughout the length of the same may be observed.

7. In a synthetic fabric treating machine, a frame, a large hollow treating roll journaled on said frame and adapted to receive the fabric to be treated, an infrared radiant heating element extending through said roll to radiantly heat its roll treating surface, means on the frame for delivering fabric to the roll and for collecting the treated fabric, means for driving said roll and said fabric delivering and collecting means, means responsive to the temperature of the heated roll surface for controlling the operation of the heating element to maintain a controlled constant temperature of the roll treating surface, preheating means for heating the fabric

connected to the frame to preheat the fabric prior to its delivery to the treating roll and comprising spaced heating plates between which the fabric is passed and guide rolls disposed at the opposite sides of the heating plates to maintain the fabric in proper spaced relationship therebetween.

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