Jan. 3, 1928.

1,655,233

A. W. MACHLET

CLOTH SINGEING APPARATUS

Filed Jan. 8, 1920

3 Sheets-Sheet 1

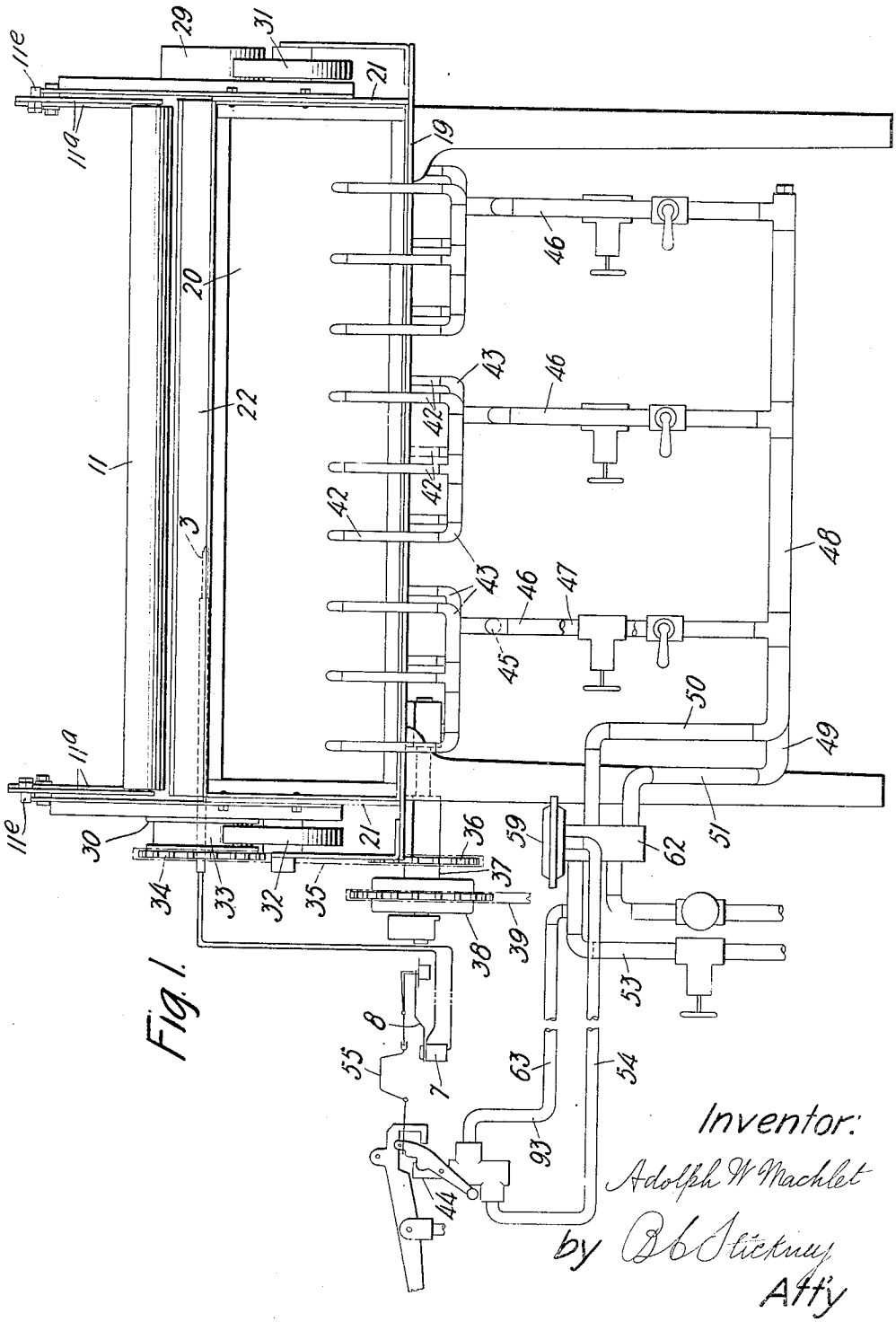


Fig. 1.

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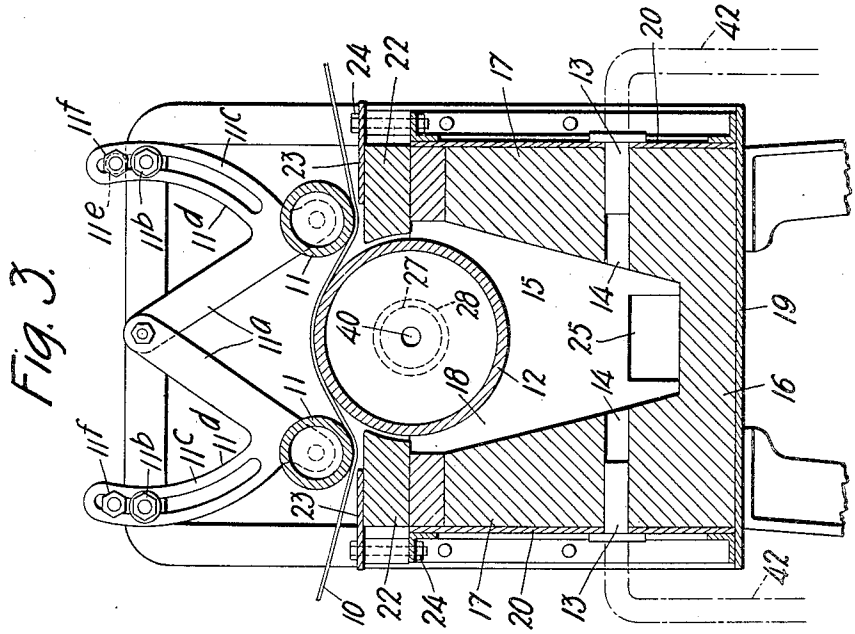


Fig. 3.

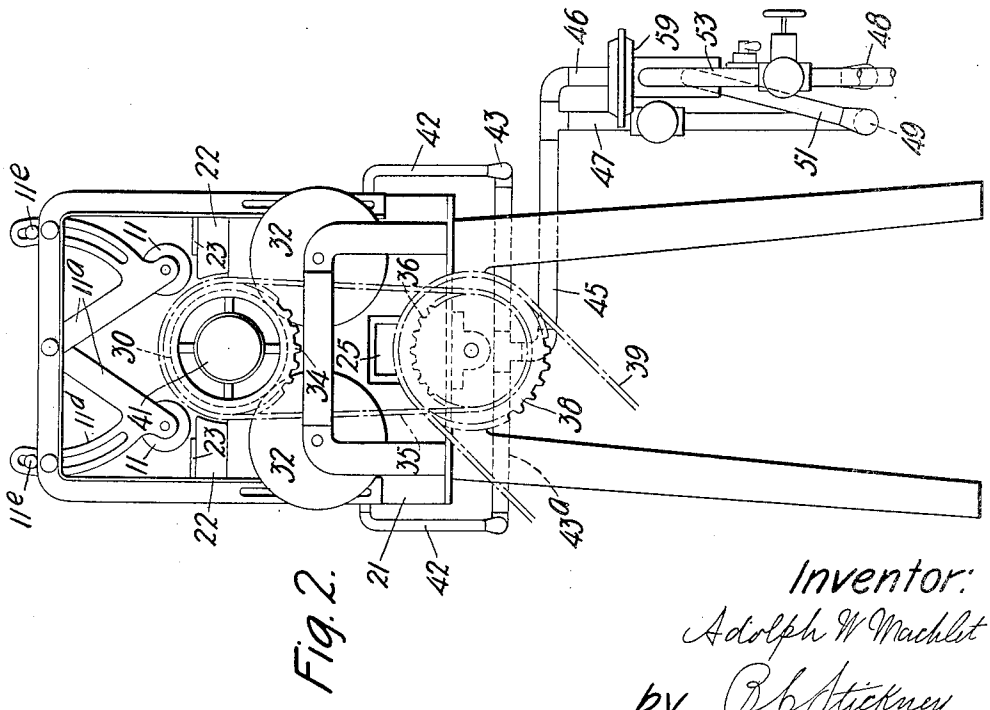


Fig. 2.

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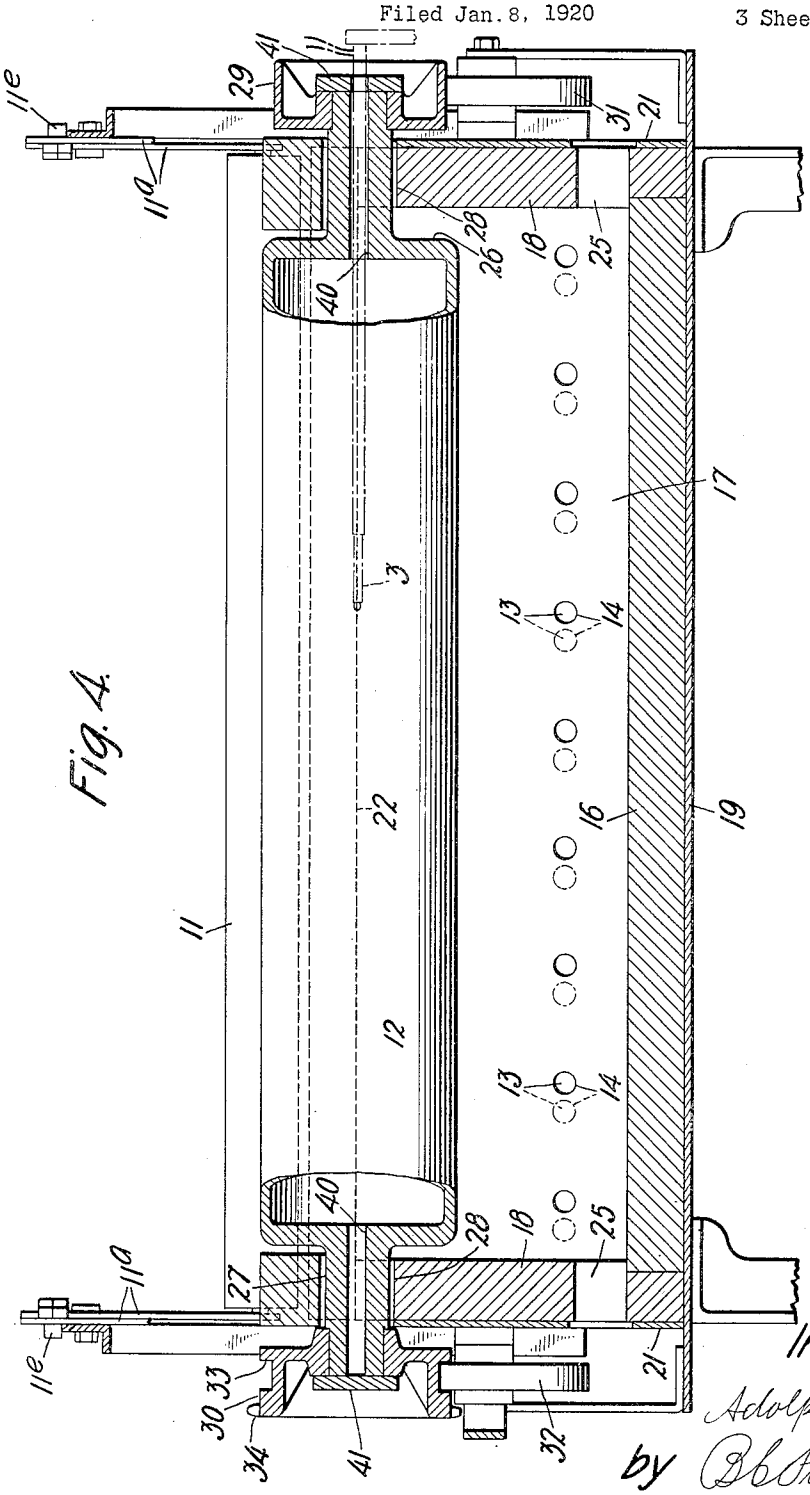


Fig. 4.

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Patented Jan. 3, 1928. 1,655,233

UNITED STATES PATENT OFFICE.

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CLOTH-SINGEING APPARATUS.

Application filed January 8, 1920. Serial No. 350,182.

This invention relates to means for subjecting cloth and other fabric to high heat, as, for example, in the operation of singeing plush or velvet, or for drying muslin, gingham, cretonne or other fabric after a starching and other operations.

To singe fabric, it has been the practice in some cases to pass it over a tube, heated by means of a stove communicating with one end of the tube, the hot gases escaping from the other end of the tube into a chimney. One end of the tube becomes hotter than the other. This method is open to the objection that the singeing or other treatment of the fabric is irregular, with the result that the final color or condition of the fabric is not uniform. Different rolls of fabric, singed in such a way over the same apparatus, do not match as to color and appearance.

In other cases the cloth or fabric has been passed over a stationary segment, which was apt to warp from the heating, with the result that the fabric passing over the same contacted in some places with the segment, without contacting in other places, so that the effect on some areas of the fabric, considered widthwise, was different from the effect upon other areas, thus destroying uniformity. This was particularly noticeable because the heating means was located directly below the segment, and this also made for unevenness in the heating. In the case of a tube, it has been attempted to give it rotative adjustment from time to time, to reduce the effect of warping, since a tube is apt to warp as well as the segment, with the result of irregular singeing. The warping of the tube was particularly objectionable where it was subjected to heat over long periods at one portion of its periphery.

Where the tube has been made of iron, it has been found that the repeated heating of the iron to the degree required for singeing, has resulted in the gradual increase in the dimensions of the tube, both diametrically and longitudinally, thus making it necessary to adopt means for effecting certain compensating adjustments; and where the increase in dimensions has been uneven, the result has been found that the goods would not singe evenly. One of the objects of the present invention is to avoid this trouble, and to preserve the uniformity of the singeing cylinder not only diametrically and longitudinally, but also in contour, with a view of insuring uniformity of the effect of the heating operation upon the cloth.

These difficulties have been found in singeing velvet, corduroy, plush and other goods. There was a difference in the shade or appearance of the cloth at different portions thereof. The difference in colors or shades was apt to occur also between different pieces, so that one piece would not match another. This difference arose partly from the difference in the height of the nap or pile of the velvet or silk. On silk especially there were found different color effects, which was a detriment especially in high grade goods. A difference in heating makes a difference in singeing and hence in the color or shade of the goods.

The heating tube has sometimes been made of iron, and has been heated to or above red heat, and it has been found that inasmuch as iron becomes oxidized at these temperatures, its conductivity and heating power are substantially diminished, making the operation unreliable.

The oxidation of iron heaters not only made for poor conduction of heat, but also made the surface of the cylinder uneven, tending to yield as unsatisfactory results the same as resulted from warping. Moreover, the oxidation tended to soil the fabric, and greatly so when the oxidation rubbed off from the cylinder, carrying dust and dirt into the fabric, as well as giving the cylinder an uneven and therefore inefficient surface. It has been attempted to use copper for a singeing heater, but this does not help, since copper oxidizes freely, and at comparatively low temperatures. Upon copper the oxide forms in black, thin scales, which shed almost as rapidly as formed, thus soiling and tending to damage the fabric, and rendering it necessary to attempt to clean the fabric by laborious brushing.

The objection has also been found in iron heaters, that the oxidizing upon the surface makes them become poorer conductors of heat, since the iron oxidizes at the heat used for singeing, which is about 1200 to 1500 degrees F. In the case of an iron heater, the oxide accumulates upon the surface of the iron, and it becomes a poorer and poorer conductor of heat, so that there is much waste of fuel in heating it. Moreover, owing to this oxidization, there is not

a satisfactory contact between the cylinder and the cloth, and hence the speed of travel of the cloth has to be reduced, thus not only lessening production, but also resulting in a poorer product. It has been attempted to overcome these difficulties by regrinding the surface of the heater, to restore its freshness, and in other ways.

An object of the present invention is to render the color or appearance of the fabric uniform, not only throughout a single piece, but also for different pieces, and to enable the apparatus to be operated at substantially higher speeds than heretofore, and to avoid the difficulty due to oxidation of the surface of the iron. A further object is to make it practicable to vary the heating under control for different purposes, and to maintain the condition for an indefinite time, without requiring constant watching by a skilled attendant.

To reach these results and secure automatically and reliably a uniform coloring or shading throughout many pieces of goods at the singeing operation, I employ a heater having means for automatically maintaining it at a given degree of heat, and employ for the material of the heater an alloy which can be depended upon to produce uniform results so long as the degree of heat is maintained at the point fixed. This gives the desired uniformity of color. In practicing the invention, I pass the fabric over a roll which is made of nichrome, and which may be heated as required for singeing and other operations, without the surface of the roll or cylinder becoming oxidized, so that dependence may be placed upon the same result being produced by the heater, by maintaining it at a uniform heat, throughout an indefinite period, so that similarity of color of different portions of the same piece of fabric, or of successive pieces of the same fabric, is insured. The nichrome cylinder is made to revolve. This is done at a relatively low speed while the fabric is drawn rapidly thereover. The rotation of the cylinder or roll is for the purpose of enabling the renewal of the heat of that portion which has just been deprived of some of its heat by the fabric. The roll is thus made to keep uniformly hot at the portion thereof over which the fabric is drawn.

The result is secured by uniformity of speed of the nichrome cylinder, with uniformity of speed of the cloth, and uniformity of heat of said cylinder. Hence, uniformity of color is secured by the automatic heat controller, so that the operator does not have to watch the color, or attend to the condition of the cylinder, which is automatically maintained in the same condition. This is important where thousands of feet of cloth pass over the cylinder in a short time, and where consequently a variation in color would not be noticed until after such variation had existed for a relatively long time, inasmuch as the cloth is sometimes run through the singer from thirty to sixty or more feet per minute, and damage is easily done, and imperfect results obtained, even though the variations are so slight as not to be detected promptly by a highly skilled artisan.

The body of the thermo-couple, which forms part of the color-regulator, is placed on the inside of the roll. The singeing roll may turn three revolutions per minute, or about nine feet of surface feed, while the cloth may run from thirty to one hundred feet. The purpose of turning the roll is to secure an even heating all the time; preferably one-third of the roll being exposed, and two-thirds being constantly subjected to the heat of the furnace.

By the use of manifolds, it is practicable to control the heat of any section or portion of the cylinder, which may for this purpose be divided into as many sections as desired. Thus the whole cylinder need not be directly heated when only a narrow strip of cloth is being singed. Moreover, by being able to control the heat of these different longitudinal sections of the cylinder, it is rendered practicable to keep the same of uniform heat throughout. It has also been seen that this uniform heat may be maintained automatically for any length of time, thereby automatically securing a uniformity in color and appearance of the finished goods, a perfectly even surface being secured throughout. A further advantage is secured, because the heating of the surface of the cylinder is uniform, and it is a good conductor, and there is no oxidization, and therefore there is no heat wasted. Since the roll is given sufficient time in which to absorb heat, it results that when once the speed of rotation has been determined upon, such speed may be kept up for the entire day without the necessity of changing.

The evenly heated roll is revolved slowly, and has time to absorb the heat, and is kept uniformly heated, and this permits the cloth to be run much more rapidly than in the case of a stationary singer. The roll is always presenting freshly heated surface portions to the cloth, and is rotated so slowly as to have time for absorbing the required heat from the furnace.

The invention can be used for a variety of other purposes, since it has great heating capacity. For example, it may be used in drying shade cloth, muslins or ginghams. The roll can apply from five to ten times the heat of ordinary steam drying rolls, and without incurring the loss of heat attendant upon the boiling of the water and bringing the steam to the drying machine. The heat is economically used, and the damp cloth

can be run much faster than over steam drying rolls.

There is such surface contact as to make it better than the practice of carrying the cloth over flames. It is superior to drying by stem or hot air, since air does not take up heat whereas the roll has heat stored in it. It is therefore more efficient than where flames or steam or hot air or other ordinary drying or heating apparatus has been used.

Other features and advantages will hereinafter appear.

In the accompanying drawings,

Figure 1 is an elevation of the cloth-singeing apparatus in one form. At this figure is shown diagrammatically the means for automatically governing the heat of the singeing roll.

Figure 2 is an end elevation of the apparatus.

Figure 3 is a sectional end elevation of the apparatus.

Figure 4 is a sectional longitudinal elevation taken about centrally of the apparatus.

The fabric to be singed, dried or heated is designated as 10, Figure 3, and passes beneath opposite guide rolls 11 (on adjustable arms 11ª) and over a heated roll 12; the fabric being drawn rapidly along by the usual means, not shown. The roll 12 is heated by means of burners 13 for mixed air and gas, said burners having outlets 14 in the opposite sides near the bottom of a flame chamber 15 formed in a furnace, which may consist of refractory material and comprise a bottom 16, side walls 17, and ends 18. The refractory material may be contained in a sheet-metal box or casing comprising a bottom 19, opposite sides 20, and ends 21. As will be seen at Figure 3, about two-thirds of the circumference of the cylinder 12 is constantly exposed to the direct heat of the furnace, the remaining third protruding above the side and end walls thereof. The flame chamber is preferably narrowed towards its bottom, as illustrated at Figure 3, so as to keep the flame space within proper limits, and not produce more flame than is necessary to heat the cylinder 12 for the purpose of the invention. Each side wall of the furnace has a cap stone or slab 22, these cap stones being held in place by metal caps 23, bolted to the frame at 24, and at their inner edges conforming to the periphery of the cylinder 12, and in close proximity thereto, so as to prevent undue escape of heat from the furnace. The stones 22 can be slidden a little closer to or away from the cylinder, and held by the bolts 24 where adjusted. The air and gas may be supplied under pressure, and the furnace ends may be provided with vents 25 at the bottom of the flame chamber.

The cylinder 12 is heat-conducting, refractory, non-oxidizing, non-warping, and self-sustaining or non-sinking at singeing heat, and is in the form of a relativity heavy casting of nichrome, which may substantially comprise about sixty per cent of nickel, ten or twenty per cent (more or less) of iron, and twenty or thirty per cent of chrome, this alloy having the advantages hereinbefore set forth, and not liable to oxidize, even though kept at singeing or other high cloth-treating heat for long periods. Upon the cylinder are cast ends or heads 26, from which extend gudgeons 27 also cast upon the cylinder, said gudgeons extending through openings 28 in the ends of the furnace, said gudgeons nearly filling said openings, thereby reducing to a minimum the escape of heat from the furnace at these points.

Upon the ends of the gudgeons are fitted rolls 29, 30, to ride upon pairs of supporting rolls 31, 32, which are mounted upon the ends of the furnace and exterior thereto. The rider roll 30 has peripheral grooves 33 to receive the supporting rolls 32, to prevent undue endwise play of the roll or cylinder 12. The cylinder 12 may be driven by means of a sprocket wheel 34 formed upon roll 30, a chain 35 connecting said sprocket wheel to another sprocket wheel 36 mounted upon a shaft 37, to which is connected a movement-reducing gearing in a drum 38, which is driven by a sprocket chain 39 from any source of power.

The cylinder 12 is preferably made hollow for economy in material and saving of weight; and the hollow may extend through the gudgeons 27, as at 40; and the ends of the gudgeons may be closed by caps 41.

There is a row of the burners 13 extending along each side of the furnace, on the opposite side of the cylinder from the fabric, and out of contact with the cylinder, and these burners are supplied with mixed gas and air through elbow pipes 42, which extend up from manifolds 43, there being illustrated three manifolds at each side of the furnace, and three pipes 42 branching from each manifold. Opposite manifolds are connected by mains 43ª, and these mains are supplied by elbow pipes 45 delivering to the middle portions of the mains, as at Figure 2, and each supplied with compressed air through a pipe 46, and gas through a pipe 47, these pipes extending vertically down to horizontal mains 48, 49, which connect by risers 50, 51 to a shell or chest 62, by which is controlled the flow of gas and air received from an air supply main 53 and a gas supply main 54. This chest may be of the type shown in the patent to George Machlet, Jr., No. 1,033,816, dated July 30, 1912, and the flow of gas and air through said chest may be controlled automatically, as set forth in said patent, according to the fluctuation of heat in the furnace, whereby the heat of the cylinder 12 may be kept uniform for an in-

definite period without the necessity of depending upon the watchfulness of an attendant. Since this cylinder is kept at uniform heat, and rotates at uniform speed, and since the cloth is moved at uniform speed, in contact with the exposed surface of the cylinder which protrudes above the flame chamber, the extent of the singeing is controlled, with the result that it does not vary either in the same piece of goods or through many pieces, and hence the color is automatically kept uniform. The type of heat regulator disclosed in said patent is shown diagrammatically at Figure 1, comprising element 3, (see Figure 5 of said patent), coil 7, needle 8, a valve 44, controlled by parts 10, 23, 26, etc., in said patent and herein generally designated as 55; and also comprising a pipe 56 (marked 54 in said patent) leading to the diaphragm housing 59, and a pipe 93 leading to compressed-air supply main 63. Slight variations in the heat of the cylinder 12 affect the electrical element or couple 3, and thereby the needle 8, which through the mechanism set forth in said patent affects a diaphragm in said housing 59, to operate a valve in shell or chest 62, to vary the supply of air and gas to the vertical mains 50, 51.

The rolls 11 may be secured either in their working positions at Figure 3, or in elevated cast-off positions by means of screws 11^b threaded into the framework in passing through slots 11^e in arms 11^d, which extend up from the outer ends of the arms 11^a. In starting the cloth over the heating roll 12, it is desired to bring the rolls 11 quickly to their exact positions; and this is accomplished by the use of stop pins 11^e secured by nuts 11^f in the slots 11^c. These stop pins 11^e may rest upon the top of the framework and may be set to any desired positions along the slots 11^c and there secured by the nuts 11^f.

Variations may be resorted to within the scope of the invention, and portions of the improvements may be used without others.

Having thus described my invention, I claim:

1. A device for uniformly singeing fabric by contact, comprising a metal cylinder, a furnace having a chamber in which the flames are confined, said cylinder confined within said flame chamber, but protruding slightly above the top thereof, stationary burners in the flame chamber out of contact with the cylinder and on the opposite side thereof from the fabric, and remote from said cylinder, and heating the flame chamber uniformly, means to revolve the cylinder at uniform speed, and an automatic heat governor including a thermotic element within said cylinder.

2. An apparatus for uniformly singeing by direct contact a fabric traveling at uniform speed, comprising a furnace, a heat-conducting cylinder of ferrous alloy of nickel and chrome, means to revolve the cylinder at uniform speed, said furnace comprising bottom, side and top walls, means for securing the top walls near the cylinder, the walls forming a flame chamber in which the lower portion of the cylinder only is exposed to flames, another portion of said cylinder protruding from the furnace and contacting with the moving fabric, and means extending within the cylinder to be controlled by the heat thereof, for automatically maintaining the heat at a certain point.

3. An apparatus for singeing cloth, comprising a refractory iron alloy cylinder, means for heating the same, said heating means including a furnace having a flame-confining chamber in which the cylinder is confined in such a manner that one peripheral portion thereof is heated while another peripheral portion thereof is exposed for contact with the cloth, means for revolving said cylinder at a uniform rate, and means for automatically maintaining the heat of the cylinder uniform for an indefinite period.

4. An apparatus for singeing in a manner to produce absolute uniformity of color throughout all portions of an indefinite number of bales of cloth, comprising a refractory iron alloy cylinder, means for heating the same, said heating means including a furnace having a flame-confining chamber having side and end flame-confining walls within which the cylinder is confined in such a manner that one peripheral portion thereof is heated while another peripheral portion thereof is exposed beyond the walls for contact with the cloth, means for revolving said cylinder at a uniform rate, and means, including a device inserted within the cylinder to be heated thereby, for automatically maintaining the heat of the cylinder uniform for an indefinite period.

5. An apparatus for uniformly singeing cloth, comprising a heat-conducting, non-warping, non-expanding, non-oxidizing iron alloy cylinder, means for heating the same, said heating means including a furnace having a flame-confining chamber in which the cylinder is confined in such a manner that one peripheral portion thereof is heated while another peripheral portion thereof is exposed for contact with the cloth, means for revolving said cylinder at a uniform rate, and means for automatically maintaining the heat of the cylinder uniform for an indefinite period.

6. A singeing machine comprising, in combination, a refractory iron alloy cylinder, a furnace having a flame chamber in which the flames are confined and in which the cylinder is mounted, means for revolving the cylinder, and flame-controlling means connect-

ed with said cylinder for automatically maintaining the heat of the cylinder at a fixed point for an indefinite period; a portion of said cylinder protruding from said flame chamber to expose a surface over which to draw the fabric.

7. An apparatus for singeing fabric by direct contact, comprising a cylinder, means to revolve the cylinder, and means to heat the cylinder during its revolution, said heating means including an enclosed furnace of refractory material below the cylinder having cap stones below the fabric and in close proximity to the cylinder, but at a sufficient distance to prevent the flames from burning the fabric.

8. An apparatus for singeing fabric by direct contact, comprising a cylinder, means to revolve the cylinder, and means to heat the cylinder during its revolution, said heating means including a furnace of refractory material and having cap stones conforming at their inner edges to the periphery of the cylinder and in close proximity thereto, to prevent undue escape of the heat from the furnace, a metal frame enclosing said refractory material, and metal caps holding said cap stones in place.

9. Apparatus for singeing cloth uniformly, comprising an iron alloy cylinder which is heat-conducting, non-warping, non-expanding, non-oxidizing and non-scaling at singeing heat, a furnace comprising a flame-confining chamber having means to heat the cylinder uniformly from end to end by flames to which the cylinder is exposed, means to revolve the cylinder, and means to draw fabric over the cylinder.

10. A cloth-singeing apparatus comprising a refractory cylinder substantially non-oxidizing and highly conductive, means to heat the cylinder, means to revolve the cylinder, means to draw fabric over the cylinder, said heating means comprising a furnace having a flame chamber within which the flames are confined and within which said cylinder is arranged, said flame chamber provided with end walls having openings, said cylinder having at its ends integral gudgeons of less diameter than the cylinder to extend through said openings in the furnace, and supports for said gudgeons at the exterior of the furnace.

11. A cloth-singeing apparatus comprising a non-oxidizing, refractory, heat-conducting iron alloy cylinder, means to heat the cylinder, means to revolve the cylinder, means to draw fabric over the cylinder, said heating means comprising a furnace having a flame chamber in which the flames are confined and within which said cylinder is arranged, said flame chamber including end walls having openings, said cylinder having at its ends integral gudgeons of relatively small diameter to extend through said openings in the furnace, riding rolls upon said gudgeons outside of the furnace, and rolls upon the furnace to support said riding rolls.

12. A cloth-singeing hollow cylinder consisting of a casting having end walls formed thereon, said end walls formed with integral gudgeons of relatively small diameter, and riding rolls upon said gudgeons, in combination with a furnace provided with supporting rolls for said riding rolls, and having a flame-confining chamber containing said cylinder, said chamber having end walls through which said gudgeons extend.

13. A furnace for heating a singeing cylinder, said furnace including a flame confining chamber having a plurality of independent sets of burners, each set being connected to a single valved pipe to regulate the heating of one longitudinal section of the cylinder independently of the other section or sections of the cylinder, the burner system comprising manifolds for groups of burners at different longitudinal sections of the furnace; the manifolds being arranged in pairs on opposite sides of the furnace, and the manifolds in each pair being controlled by a single set of valves.

14. An apparatus for securing uniformity of color at a singeing operation, comprising means for advancing the fabric rapidly, a cylinder having hollow end gudgeons over which cylinder the fabric is drawn, means to expose the cylinder to external heat on the side thereof opposite the fabric, means for revolving the cylinder slowly, and means extending through a hollow gudgeon for automatically maintaining the heat of the cylinder exactly at the required singeing point.

15. A heat-conducting, ferrous alloy of nickel and chrome cloth-singeing bed, means for drawing fabric evenly and at uniform speed rapidly over said bed, means for slowly moving said bed to expose different areas thereof to the fabric, and stationary means for heating uniformly by diffused heat only the portion of said bed which is remote from said fabric.

16. The combination of a singeing cylinder, means to revolve the same, and means to heat the same including a furnace having a flame-confining chamber provided with a system of burners, means being provided to regulate the heating of any of several longitudinal sections of the cylinder independently of the remaining section or sections.

17. The combination with a heating roller and means to revolve the same, of a pair of fabric-guiding rollers, arms upon which the rollers are pivoted, slotted arms extending from said arms, stop pins adjustable in the slotted arms, and means for securing the slotted arms where adjusted.

18. A heat-conducting, refractory, non-oxidizing, non-warping, cloth-singeing cylinder of ferrous alloy of nickel and chrome,

means for rapidly drawing fabric evenly and at uniform speed over said cylinder, means for revolving said cylinder at a surface speed slower than the speed of the fabric to expose different areas thereof to the fabric, and stationary means for uniformly diffusing heat only to the portion of said cylinder which is remote from said fabric.

19. An apparatus for uniformly singeing fabric, comprising a heat-conducting, non-warping, non-expanding, substantially non-oxidizing, non-scaling iron alloy cylinder, means to revolve the cylinder at uniform speed, a furnace having a chamber in which the cylinder is exposed to uniform diffused heat from end to end and thereby heated to or above red heat, and means extending within the cylinder to maintain the heat of the cylinder uniform.

20. Singeing means for producing an indefinite succession of rolls of fabric treated thereby to match one another uniformly throughout in color and appearance, comprising a heat-conducting, non-oxidizing, non-warping, non-expanding iron alloy cylinder, a furnace having a heat-confining chamber with burners in it arranged to produce diffused heat, in which one portion only of the periphery of said cylinder is exposed to the heat, means for rapidly drawing the fabric at uniform speed over an exposed peripheral portion of said cylinder in contact therewith, means for revolving said cylinder slowly at a uniform rate, and means for automatically maintaining the heat of said cylinder uniform for an indefinite period.

21. The combination of a singeing roll, means for revolving the roll at a relatively low speed, a furnace having a heating chamber in which the flames are confined and within which the roll is so confined that the main portion thereof is constantly subjected at all points to the heat of the furnace while only a relatively small portion thereof is exposed outside of the furnace, and means for drawing fabric over said exposed portion.

22. In a fabric-singeing apparatus, the combination of a rotatable nichrome singeing roll, a flame-heater to heat the roll by diffused heat only to a singeing temperature, and arranged relatively to the roll so as to maintain that portion of the roll that singes the fabric at a uniform singeing temperature from end to end, and means to rotate the roll at a constant speed, whereby uniform singeing of the fabric is attained.

23. Singeing means causing an indefinite succession of rolls of fabric treated thereby to match one another uniformly throughout in color and appearance, comprising a heat-conducting, non-oxidizing, non-warping, non-expanding cylinder, a furnace having a heat-confining chamber in which one portion of the periphery of said cylinder is exposed to diffusive heat, means for rapidly drawing the fabric at uniform speed over an exposed peripheral portion of said cylinder in contact therewith, means for revolving said cylinder slowly at a uniform rate, and means for automatically maintaining the heat of said cylinder uniform for an indefinite period, said cylinder formed of the herein-described alloy of nickel, iron and chrome.

24. An apparatus for singeing fabric by direct contact, comprising an iron alloy cylinder, means to draw the cloth rapidly at uniform speed over the cylinder, means to revolve the cylinder, and a furnace having a heating chamber within which the flames are confined within which the cylinder is also confined in a manner to expose without the chamber only the side thereof that contacts with the fabric; said furnace diffusively heating the cylinder uniformly throughout its length.

25. Singeing means giving uniform color and appearance to an indefinite length of fabric, comprising a cylinder of the described nickel, iron and chrome, a furnace having flame-confining walls forming a heat-confining chamber in which one side of the cylinder is exposed to diffusive heat, means outside the furnace supporting the cylinder, the body of said cylinder being self-supporting at singeing heat, a side of said cylinder protruding from the heating chamber at a point remote from the flames, means for revolving the cylinder uniformly and slowly in one direction, and means for drawing fabric at high speed over the protruding side of the cylinder.

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