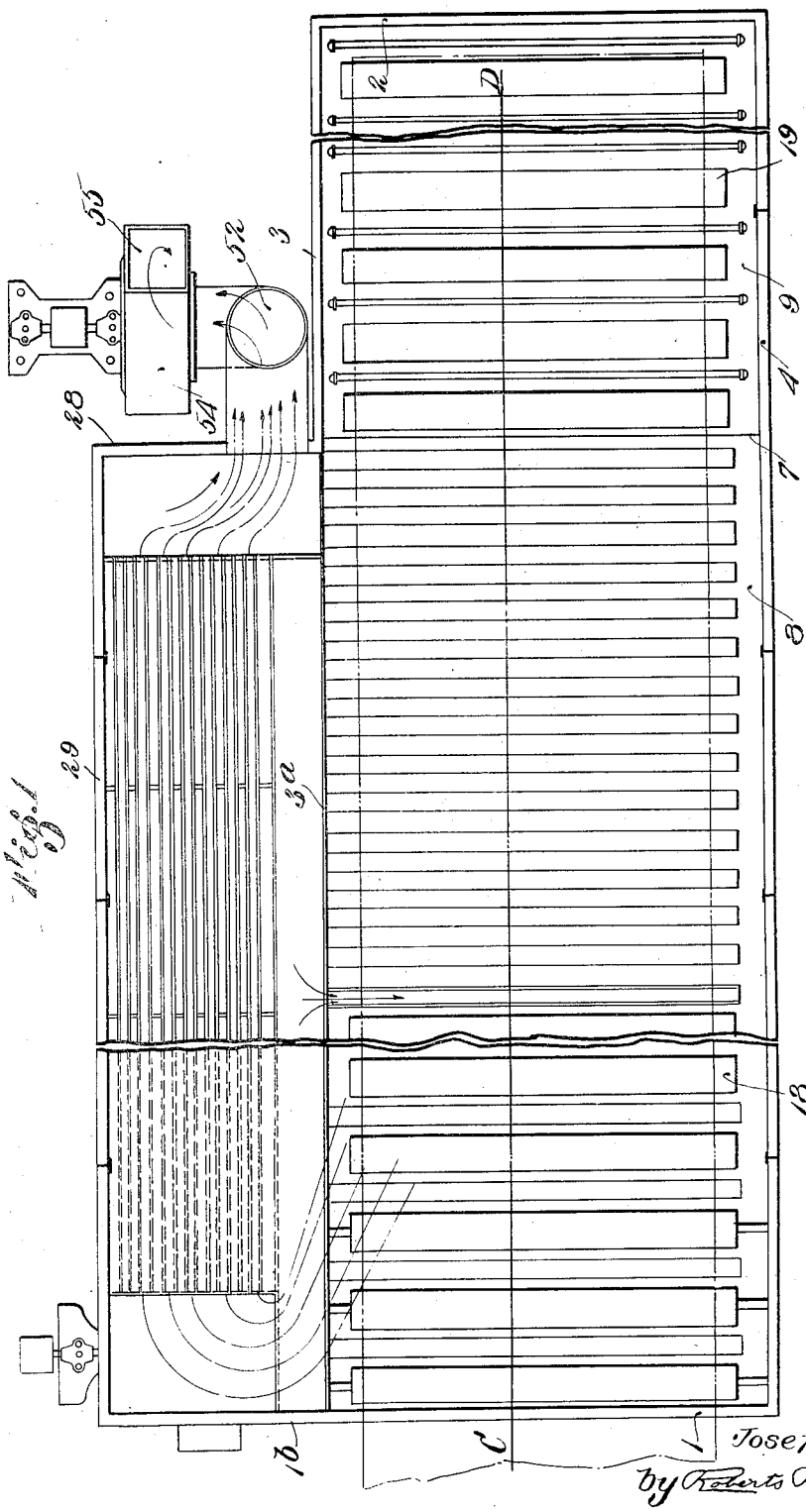
May 21, 1929. J. H. WALSH 1,714,062

PROCESS OF DRYING AND CARBONIZING TEXTILE FABRICS

Original Filed April 7, 1922 4 Sheets-Sheet 1



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PROCESS OF DRYING AND CARBONIZING TEXTILE FABRICS

Original Filed April 7, 1922 4 Sheets-Sheet 2

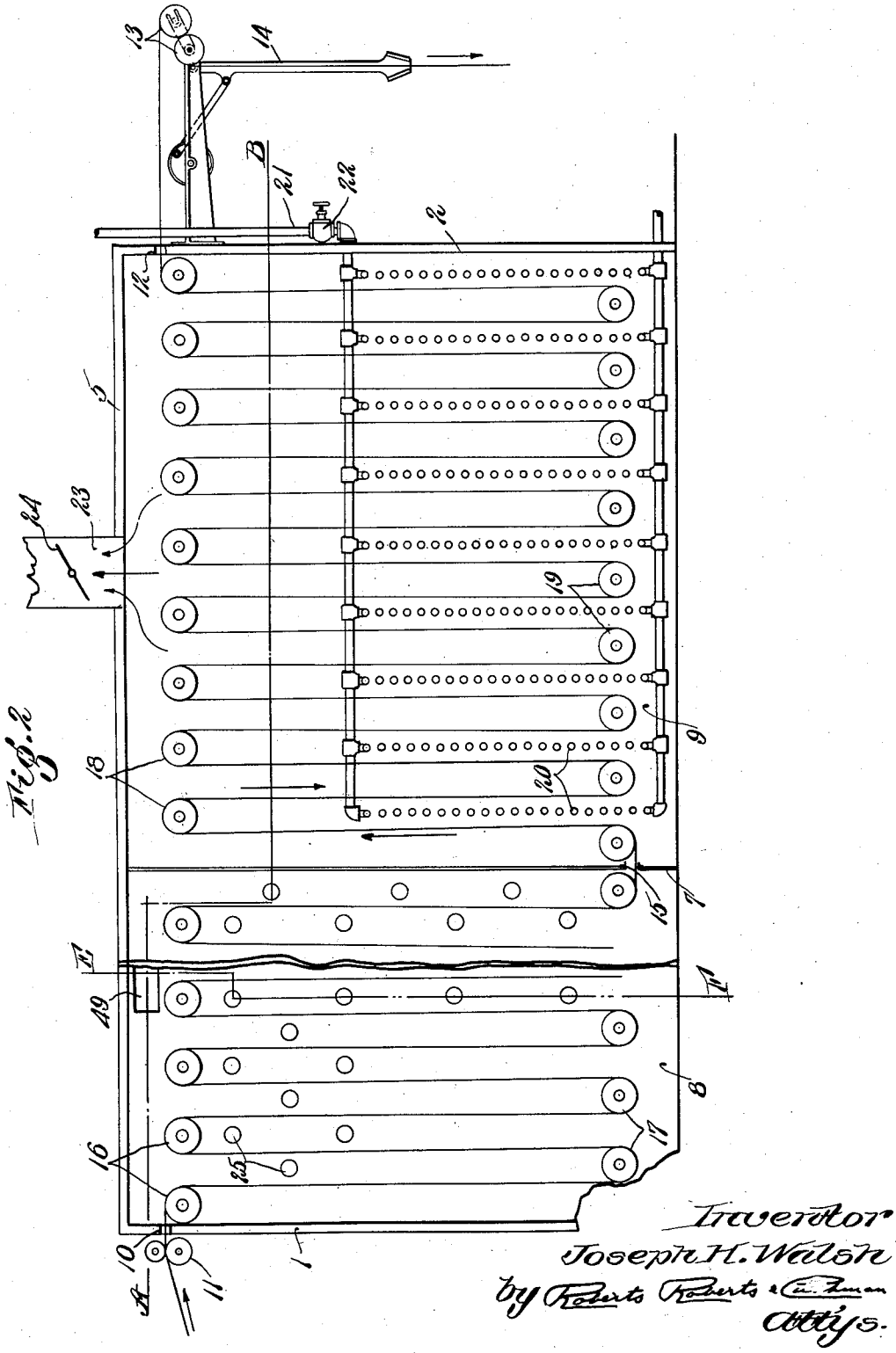


Fig. 2

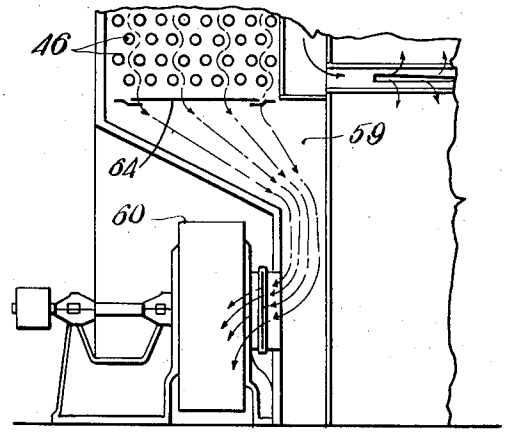
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PROCESS OF DRYING AND CARBONIZING TEXTILE FABRICS

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Fig. 5



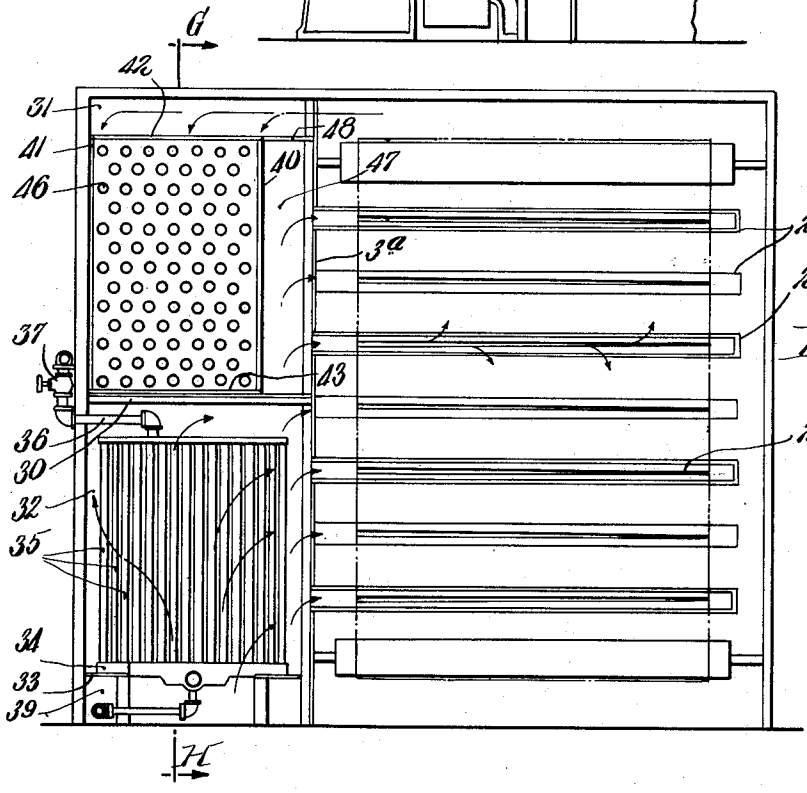
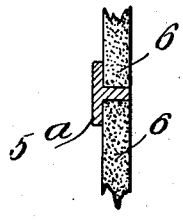


Fig. 3

Fig. 6



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PROCESS OF DRYING AND CARBONIZING TEXTILE FABRICS

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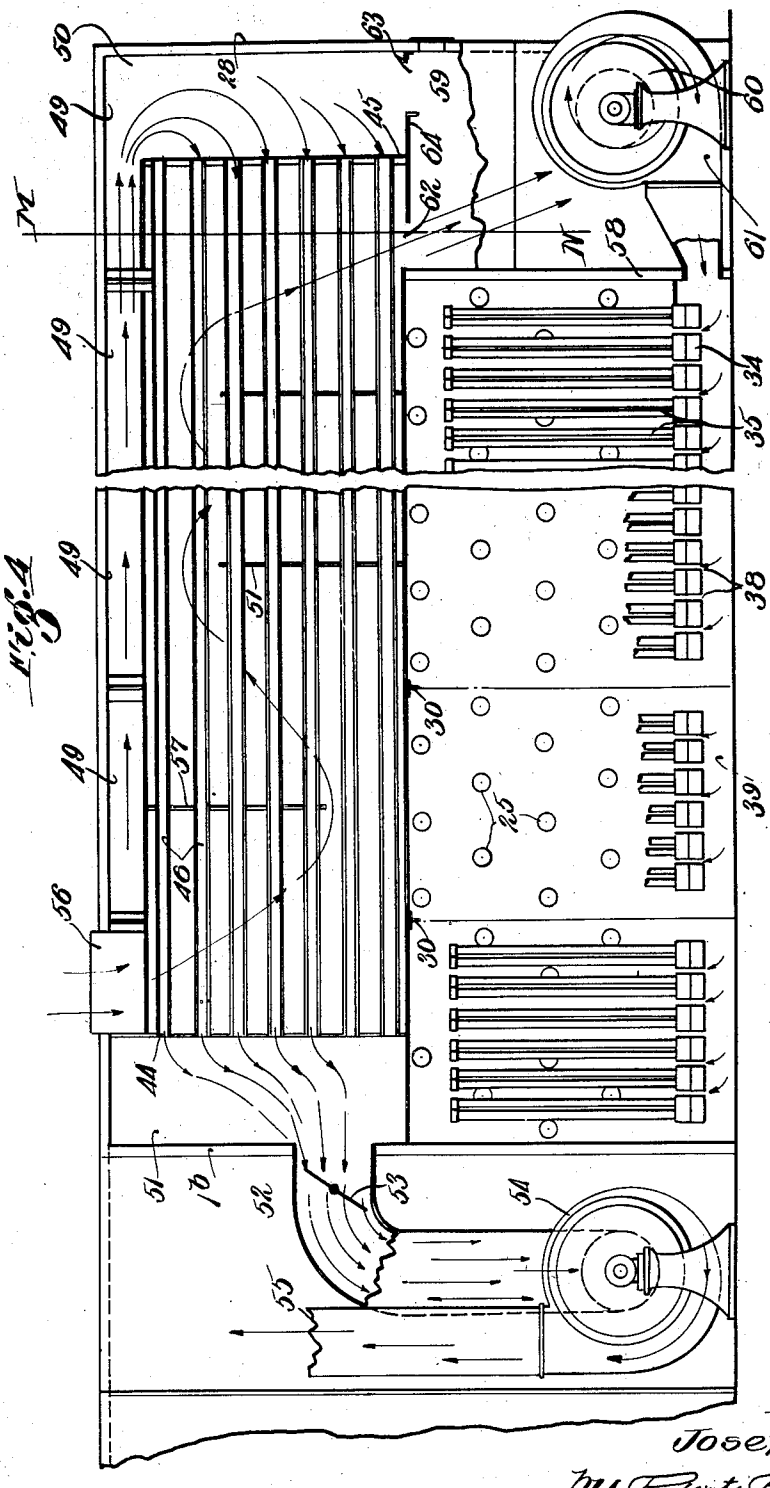


Fig. 4

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UNITED STATES PATENT OFFICE.

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PROCESS OF DRYING AND CARBONIZING TEXTILE FABRICS.

Original application filed April 7, 1922, Serial No. 550,538. Divided and this application filed March 16, 1925. Serial No. 16,082.

This invention relates to the treatment of textile fabrics by reagents and heat, and comprises a process useful, for example, in drying and carbonizing such fabrics, this application being a division of application Serial No. 550,538 which has matured into Patent Number 1,530,065, dated March 17, 1925.

As a step in the finishing of woolen or other animal-fibre textiles the material is often subjected to what is commonly known as a carbonizing treatment in which vegetable matter, such for example as fragments of burrs, nettles and the like, which have not been removed during the preliminary treatment of the fibre, are charred by the application of acid and heat, so that their complete removal may be effected by beating, shaking or blowing out the charred substances. In accordance with one such process, the fabric is first moistened with dilute acid, and then the material is subjected to a drying heat to drive out the moisture and concentrate the acid retained in the pores of the fabric to a point such that upon a predetermined further temperature increase the desired reaction is attained without destruction of the fabric. The discharge of moisture from the fabric has in many cases been accomplished by the application of heat so intense as actually to boil the moisture from within the fibres, causing disruptive evolution of steam and irregular concentration of the acid solution with consequent damage to the quality of the finished material. Successful practice of the treatment requires exactitude in the evaporative and heating stages, without which damage and loss must occur.

In prior practices of which I am aware the mode of application of heat for the mentioned purposes has been exceedingly wasteful, the fabric usually being baked in transit over very hot heating coils without any serious attempt to provide efficient means for directing the heat against the fabric, to prevent the escape of unused heat, or to control the temperature or moisture content of the surrounding atmosphere with any degree of certainty. The total heat wasted in an apparatus of the prior type for handling fabric in commercial quantities is consequently a large and serious item of expense in cloth finishing establishments. As usually operated, the treatment is carried out in the open, with no provision against escaping fumes damaging to the health of workmen and destructive of machinery and metal fittings. When the cloth has been treated in enclosures, so far as I am aware, no provision has heretofore been made for the positive removal of the vapors from the vicinity of the material, thus causing irregular evaporation and concentration of the reagent and promoting recondensation of the moisture. This has discredited, by irregular results, attempts to guard the health of the operators and save heat by enclosing the place of treatment.

The popular way of supporting the cloth for treatment is by means of guide rolls which cause it to travel in substantially horizontal runs during drying and carbonizing, in order to apply heat from unenclosed coils. This mode of support necessitates intermediate supporting means to prevent sagging of the runs into contact with one another, and makes it necessary to rotate some at least of the guide rolls by mechanical means in order to provide for the proper movement of the fabric. When mechanically driven parts are employed near the drying cloth or in a carbonizing chamber, it is difficult to prevent rapid corrosion of the driving mechanism by the acid fumes evolved. More seriously, the arrangement of the fabric in horizontal runs tends to cause moisture to drip from one run to another, causing spotting and other damage to the material.

In the carbonization of the material little effort has heretofore been made to insure thorough exposure of the interior fibers to the action of the acid. Thus progressive heating of the material sometimes fails to produce the carbonizing effects theoretically attainable, which is attributable to the formation of an unbroken coating or crust of intermediate oxidation products which tend to resist the further action of the acid. Regulated evaporative drying and carefully controlled subsequent heating I find to be necessary to certainty of result and uniformity of product.

Objects of the present invention are accordingly to provide a treatment for previ-

ously acidulated fabric by which evaporative drying at a predetermined rate proceeds uniformly and without damage; to accomplish the carbonization more rapidly, thoroughly, and uniformly than before; and to prevent leakage of fumes into the work room.

The accompanying drawings illustrate by way of example one embodiment of means suitable for practising the improved process. In the drawings,

Fig. 1 is a horizontal section through the apparatus taken on the line A—B of Fig. 2, the central portion of the apparatus being broken away;

Fig. 2 is a longitudinal vertical section on a line such as C—D of Fig. 1;

Fig. 3 is a vertical transverse section on the line such as E—F of Fig. 2;

Fig. 4 is a longitudinal, vertical section through the heating chamber and economizer device on the line G—H of Fig. 3;

Fig. 5 is a fragmentary vertical cross section on the line M—N of Fig. 4; and

Fig. 6 is a typical cross section through one of the walls of the enclosing housing of the device.

Referring to the drawings, and particularly to Fig. 1, an elongate housing is shown comprising the end walls 1, 2 and the side walls 3, 4, this housing also being provided with a roof or cover 5 as indicated in Fig. 2. The walls and roof of this structure are preferably constructed as indicated in Fig. 6 wherein an angle iron 5^a is illustrated as constituting a support or stud to which are secured the adjacent ends of slabs 6 forming the sheathing or wall of the housing. These slabs are of acid-resistant and preferably heat-insulating material, for example, sheet asbestos, or the substance known commercially as "asbestos wood". This material comprises in general a composition of asbestos fibre together with a cementitious binder with or without a suitable filler all united under heavy pressure to form slabs, boards or other structural shapes useful for the desired purposes. This housing is divided by a vertical partition 7 into an evaporative dryer compartment 8 and a heater and carbonizer compartment 9, respectively. At the upper portion of the wall 1 of the housing an opening or slot 10 is provided for the ingress of the material, suitable guide rolls such as 11 being preferably provided outside the housing for directing the material toward the slot. The opposite end wall 2 is provided with a corresponding slot 12 at its upper part for the egress of the fabric, suitable guide rolls 13 being provided for receiving the fabric as it passes out through the slot 12. One or both of the latter guide rolls may be driven, if desired, to impart tension to the web of material, tending to draw the same longitudinally through the housing, and a suitable folding mechanism indicated generally at 14 may be provided for the delivered web. The lower part of the partition 7 is provided with a slot 15 permitting the passage of the web of material from the compartment 8 into the compartment 9.

In the upper part of the compartment 8 a series of guide rolls 16 is arranged, a corresponding series of rolls 17 being located in the lower part of said compartment. The rolls of the upper and lower series are staggered relatively to each other, and are so disposed that the fabric, in passing over the rolls 16 and under the rolls 17, is caused to lie in a series of substantially parallel runs extending through most of the vertical space in the housing. In the compartment 9, corresponding upper and lower series of guide rolls 18 and 19 are similarly arranged, so that the fabric in passing through such compartment is caused to travel in parallel vertical runs in the same manner as in compartment 8. Between certain, at least of the parallel runs of fabric in the compartment 9, vertically disposed controllable radiating heaters, such as the steam coils 20, are provided, the coils being supplied through the pip 21 controlled by valve 22 outside the housing. If desired, the roof 5 of the compartment 9 may be provided with an educt flue 23 controllable by means of a damper such as 24.

That portion 3^a, Fig. 1, of the side wall 3 of the housing which extends along the compartment 8 is somewhat thinner than at other points, as indicated at 3^a, and this portion of such wall is provided with vertically disposed series of openings in which are secured the ends of nozzle tubes 25. These tubes extend transversely of the compartment 8 and between the parallel runs of the fabric. Preferably these nozzle tubes are of asbestos-wood or other acid-resistant material and are closed at their outer extremities as indicated at 26, and are each furnished with tapering longitudinal air discharge slots 27 widest near partitions 3^a and arranged in diametrically opposite sides of the tube, and so disposed that air issuing from them is directed against the surface of the adjacent run of material. If desired, the nozzle tubes themselves may also be tapered from their open ends toward their closed extremities.

The end wall 1 of the housing is extended as indicated at 1^b, Fig. 1, beyond the side wall 3^a, forming with the wall 29, and end wall 28 an auxiliary housing, see Figs. 4 and 5. Extending transversely across the housing is a series of bars 30 and a horizontal partition 43 defining upper and lower preheating and heating compartments 31 and 32, respectively. In the lower part of the lower compartment 32 a transverse horizon-

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tal partition 33 supports a series of heaters comprising headers 34 to which radiator coils 35 are connected, openings 38 being provided between these headers for the flow of air currents. Coils 35 are supplied with steam by means of pipe 36 controlled by valve 37 outside the housing. The several headers 34 are spaced apart to provide slots 38 through which air from the space 39 beneath the partition 33 may pass upwardly between the several heating coils in the compartment 32.

Resting upon the bars 30 in the preheater compartment 31 is an economizer device, which may consist of a rectangular box comprising the side walls 40 and 41, the top and bottom walls 42 and 43 respectively, and the end walls 44 and 45 (Fig. 4). These end walls are furnished with series of openings in which are secured the ends of open-ended tubes 46, and these tubes penetrate transverse baffles 57. While the tubes 46 may be of metal or of metal coated with acid-resistant paint or enamel, it is practicable and preferred (in view of the heat-transferring efficiency of the large surface area presented by such tubes and the rate of motion of the hotter and cooler air and the relatively continuous operation) that the tubes may be formed of acid-resistant or acid-proof material having a relatively small heat-conducting capacity, such as asbestos-wood, without preventing the heat-transferring effect of the device. The economizer device is of a width such as to leave a space 47 between the wall 40 thereof and the wall 3^a of the housing, which space communicates freely with the lower compartment 32. Heated air from the lower compartment 32 may thus be distributed substantially uniformly over the entire area of the wall 3^a from which the tubes 25 extend, so that all of such tubes may be supplied with air under substantially uniform pressure. The space 47 is closed at its top by a horizontal partion 48, and the upper portion of the compartment 8 of the main housing communicates with the space above the economizer device by means of slots or openings 49, (Figs. 1 and 4). It is thus possible for spent and heated air from the drying compartment 8 to pass into the space above the economizer device and to flow longitudinally of the upper part of chamber 31 into the space 50 between the wall 28 and the end member 45 of the economizer device. From the space 50 the exhausting air passes freely through the economizer tubes into a corresponding space 51 at the opposite end of the economizer device. This latter space communicates, by means of a duct 52 controlled by damper 53, with an exhaust fan 54, such fan delivering the moisture and acid-laden fumes through a pipe 55 to any desired point of discharge. Desirably, by this arrangement, the spent air is under negative pressure within and beyond the economizer device.

At that end of the economizer device adjacent to the fan 54 a suitable inlet opening 56 is provided whereby fresh air may be admitted to the interior of the economizer box and into the space surrounding the tubes 46, to pass longitudinally of the economizer device while contacting with the outer surfaces of the tubes and in the tortuous path compelled by the baffle plates 57. The heating compartment 32 is closed at one end by a vertical partition 58 (Fig. 4) setting off a chamber 59 communicating with the intake of a fan 60. This fan, by means of a conduit 61, serves to deliver air into the space 39 beneath the radiator headers.

The space within the economizer device surrounding the tubes communicates with the chamber 59 through an opening 62, controlled by a sliding damper 64. The spent-air space 50 at the end of the economizer device also communicates with the chamber 59 by means of an opening 63, also controlled by the damper 64, which thus provides means to vary simultaneously and oppositely the relative areas of the openings 62 and 63, at will.

In operation, in the form shown, the web of fabric enters through the opening 10 and passes in vertical runs over and under the guide rolls 16 and 17 in the drying chamber 8 where it is subjected in a constantly-renewed and relatively homogeneous atmosphere to the action of the incoming blasts of heated air emerging from the slots in the nozzle pipes 25. The heat of the incoming air, having regard for the humudity of the induct air, the rate and pressure of the blasts, and the speed of the wet web of material or any of these factors, may be so regulated that as the fabric leaves the drying chamber through the opening 15 in the partition 7 it is substantially dry. As the dried fabric traverses in repeated vertical runs the carbonizing chamber 9, it is subjected in a comparatively still atmosphere to the action of radiant heat from the heating coils 20, and is thereby gradually raised to a temperature sufficient to cause carbonization of the vegetable matter. It will be noted that in passing through the chamber 9 the fabric is repeatedly and alternately subjected to the high atmospheric temperature existing in the upper part of said chamber and to the temperature in the lower part thereof, while the passage of the fabric about the several guide rollers serves mechanically to cause relative movement of the fibres composing the fabric. This way of moving the cloth compensates for variation in temperature or in humidity between the bottom and top of this chamber, if any exists, and together with the mechanical movement of

the fibres, serves effectively to expose all the carbonizable contents to a dependable average temperature for the reaction by the acid concentrate formed by the drying operation, at the same time breaking up or cracking any incrustation upon the fibres which might protect their vegetable impurities from the action of the heat; and thus securing uniform, rapid and thorough carbonization of such vegetable material as may be incorporated in the fabric. By the use of the damper 24 and the controllable heating coils 20 the temperature in the carbonizing chamber may be accurately regulated. During the traverse of the fabric through the drying and carbonizing chambers, the fans 54 and 60 are operated, the fan 54 serving to withdraw the moisture and acid-laden air from the drying chamber through the openings 49, causing the air to pass longitudinally through the economizer tubes and discharging it through the educt pipe 55. At the same time the fan 60 draws fresh air in through the opening 56, the fresh air passing repeatedly over the tubes in and longitudinally of the economizer device and in heat-transferring relationship to the spent air within the tubes 46, and being delivered for further heating into space 39, thence passing through the radiator coils 35 and through the nozzle tubes 25 into the drying chamber 8. For controlling the admission of fresh air the damper 64 may be manipulated, it being evident that if this damper be placed to close the opening 62 no fresh air will be admitted to the apparatus, in which event the air from the drying chamber will merely be circulated through the apparatus, passing from the space 50 into the chamber 59, and from thence to the radiator coils for reheating. In this case fan 54 is stopped or slowed. If, on the other hand, it be desired that none of the air be recirculated, the damper 64 may be positioned entirely to close the opening 63. Evidently, by arranging the damper at intermediate positions any desired mixture of fresh air and of the moisture-laden air from the chamber 8 may be admitted to the fan 60 for recirculation in the drying chamber. In either adjustment, it will be observed that the use of two blowers, (of which fan 60 causes positive internal pressure in chambers 39, 42, 47; and fan 54 causes negative internal pressure in chambers 8, 50, and 51) enables the relative speeds to be so adjusted as to control the pressure in chamber 8 within delicate limits. Desirably, this pressure is normally slightly negative, and this avoids leakage of fumes.

While in the above description a specific series of steps of the method and one arrangement of the various heating, circulating and economizer devices has been described, it is to be understood that the invention is not restricted to the recommended steps or to the specific arrangements, materials or devices but that various changes and modifications may be made without departing from the spirit of the invention.

I claim:

1. That process of drying and carbonizing webs of fabric comprising guiding a web of fabric in a series of vertical runs in a heat insulated chamber, moving such web through the chamber, and subjecting such web within the chamber to the successive actions of direct radiant heat and highly heated still air alternately applied during each run.

2. That process of drying and carbonizing webs of fabric comprising guiding a web of fabric in a series of vertical runs in a heat insulated chamber moving such web through the chamber, and subjecting such web within the chamber to the direct blasts of heated air impinging substantially perpendicularly against the runs at the first part of the series and to direct radiant heat and highly-heated still air alternately applied at the second part of the series.

3. That process of drying and carbonizing webs of fabric comprising guiding a web of fabric in a series of vertical runs in a heat insulated chamber moving such web through the chamber, said chamber being divided into two compartments and subjecting the web, as it passes through the first compartment, to blasts of heated air impinging substantially perpendicularly against the web and, as it passes through the second compartment, to direct radiant heat and highly-heated still air alternately applied.

Signed by me at New York city, N. Y., this 13th day of March, 1925.

JOSEPH H. WALSH.

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