June 24, 1930. L. BUCK 1,766,595

DRYING APPARATUS AND METHOD

Filed April 25, 1929 4 Sheets-Sheet 1

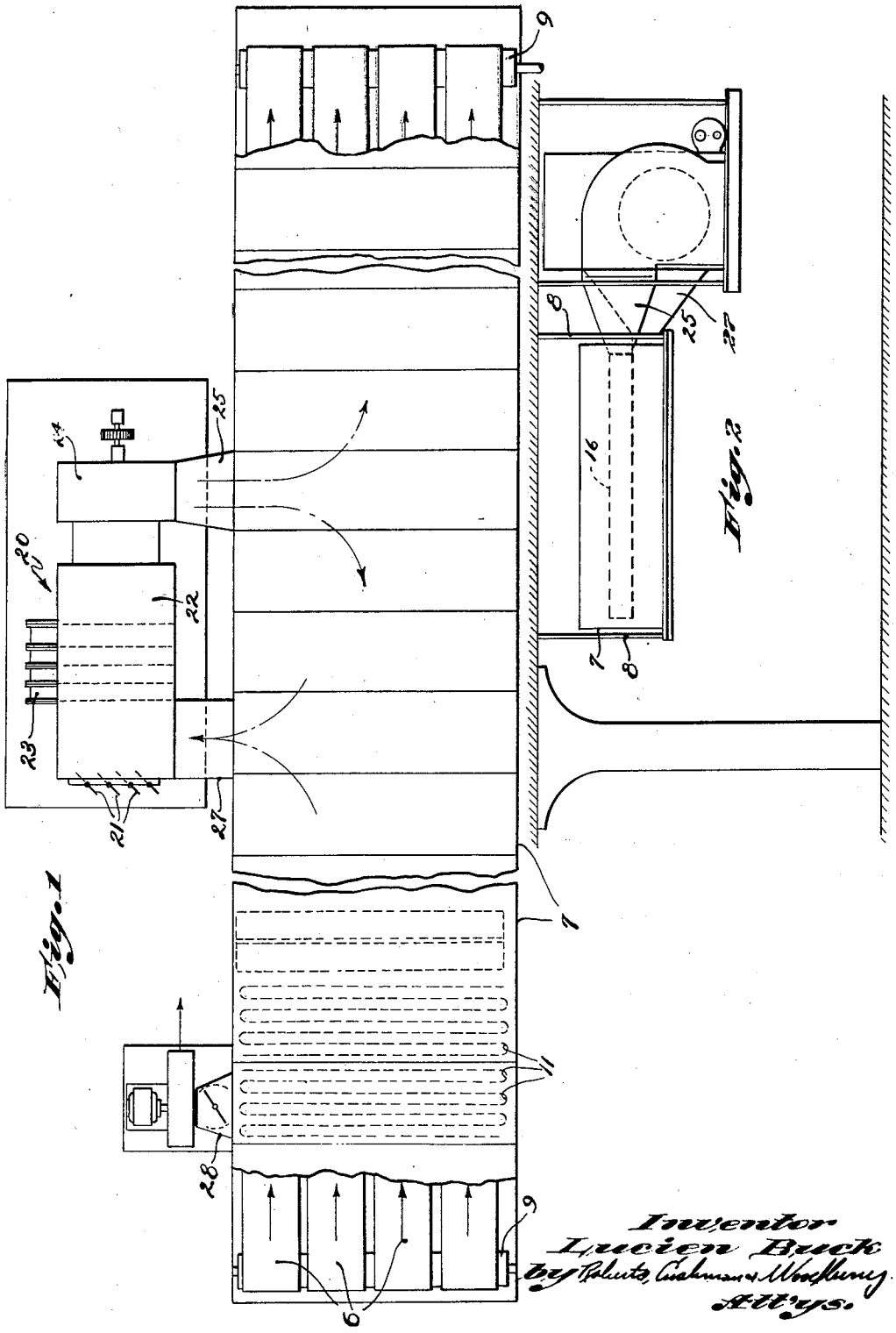


Fig. 2

Fig. 1

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DRYING APPARATUS AND METHOD

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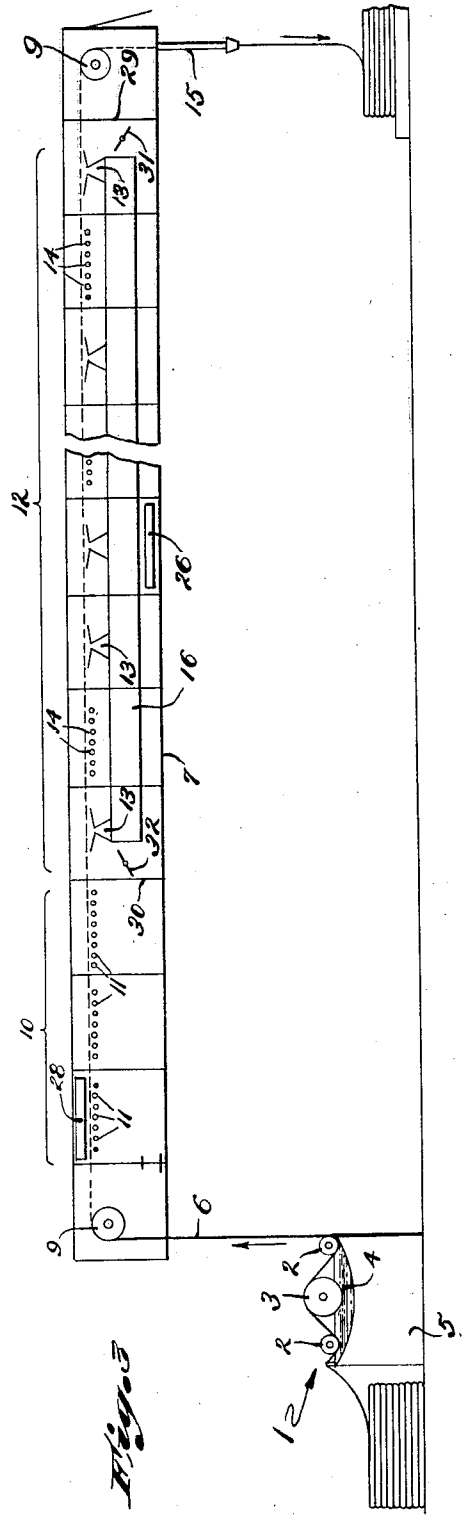


Fig. 3

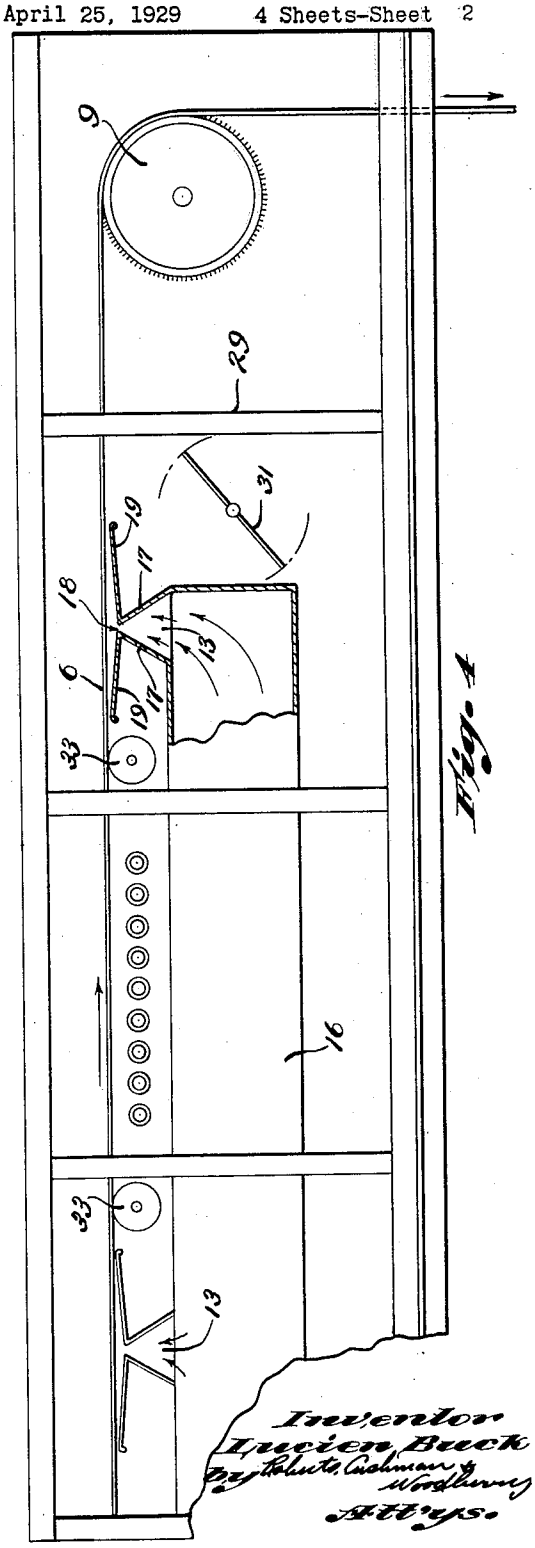


Fig. 4

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DRYING APPARATUS AND METHOD

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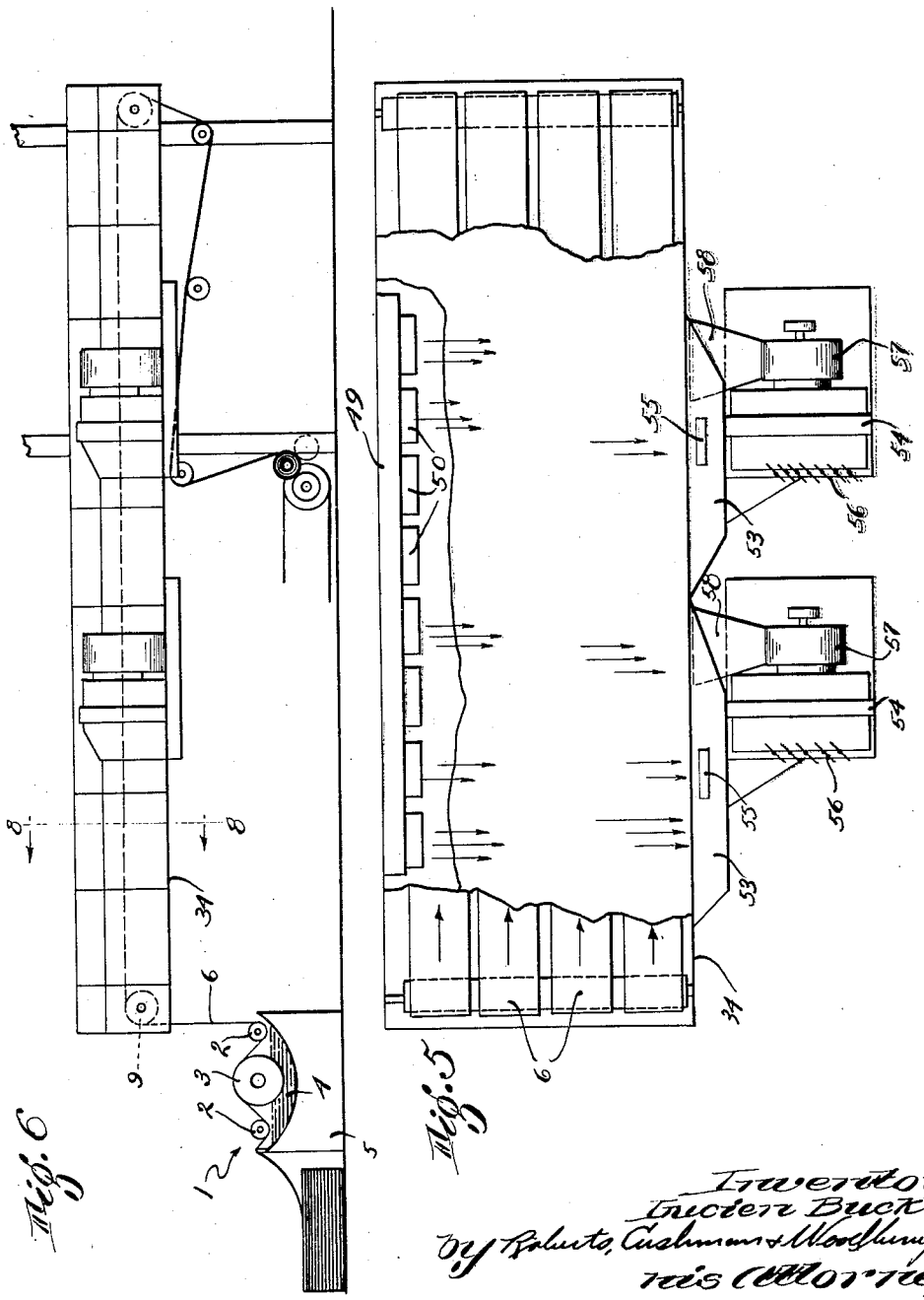


Fig. 6

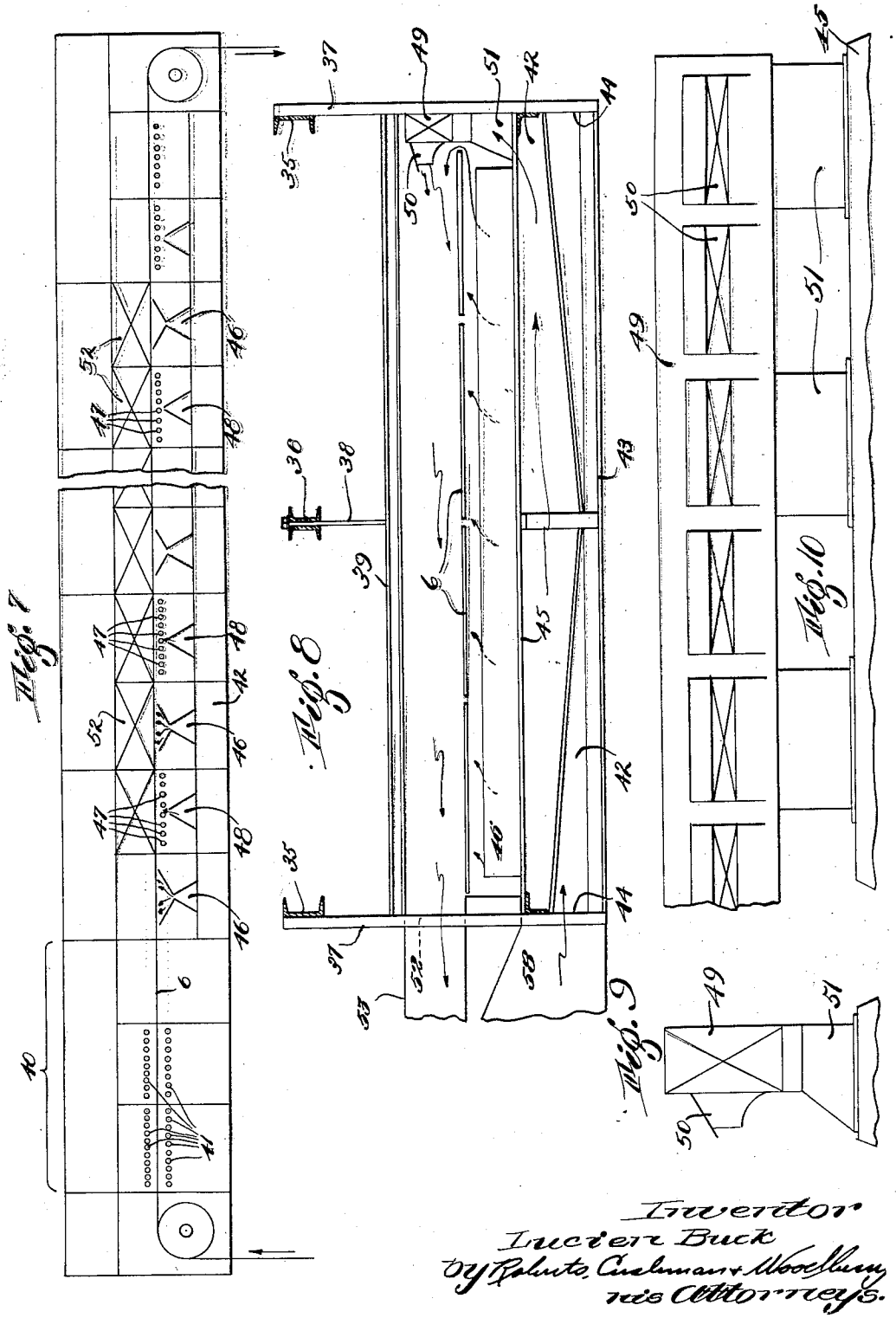
Fig. 5

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DRYING APPARATUS AND METHOD

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UNITED STATES PATENT OFFICE

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DRYING APPARATUS AND METHOD

Application filed April 25, 1929. Serial No. 357,932.

This invention relates to an improved process of and apparatus for drying elongate strips of fabric which have been moistened, as for example by passing them through a sizing or other bath, the improved process and apparatus being more particularly applicable to the treatment of carpeting which is usually steamed or sized with a comparatively heavy, viscous fluid, and which is provided with a closely woven body portion, having, in many varieties of carpet, a heavy pile on its upper surface. This application is a continuation in part of my copending application, Serial No. 209,719 filed August 1, 1927.

Heretofore material of this character has ordinarily been dried by drawing the same over an elongate group of steam coils or the like, intimate contact with the hot steam pipes having been deemed essential to the proper drying of the fabric within a reasonable length of time, although movement of the fabric in direct contact with the pipes has an objectionable effect upon the carpeting, for example causing the surface of the fabric to be coated with a glazed or scale-like facing. The present invention discloses an improved process and apparatus permitting the introduction of the fabric into a heating chamber where it may pass along a path in closely spaced relation to a series of heating coils. The carpet then enters a drying chamber where it passes through a series of zones containing heating factors and air nozzle outlets. The fabric may be supported upon rolls which hold it in spaced relation to the air outlets and to the heating factors so that frictional contact with these elements is avoided.

In order to permit the effective and rapid drying of material such as carpeting having a comparatively long and heavy nap or pile, such for example as Wilton and Axminster velvet which absorbs a great deal of moisture, additional drying jets are preferably provided to insure a rapidly flowing air current which passes transversely over the fabric and which may be heated in any desired manner. Preferably such an air draft is directed from the same source of drying air supply as that which provides the main air jets that are disposed beneath the moving fabric.

Drying apparatus of this character may be provided with draft inducing and controlling means whereby the flow of the drying air may be controlled, a portion of the warm moisture-laden air being vented to the atmosphere and a portion thereof being returned to the drying air heater and again being circulated about the moist fabric. Means may be provided controllably to vary the proportions of the air thus vented to the atmosphere and returned to the drying air heater.

A further aspect of the invention relates to improved structural features of the dryer which permit its ready assembly in standardized units or sections so that dryers of maximum efficiency and of various lengths and capacities may readily be made to suit individual installations or characters of fabric to be treated.

In the accompanying drawings in which certain preferred embodiments of my invention are illustrated,

Fig. 1 is a broken plan view of one form of improved drying apparatus, parts of the same being broken away and parts being diagrammatically indicated;

Fig. 2 is an end elevational view of the drying apparatus;

Fig. 3 is a broken diagrammatic view taken in side elevation;

Fig 4 is a side elevational view of the portion of the drier adjoining the point of fabric exit, the outer wall of the drier being removed more clearly to disclose its construction;

Fig. 5 is a view similar to Fig. 1 and showing the preferred embodiment of the invention;

Fig. 6 is a side elevation of the drier shown in Fig. 5;

Fig. 7 is a diagrammatic view of the same;

Fig. 8 is a section on line 8—8 of Fig. 6;

Fig. 9 is an elevational detail of a portion of the drying means shown in Fig 8; and

Fig. 10 is a side elevational view of the same.

The type of drier illustrated in the accompanying drawings, as for example in Figs. 1, 2, 3 and 4, is adapted to receive fabric that has passed through a sizing bath or which has been steamed, apparatus for the former purpose being diagrammatically indicated in Fig. 3 by the numeral 1. In this apparatus fabric passes under the outer rolls 2 and over the intermediate roll 3, the latter having its lower portion immersed in the sizing solution 4 which is contained in vat 5.

The carpet or similar fabric 6 then passes into the elongate drying chamber 7 which may conveniently be supported or suspended adjoining the ceiling of the room, as by hangers 8 (Fig. 2). The carpet or other fabric passes to a roll 9 fairly near the top of the drying chamber, it being understood that a plurality of parallel strips of the fabric may move through the drying chamber at the same time, the present disclosure for example showing four parallel strips of carpet 6 moving in the direction of the arrows of Fig. 1.

The carpeting as it passes along its horizontal path is first introduced to the preheating zone 10 where it passes a plurality of steam coils 11 which may be located both above and below the fabric, if desired. Thus the temperature of the moist fabric is raised, and it is prepared for treatment in the subsequent drying zones. The drying zones are designated in general by the numeral 12, Fig. 3, certain zones having air outlets 13 and other zones, having steam coils 14, being interspersed therebetween. Preferably one of the air outlets is located at the entrance of the drying section; adjoining this outlet is a set of steam coils 14; succeeded by one or more air outlets 13; then another steam coil 14; and succeeding air outlets and steam coil zones until the outlet end of the drying chamber is approached. Adjoining this end of the chamber there is a similar air outlet 13. The fabric then passes over the second roll 9 from which it may continue in a downward direction for folding by mechanism 15 or other desired disposition.

Fig. 4 shows somewhat in detail the arrangement of the drying zones, it being apparent that an elongate drying duct 16 extends along the drying section from the preheating zones nearly to the point where the carpet leaves the drying chamber. This duct 16 is preferably supported between the upper and lower portions of the drying chamber in any suitable manner. If desired, though not necessarily, both the drying chamber and the air duct may be arranged in sections of standardized lengths as shown, so that drying apparatus of this character may be erected in various desired lengths to suit various conditions and types of fabric to be treated.

The air outlets 13 are located at the top of the air duct 16 and each comprises opposite walls 17 inclined toward each other to provide a nozzle-like throat or restriction 18 below the path of the fabric to be dried. The outer portion of the air outlet then merges into a flared skirt or outlet portion having outwardly inclined surfaces 19 which are disposed at a small angle to the plane of fabric movement, whereby the drying air may impinge directly upon a substantial area of the fabric to be dried and its period of contact therewith is prolonged.

Adjoining the drying chamber (Fig. 1) is a suitable source of drying air designated by the numeral 20. This mechanism may comprise a series of louvres 21 which may be swung to various angles in order to vary the amount of atmospheric air admitted to the blast inducing means. The air flows to chamber 22 within which is located a suitable heater 23. The heated air then passes to the fan or blower 24 and thence through the passage 25 into air duct 16, Fig. 1. While for convenience of illustration, I have disclosed a single heater and blower, the source of drying air supply in many applications of my invention may comprise a plurality of heaters and blowers disposed at intervals along the drier.

Means are provided to conduct a proportion of the heated moisture laden air, which has passed over the fabric, back to the factor or factors 20. For this purpose an air outlet 26 is located below the duct 16 in the wall of chamber 7 and is connected with chamber 22 by the passage 27, Fig. 1. Another air outlet 28 permits a portion of the moisture laden air to be exhausted to the atmosphere; this outlet may be located adjacent to the series of steam coils in the preheating chamber. The arrangement of the air duct 16 and outlets 26 and 28 cooperates with suitable partitions 29 and 30 as well as dampers 31 and 32, to permit regulation of the air movement so that the proportion of moisture laden air which passes through the respective outlets may be varied.

The partition 30 is located between the preheating and drying sections and extends upwardly substantially to the plane of fabric movement so that air passing from the drying section to the outlet 28 always flows over the top of partition 30. Partition 29 is located near the exit end of the drying chamber and is provided with a slot to permit the passage of the fabric therethrough. Preferably the ends of the drying air duct 16 are located near the partitions 29 and 30 respectively and the dampers 31 and 32 may be turned to a position wherein

they substantially prevent air flow between the ends of the duct and the adjoining partitions, so that substantially all of the moisture laden air must be exhausted through outlet 28, or the dampers may be turned so that a portion of the air passes beneath the duct 16 and is returned to mechanism 20 through outlet 26. Thus the amount of the moisture in the dry air may be varied to suit the particular steamed or sized fabric which is being utilized.

The carpet or other fabric is preferably held in spaced relation to the outlet portion 19 of air outlets 13 by means of supports or rolls 33, so that a narrow space is provided between the outer portions of the air outlets and the carpets. The shape of the air outlets in conjunction with this arrangement of the fabric in juxtaposition thereto prolongs the contact of the air with the fabric which enhances the absorption of the moisture from the moving carpet or the like.

Figs. 5 to 10 inclusive illustrate a further development of the invention which is particularly desirable in treating carpeting such as Axminster or Wilton fabrics or other materials of this type characterized by a comparatively thick, heavy pile. The drier shown in Fig. 6, for example, comprises a drying chamber 34 which receives the carpeting 6 or the like from any suitable steaming or sizing apparatus such as that previously described and which as shown in Fig. 6 is designated by similar reference numerals. The drier shown in Fig. 6 may be suspended from suitable horizontal beam elements 35 and 36, the former supporting uprights 37 to which the side panels of the drier are secured, and the latter supporting intermediate hangers 38 which engage the intermediate portions of upper transverse frame members 39. It is evident that the frame elements thus formed may be standardized and adapted to engage standardized panels in order to permit the construction of the drier in any desired one of a number of standardized lengths.

This form of drier (Fig. 7) may have a preheating zone 40 provided with steam coils 41, similar to the parts 10 and 11 previously described, so that the carpeting passes in closely spaced relation to the coils and is prepared for drying in the subsequent zones. An elongate drying duct or plenum chamber 42 extends along the lower portion of this drier, being formed by the bottom wall 43 and side walls 44 of the drying chamber and by a top horizontal wall 45. This duct is provided with a plurality of air outlets 46 which may comprise nozzle-like passages having flared end portions similar to the nozzles 13 described above. Interspersed with the zones which are provided with these drying outlets or nozzles are zones having steam coils 47 or the like, which are adapted to radiate heat upon the lower face of the fabric strips, the fabric being supported in closely spaced relation to these coils in the manner previously described. In this embodiment of the invention, however, additional air outlets 48 may, if desired, be arranged beneath the coils 47, adapted to emit jets of air which aid in the transfer of heat from the coils to the moving fabric and particularly to the lower surface thereof.

In order to insure effective drying of the upper surface or pile of the fabric while the body portion is being dried, I provide additional drying means adapted to emit air drafts which sweep across the pile bearing faces of the fabric. For this purpose I provide an elongate air conduit 49 (Figs. 5 and 8). This conduit is provided with a plurality of hooded or nozzle like outlets 50 to direct the air over the face of the fabric strips 6. Passages 51 connect the conduit 49 with the main drying air duct 42, so that a portion of the air supplied to the latter passes upwardly and sweeps over the upper face of the fabric.

The arrangement described insures efficiency in operation since it furnishes air at high temperature and at high velocity for drying the pile surface of the fabric which is more difficult to dry than the back. It will be noted that the back side of the fabric is subjected to radiant heat which facilitates evaporation but that only a portion of the air, for example, from 30 to 50 per cent, passes in contact with this under surface. When this air, partly cooled by contact with the moist fabric, escapes upwardly around the edge of the fabric at the point P, it meets another and preferably relatively larger portion of air at high temperature issuing through the nozzles 50, and the temperature of the air above the fabric is thus higher than that of the air which escapes from below the fabric. Furthermore, as the entire volume of air furnished by the blower traverses the upper surface of the fabric, it moves at high velocity which is conducive to effective drying.

In conjunction with this embodiment of the invention, I have shown a slightly different arrangement of heating and draft-inducing means for supplying drying air to the duct 42. For example the upper portion of the drying chamber may be provided with ports or openings 52 connected to elongate chambers 53 (Fig. 5) that supply the air to heaters 54. Suitable outlet ports 55 may be arranged in the chambers 53 to permit the exhausting of a portion of the moisture laden air to the atmosphere, while damper regulated openings 56 adjoining the heating factors 54 permit the introduction of atmospheric air in order to compensate for that exhausted. From the heating fac-

tors 54 the heated air passes to the draft inducing factors or blowers 57 which are connected by passages 58 with the sides of the air duct 42. Thus the moisture content of the drying air supplied to the drier may be varied to suit the particular conditions, it being evident that the use of a plurality of heat and draft-inducing factors with separately controllable dampers permits the more convenient adaptation of the drier to different requirements.

By providing the elongate chambers 53 for the reception of the air discharged from the space above the fabric it is possible to maintain a substantially uniform flow of air transversely so that the entire width of the fabric is dried with the same rapidity.

Preferably the air heating and circulating units comprising the heater 54, the fan 57, and the casings forming the chambers 53 and 58 are independent of the sections forming the drying chamber, so that any number of heating and circulating units desired may be applied in accordance with circumstances, and by designing these units for maximum working efficiency, it is possible, by assembling the proper number of such units with the drying chamber, to obtain a much higher efficiency in drying than is usual, while it is also possible, if desired, to supply air at different temperatures of different portions of the drying chamber.

It is evident that the present invention provides a drier which is adapted to treat comparatively heavy fabric such as carpeting that has been wet by a sizing or a steam bath, by raising the temperature thereof in the preheating section so that excess moisture may promptly be absorbed when it reaches the drying zones, and then by effectively drying the carpet in the drying zones. The warm drying air in the latter removes the moisture from the heated fabric quite rapidly and permits more rapid and uniform drying of the same, while the radiant heat from the steam coils aids in attaining this effect and maintains the fabric at a suitably elevated temperature, the nozzles which may be disposed below the heating coils still further aiding the drying effect due to the arrangement of the carpet supporting means, so that the latter passes in closely spaced relation to the heating coils, and the flared air outlets prolong the contact of the air with the carpeting. Since the proportion of heated moisture-laden air to the freshly admitted air may be regulated, economy of operation may be effected and unnecessary waste of drying air is prevented.

I claim:

1. Drying apparatus of the character described comprising an elongate chamber, means for passing a fabric therethrough, a plurality of heating coils arranged below the fabric path, means for supporting the fabric out of contact with the coils but in closely spaced relation thereto whereby radiant heat from the latter is effective in heating the fabric, a plurality of drying air outlets interspersed with the coils and adapted to emit drying air upon the lower face of the fabric, means for supplying drying air to said outlets including heating means and a draft inducing factor, and a series of air outlets arranged to receive air from said air supplying means and to emit the same over the upper surface of the fabric.

2. Drying apparatus of the character described comprising an elongate chamber, means for passing a fabric therethrough, a plurality of heating coils arranged below the fabric path, means for supporting the fabric out of contact with the coils but in closely spaced relation thereto whereby radiant heat from the latter is effective in heating the fabric, a plurality of drying air outlets interspersed with the coils and adapted to emit drying air upon the one face of the fabric, longitudinally disposed air outlets arranged to emit a draft of drying air over the other face of the fabric, and an air exhaust opening disposed opposite said last-named outlets and arranged to receive air from both the first and last named outlets.

3. Drying apparatus of the character described comprising an elongate chamber, means for passing a fabric therethrough, a plurality of heating coils arranged below the fabric path, means for supporting the fabric out of contact with the coils but in closely spaced relation thereto whereby radiant heat from the latter is effective in heating the fabric, and a plurality of drying air outlets interspersed with the coils and adapted to emit drying air upon the under side of the fabric, said outlets being provided with flared ends juxtaposed to the plane of fabric movement and making an acute angle therewith whereby to prolong contact between the issuing air and the fabric.

4. Drying apparatus of the character described comprising an elongate chamber, means for passing a fabric therethrough, a plurality of heating coils arranged below the fabric path, means for supporting the fabric out of contact with the coils but in closely spaced relation thereto whereby radiant heat from the latter is effective in heating the fabric, a plurality of drying air outlets interspersed with the coils and adapted to emit drying air upon the lower face of the fabric, an elongate plenum chamber extending along said drying chamber, connections between the interior of the latter below the fabric path and the plenum chamber, and outlets from the latter to emit air transversely above the fabric.

5. Drying apparatus of the character described comprising an elongate chamber, means for passing a fabric therethrough, a plurality of zones in said chamber, said zones being defined by interchangeable standardized sections of said chamber, heating coils in certain zones of said chamber and drying air outlets located in other zones of said chamber, a preheating section near the point of fabric entrance to said chamber, said section being provided with a plurality of heating coils, and an elongate air duct supported within the chamber and extending from a point near the preheating zone substantially to the point of fabric exit.

6. Drying apparatus of the character described comprising an elongate chamber, means for passing a strip of pile fabric therethrough with the pile surface of the fabric uppermost, means for subjecting the lower surface of the fabric to radiant heat, elongate plenum chambers extending along said first chamber at opposite sides of the latter, the drying chamber having a series of passages providing communication with the respective plenum chambers, means for producing a current of heated air and for delivering a portion of said current into one of said plenum chambers from which it emerges into the drying chamber and passes transversely across into the opposite plenum chamber, means connecting the last chamber with the intake side of the means for inducing the air current, and means for directing a portion of the heated air current into the space beneath the fabric.

Signed by me at Paris, Kentucky, this nineteenth day of April, 1929.

LUCIEN BUCK.