

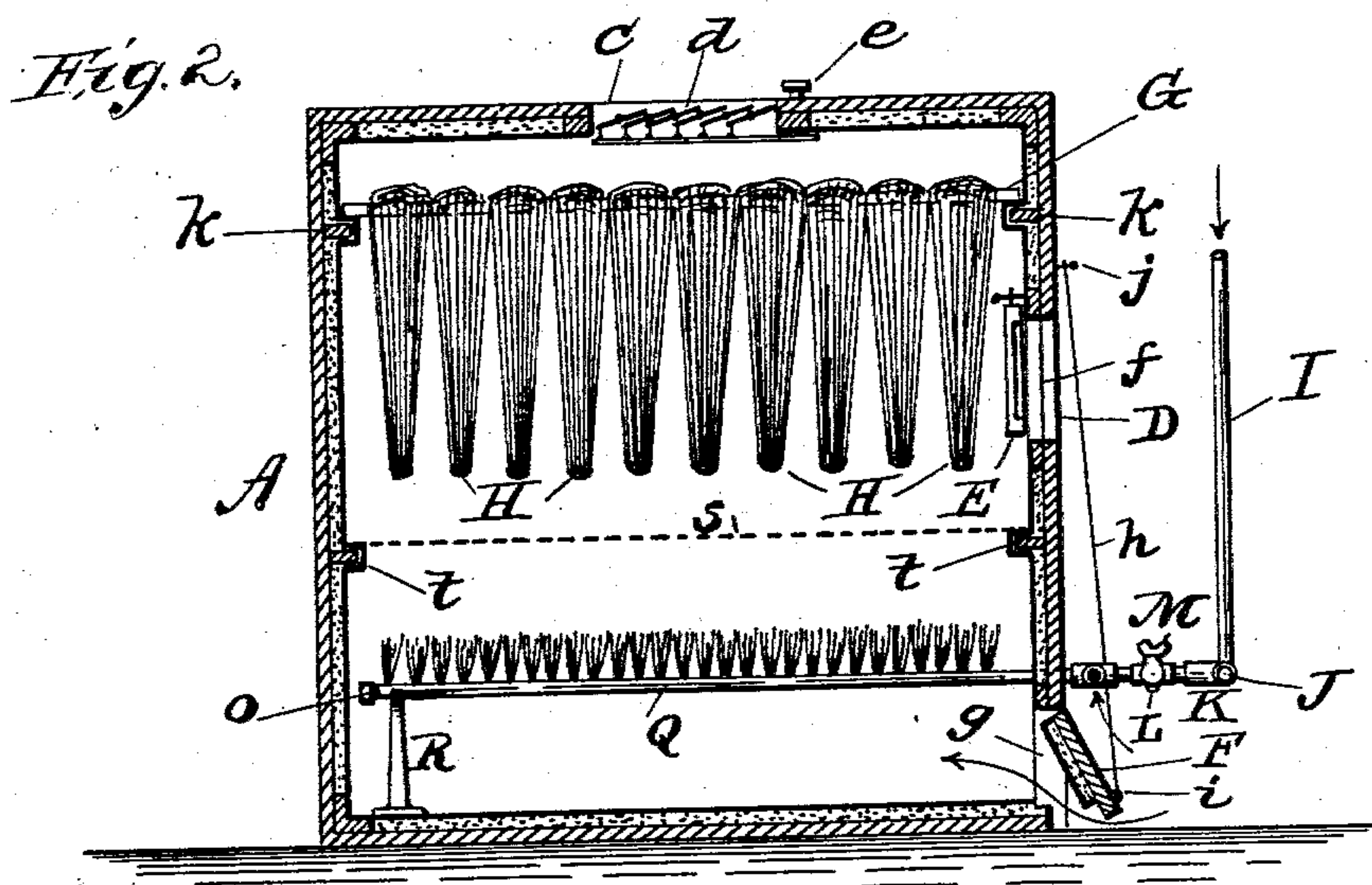
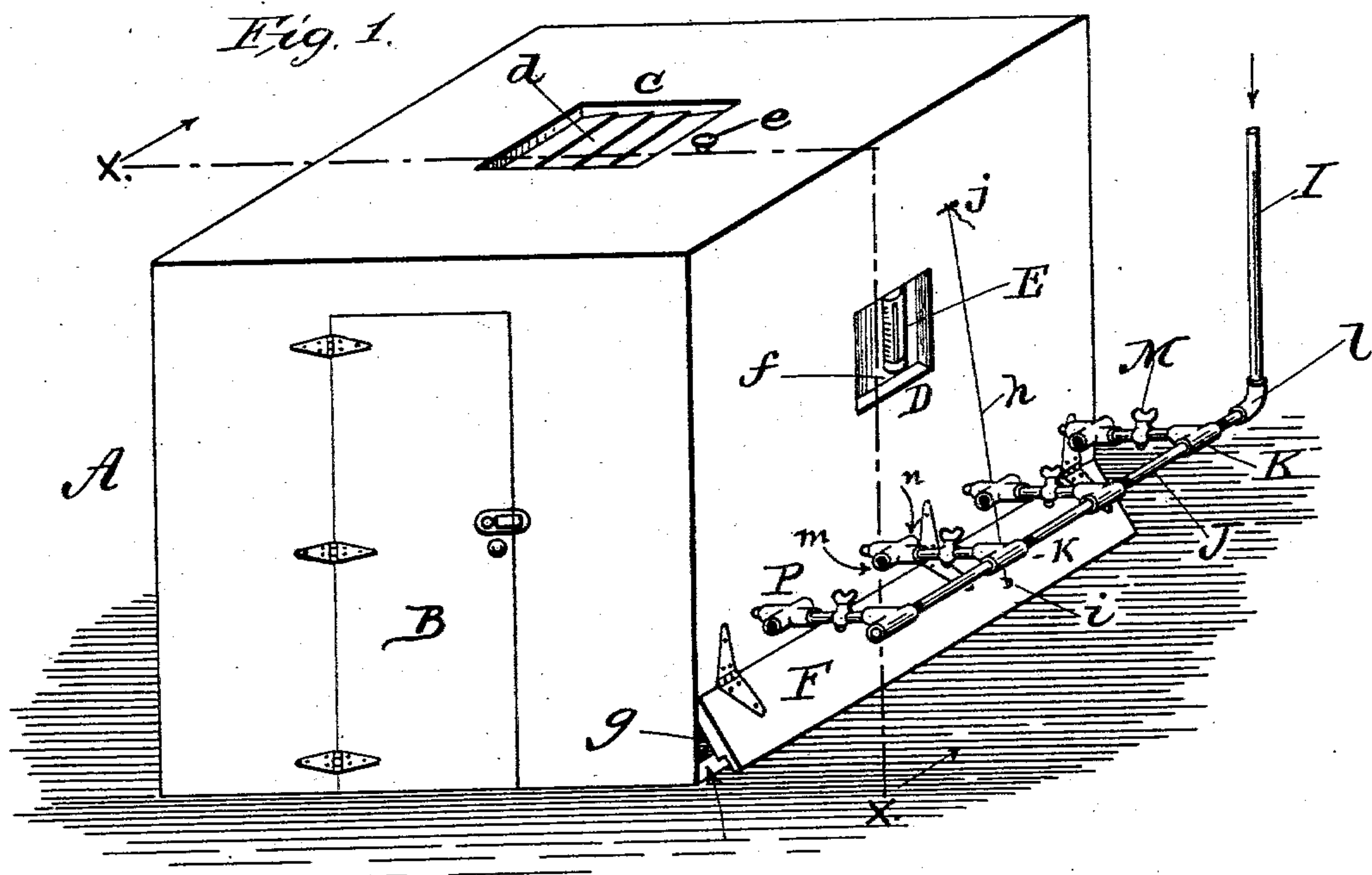
No. 629,318.

Patented July 18, 1899.

R. A. GAGE.
PROCESS OF DRYING YARN.

(Application filed Mar. 11, 1899.)

(No Model.)



WITNESSES.

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RICHARD A. GAGE, OF PAWTUCKET, RHODE ISLAND.

PROCESS OF DRYING YARN.

SPECIFICATION forming part of Letters Patent No. 629,318, dated July 18, 1899.

Application filed March 11, 1899. Serial No. 708,689. (No specimens.)

To all whom it may concern:

Be it known that I, RICHARD A. GAGE, a citizen of the United States, residing at Pawtucket, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Processes of Yarn-Drying, of which the following is a specification, reference being had to the accompanying drawings.

10 Like letters indicate like parts.

Figure 1 is a perspective view of the apparatus which I use in my improved process of yarn-drying. Fig. 2 is a sectional view of the same as seen on line *x x* of Fig. 1, the yarn-skeins and their supports, as also the several gas-pipes, being shown in elevation.

My invention relates to processes of drying yarn after the same has been colored by immersion in the dye-tub; and it consists in the exposure of such yarn (after the excess of moisture has been taken therefrom by pressure or by the operation of an extractor) to the action of a highly-heated atmosphere within an inclosed chamber which is provided with proper heating means, supports, and dampers, so that the dyestuff is first quickly dried to such a consistency that it cannot extend down the skein by gravity, and then subjecting it to a lower degree of heat, exceeding, however, 212° Fahrenheit, in order to drive out the remaining moisture in the form of steam and to thoroughly dry the yarn in position.

It has been common hitherto to dry yarn after it has been dyed by hanging the damp skeins upon a bar or support vertically within a drying-room which is heated by steam-pipes and which is provided with an exhaust-fan to remove the steam arising from the drying yarn. The temperature of the room, however, resulting from the heat radiating from the steam-pipes cannot easily be maintained uniform, and ordinarily does not exceed 160° Fahrenheit, while the time required for the drying of the yarn under such conditions is from ten to twelve hours, during which time the steam heat is kept up at considerable cost and with much care and labor. As the air of the drying-room becomes more and more saturated with the moisture arising from the drying yarn, the drying process is necessarily impaired, because the damp yarn cannot dry

as quickly in a damp atmosphere as in a dry one, and therefore the steam or damp hot air must be taken out of the drying-room by means of exhaust-fans or otherwise and fresh air admitted, which requires to be heated up to the desired temperature, as before. The dye liquid which has been absorbed by the yarn and which has not been removed therefrom by the squeezing or extracting process is liable to flow or gradually extend down the skein by gravity and to accumulate at and near the lower end of the skein, thus making the yarn uneven in color and more intense in shade at and near the bottom of the skein. To obviate this difficulty, various devices have been employed—as, for example, means to rotate the bars upon which the skeins are hung, thus causing the yarn to change its position gradually and regularly in the vertical plane; but such rotating means require the expenditure of power for a considerable period of time. I have discovered that the operation of gravity which causes the downward flow of the dyeing liquor upon the skeins may be arrested and the dyestuff may be dried quickly and evenly in its place upon the yarn and all flow or spreading of the dyestuff may be prevented by exposing the wet yarn while hanging in skeins vertically upon a supporting-bar to the action, within a chamber, of an intense heat—about 400° Fahrenheit—for a short time until the dye liquor upon the yarn-skeins is dried to such a condition that it cannot flow at all, and then to a less-intense heat, exceeding, however, 212° Fahrenheit, by which the drying of the dye liquid is more slowly continued, but quite quickly completed, and the moisture is driven off as steam through suitable dampers or openings in said chamber.

As the temperature of steam is 212° Fahrenheit and can never exceed that heat and as conduction and condensation upon the exterior surfaces of the steam-pipes reduce the amount of heat radiating therefrom, and as the temperature of the room is necessarily diminished to a considerable degree by the drafts which are required to carry off the moisture evaporating from the damp skeins, it is necessary in order to provide for the quick drying of the yarn to use some other heating means than steam-pipes. I therefore

resort to the combustion of carbureted hydrogen or common illuminating-gas under pressure from pipes into which common atmospheric air flows and there mingles with said gas, thus producing an intense heat, which rapidly dries out the moisture of the damp skeins as steam. Instead, however, of using illuminating-gas it is evident that coal-oil may be used in combination with atmospheric air to obtain the blue intense flame.

In my pending application for Letters Patent for an improved apparatus for drying yarn, Serial No. 693,777, filed October 17, 1898, and allowed February 7, 1899, I have shown and described the apparatus which embodies the best means known to me for the practice of my said invention. Said apparatus is described as follows:

A drying room or chamber A has a door B for entrance or exit.

C is an opening with a set of dampers *d* therein, operated by a knob *e* or otherwise.

D is an opening or window having a glass pane *f*, behind which, within the chamber, is mounted a thermometer E.

A ventilator F is hinged at one side of the chamber A at the bottom and is arranged to swing outwardly. When swung to lie in a vertical direction, it closes the space *g*. A cord or chain *h*, fastened to an eye *i* of the ventilator F and secured to a nail *j*, holds the ventilator in an elevated position.

Skein supporters or bars G are mounted loosely on brackets *k* within the chamber A and extend from side to side. The yarn-skeins H are suspended on said bars G.

A gas-supply pipe I conveys common illuminating-gas (carbureted hydrogen) from the main under pressure to the apparatus. Said pipe I is connected to a straight pipe J by an elbow-joint *l*. From the pipe J extend a number of pipes conducting gas into the chamber A. A T-pipe K receives the pipe J and opens into a valve L, whose plug is operated, as usual, by the thumb piece or key M. The outer ends *m* and *n* of the two-way pipe P are open to the external atmosphere. A gas-jet pipe Q is connected at one end with the pipe P, and its inner or opposite end is closed by the cap *o*. The pipe Q is supported at its inner end by a post or standard R from the floor of the chamber A. The pipe Q has a number of small openings near each other, through which the mingled air and gas passes in jets and is there ignited.

In Fig. 2 the dotted line *s* indicates a wire or slatted screen resting upon brackets *t*, which is useful for the drying of raw stock.

The yarn-skeins which have been immersed in the dye liquor and subjected to a squeezing or extracting process to remove the excess of moisture are hung in their wet condition upon the beams or supports G in the drying-chamber A, furnished with my apparatus. As soon as the gas-jets are lighted the openings B, C, *d*, and F of the chamber A are closed. The burning mingled gas and air

rapidly carry up the temperature within the closed chamber to the desired degree, preferably about 400° Fahrenheit, and fills said chamber with carbon dioxid (or carbonic anhydrid.) The affinity of water and carbon dioxid greatly facilitates the drying process. When the heat has risen to 212° Fahrenheit, the water passes from the yarn-skeins in the form of steam and rises to the upper portions of the chamber. The heat still continuing to increase at a rapid rate first causes the dye liquor to dry *in situ* upon the yarn by extracting the moisture therefrom and so prevents it from flowing by gravity down the skein. It is desirable to reach this stage of the process as soon as possible, and therefore the chamber should remain closed until this time. Then, as it is important not to subject the yarn any longer to such very intense heat, the dampers *d* at the top of the chamber are opened, and so the steam accumulated in the top of the chamber *a* escapes therefrom. Air is admitted through the lower ventilator F into the chamber *a* from without; but as it passes to the gas-flame before reaching the yarn-skeins said new air is heated before acting upon them. By these means the temperature of the chamber is considerably reduced, preferably to about 300° Fahrenheit, or, if desired, to any other degree exceeding 212° Fahrenheit, and the yarn thereafter is more moderately dried, the moisture passing off in the form of steam. As soon as the yarn has become thoroughly dried (which may be determined by any suitable hygrometer within the chamber or by feeling or after some experience by the attendant in working this process by his own judgment, based upon the lapse of time) the yarn is removed from the chamber and a new quantity is put in to be dried. In this manner yarn can be thoroughly dried in about fifteen minutes and will be uniform in color and shade.

In yarn-drying as heretofore practiced the yarn has always been exposed to atmospheric air either in an inclosed room or chamber artificially heated or in a room or chamber in which atmospheric air at its normal temperature circulates in currents or drafts produced by the natural movement of the air through suitable openings in the walls of the room or chamber or by fans or other mechanical means. My improved process of yarn-drying herein described differs from all previous processes, because the atmosphere to which the yarn is exposed for drying is heavily charged with carbon dioxid, as well as intensely heated, and so is peculiarly adapted to extract and absorb the water from the wet skeins.

It is new in the art of yarn-drying to subject the yarn to a heat exceeding the temperature of steam heat either for the purpose of arresting the downward flow of the dye liquor upon the yarn or for any other purpose, and it is also new to vary the intensity of the heat within the drying-chamber, whereby the yarn is first and for a short time exposed to a very

intense heat in order to thicken the dye liquor and to arrest the downward flow of the dye liquor, as above set forth, and then to a less intense heat for the more moderate drying of the yarn at a temperature exceeding that of steam.

I claim as a novel and useful invention and desire to secure by Letters Patent—

1. The improved process of yarn-drying herein described consisting in the exposure of the yarn, when damp, to the direct action, within a chamber, of an intensely-heated atmosphere charged with carbon dioxide for a period of time sufficient to arrest the downward flow of the dye liquor upon the yarn and then reducing the temperature within said chamber to a degree somewhat exceeding that of steam, thereby more moderately to complete

the drying of the yarn, substantially as specified.

2. The improved process of yarn-drying herein described, consisting in subjecting the yarn, when damp, to the action of intense heat, within a chamber, sufficient to arrest the downward flow of the dye liquor upon the yarn and after said flow has been thus arrested, in reducing the temperature of said chamber sufficiently to moderately complete the drying of the yarn, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

RICHARD A. GAGE.

Witnesses:

GEORGE FARNELL,
WARREN R. PERCE.