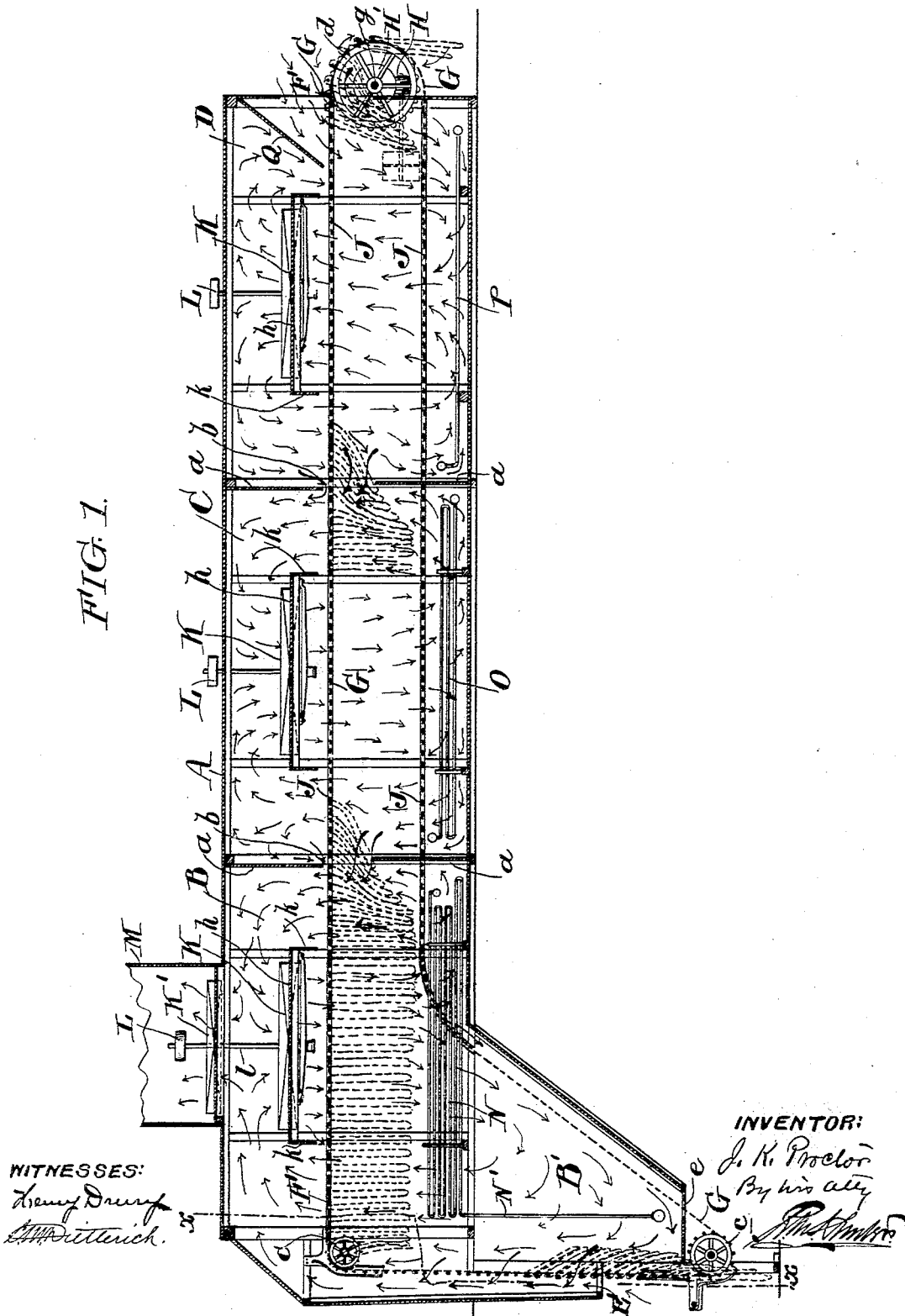


J. K. PROCTOR.
DRYING MACHINE.

No. 504,747.

Patented Sept. 12, 1893.

FIG. 1.



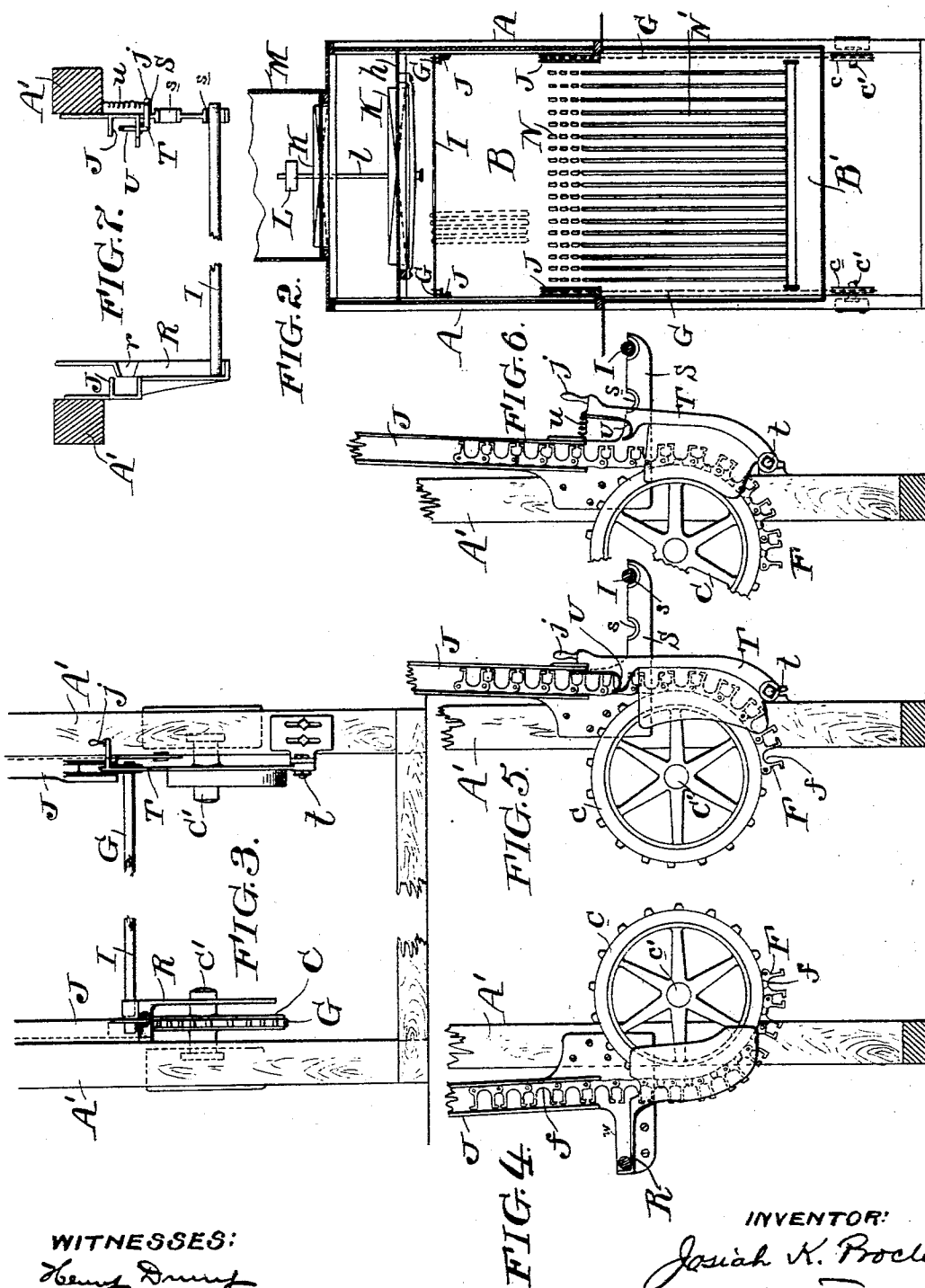
(No Model.)

2 Sheets—Sheet 2.

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WITNESSES:

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UNITED STATES PATENT OFFICE.

JOSIAH K. PROCTOR, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE PHILADELPHIA TEXTILE MACHINERY COMPANY, OF SAME PLACE.

DRYING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 504,747, dated September 12, 1893.

Application filed January 26, 1893. Serial No. 459,770. (No model.)

To all whom it may concern:

Be it known that I, JOSIAH K. PROCTOR, of the city and county of Philadelphia and State of Pennsylvania, have invented an Improvement in Drying-Machines, of which the following is a specification.

My invention has reference to drying machines, and consists of certain improvements which are fully set forth in the following specification and are shown in the accompanying drawings which form a part thereof.

My invention relates particularly to that class of drying machines in which the material to be dried is moved through the drying inclosure and is subjected while moving to heat furnished by radiating surfaces, the heated air being diffused and mixed by means of air currents.

My invention, while designed primarily, for the drying of yarn, or other textile spun or twisted threads or fibers, in skeins or hanks, is not confined to the drying of any particular kind of material, but relates with equal force to any material or goods which can be hung or suspended on poles and can be carried thereon continuously through the drying room, entering it at one point and issuing from it at another.

It is also an object of this invention to provide means for feeding the poles, on which the material is suspended, to the carriers which carry the poles through the machine.

In the drawings: Figure 1 is a longitudinal vertical sectional view of a drying machine embodying my invention. Fig. 2 is a transverse vertical sectional view of the same on the line $x-x$ of Fig. 1. Fig. 3 is a front elevation of a portion of the feeding end of the machine on an enlarged scale. Fig. 4 is a side elevation on an enlarged scale of one of the side posts at the feeding end of the machine and of the feeding mechanism for feeding the poles to the machine. Fig. 5 is a similar view of the opposite post. Fig. 6 is a similar view to Fig. 5, illustrating the operation of the pole feeding mechanism; and Fig. 7 is a plan view of some of the parts shown in Figs. 3, 4, and 5.

The directions of the air currents are indicated in Fig. 1 by the arrows.

A is the drying inclosure, consisting of a

room closed to the external atmosphere except through the openings hereinafter referred to, and divided by vertical partitions a into a series of compartments B, C, D, communicating one with another through apertures b in the partitions a . The front end of the drying inclosure A may have an extension B' extending down to a lower elevation than the body of the inclosure and constituting a portion of the first interior compartment B. When the drying inclosure is constructed in this manner, the extension B' may extend down to a floor of the building lower than that on which the main portion or body of the inclosure is located; and the material to be dried may be fed into the machine at this lower elevation, and may then be carried up to the body of the machine and conducted through the successive compartments of the drier. In treating some classes of goods in some buildings this downward extension B' is very desirable, while in other cases it may be omitted and the drying inclosure or room A may be arranged entirely on one floor.

It is not material to the invention into how many compartments B, C, D, the drying inclosure A is divided; and the number may be made to suit the material to be treated. The drying inclosure A is provided with an opening E at its front end and with an opening F at its rear end.

G, G, are carriers which traverse the drying inclosure and conduct through it the material to be dried. These carriers preferably consist of two endless chains, made alike each to each and of equal lengths, passing about idler sprocket guide wheels c, c , and driving sprocket wheels d, d . The sprocket wheels c, c , act simply as guide wheels for the chains and are carried each upon a separate stud c' upon the inside of the frame of the inclosure A, so as to offer no obstruction to the depending material carried by the chains as it passes between them. The sprocket wheels d, d , which drive the chains G, G, are located at one end of the machine, preferably within the opening F, and are carried by a shaft g . The shaft g may be driven in any convenient and well known manner, as by the worm H and worm wheel H' (see Fig. 1) to operate

the endless chains G in such fashion as to cause the chains to travel equal distances in equal times.

The guide sprockets *c* at the front end of the machine are preferably located outside of the inclosure A and adjacent to the opening E and the chains G, G, may pass to the sprockets *c, c*, through small openings *e* in the inclosure A.

The endless chains G, G, are provided with a series of seats or sockets to receive the ends of the supporting poles I, by which the yarn or other material to be dried is carried. I prefer to construct the chains of a series of U shaped links *f*. The U shaped portions *f* of the links thus constitute the seats or sockets for the ends of the poles I.

J, J, are guideways located upon the inside of the side walls of the inclosure A to support and guide the chains G, G, as they traverse the inclosure. These guideways are preferably shaped in cross section as shown in Fig. 7.

I, I, are the poles on which the material to be dried is suspended. These poles are supported at their ends in opposite links *f* of the chains G, G, and are carried by the chains through the machine, traversing successively each compartment B, C, D. In the drawings hanks of yarn are shown at intervals supported on certain of the poles. A portion of the poles have been omitted in the drawings merely for convenience of illustration.

K are air moving fans, one of which is located in each of the compartments B, C, D. The fans are preferably arranged horizontally in a floor or horizontal partition *h* immediately above the chains G. The edges of the partitions *h* may be provided with projecting skirtings *k* to guide or direct the air currents. The fans K are carried upon vertical shafts *l*, journaled in suitable bearings and may be driven in any convenient manner as by the belt pulleys L.

K' is a fan located within an open flue or chute M, in the top of the drying machine, leading from the first compartment B. The fan K' may be carried by the shaft *l* of the fan K of the compartment B, and is preferably similar to the fan K but of smaller diameter and connected to move air in the opposite direction.

N is a heating coil arranged within the compartment B first traversed by the material under treatment to heat the air currents which are circulated therein by the fan K. When the compartment B is provided with the downward extension B', the heating coil N of that compartment may have an extension N' extending down into the extension B'. O and P are similar but successively smaller heating coils arranged in the compartments C and D respectively, to heat the air therein.

Q is an air deflector located at the opening F preferably above the sprockets *d, d*. The air deflector Q may be adjusted to regulate the amount of air admitted to the interior of the inclosure through the opening.

I shall now describe the mechanism for feeding the poles to the traveling chains after they have been supplied with the yarn or material to be dried. This construction is more particularly shown in Figs. 3, 4, 5, 6, and 7. R and S are projecting brackets secured to the side posts A' at the feeding end of the machine and extending back to a position adjacent to the traveling chains G, G, but having arms extending outward beyond said chains. One of these brackets, as R, has an open notch or straight way *w* to support one end of a pole and a recess *r* located in line with the chain G, and opposite the open side of the guideway J, and the other bracket S may be provided with one or more notches or recesses *s* adapted to receive and support the other end of the pole. A single notch *s* is all that is necessary for loading and operating a single pole. Additional notches may be employed to permit the operator to load additional poles before the first pole is fed to the conveyer. T is a lever fulcrumed as at *t* to a post A' and extending vertically adjacent to the bracket S. The lever T may be moved on its fulcrum *t*, and is provided with a notched or recessed boss U adjacent to its top. The lever T may be retained in a normally vertical position as is shown in Fig. 5 by a spring *u*, and may be provided with a handle *j*. The spring *u* is so arranged that it will cause the lever T to return to its normal vertical position whenever it is released. The lever T may be moved forward on its fulcrum *t* by the handle *j*. When the lever T is in its normal position the boss U is adjacent to the chain G. In the drawings I have shown the spring *u* in the form of a spiral spring connected to the post A' and the lever T. This particular arrangement, however, is not material. A pole I having been provided with the hanks of yarn or other material to be dried, occupies, just before it is placed within the grasp of the carrying chains G, G, the position shown in Fig. 7. When it is desired to place the pole within the grasp of the chains, the end of the pole I which rests on the bracket R is pushed forward until it drops into the recess *r*, and as soon as one of the recesses *f* of the chain G moves into line with the recess *r*, the end of the pole is thrust to the left so that it enters the recess *f* in the chain. As soon as this end has entered the chain G on one side of the machine, the lever T is drawn forward by its handle *j*, as is shown in Fig. 6, and the other end of the pole is lifted from the bracket S and is placed in the recessed boss U of the lever T. The lever T is then released and is drawn back by the spring *u* into its normal position shown in Fig. 7, and forces the end of the pole into the opening of the chain G opposite to that which holds the other end of the pole. The two ends of the pole are thus received by the chains G, G, and are carried by them into the machine while a new pole is being provided with yarn and fed to the chains. As the movement of

the chains is very slow, sufficient time is allowed for these operations. It will be observed that the end of the pole which rests on the bracket R is thrust side-wise into the link of the chain on that side while the other end of the pole which rests on the bracket S is carried forward into the link of the chain by the lever T; the peculiar shape of the link admits of these two movements in placing the pole within the links.

The operation of drying in this apparatus is as follows: The material to be treated is placed upon the sustaining poles and the poles are fed to the chains G, G, in the manner described, one pole being placed successively in each pair of opposite links of the two side chains. The poles with the material supported by them are carried through the drying inclosure A, by the chains G, G, passing successively through the compartments B, C, and D therein. The external cold air is drawn into the compartment D through the opening F by the operation of the fan K in that compartment and is circulated through that compartment in the manner indicated by the arrows, passing through the suspended material continuously downward in one part and continuously upward in another part. The air in this compartment is heated to some extent by the small heating coil P. A portion of this air is drawn by the second fan through the opening *b* into the compartment C and is there circulated in a manner similar to the circulation in the compartment D. The air in this compartment is heated to a higher temperature by the larger heating coil O and a portion of this air is drawn off into the compartment B through the opening *b* by the third fan K. This air in the compartment B is circulated therein in a manner similar to the circulation in the compartments C and D, and is still more highly heated by contact with the large heating coils N, N'. After the air has been circulated through this compartment in the manner indicated by the arrows, it is allowed to escape through the air chute M. The air is drawn out through the air chute M by the fan K', and this fan, by withdrawing the air from the compartment B produces a partial vacuum therein and so assists in drawing the air through the openings E and F and successively through the compartments D and C. It will be seen that the air currents travel successively through the compartments D, C, and B in a direction opposite to that in which the material is carried by the chains and that these air currents are circulated in each of the compartments through the material, the same air being recirculated many times in each compartment, thus forming recirculating currents of air, the current in one compartment being recirculated entirely independently of any current which is being recirculated in any other compartment. By reason of the variation in the heating appliances in the successive compartments, it will be seen that the material is subjected in its pas-

sage through the inclosure A to different degrees of heat, the greatest being in the first compartment, into which the material is introduced in its most wet condition, and the degree of heat diminishing as the material becomes more dry, and being least in the last compartment. This is a very important feature in the drying of certain goods which cannot be subjected to a high degree of heat in a nearly dry condition without injury. In this apparatus as the moisture in the material is evaporated, the material is subjected to successive currents of diminishing temperature. It will be observed also, that the humidity of the air currents increases with the heat, those in the compartment last traversed by the goods being substantially dry.

The extension B' to the compartment B provides an enlarged heating chamber for the currents driven downward by the fan K through contact with the heating pipes of the depending portion N' of the coil N. The material to be dried is considerably heated and a portion of the moisture is driven off therefrom during its passage perpendicularly upward through the extension B'. A thin current of air passing in at the air inlet E passes upward along the end of the drier and receiving the heavy moisture first driven off by the air passing through the material as it rises through the extension B' is driven at once by the fan I out of the machine without any further recirculation in it, thereby avoiding a useless expenditure of heat, and shortening the time of drying, since this current is not reheated, and being fully surcharged with moisture, is not again brought into contact with the goods.

In the drawings, the long arrows shown passing through the material at the air inlet F at the openings *b* between the compartments and through the material passing upward through the extension B' indicate the currents which, in practice, pass in the direction indicated, through the interstices which exist between adjacent pieces of the goods as they hang on the poles, as also through the material itself where the material is of a character to admit of the passage of the currents through it.

At certain places in the drawings the goods are shown massed together by the overlapping of the goods. This is accomplished by making the apertures *b* too small to permit the suspended hanks or goods to pass freely through them. The massing together of the goods at these points prevents the too free passage of the air currents through the openings *b* between the successive compartments. The same result may be obtained at the feeding inlet E where the goods hang vertically, and at the air inlet F where the goods drag over the end wall of the inclosure and over the shaft *g* of the sprocket wheels *d, d*.

My invention is not necessarily limited to the particular heating coils N, O, P, shown, as it is apparent that the heating coils may

be differently arranged, and in some cases, it may be an advantage to have no heating coils in the compartment last traversed by the material, or the heating coils may be of equal area. The amount of fresh air admitted to the inclosure A through the opening F and the consequent humidity of the currents may be regulated by adjusting the door or deflector Q.

10 While I prefer the details of construction which are here shown, I do not limit myself to them as it is apparent that they may be modified without departing from my invention.

15 Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a drying machine having exterior walls or partitions forming a drying inclosure, the following combination and arrangement of parts:—a conveyer consisting of two endless chains and a series of rods or poles to hold the hanging material arranged so that the air currents may freely move down and up through the material, one or more sections of floor or horizontal partition located above the conveyer, fans located in said partition, heating coils situated below the material, the arrangement of these parts being such as to secure a continuous flow of air from the fans downward between the poles along the hanging material and through the heating coils and from thence upward through the material and between the poles to the fans, a fan arranged near the feed end of the inclosure to continuously remove a portion of the air from within the inclosure and an air inlet passage near the delivery end of the inclosure to admit a portion of the external air; all for the purpose of quickly and uniformly drying the material passing through the inclosure.

2. The combination in a drying machine arranged to carry materials or goods suspended from rods or poles continuously through a drying inclosure, of external walls or partitions forming a drying inclosure, the said walls or partitions extending downward so as to form a downward extension to the inclosure reaching downward below the floor on which the main body of the drier rests, with an air circulating fan located above the material so as to force the air continuously downward through the materials or goods and into the

said downward extension in one part and continuously upward through the said downward extension and through the materials or goods in another part of the inclosure, and heating coils in said inclosure.

3. The combination in a drying machine arranged to carry materials or goods suspended from rods or poles continuously through a drying inclosure of external walls or partitions forming a drying inclosure, the said walls or partitions extending downward so as to form a downward extension to the inclosure reaching downward below the floor on which the main body of the drier rests with an air circulating fan located above the material so as to force the air continuously downward through the materials or goods and into the said downward extension in one part and continuously upward through the said downward extension and through the material or goods in another part of the inclosure, and heating coils in said inclosure, and an exhaust fan arranged in the top of said inclosure to remove a portion of the air therefrom.

4. In a device for feeding poles to the conveying chains of a drying machine, the combination of the conveying chain G, the projecting brackets R and S to support the poles while being loaded with the material to be dried, the bracket R having a recess or notch opposite the side of one of the chains for the purpose of guiding the pole into a socket of the chain, when the socket comes opposite the said recess or notch and the pole is thrust sidewise toward the chain, the lever T fulcrumed at *t* and retained in position by the spring *u* and adapted when drawn forward, to receive that end of the pole opposite to the end which rests on the bracket R and when drawn back by the spring to place the end of the pole automatically into a socket of the chain adjacent to the said lever, and the guideways J which keep the poles in position within the sockets of the chain after they leave the feeding device.

In testimony of which invention I have hereunto set my hand.

JOSIAH K. PROCTOR.

Witnesses:

J. H. KNOWLES,
WM. H. WIGHTMAN.