April 22, 1930. T. W. PROSSER 1,755,334

DRYING APPARATUS

Filed July 13, 1925 2 Sheets-Sheet 1

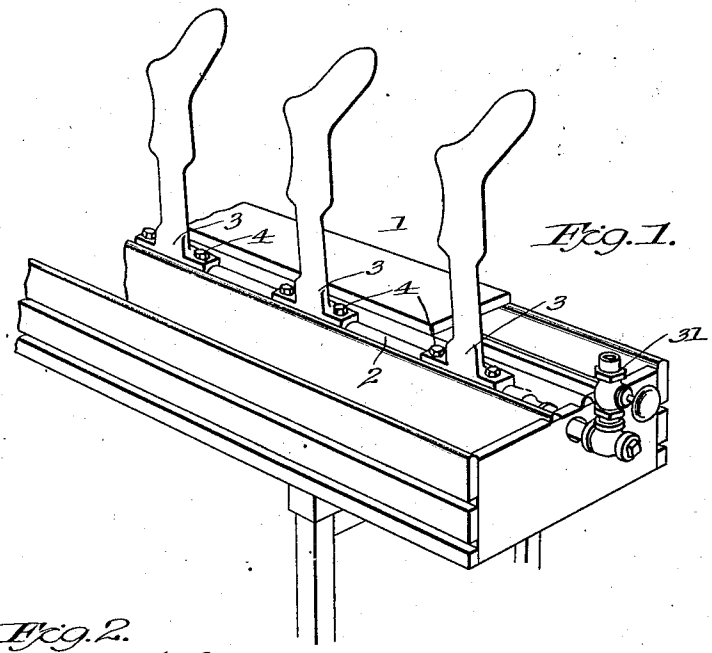
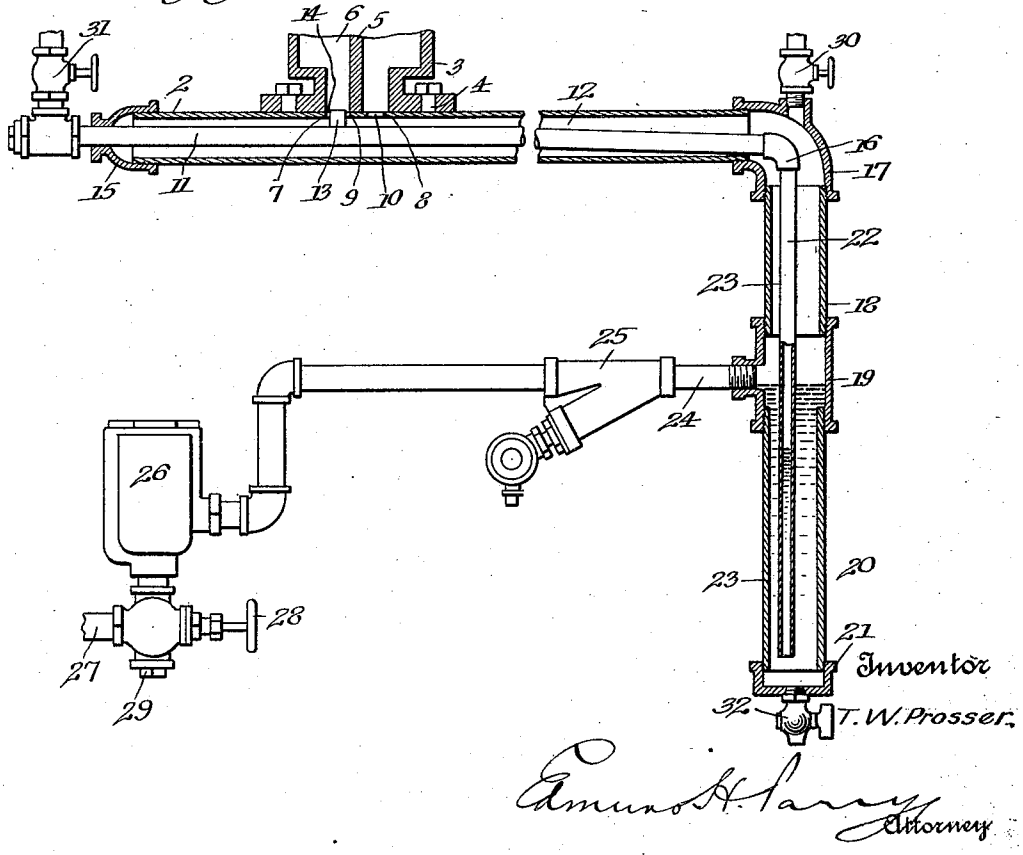


Fig. 1.

Fig. 2.



Inventor
T. W. Prosser.
Edmund H. Sawyer
Attorney

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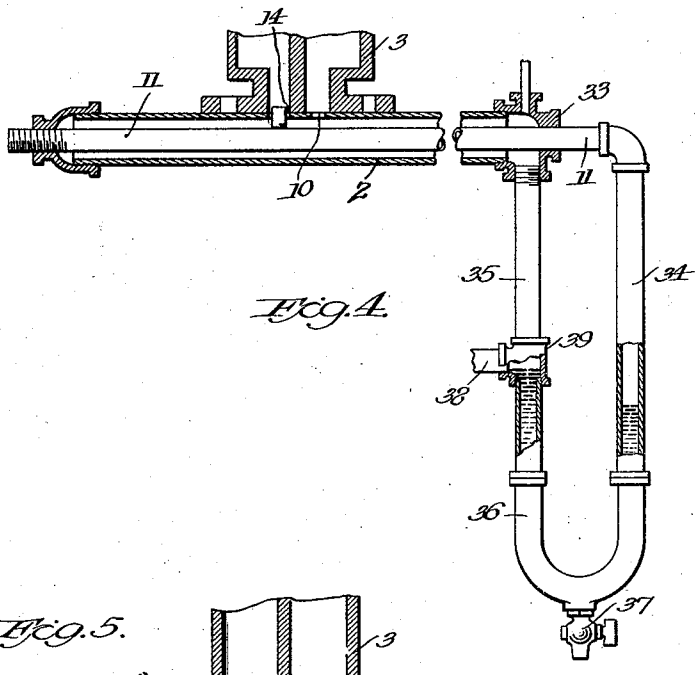


Fig. 4.

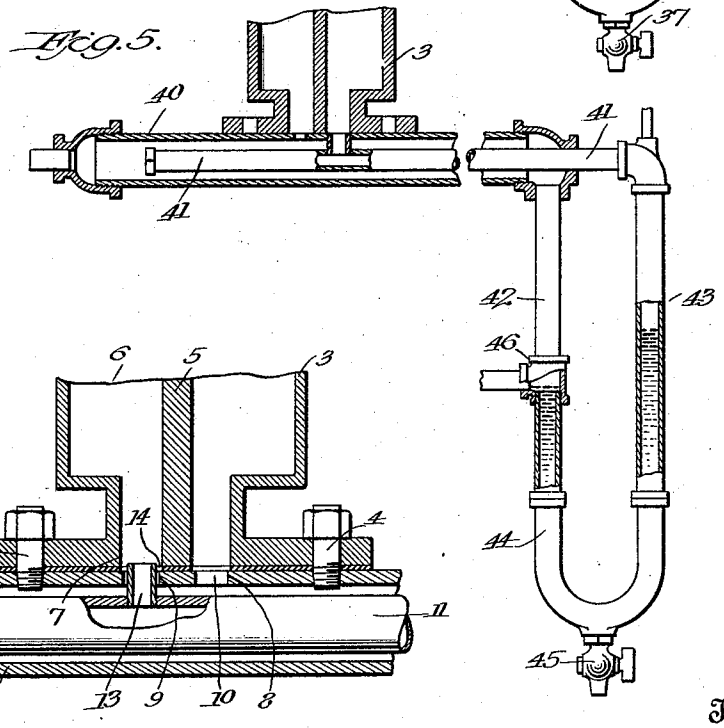


Fig. 5.

Fig. 3.

Inventor

Thomas W. Prosser.

Attorney

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UNITED STATES PATENT OFFICE

THOMAS W. PROSSER, OF KANKAKEE, ILLINOIS, ASSIGNOR TO PARAMOUNT TEXTILE MACHINERY CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

DRYING APPARATUS

Application filed July 13, 1925. Serial No. 43,216.

This invention relates to drying apparatus and, more particularly, to a steam-circulating system therefor.

Present-day practice of finishing hosiery in hosiery plants involves, very generally, the use of a series of hollow metal forms mounted on a table and connected to steam-supply and exhaust pipes, respectively, for effecting a circulation of steam through the forms: A type of such a structure is disclosed in United States Patent No. 1,253,994, granted January 15, 1918, on the invention of P. M. Smith and myself. In connection with this practice, certain problems have developed to which the present invention is directed. Due to the presence of certain foreign matter, adhering more or less loosely to the inner walls of the pipes or passageways employed in conducting the steam to and from the forms, difficulty is encountered in maintaining these passageways clear for the flow of the steam and also for the condensate therefrom. Moreover, if exhaust-steam from an engine is employed—and it frequently is—a certain amount of oil may be carrried into the circulating system with the steam. This oil, adhearing to the inner walls of the pipes, tends to collect any loose foreign matter and, as a result, often forms a sticky mass if permitted to accumulate, and which tends proportionately to decrease the area of the pipes and passageways. Experiments have shown that, if some of these passageways are made large enough to enable the foreign matter to pass therethrough (when it forms) they would be quite too large to allow merely the condensate to pass, with the result that a large amount of steam will tend, at times, to flow directly into the returns or exhaust pipe and the forms, as a consequence, would become steam-bound, making it difficult to remove the air therefrom.

It is a primary object of the present invention to provide a system wherein these difficulties do not exist: To that end, I provide passageways of adequate capacity for the passage of both the condensate and foreign matter and, at the same time, introduce into the structure means for preventing the passage of steam from the feed-pipe into the return-pipe; that is to say, I arrange the feed and return pipes so that, while the forms are supplied with steam through the feed-pipe, these forms, all of them, drain into the return-pipe; and, in conjunction therewith, I provide an outlet in association with and common to both passageways for the condensate therefrom, and another outlet, also common to both passageways, for the removal of foreign matter therefrom. I also provide means in the form of a water-head—a water-leg—to prevent the passage of steam directly from the feed-pipe into the return-pipe. The association of a water-leg with the two outlets permits the use of large passageways for the condensate and the foreign matter while maintaining the required differential in pressure between the steam-line and the return-line. It also provides a place for the foreign matter to fall by gravity from both the steam and return pipes, with ready means for the removal thereof from the system, and permits the use of a single trap for taking the condensate from both lines.

In order that the invention may be more readily comprehended, I have, in the accompanying drawings, illustrated a preferred and practical embodiment thereof as well as two modifications; it being understood, however, that these drawings are merely illustrative, that other embodiments and utilizations of my inventive-concept are within the underlying principles of the invention, and that the illustrated embodiments are susceptible of a wide range of variation and modification without departing from the spirit of these principles or the salient features thereof.

In these drawings:

Figure 1 is a view in perspective, somewhat fragmentary, of a structure with my invention embodied therein;

Fig. 2 is a fragmentary view, in sectional elevation, of the circulating-system constituting my inventive concept;

Fig. 3 is also a fragmentary view, on a larger scale, showing a form mounted on the return-pipe and the means for communication between the form and the steam-supply and return-pipe;

Fig. 4 is a view, similar to Fig. 2, of a modified type of structure; and

Fig. 5 is a similar view of another modification.

In these drawings, it will be seen that the structure therein shown includes certain features disclosed in the aforementioned patent. In this instance, however, the arrangement of forms on the exhaust-pipe is not necessarily that indicated in the drawings of the patent, though it may be.

Referring, now, to the drawings, and to Figs. 1 to 3 thereof, it will be noted that the reference-character 1 designates a table, generally, of appropriate construction.

Extending longitudinally of the table is a form-supporting element 2 which, in this instance, is a conduit constituting an exhaust or return pipe, on which are mounted, in spaced-apart relation, a series of hollow metal forms 3, these being secured to the pipe 2 in any appropriate manner, as by bolts 4.

Each form is hollow, with a central partition 5 to provide an internal channel or passageway 6. The channel terminates in inlet and exhaust ports 7 and 8, respectively, registering with apertures 9 and 10 in the return-pipe 2.

Disposed within and, thus, encompassed by the conduit 2 is a steam-supply conduit 11 constituting a feed-pipe, this being of a diametral dimension considerably less than the inside dimension of the conduit 2 to provide a passageway 12 with which the port 8 of the form 3 communicates.

Threaded into the conduit or supply-pipe 11 is a nipple or nozzle 13 which extends through the aperture 9 in the conduit 2 and through the port 7 of the form 3. Steam introduced from a suitable source of supply (not shown) flows into the conduit 11, up through the nozzle 13, and into the channel of the form and circulates therethrough and, as exhaust and condensate, passes at a lower pressure through the port 8 into the passageway 12 in the return-pipe. The outside diametral area of the nipple 13 is smaller than that of the port 7 in the form and the opening 9 in the return-pipe, providing a passageway 14 for the condensate which forms in the left-hand side of the channel 6.

It has been explained that there are a series of forms—such as 3—mounted on the return-pipe 2, and, in order to maintain a higher pressure in the supply-pipe 11 than exists in the form, the area of all the nipples, combined, is such as to cause more resistance to the flow of steam out of the supply-pipe 11 than is offered to the steam entering that pipe, thus producing a differential between the pressures in the supply-pipe and the return-pipe. The object in maintaining this differential is to produce a comparatively rapid flow of steam into the forms—operating to displace any air which may be in the forms—through the port 10 and, also, to insure that each form gets its fair share of steam, thus causing all the forms to heat uniformly and remain hot when hosiery is drying on them; in fact, it is essential that there shall be a differential between the pressure existing in pipe 11 and return-pipe 2, in order to secure satisfactory functioning of the entire drying-system.

The conduit 11 is supported within the conduit 2 at one end by a reducer-element 15 and at the other by an elbow-member 16. The conduit 2 is provided with an extension or member including an elbow 17, a pipe 18, a T-element 19, and an extension 20 terminating in a clean-out cap 21.

The conduit 11, in addition to having the elbow 16, also has an extension or member 22, this being housed in the elbow 17, in the pipes 18 and 20, and in the T 19, and terminates above the plane of the clean-out cap 21, and is of smaller outside diametral dimensions than those of the parts just mentioned so as to provide a space 23, for a body of water, the function of which will presently be described.

Threaded into the T 19 is a pipe 24 (provided with a strainer 25 of any appropriate design) and terminating in a trap 26, and out of which extends a pipe 27 communicating with the main drain, not shown. The trap is provided with a valve 28 and a plug 29, the latter being to enable the trap to be tested, as usual.

In the elbow 17 is a valve 30 which may be automatically or manually operated (as desired) when the forms are heating to permit free escape of air from the system.

To control the supply of steam to the conduit 11, a valve 31 is provided for the conduit beyond the reducer 15.

Operation: Assuming that the forms are cold by reason of temporary non-use, and it being desired to start them in operation, the valve 31 is opened, whereupon steam from the source of supply flows into the conduit 11, thence through the nipples 13 into the channels 6 of the several forms, circulating therethrough and, as condensate, (until the forms heat up) flows through the space 14 and the port 8 into the passageway 12 in the conduit 2; any air in the system being displaced and forced along to be discharged through the valve 30 (if it be open) or through the trap 26 where it may be released, it being understood that the valve 30 cooperating with the trap permits the release of air from the system more quickly, and this will facilitate the more rapid heating of the forms. The condensate flowing from both the steam-supply and the return-pipe collects in the space 23 in the pipe 20 and gradually rises until it reaches the level of the pipe 24 threaded into the T 19, whereupon any additional

condensate will flow through the trap 26 and, thence, to the main drain through the pipe 27. The height of the water-head in the space 23 is sufficient to prevent steam from passing from the feed-pipe 11 into the return-pipe 2 and thereby maintains the required differential in pressure between these two pipes and causes circulation of the steam through each form.

The strainer 25 operates to strain any dirt that may flow with the condensate towards the trap and which would prevent functioning thereof.

The clean-out cap 21 provides means, in the form of an outlet, common to both the steam-supply and return-pipe for removing any foreign matter that may by gravity, or otherwise, have accumulated in the cap from either or both pipes. To drain the cap at any time, as for preventing freezing, it is provided with a pet-cock 32.

It will be understood that the pipe 24 and the elements extending therefrom constitute an outlet communicating with both the steam-supply and return-pipe to permit removal of condensate therefrom. This outlet and the passageways thereto may be made of ample size to facilitate such removal without interfering in any way with the functioning of the system. In the drawing (Fig. 2) the pipe 22 is shown somewhat smaller than the pipe 11; but it is to be understood that it may be as large as that pipe, if desired; also, the passageway 23 may be made of any required size to accommodate any special conditions, such as fluctuations in the flow of condensate, an unusual quantity of foreign matter, etc. It will be seen, also, that this outlet is common to both of the pipes, the same as the clean-out cap 21, which also constitutes an outlet, is common to both pipes.

It will be noted that the two steam areas, of different pressures, are always separated by a head of water—constituting a water-leg—in the lower portion of the space 23. The condensate from the feed-pipe 11 passes up through this water-head on its way to the outlet in the T-member 19, while the condensate from the forms 3 passes direct to the outlet. Thus, the condensate from both lines is discharged by the same trap.

In Fig. 4, I have shown a modified type of structure: In this instance, the steam-pipe 11 extends through a fitting 33 and is connected to an extension 34. The return-pipe 2 drains into an extension 35. The two extensions 34 and 35 are connected by a loop 36 having a plug 37 (common to both) for the removal of foreign matter. This loop also forms a water-leg for maintaining the differential in pressure between the feed and return pipes. An outlet 38, in T 39, is common to both pipes. The pipe 38 communicates with the main drain through a trap or otherwise.

In Fig. 5, I have disclosed another modification involving a reversal of the relative disposition of the steam-supply and return-pipe. In other words, the steam-supply pipe 40 encompasses the return-pipe 41. Each of these pipes has an extension 42 and 43, respectively, connected by a loop 44 having a plug 45 for the removal of dirt, etc. The loop 44 constitutes a water-leg which separates the exhaust steam from the steam in the feed-line. In this instance, the higher pressure in the feed-line would be in the trap (not shown but corresponding to that marked 26 in Fig. 2) and this would prevent its escape. The condensate from both elements 42 and 43 passes into an outlet 46 that communicates with the main drain through a trap or otherwise. In this instance, the outlet is shown as mounted on the extension 42 and, thus, as being in direct communication with the high-pressure conduit. This, of course, changes the relative positions of the water-head, but the device functions similarly to that described in connection with the structures of Figs. 1 and 4.

What I claim is:

1. A two-pipe drying system comprising a feed-pipe, a return-pipe, a series of hollow drying units communicating with the feed-pipe and all draining into the return-pipe, free passageways for condensate and foreign matter from each of said pipes, a common outlet communicating with the passageways for the condensate, and means for maintaining a differential in pressure between the feed and return pipes and including a water-leg between said pipes and in circuit with and common to each unit of said series and operating to prevent passage of steam from the feed-pipe into the return-pipe.

2. A two-pipe drying system comprising a feed-pipe, a return-pipe, one within the other, a series of drying units mounted on the outer pipe and communicating with the feed pipe and all draining into the return-pipe, free passageways for condensate and foreign matter from each of said pipes, a common outlet communicating with the passageways for the removal of the foreign matter, a common outlet communicating with the passageways for the condensate, and means for maintaining a differential in pressure between said pipes and including a water-leg between said pipes and in circuit with and common to each unit of said series and operating to prevent the passage of steam from the feed-pipe into the return-pipe.

3. A two-pipe drying system comprising a feed-pipe, a return-pipe, one of the pipes being disposed within the other, a series of drying units mounted on the outer pipe and communicating with the feed pipe and all draining into the return-pipe, members connecting with the pipes and of capacity to permit the free passage of condensate and foreign matter, means adjacent the members

and common thereto for the removal of the foreign matter from both members, an outlet for condensate from the units, and means for maintaining a differential in pressure between the pipes and including a water-leg between the pipes and common to and in circuit with each unit of said series and operating to prevent outflow of steam into the return-pipe.

4. A two-pipe drying system comprising a feed-conduit, a return-conduit, one within the other, a series of drying units mounted on the outer conduit and communicating with the feed pipe and all draining into the return-conduit, a common outlet communicating with the conduits for condensate from the two pipes and the units, and a common outlet independent of the condensate-outlet and also communicating with the conduits for the removal of foreign matter therefrom.

5. A circulating system including a steam-supply conduit, an exhaust-conduit associated therewith, a series of drying units having inlet and outlet ports communicating with both conduits, respectively, and a water-seal interposed between the conduits and common to all of the units of the series and operating to maintain a differential in pressure between the conduits and between the ports of each unit.

6. A circulating system including a steam-supply conduit, an exhaust-conduit associated therewith, a series of drying units on one of said conduits, each unit having inlet and outlet ports communicating with both conduits, respectively, a water-seal interposed between the conduits and common to all of the units of the series and operating to maintain a differential in pressure between the conduits and between the ports of each unit, and an outlet common to the two conduits for the condensate therefrom.

In testimony whereof I affix my signature.

THOMAS W. PROSSER.