F. P. REED AND C. NELSON.

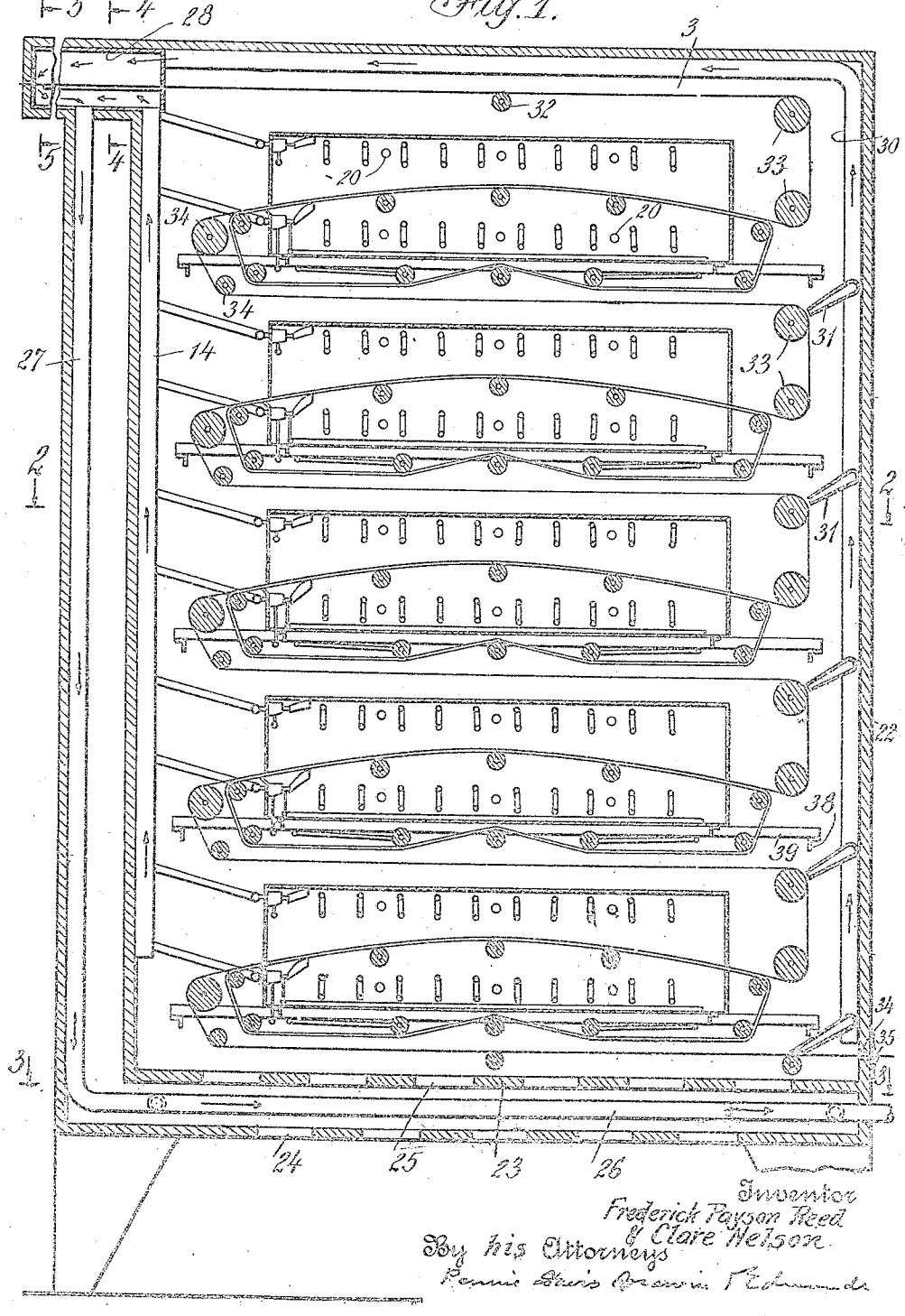
DRIER.

APPLICATION FILED MAR. 30, 1921. RENEWED JULY 26, 1922.

1,432,735. Patented Oct. 17, 1922.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2,

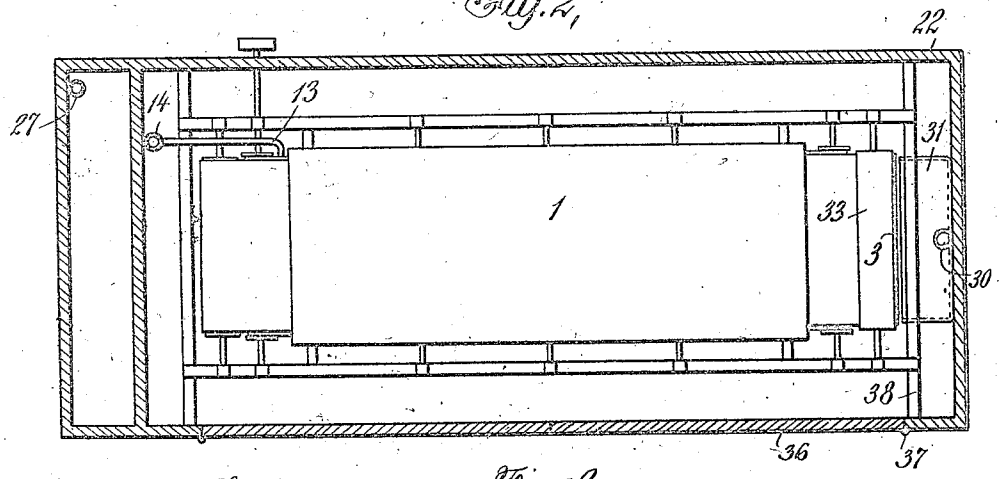


Fig. 3,



Fig. 4,

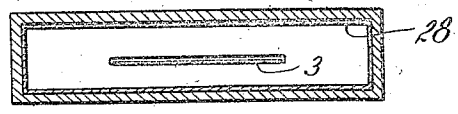
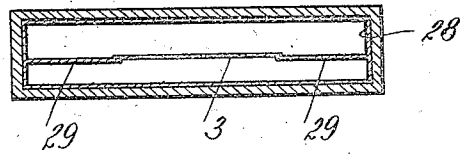


Fig. 5,



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3 SHEETS—SHEET 3.

Fig. 6,

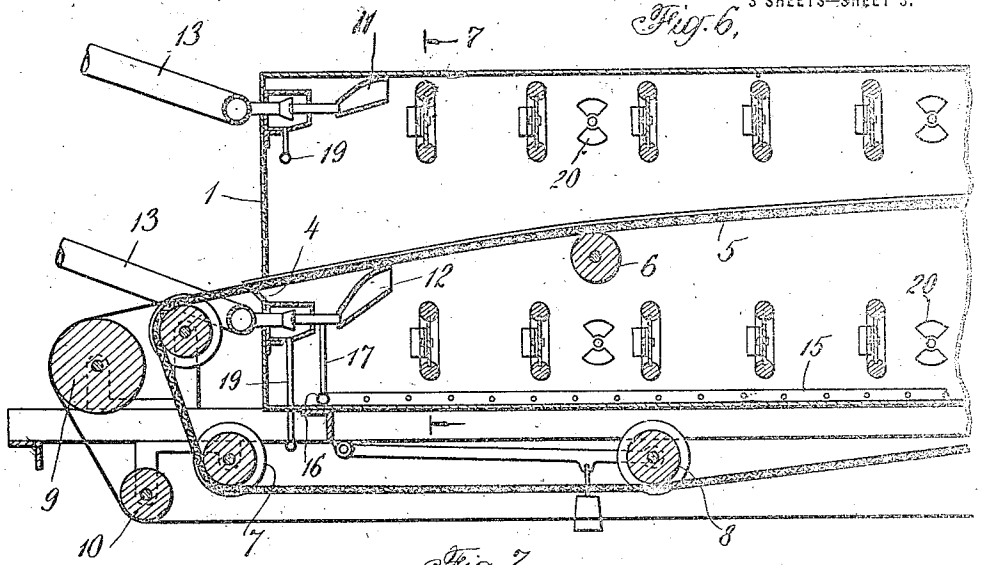


Fig. 7,

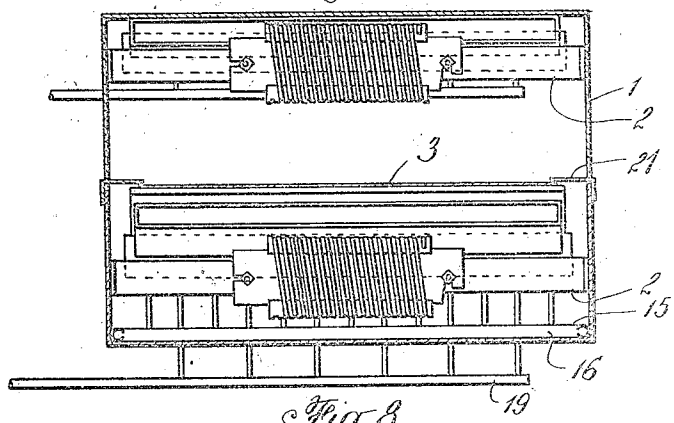
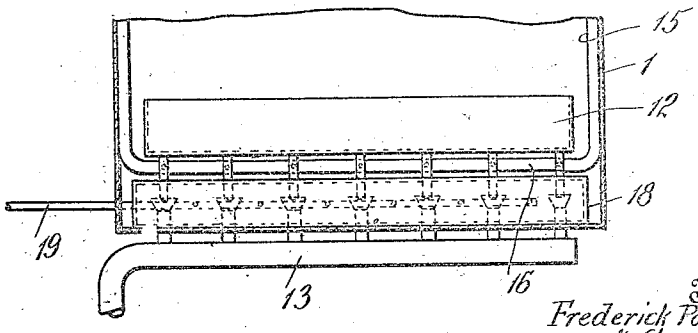


Fig. 8,



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Patented Oct. 17, 1922. 1,432,735

UNITED STATES PATENT OFFICE.

FREDERIC PAYSON REED, OF EAST ORANGE, NEW JERSEY, AND CLARE NELSON, OF BROOKLYN, NEW YORK, ASSIGNORS, BY MESNE ASSIGNMENTS, TO CHARLES C. ORCUTT.

DRIER.

Application filed March 30, 1921, Serial No. 456,857. Renewed July 26, 1922. Serial No. 577,736.

To all whom it may concern:

Be it known that we, FREDERIC PAYSON REED and CLARE NELSON, both citizens of the United States, whose residences and post-office addresses are 338 Springdale Avenue, county of Essex, East Orange, New Jersey, and 45 South Elliott Street, Brooklyn, New York, respectively, have invented certain new and useful Improvements in Driers; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention is an improvement in driers, and relates to that type of drier forming the subject-matter of application No. 434,231, filed December 31, 1920, wherein a casing is provided, having means for heating the same, and having a foraminous support for the web, moving with the web through the casing, and holding the web in a predetermined relation with respect to the heating means.

With this type of heater, and with other types now in use, the opposite faces of the web are subjected in alternation to a relatively high temperature, which vaporizes the moisture, and this vapor is condensed on the face of the web remote from the source of heat, and on those portions of the web beyond such source. Thus the web during its travel is subjected to periods of intense drying, alternating with periods of cooling and recondensation of vapor, and consequent rewetting of the web, conditions which obviously do not conduce to uniform drying and perfect curing of the web.

An object of the present invenion is to provide a drier, by means of which the web may be dried in air of a substantially uniform temperature and dryness, without abrupt and violent variations, whereby to obtain a uniform drying and curing of the web at relatively low temperatures.

A further object is to provide means in connection with the drier for removing the vapor formed, to prevent recondensation on the cooler portions of the web, and for preheating the air admitted to the drier by means of such vapor.

Another object is to provide a heater unit so constructed and arranged that both faces of the web may be simultaneously subjected to a drying action, by means of air, while the vapor laden air is continuously withdrawn from the heater.

Another object is to provide an enclosing casing for a battery of such heater units, so arranged that the vapors evolved in the drying of the web may be continuously withdrawn from the enclosing casing, and from the casings of the heater units, and fresh air supplied to the said casings, such air being dried and preheated by the vapor withdrawn, but out of contact therewith.

In the drawings:

Figure 1 is a vertical section through a battery of the heaters and their enclosing casing,

Figures 2, 3, 4 and 5 are sections on the lines 2—2, 3—3, 4—4 and 5—5, respectively, of Figure 1,

Figure 6 is an enlarged detail section at one end of one of the units,

Figure 7 is a section on the line 7—7 of Figure 6,

Figure 8 is a horizontal section at one end of one of the units.

In the construction forming the subject-matter of application No. 434,231, filed December 31, 1920, a form of heater is shown, comprising an open top casing and provided with heating means, and with means for guiding the web of paper in the open top, so that the under side of the web is subjected to the heated air within the casing. With this arrangement, the opposite faces of the web are alternately subjected to alternate drying and rewetting, that face of the web passing through the heater unit being subjected to a relatively high temperature, while the opposite face is subjected to the cooler air outside the unit. The vapors formed in the drying of the web are recondensed on this face of the web, and it will be obvious that the web as a whole is subjected to alternate drying and rewetting, when a plurality of heating units is used, conditions which are not conducive to the best results.

In the present invention, the heater units are closed casings, having heating means, and having a passage for the web, and means for guiding and supporting the web, the heating means being arranged at opposite

faces of the web, so that both faces are subjected to the same temperature, and means is provided for withdrawing the vapors from the casing at the opposite faces of the web. In order to insure a suitable supply of fresh preheated air and to control such supply, we enclose the battery of heater units in an enclosing casing from which the vapors are also withdrawn continuously, and the incoming air is preheated by such vapors, out of contact therewith. Each of the heater units comprises a casing 1 of suitable material, and of substantially rectangular cross section, having heater units 2 arranged therein, the said units in the present instance being electrically controlled. The units are arranged in two series, namely a series near the top of the casing, and a series near the bottom, and any desired number of units may be used in each series. The units are supported transversely of the casing as shown, and the web 3 to be dried passes between the series. At each end the casing has a slot or opening indicated at 4 for the web, and the web is supported by endless belt 5 during its travel through the casing, the said belt being preferably of foraminous material, of the character shown and described in the above mentioned application for patent. The endless belt is supported by guide rollers 6 within the casing, and by other rollers 7 outside the casing, in such manner that the upper run of the belt extends longitudinally of the casing in arched formation. The lower run passes beneath the casing, and counter weighted tension rollers 8 are arranged beneath the casing, for engaging the lower run of the belt, to tension the same. The supporting rollers 6 are journaled transversely of the casing in the side walls thereof, and other rollers 9 and 10 are arranged outside of the casing, and beyond the rollers 7 at each end of the casing for guiding the web.

By providing heaters above and below the web, both faces thereof are uniformly dried, and in order to withdraw the vapor laden air, to prevent recondensation, we arrange within the casing of each unit, nozzles 11 and 12. The nozzle 11 is in what may be considered the upper compartment of the casing, that is above the web, while the nozzle 12 is in the lower compartment, that is below the web. These nozzles are connected with branch pipes 13 from a header 14 arranged at one end of the battery of units, and common to all the units of the battery. In the bottom of the heater unit casing, we arrange perforated pipes 15, extending longitudinally of the casing near the side walls, and the said pipes are connected at that end adjacent to the header 14 by a cross-pipe 16, and this pipe in turn is connected to the nozzle 12 by a pipe 17. The nozzles 11 and 12 extend substantially the full width of the casing, and each nozzle is connected to the adjacent branch 13, by means of a separating device of the character shown and described in application No. 434,231, filed December 31, 1920, and indicated generally at 18. The separating device separates the condensate from the air, the condensate being carried away by drain pipes 19, while the air passes into the branches 13 and from thence to the header 14. The nozzles 11 and 12, and the pipes 15 remove the vapor laden air as fast as the vapor forms, and fresh air flows into the casings 1 through damper controlled openings 20. To assist in guiding the web, and to complete the closure between the upper and lower compartments, partly brought about by the passage of the web, flanges or ledges 21 extend inwardly from the side walls of the casing, overlying at their inner edges the adjacent edges of the web. In practice that portion of the casing which is above the web is made separable from the lower portion, as indicated in Figure 7, and the flanges 21 are on the lower portion, the upper portion of the casing resting upon the flanges. With this arrangement when access is desired to the interior of the casing, the top portion thereof may be lifted.

Preferably each battery of units, as shown in Figure 1, is within an enclosing casing 22, of suitable size and shape. This casing has a false bottom 23, and the bottom and the false bottom have inlet openings 24 and 25 for air, the openings of the false bottom being staggered with respect to those of the bottom. Within the compartment formed between the false bottom and the casing bottom, there is arranged a heating coil 26, over which the air entering the enclosing casing must pass. The heater 26 is connected by a pipe 27 with a casing 28 arranged at the top of the enclosing casing and at the end adjacent to the header 14. The header 14 also communicates with this casing, and the web 3 as it enters the enclosing casing passes through this casing 28. As shown in Figure 5, the web passes a little below the middle of the casing, and flanges or ledges 29 extend inwardly from the side walls of the casing, to engage beneath the side edges of the web, to support the same, and to form with the web a closure, dividing the casing into upper and lower compartments. The header 14 and the pipe 27 communicate with the lower compartment, and a pipe 30 extends from the upper compartment into the enclosing casing, and to that wall remote from the header 14. Here the pipe extends outwardly alongside the end of the enclosing casing, and at suitable intervals it is provided with nozzles 31. These nozzles have their inlet openings adjacent to the web, and between heater units.

As clearly shown in Figure 1 the web

passes into the enclosing casing 22 through the casing 28 above the topmost heater unit of the battery, being guided by direction elements 32 and 33 in the form of rollers. The rollers 33 are so arranged, that the web may pass downwardly and through the topmost heater unit. Direction elements 34 are arranged at the opposite end of the unit, for guiding the web downwardly and backwardly across the enclosing casing through rollers 33, which guide the web into the second heater unit. This arrangement is followed throughout the battery, the web eventually passing from the last unit out through a passage 34^a in the wall of the enclosing casing, and this passage preferably has flap valves 35 for preventing escape of air at the passage.

In the operation of the improved heater, as the web travels through the heater units, the moisture is vaporized, and the vapor is withdrawn by means of the nozzles 11 and 12. Any vapor in the enclosing casing is also withdrawn by the nozzles 31, and such vapor passes into the casing 28. From thence the vapor passes through the pipe 27 to the heater 26. Air to replace that withdrawn passes upwardly through the inlets 24 and 25 being heated in its passage by the heater 26. A portion of this air passes through the damper controlled openings 20 into the casings. Thus there is provided a constant circulation of air through and over the heater units, so that the vapor is carried away as it is formed, being replaced continuously by fresh dry preheated air, and the vapor laden air is utilized to heat the fresh air. In order to permit access to the heater units for repairs and the like, the enclosing casing 22 is provided with doors 36 which are hinged to the casing as indicated at 37 to swing into open or closed position. The heater units are supported in any suitable manner, as for instance by cross-bars 38, connected with the enclosing casing walls, and each unit has a supporting frame 39 which rests upon these cross-bars 38. In the form of drier described, the opposite faces of the web are uniformly heated, and the evolved vapor is removed as fast as it is formed.

It will be understood that the flanges or ledges 29 do not extend to the outer end of the casing 28, so that a space is provided on each side of the web for permitting the vapor to pass from above the web to below the same.

We claim:—

1. A drier for paper or the like, comprising a series of heater units through which the web of paper to be dried is drawn, each unit having means for heating the opposite faces of the web, and means for withdrawing vapor laden air from the units.

2. In combination with a heater unit comprising a closed casing having means for heating the same, and a passage for permitting the web to pass through the casing, of an enclosing casing for the unit, means for withdrawing the vapor laden air from the heater casing and the enclosing casing, a heating coil through which said vapor laden air is passed, the enclosing casing having air inlets adjacent to which the heater is arranged.

3. In combination with a heater unit comprising a closed casing having means for heating the same, and a passage for permitting the web to pass through the casing, of an enclosing casing for the unit, the enclosing casing having inlets for air, and means for withdrawing the vapor laden air from the casings and for heating the entering air therewith.

4. A drier for paper or the like, comprising a series of heater units through which the web of paper to be dried is drawn, each unit having means for heating the opposite face of the web, and means for withdrawing vapor laden air from the units, an enclosing casing for the units, said casing having air inlets, and the withdrawing means for the vapor laden air having means adjacent to the air inlets of the enclosing casing for preheating the entering air.

5. A drier comprising a plurality of units, each unit comprising a source of heat, and means engaging one face of the web for supporting and guiding the web in a predetermined relation with respect to the heating means, said units being arranged to be engaged by the web in succession and with the opposite faces of the web in alternation, and means in connection with each unit for heating the face of the web not engaged with the guiding means.

6. A drier comprising a plurality of units, each unit comprising a source of heat, and means engaging one face of the web for supporting and guiding the web in a predetermined relation with respect to the heating means, said units being arranged to be engaged by the web in succession and with the opposite faces of the web in alternation, means in connection with each unit for heating the face of the web not engaged with the guiding means, and other means for removing the vapors as they form.

7. In a drier of the character specified, a series of heater units, means for supporting and guiding a web of paper through the units in succession, and means for maintaining a circulation of air through the units whereby to facilitate the drying of the web and to carry away the vapors.

8. In a drier of the character specified, a series of heater units, an enclosing casing for the units, means for supporting and guiding a web of paper through the units in succession, and means for maintaining a circulation of air through the casings whereby to facilitate the drying of the web and to

carry away the vapors, and a heater for the entering air controlled by the air withdrawn from the casing.

9. In a drier of the character specified, a casing, means for supporting and guiding a web of paper through the casing, means for circulating air through the casing and heating means within the casing, said means being arranged on opposite sides of the web to simultaneously heat the air at opposite faces of the web.

10. In a drier of the character specified, a casing, means for supporting and guiding a web of paper through the casing, heating means within the casing, said means being arranged on opposite sides of the web to simultaneously dry the opposite faces thereof, and means for withdrawing the vapors from the casing as they are formed.

11. In a drier of the character specified, a casing, means for supporting and guiding a web of paper through the casing, heating means within the casing, said means being arranged on opposite sides of the web to simultaneously dry the opposite faces thereof, and means for maintaining a circulation of air through the casing whereby to facilitate the drying of the web and to carry away the vapor.

12. In a drying machine, a series of drier units, each comprising a casing having means for guiding a web of paper or the like to be dried therethrough, means for circulating air through the casing of each unit, and means within the casing for heating the air.

13. In a drying machine, a drier unit comprising a casing through which the web of paper or the like to be dried passes, means for circulating air through the casing, and means within the casing for heating the air.

14. In a drying machine, a drier unit comprising a casing through which the web of paper or the like to be dried passes, means for circulating air through the casing, means within the casing for heating the air, and means moving with the web for supporting and guiding the same.

In testimony whereof we affix our signatures.

FREDERIC PAYSON REED.
CLARE NELSON.