May 5, 1942. E. A. MAHANNAH 2,282,070

APPARATUS FOR DRYING PAPER AND PAPER PULP SAMPLES

Filed Aug. 2, 1940

Fig. 1.

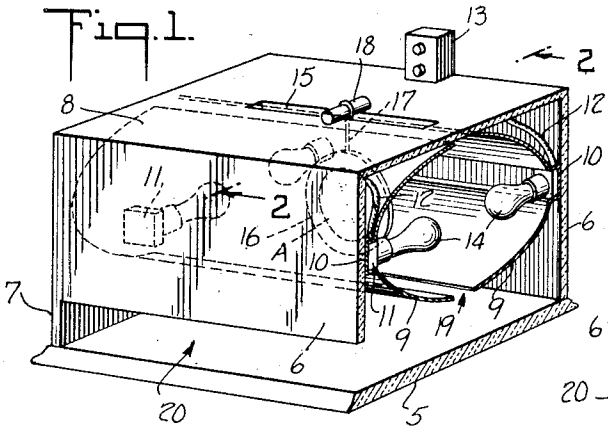


Fig. 2.

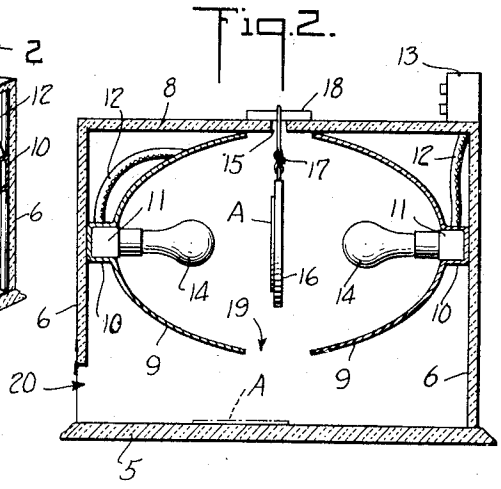


Fig. 3.

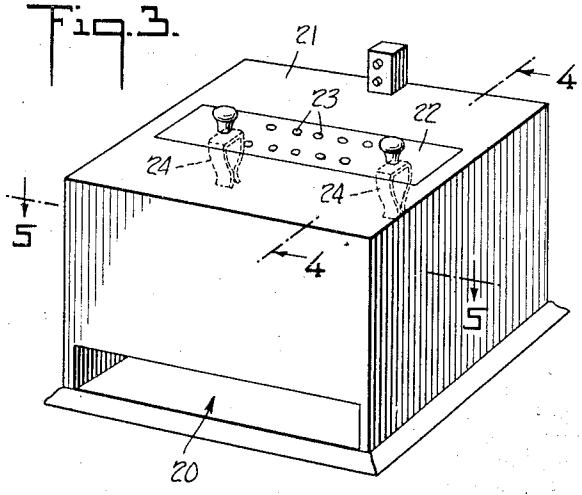
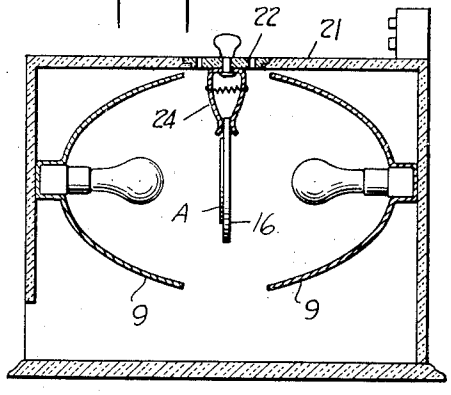


Fig. 4.



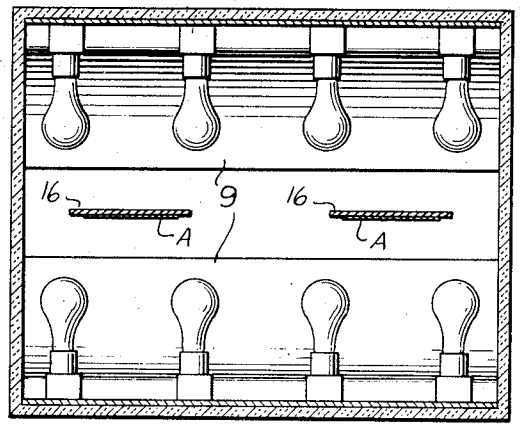


Fig. 5.

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APPARATUS FOR DRYING PAPER AND PAPER PULP SAMPLES

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Application August 2, 1940, Serial No. 349,428

4 Claims. (Cl. 34—150)

This invention relates to new and useful improvements in drying apparatus and particularly seeks to provide a novel laboratory oven which is adapted to be used in the machine room of a paper mill for the drying of paper samples or the like.

It is necessary, in the manufacture of paper, to periodically take samples of paper from the web formed on the paper machine and to subject the sample taken to one or more of a number of routine tests in order that the quality of the paper being made can be quickly determined and satisfactorily maintained.

Of the many tests which can be performed on paper samples, the most useful determine the moisture content of the paper web or determine the brightness index of the paper when in a bone dry or substantially bone dry state.

Heretofore several forms of drying devices have been employed by which the moisture of a paper sample can be expelled, and these devices generally consist of a hot air blast drier or any one of various forms of steam heated driers. In using any of the prior known forms of drying devices it has been found that the time necessary to bring a paper sample to bone dry condition took from 20 to 30 minutes. Since the time for drying a paper sample through the use of the older devices was of such long duration accurate control of the paper being manufactured could not be maintained to the desired degree.

This invention overcomes the difficulties heretofore encountered through the use of prior known drying devices and provides a drying oven capable of bringing a paper sample from a moisture content equal to that of the web in the machine to a bone dry state in from 2 to 5 minutes through the use of opposed banks of infra-red lamps and reflectors. It has been found that the interior of an oven constructed in accordance with this invention can easily be maintained at 135° C., which is a sufficiently high temperature to quickly dry a paper sample held therein. The drying is also materially accelerated by the internal self-generation of heat induced in the material to be dried by exposure to the infra-red rays.

Therefore, an object of this invention is to provide a novel drying oven adapted to dry a sample of paper or paper pulp from the normal machine moisture content to a bone dry state in a relatively short period of time without scorching.

Another object of the invention is to provide an apparatus of the character stated which includes an enclosed box in which is mounted a pair of opposed longitudinally disposed banks of infra-red lamps.

Another object of the invention is to provide a device of the character stated in which the infra-red lamps are mounted with the filaments thereof disposed at substantially the focal plane of a pair of opposed parabolical trough reflectors.

Another object of the invention is to provide a device of the character stated which includes mounting means for supporting a sample of paper to be dried intermediate the banks of infra-red lamps and the reflectors associated therewith.

Another object of the invention is to provide a device of the character stated in which the sample mounting means includes a chromium plated metallic plate dependably supported intermediate the lamp banks and to which a paper sample is adapted to adhere while moist and from which the paper sample will automatically drop when reduced to an oven dry state.

Another object of the invention is to provide a device of the character stated in which the bottom portion of one of the side walls thereof is provided with a hand hole through which the dried paper sample is adapted to be removed.

Another object of the invention is to provide a device of the character stated which is simple in design, rugged in construction and economical to manufacture.

With these and other objects in view, the nature of which will become more apparent, the invention will be more fully understood by reference to the drawing, the accompanying detailed description, and the appended claims.

In the drawing:

Fig. 1 is a perspective view, partly in section, of a drying oven constructed in accordance with this invention;

Fig. 2 is a vertical section taken on line 2—2 of Fig. 1;

Fig. 3 is a perspective view of a slightly modified form of drying oven;

Fig. 4 is a vertical section taken on line 4—4 of Fig. 3; and

Fig. 5 is a horizontal section taken on line 5—5 of Fig. 3.

Referring to the drawing in detail the invention as illustrated is embodied in a drying oven formed from asbestos board or other material possessing similar thermal insulating and heat

resisting properties and includes a base 5, front and rear walls 6, end walls 7 and a top 8.

A pair of opposed parabolical trough reflectors 9, 9 are mounted within the oven and are located above the base 5 a distance sufficient to permit the insertion of a hand between the bottom of the reflectors and the base. Each reflector 9 is provided with a longitudinally extending trough portion 10 by which the respective reflectors are secured to the adjacent wall 6.

A plurality of lamp sockets 11 are mounted in the troughs 10 of the respective reflectors and are disposed in opposed pairs throughout the length of the oven. In the form of oven illustrated in Figs. 1 and 2 of the drawing the four lamp sockets employed therein are preferably connected in series through wiring generally indicated at 12, and the current is controlled through the medium of a switch 13 connected to a source of electrical energy (not shown). It has been found satisfactory to employ heat generating, infra-red lamps 14 of the 250 watt, 110 volt type which, when connected in series in the well-known manner, require an electrical input through the switch 13 of 440 volts. It is of course entirely practical to employ a 110 volt power line and connect the lamps in parallel circuit.

The top of the oven is provided with a slot 15 through which paper sample supporting means is adapted to be inserted. The sample supporting means comprises a highly polished or electroplated metal disc 16 dependably supported from the top 8 by a wire 17 and toggle bar 18. It should be noted that the axis of the toggle 18 is disposed at right angles to the general plane of the disc 16 in order that the plane of the disc will lie parallel to the longitudinal axes of the reflectors 9 and the plane surfaces of the disc be directly exposed to the reflected heat emanating from the infra-red lamps 14.

When a paper or paper pulp sample is taken from the web formed on a paper machine, it is preferably cut in the form of a disc A having a diameter less than the diameter of the sample supporting disc 16. The sample disc A is pressed onto one surface of the sample supporting disc 16 and the moisture content of the sample will cause the same to adhere to the supporting disc. The supporting disc is then inserted into the oven through slot 15 and dependably maintained therein by the toggle 18. It should be noted that the supporting disc 16 and the associated sample A are disposed intermediate the opposed reflectors 9 and the associated infra-red lamps 14 so that the sample is exposed directly to the heat therefrom. After a sample has been inserted into the oven the externally radiated and the internally generated heat will, of course, drive out the moisture and the sample will reach a bone dry condition. When the bone dry condition of the sample has been reached it will no longer adhere to the supporting disc 16 but will drop downwardly through the gap 19 between the reflectors 9 and fall to the bottom of the oven. The front wall 6 of the oven may be provided with a hand hole 20 through which a hand may be inserted to remove the dried sample.

In determining the moisture content of the sample, it is of course obvious that the weight of the sample as removed from the paper making machine will be taken at the time of removal and then the weight of the sample will be taken after it has reached a bone dry condition and has fallen to the bottom of the oven. The difference between these two values will give the weight of moisture contained in the sample and by simple arithmetic the percentage of moisture can be determined.

In using an oven of the type disclosed herein for the drying of paper samples it has been observed that effective operating temperatures of around 135° C. are maintained. Such a temperature within the oven is sufficiently high that a sample of paper can be completely dried in from 2 to 5 minutes. The moisture which is expelled from the paper sample as a result of heating is carried out of the oven by the circulation of air passing in through the hand hole 20 and upwardly and out through the slot 15 in the top. Thus the air within the oven is maintained in a substantially dry state and the drying of paper will therefore be somewhat accelerated.

It has been observed that paper samples which have been dried in an infra-red oven of the type disclosed herein possess a brightness index 1–1.5 points higher than similar samples dried in a steam oven.

In Figs. 3, 4 and 5 of the drawing there is illustrated a slightly modified form of drying oven which is formed in a manner similar to that previously described but which includes a top 21 having a relatively large elongated aperture formed therein. The aperture formed in the top 21 is adapted to be closed by a lid 22 provided with a plurality of ventilation orifices 23. A pair of spring clips 24 are dependably secured to the lower face of the lid 22 and are adapted to maintain a sample mounting disc in position intermediate the reflectors. In this form of oven there is disclosed a four-lamp bank of infra-red lamps associated with each of the reflectors instead of the two lamp banks disclosed in the previously described oven. The wiring connections for the eight lamps included in this modified form of oven must necessarily be disposed in series-parallel relation so that two sets of four lamps are each connected in parallel, and the four lamps in the respective sets are connected in series. This is necessary in order that the 440 volt power line may be used as in the other form.

It should be noted that if it is desired to employ an oven constructed in accordance with this invention to dry paper samples of considerably larger area than that of the disc 16, such samples may be folded to such size as to fit within the oven and be directly supported by the clips 24. In such instances the discs 16 will not be used, and the removal of the dried sample will have to be effected by lifting the lid 22 at the time the drying is completed, rather than through the hand hole 20.

Thus it will be seen that the herein disclosed invention provides a novel oven in which paper samples are adapted to be quickly dried; which includes an enclosed box in which are mounted sets of opposed longitudinally disposed infra-red heat emanating assemblies; which includes a highly polished metallic plate dependably supported intermediate the heating assemblies and to which a paper sample is adapted to adhere while moist and from which the paper sample will automatically drop when reduced to an oven dry state; and which is simple in design, rugged in construction and economical to manufacture.

It is of course to be understood that certain details of arrangement and proportion of parts may be variously modified without exceeding the scope of the appended claims.

I claim:

1. In an oven for drying articles of sheet material, a concave trough reflector secured to one wall of said oven, heat radiating devices located within the concavity of said reflector, and means located in front of said reflector and in spaced relation to said heat radiating devices for supporting the sheet material to be dried, said supporting means being provided with a highly polished generally vertical plane surface opposing said reflector and to which articles of sheet material will adhere when moist and from which said articles will fall when dry.

2. In an oven for drying articles of sheet material, a pair of opposed trough reflectors secured within said oven in spaced relation, heat radiating devices located within the defined limits of at least one of said reflectors, and means located intermediate said reflectors for supporting the sheet material to be dried, said supporting means being provided with a highly polished generally vertical plane surface opposing said reflector and to which articles of sheet material will adhere when moist and from which said articles will fall when dry.

3. An oven for drying articles of sheet material and including a bottom, front and rear walls, end walls and a top, opposed trough reflectors secured adjacent the opposing faces of two of said walls, infra-red heat radiating devices associated with said reflectors, and means dependably supported from said top and located intermediate said reflectors for supporting the sheet material to be dried, said supporting means being provided with a highly polished generally vertical plane surface to which articles of sheet material will adhere when moist and from which said articles will fall when dry.

4. An oven for drying articles of sheet material and including a bottom, front and rear walls, end walls and a top, opposed trough reflectors secured adjacent the opposing faces of two of said walls, infra-red heat radiating devices associated with said reflectors, and means dependably supported from said top and located intermediate said reflectors for supporting the sheet material to be dried, said supporting means being provided with a highly polished generally vertical plane surface to which articles of sheet material will adhere when moist and from which said articles will fall when dry, one of said walls and said top being provided with apertures through which a current of air is adapted to pass and thereby carry off the moisture expelled during drying of the sheet material.

EVERETT A. MAHANNAH.