Feb. 25, 1930. S. LIPSIUS 1,748,136

HEATING AND DRYING APPARATUS

Filed Sept. 3, 1925 2 Sheets-Sheet 1

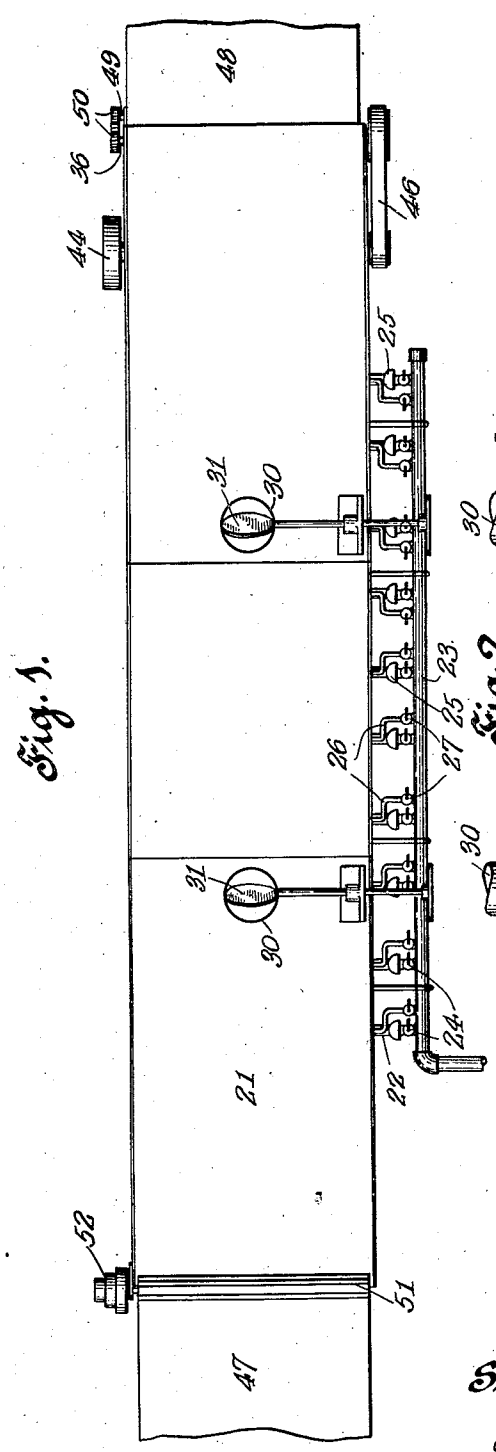

Fig. 1.

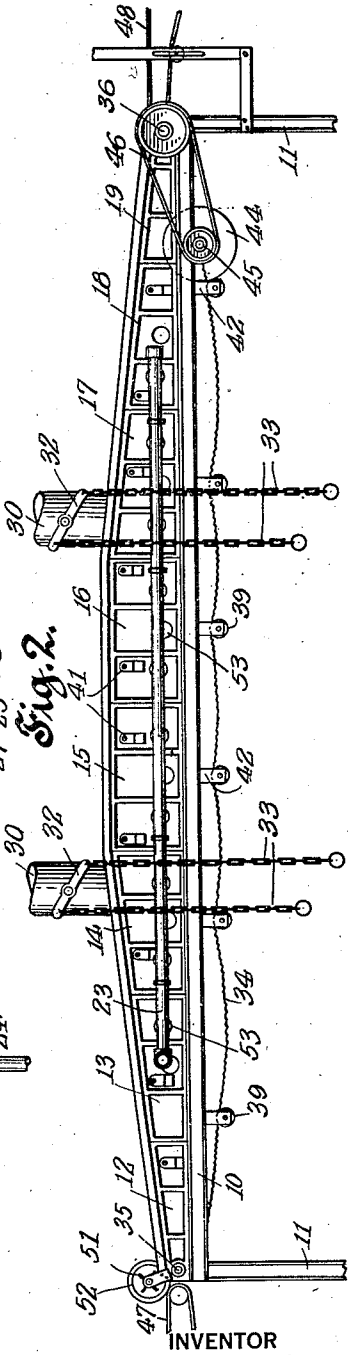

Fig. 2.

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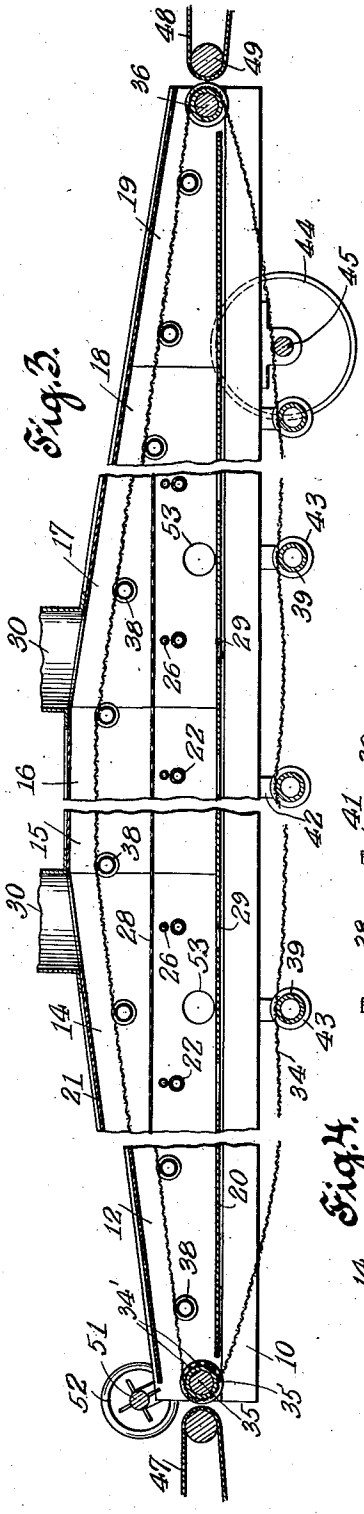

Fig. 3.

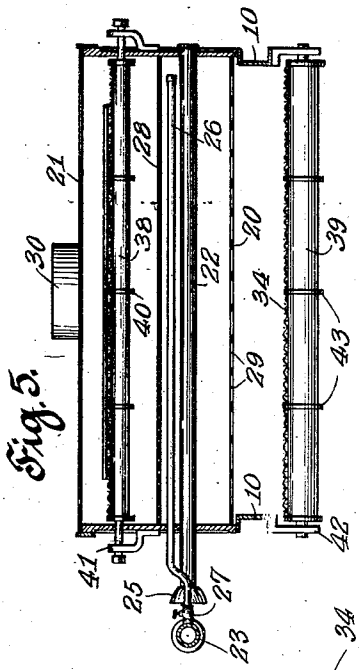

Fig. 5.

Fig. 6.

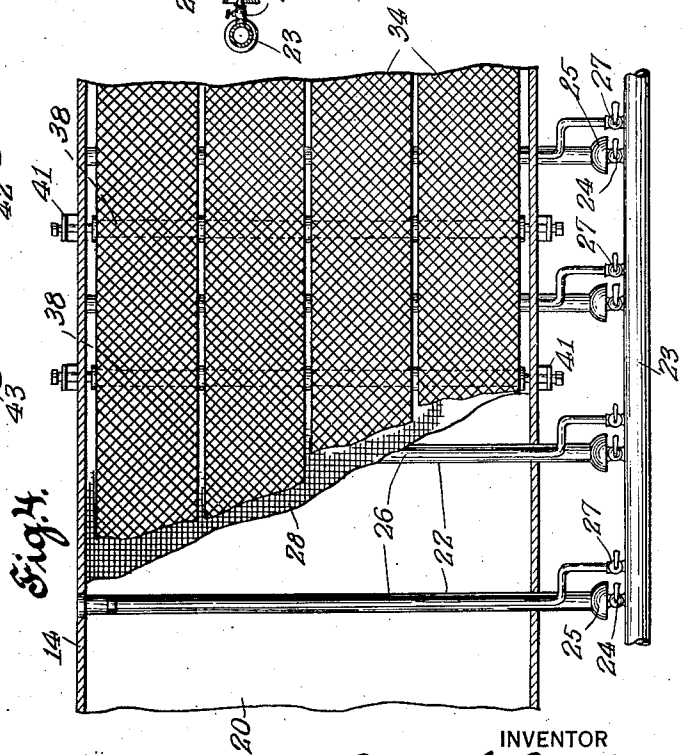

Fig. 4.

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UNITED STATES PATENT OFFICE

SAMUEL LIPSIUS, OF NEW YORK, N. Y.

HEATING AND DRYING APPARATUS

Application filed September 3, 1925. Serial No. 54,177.

In the past it has been customary to employ machines of approximately 100 feet in length for drying gummed and varnished paper and other similar fabrics. In some cases these machines have chambers heated by steam and in others heated by gas burners. In some cases it has been found necessary in fact to run double length conveyors in order to get thorough drying. Such machines take up an enormous amount of floor space and the heating is very uneconomical. So much so, in fact, that the rooms where the drying is done are very uncomfortable for the operators and unsanitary. In the gas heated dryers which have been used for this purpose prior to my invention, the gas burners have been mounted above the conveyor and the result is that an enormous excess of heat is required in order to force the hot air far enough down to reach the conveyor and the paper carried thereon. Such apparatus requires such excessive temperature that great danger is incurred in the fire hazard. Frequently the sheets passing beneath the flame are turned over and ignited, setting fire to the entire apparatus. This is particularly likely to occur on account of the fact that the fumes arising from the gum or varnish are highly combustible. It has also been customary in machines of this type and with which I am familiar to employ canvas belts or conveyors for the gummed sheets. In these conveyors the canvas is, of course, highly combustible and dangerous. Furthermore it has been found necessary in machines with which I am familiar to employ volume air blowers for forcing the hot air downward against the sheets which are to be treated. This, of course, entails additional expense for blower apparatus and also the additional expense of power and upkeep. When we consider that the total length of the conveyor in one of these machines may be anywhere from 150 to 300 feet long, the expense of operation and the danger from fire are very serious matters. Steam heated apparatus is also highly objectionable in that it requires the expense of a steam plant and sometimes the services of a licensed engineer. In many cases steam is entirely out of the question. When gas burners are employed according to the old method it is necessary to operate them with great care and at comparatively slow speed in order to avoid danger from conflagration.

The main object of my invention is to provide simple, compact, and reliable apparatus for automatically and rapidly handling sheets of paper or other fabric as they are delivered from a coating or gumming machine and delivering them in a finished condition so that they may be handled.

Another object is to prevent the sheets from being crumpled or mussed in handling.

Another object is to provide such apparatus which will operate at a minimum expense and maximum of safety.

Another object is to provide means for controlling the temperature and time of operation.

Briefly the invention contemplates the use of a special elongated oven containing heating means and a wire conveyor or conveyors. I preferably employ a series of gas burners for heating purposes and interpose between the burners and the sheets which are being heated a fine perforated plate or wire screen which permits the heat to pass economically upward without danger of the flame passing through the screen. I have also provided means for carrying away the vapors from the gum or varnish and the products of combustion from the burners. The heater is preferably made up into sections so that the length of the heater may conveniently be extended or diminished to suit varying conditions in the establishment where the heater is to be installed. Details of the improvements will be understood from the following specification and the accompanying two sheets of drawings.

Fig. 1 is a plan view on a very small scale showing one form of apparatus embodying the improvements of my invention.

Fig. 2 is a side elevation of the same.

Fig. 3 is a longitudinal sectional view on a somewhat larger scale.

Fig. 4 is a fragmentary plan view of a part of the apparatus showing the conveyors and burners.

Fig. 5 is a transverse sectional view of the heater and conveyors.

Fig. 6 is a detail side view and partial section of one of the burners.

In the preferred form of the apparatus I employ longitudinal supporting channels 10 which may be carried by uprights or posts 11. The side of the heater may conveniently be made up of a series of sections, such as 12, 13, 14, 15, 16, 17, 18, and 19, all of which are suitably supported upon the side channels 10. By increasing or diminishing the number of sections, the length of the heater may be made to fit the particular needs of the shop where the apparatus is to be used. Preferably the heater is provided with a bottom plate 20 which may be supported on the side channels as shown in Fig. 5. The top or roof of the heater 21 extends from one end to the other, being supported by the side plate sections.

In the particular form shown I employ a series of gas burners 22 each of which at one end is connected to and supported by the longitudinal manifold or main gas pipe 23 and provided with a gas cock 24 and an air ignition device 25. The opposite end of the burner is preferably supported in the opposite side of the heater as shown in Figures 4 and 5. I also preferably provide a pilot burner pipe 26 which is connected to the manifold 23 and provided with a gas cock 27. This pilot burner extends across the main burner between the exit openings in the main burner which are provided along the opposite sides so that the flames will pass out on the opposite sides of the pilot burner pipe 26.

Above the burners I provide the screen 28, preferably of fine wire or finely perforated sheet metal so as to permit the heat from the burners to pass upwardly but without passing any flame. The bottom of the heater is preferably provided with a series of perforations 29 to allow for the admission of fresh air through the bottom. I also provide one or more outlets 30 for the products of combustion. These outlets are preferably controlled by dampers 31 and cross-bar 32 or chains 33, so that the rate at which the products of combustion escape may be controlled. In this way it is possible to control the temperature of the heater very nicely.

The conveyor 34 is preferably formed of wire mesh. This conveyor runs on the main rollers 35 and 36 at the entrance and exit ends of the machine. It is supported inside the heater above the row of burners 22 and above the screen 28 by a series of rollers 38, and beneath the heater by a series of rollers 39. All of these rollers are preferably tubular in form so as to be very light and thus exert but a minimum of resistance to travel. Preferably the conveyors are divided up into a series of strips arranged side by side, as shown in Fig. 4. The upper rollers 38 are preferably provided with flanges 40 between the adjacent strips of the conveyor so as to keep each strip running straight and without interference with the adjacent strip or strips. The ends of these rollers are preferably supported in bearing brackets 41 outside of the heater chamber so that the bearings may be properly lubricated without subjecting them to the heat from the burners inside the chamber. The lower rollers 39 are supported by brackets 42 suspended from the lower edge of the side channels 10. These lower rollers are also preferably provided with flanges such as 43 to keep the adjacent strips of the conveyor separated and each running true in its own path.

The meshwork conveyors are preferably formed of interlocked wire helices. This forms a flexible and durable conveyor which allows free passage of the heated air and yet is incombustible. Preferably the conveyor is made up of sections composed alternately of right hand helices and left hand helices. Each section may be say a foot or so long. This reverse lay of the wires keeps the conveyor running straight without any tendency for it to work side ways on the rollers. The surface of the guide rollers is preferably formed of some yielding material such as semi-hard rubber or imitation leather 35′ into which the conveyor sinks so as to give a good gripping connection. I also preferably stud the rollers with devices such as round headed screws 34′ so as to prevent the wire meshwork from slipping and ensure all the conveyors travelling at the same speed.

The conveyor may be driven in any suitable manner, as, for instance, from a motor or drive wheel 44 on the shaft 45, which is provided with belt 46 for driving the exit roller 36.

The gummed or coated sheets of paper or other fabric are deposited in any suitable manner on a conveyor 47 and from this automatically deposited at the entrance end of the heater upon the upper run of the conveyor 34. At the exit end the heated sheet is deposited on the conveyor 48 which may take it off to any place desired. If necessary the conveyor 48 may be long enough to constitute a cooling conveyor, as is customary in such machines. The conveyor roller 49 may be driven by gears 50 from the shaft 36.

At the entrance end, considerable difficulty has sometimes been caused by the gummed sheets or varnished sheets failing to lie flat upon the conveyor 34. The hot air passing from the heater at this entrance end sometimes tends to lift the sheets, particularly if they are light, in weight, and frequently turns the sheets over and causes them to adhere one upon another, especially when the coating material is sticky or adhesive. I have found that this may be very readily prevented by means of a sort of fan 51 which may be driven in any suitable manner, as, for instance, from

the pulley 52. The rotation of this member 51 causes sufficient force of air pressure against the sheets as they strike the conveyor 34 to hold them in place until they get well inside the heater where the pressure of the air or products of combustion is substantially the same on top of the sheet as it is beneath, and there is, therefore, nothing to dis-arrange or turn the sheet over. In this connection it will be noted that I have not employed any burner in the first or entrance section of the heater nor have I found it necessary to use a burner in this section or in the exit section 19. The burner and section constructions are preferably such, however, that the burners may be removed or added as desired so as to provide a maximum adaptability to fill the conditions which may be met with in practice. Preferably each of the central sections is provided with an opening such as 53 through which air is admissible to the heater and through which the operation of the burners and conveyor may be observed.

I have found that I am able to accomplish efficient drying of the varnish or gummed paper by apparatus of this character at a very high rate of speed and in a much smaller and more compact space than apparatus previously used for this purpose. It has also been found that this apparatus requires very much less gas to operate it effectively and without damage to the material being treated than has heretofore been possible with the customary forms of dryers used by lithographers and finishers. It has also been found that this apparatus is much more sanitary than the old forms which required much more heat and gas. The ordinary drying machine causes the temperature of the air in the room to become most unhealthy, and the products of combustion which, unless they are led away from the room, are dangerous to the operators. According to my invention it is possible to get thorough and complete drying without any danger of injuring the paper or other fabric being treated. The use of excessive temperatures also tends to curl up and make paper very difficult to handle. According to my invention these difficulties are largely eliminated.

I have found excellent results obtainable with a machine only twenty-five feet long. The screen 28 need extend only just beyond the last burners at the opposite ends of the row of burners, leaving the extreme ends unobstructed to permit the products of combustion to pass freely upon the ends.

I claim:

1. In a drier, heating means, a horizontally extending conveyor for carrying sheets through over said heating means, means for depositing sheets on said conveyor, a housing for said heating means and conveyor which housing is open at the ends for the entrance and discharge of said sheets, and a fan for holding the sheets on said conveyor against the action of hot air from the heating means issuing out of the housing entrance opening.

2. A machine for drying gummed paper comprising a housing open at its ends and higher in the center than at the ends and having separately controllable outlets for fumes spaced apart near the top, a wire mesh conveyor for carrying gummed sheets into, up through and out of said housing, supports for said conveyor within said housing, supports for the return of said conveyor beneath said housing, a series of gas heaters within said housing beneath the upper run of said conveyor, and a fan just above said conveyor at the entrance of said housing directing a current of air against the conveyor and into the housing.

3. A machine for drying gummed paper and the like comprising an oven having a long flat topped central portion and two long ends tapering off to comparatively shallow entrance and exit portions, a wire mesh conveyor extending upwardly at an incline from the entrance end, then substantially horizontally across the central portion, then downwardly on an incline to the exit end, and returning beneath the oven, a series of burners arranged transversely to the oven in a common plane in the central and end portions thereof, and means for blowing a stream of air downward and forward against the conveyor and into the entrance to said oven.

4. A machine for drying gummed paper and the like comprising an oven having an elongated central portion and elongated tapered end portions with outlets at the upper ends of said tapered end portions, a conveyor supported to travel in said oven upwardly from the entrance, across the top, and downwardly to the exit, a series of gas burners arranged in the central and end portions of said oven, and a horizontal screen extending above said burners and beneath said conveyor.

5. In a drier, an elongated heater oven, a foraminous conveyor within said oven, means for delivering sheets onto said conveyor at the entrance to said oven, means for heating air beneath said conveyor within said oven and means adjacent the entrance to the oven for directing air downwardly and forwardly against the sheets as they enter the oven, said means also directing air to oppose the emission of heated gases from said oven at the entrance.

6. A drier comprising a heater oven having side channels, a bottom plate and sectional side plates supported by said side channels, top plates supported by said sectional side plates, guide rolls suspended from said channels beneath said bottom plate, guide rolls supported by said side plates within said oven, a conveyor travelling over said guide rolls within and beneath said oven and heating

means beneath said conveyor within said heater oven.

7. In a drier, an elongated oven having entrance and exit passages at opposite ends, and having a hot air outlet between the ends, a conveyor movable longitudinally in said oven for carrying gummed sheets through the oven, means for heating the air within said oven, and means arranged adjacent the entrance passage above the conveyor for directing air downwardly and forwardly against the sheets and holding them on the conveyor as the sheets enter the oven and counteracting the tendency of the hot air in the oven to lift the sheets as they enter the entrance passage.

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