

Nov. 1, 1938.

R. BYRON

2,134,906

METALLIC LITHOGRAPHIC OVEN

Filed Jan. 9, 1935

3 Sheets-Sheet 1

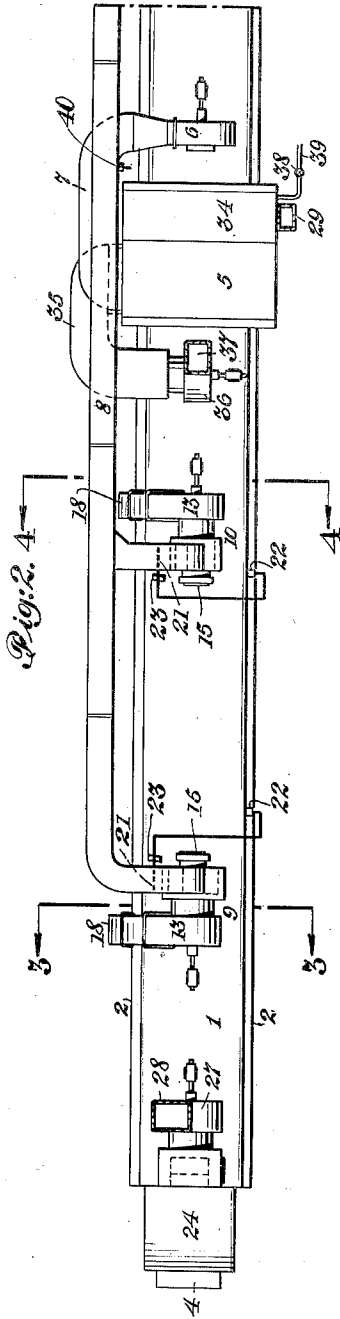
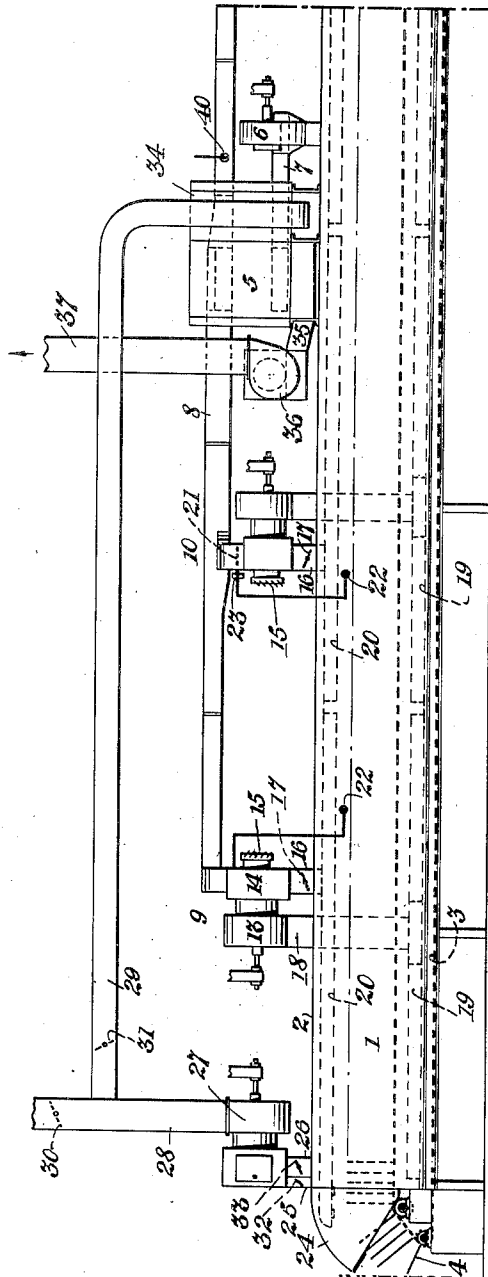


Fig. 1.



INVENTOR
Ralph Byron
BY *C. Campbell Hummel*
ATTORNEY

Nov. 1, 1938.

R. BYRON

2,134,906

METALLIC LITHOGRAPHIC OVEN

Filed Jan. 9, 1935

3 Sheets-Sheet 2

Fig. 2a

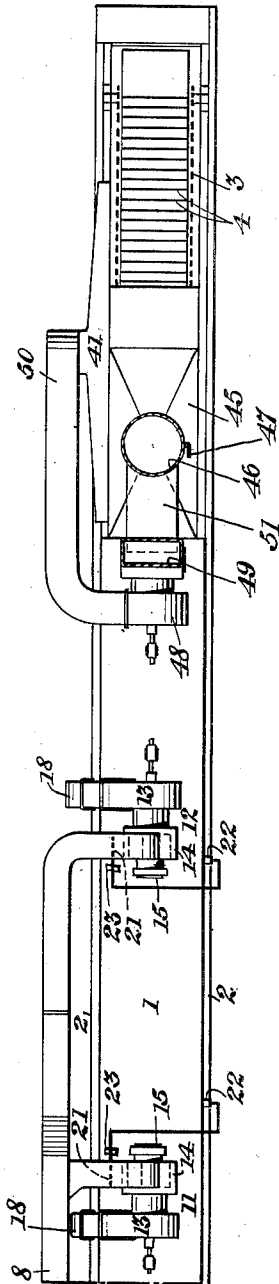
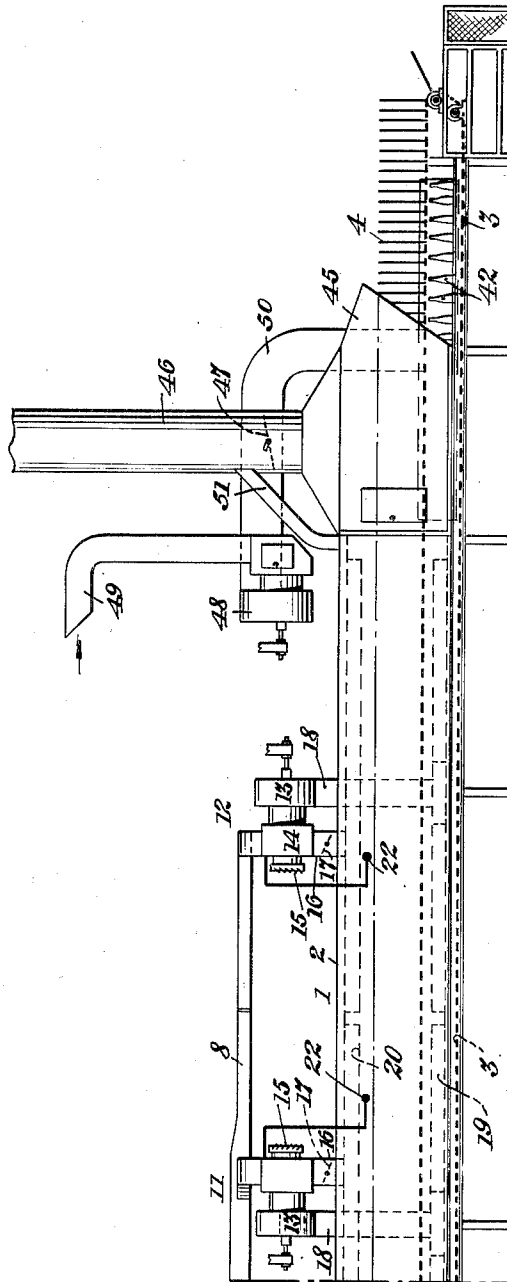


Fig. 1a



INVENTOR
Ralph Byron
BY *C. Campbell Hummer*

ATTORNEY

Nov. 1, 1938.

R. BYRON

2,134,906

METALLIC LITHOGRAPHIC OVEN

Filed Jan. 9, 1935

3 Sheets-Sheet 3

Fig. 4.

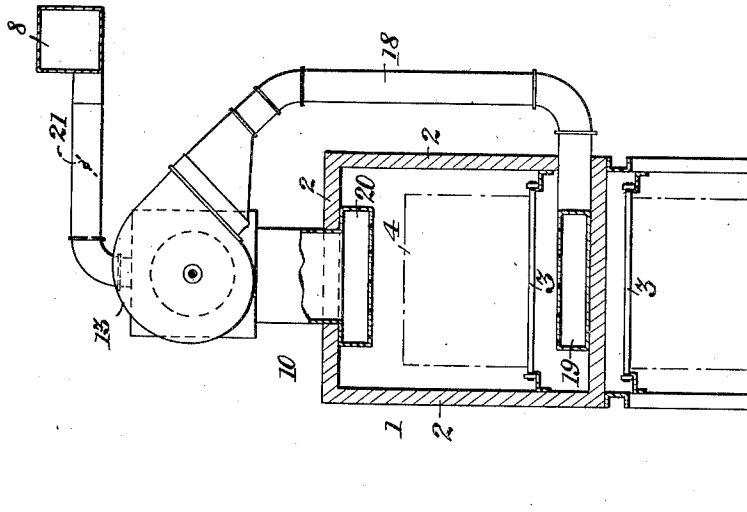
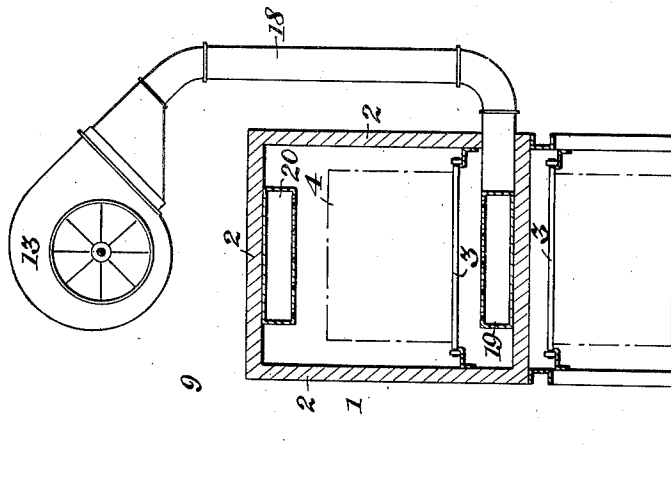


Fig. 3.



INVENTOR
Ralph Byron
BY *C. Campbell Horvick*

ATTORNEY

UNITED STATES PATENT OFFICE

2,134,906

METALLIC LITHOGRAPHIC OVEN

Ralph Byron, New York, N. Y., assignor to J. O. Ross Engineering Corporation, New York, N. Y., a corporation of New York

Application January 9, 1935, Serial No. 1,006

3 Claims. (Cl. 34—12)

This invention relates to an oven for baking or drying metallic lithographed or coated sheets.

In the making of metal lithographed sheets or in allied industries where metal is coated it is necessary after coating to dry or bake the sheets and to cool them in order to fix the coatings and to permit subsequent handling. Many of the inks or coatings contain volatile solvents which have a fuel value and sometimes are of an explosive nature when in sufficient concentration. The metal sheets that are used are thin and in consequence are not easily handled. The drying or baking must be of such a nature that the sheets are uniformly dried and within close temperature limits due to the nature of the inks or coating. In cases where the solvents give off volatile gases it is not desirable to exhaust them to the atmosphere and yet they are generally of such a nature that a temperature of too high a degree must be used to burn them for that temperature to be utilized in the oven or dryer. The temperature utilized in a dryer of this type is generally below 450° Fahrenheit, while the auto-ignition temperature of many of the vapors given off in the solvents ranges from 700 to 1100° Fahrenheit. Hence, if an attempt is made to utilize the fuel value of the solvents the temperature of the heating medium will be too high. I propose to utilize the heating value of the gases arising from the drying of the plates without using the same gases as a circulating heating medium.

In any dryer there is the necessity for the proper control of the temperature of the circulating drying medium. Such proper control is almost impossible where a single source is utilized with a unitary point of distribution. In addition, in order to keep the cost of operation as low as possible, the heater must be operated at its greatest fuel efficiency and lowest heat loss and also the fuel content of the solvents should be recovered and used as fuel and further the waste heat from the air and gases in the device should be utilized.

One of the objects of my invention is to provide a satisfactory dryer or oven for metal printed or coated sheets wherein a proper atmosphere at a proper temperature may be maintained throughout the dryer.

Another object of my invention is to utilize the fuel content of the solvents and other volatiles given off during the drying without injury to the materials being dried.

Still another object of the invention is to add

fresh air to the circulating heating medium to improve the quality of the finished product.

A still further object of this invention is to provide a dryer for metallic coated or printed sheets and the like that will utilize the heat content of the fuel efficiently while at the same time using the fuel value of the solvents and the heat content of the waste air and volatiles from the oven.

Other objects will appear more fully hereinafter.

In carrying out my invention, I propose to provide a dryer wherein the metallic sheets are supported by finger bars or wickets on an endless carrier; the wicket or finger bars being spaced approximately an inch and a quarter apart. The closeness of the spacing is necessitated by the requirement of compactness on the part of the dryer and which requirement increases the difficulty of both the drying and the cooling. A single heater is utilized. This heater is what is known as the indirect type, that is, one wherein the products of combustion (heating medium) are not permitted to intermingle with the drying medium which is generally air.

With my invention, the heater is run at a higher temperature than is required for the drying medium to be furnished within the oven. This makes it possible to burn the volatiles drawn from the dryer in the combustion chamber of the indirect heater. In addition to their fuel value, the temperature of the gases is in the neighborhood of 300° Fahrenheit, which compared with the normal average temperature of combustion air operates to increase the thermal efficiency of the heater. The heating medium is led to mixing boxes at stations distributed lengthwise of the dryer. At the stations are located blowers or fans having connection with the mixing boxes and connections with openings below the carrier for the metallic sheets. At each station in the top of the dryer are conduits leading to the mixing boxes. In addition, there are fresh air openings in the mixing boxes. Dampers are placed in the three conduits leading to the mixing boxes whereby the temperature within each mixing box may be controlled automatically. For instance, if the temperature adjacent one unit drops, the damper opens in the line of the connection to the heater permitting relatively high temperature air to be admitted to the mixing box thereby raising the temperature of the circulating medium at the station. The fresh air inlet to the mixing box, I have shown as manually controlled. If desired, it may be automatically controlled to

conjointly act with the automatic damper or valve from the heater, that is, when the heater valve is opened the fresh air valve might be closed or vice versa. In practice, I have found that due to the plenum pressure of the heating medium and the suction pressure of the fan or blower at the station, sufficiently quick action is obtained in raising or lowering the temperature in the mixing chamber without the necessity of the automatic control of the fresh air inlet. The admixture of fresh air at the stations is particularly desirable by reason of the fact that the circulating medium should contain oxygen and if the gases from the oven alone are recirculated without the addition of fresh air the quality of the product is not as good. In order to prevent too high a pressure within the dryer and to prevent the building up of too high a percentage of volatiles from the solvents it is necessary to exhaust some of the gases from the dryer. This I preferably do near the entering end because the concentration of the solvents is higher at this point and because the temperature of the exhausted gases is lower, hence the oven or dryer efficiency will be greater if the gases are exhausted at the coolest point. By having the stations positioned at different places lengthwise of the oven the controls may be fixed so that if necessary a uniform temperature in the dryer may be maintained or the temperature may be varied lengthwise of the dryer as desired since the temperature of the heating medium is sufficiently high to be able to attain the necessary working temperature at any point.

By my method of admission of the heating medium through stations with the mixing boxes it is possible to control the velocity and quantity of the air admitted at each station. This may be accomplished in a variety of ways such as the initial installation of different size fans or blowers or by control in any well known manner of the speed of the fan, or by a damper in the conduit or opening from the fan discharge to the plenum chamber.

Referring to the drawings:

Figure 1 is a view in elevation of one-half of the dryer or oven embodying the principles of my invention.

Figure 1a is a view in longitudinal elevation of the other half of the dryer or oven embodying the principles of my invention.

Figure 2 is a plan view of Figure 1.

Figure 2a is a plan view of Figure 1a.

Figure 3 is a cross sectional view of Fig. 2 along the line 3—3, looking in the direction of the arrows.

Figure 4 is a cross sectional view of Figure 2 along the line 4—4, looking in the direction of the arrows.

The dryer or oven 1 is of metallic construction having insulated walls 2 with the usual supporting frames. An endless carrier 3 is adapted to be motivated in any well known way through the oven. This carrier carries fingerbars or wickets 4 to receive the metallic sheets which are being treated. An indirect heater 5 is preferably positioned on the top of the dryer in order to save floor space but this heater may be stationed alongside of the dryer if required. Indirect heater 5 is of any well known type wherein the products of combustion and the heating medium, that is, generally air are not permitted to intermingle. The path of the circulating heating medium may be described as follows: Fan 6 which may be driven in any well known manner forces the air

through duct 7 into heater 5 whence it passes to the main distributing duct or headers 8 leading to the distributing stations or zones 9, 10, 11, 12. At each zone there is a circulating fan 13, which may be driven in any well known manner, and a mixing box 14 communicating with the header 8 and fan 13. Also leading into this mixing box is an adjustable fresh air opening 15 and a return air connection 16. A damper 17 is located in the return air connection. At each station or zone the air passes from the outlet of fan 13 into a duct 18 leading to a perforated supply duct 19 running lengthwise of the oven underneath the metallic sheets to be dried. The air passes from supply duct 19 upward between the sheets into a similar collector duct 20 whence it goes through air connection 16 to mixing box 14 and is recirculated. In the connection from the main header duct 8 to each mixing box 14 is an automatic damper 21 actuated by a thermostatic element 22 operating a damper motor 23 in any well known manner to operate the damper 21.

At the entering end of the oven is provided a hood 24 having a connection 25 leading into the inlet of a fan 27. Connection 26 leads from the duct 20 to the fan 27 for delivering air from the duct to the fan. The air is discharged from fan 27 through duct 28 where it may be either spilled to atmosphere or recirculated through duct 29 back to the combustion chamber of heater 5. The proportions of air spilled or recirculated are controlled by means of dampers 30 and 31. There are dampers 32 and 33 on the inlet side of fan 27, damper 32 controlling the amount of air removed from hood 24 and damper 33 controlling the amount of air removed from oven 1 through duct 20. The amount of air handled by fan 27 is approximately equal to the amount of fresh air and heating medium entering the oven. Whereas one fan is shown for handling both the exhaust from the hood and from the duct 20, it is also possible to use one fan exhausting from the hood only and spilling to atmosphere, and another connection exhausting directly from the duct to the combustion chamber on the heater.

The operation of the dryer is as follows:

The endless carrier 3 introduces the metallic sheets into the drying chamber. The heating medium from stations 9, 10, 11, 12, is blown up through conduits 19 between and around the metallic sheets, and after drying the sheets, is withdrawn from duct 20. The temperature of the heating medium within the oven at the various points is controlled dependent upon the desired zone temperature as follows:

Some of the exhausted air passes up from duct 20 into connection 16 and thence into mixing chamber 14. Fresh heating medium is simultaneously admitted to the mixing chamber 14 from the central heater 5 through conduit 8. The amount of hot heating medium is controlled with respect to each mixing box 14 automatically by thermostatic elements 22 located in each zone of the dryer. Fan 13 then circulates the mixture through conduit 19. In order to have the highest efficiency possible, a portion of the air from the oven containing the volatiles is withdrawn from the point of greatest concentration and is conducted through connections 25, 26, and moved by fan 27, thence through conduits 28, 29, to furnish preheated air and volatile fuel to the combustion chamber of the indirect heater.

It should be noted that by this means the volatiles, if explosive, may be kept down in the recirculated heating medium to a concentration 75

that will not be explosive and may be controlled with respect to the desired degree of concentration. The exhaust air from the oven containing these volatiles in passing through the combustion chamber 34 is heated to a temperature of about 1100° Fahrenheit which is above their auto-ignition temperature and consequently the fuel value of the volatiles regardless of concentration is taken advantage of since they must burn at this temperature. These products of combustion pass around the interchanger in heater 5 thereby giving off their heat to the incoming fresh air from blower 6. After giving off their heat the products of combustion pass through duct 35 into fan 36 and are discharged to atmosphere through stack 37. By burning the volatiles, not only is the heat value recovered but also they are discharged through the stack 37 in a form that is less harmful to the surrounding area. Also the air mixed with the volatiles introduced through conduit 29 into combustion chamber 34 may be said to be preheated and thereby increases the efficiency of the heater. Additional fuel, of course, is required in the heater but the amount is materially reduced by the utilization of the volatiles. The amount of fuel being burned in combustion chamber 34 is controlled by a valve 38 in the fuel supply line 39. Valve 38 is actuated by a thermostat 40 located in duct 8. In this way any predetermined temperature may be continuously maintained in duct 8. In other words, the makeup hot heating medium can be at a constant temperature.

The dryer 1 is of little use without means for cooling the metallic sheets, since no matter how thoroughly they are dried they will be tacky and difficult to handle as they come from the dryer 1. In addition, in many instances, the surface of the metallic sheets is materially improved by a cooling or chilling process.

At the exit end of the dryer or oven 1, I provide a hood or chamber 45 with an exhaust stack 46 to permit the entrained hot drying medium to be exhausted from between the metallic sheets while at the same time blowing a cooling medium between the sheets thereby enabling a reduction of temperature that can be controlled without harm to the coated surface of the sheet. Damper 47 enables the operator to control the amount of air discharged to atmosphere.

A vent pipe 51 connects with stack 46 before the damper 47. This acts as a pressure relief in the oven to prevent heating medium from spilling into the cooling zone.

It will thus be seen that I have invented a dryer for metallic sheets and the like wherein the sheets may be dried in a controlled predetermined atmosphere of predetermined temperature, wherein the temperature may be varied or uniform at different parts of the dryer and the quantity or velocity of the drying medium may be controlled, and wherein relative quantities of fresh and recirculated air as well as the fresh heating medium may be controlled, and wherein the fuel value of the solvents may be utilized and the heating value of the waste heating medium may also be utilized both in connection with the oven itself and in connection with the heater.

What I claim is:

1. A drying oven for metal lithographic plates or the like comprising a housing, means for conveying said plates or the like through said housing, a furnace, a duct leading from said housing to said furnace for conducting to said furnace volatiles given off by said plates in said housing, means for heating said furnace to the auto-ignition temperature of said volatiles, an indirect heat interchanger in said furnace, means for drawing air through said heat interchanger and delivering the same to different zones in said housing, a mixing box for each zone, a main hot air distributing duct leading from said indirect heat interchanger to said mixing boxes, ducts for delivering air from each mixing box to its associated housing zone and for returning air from said zone to said mixing box, and dampers for regulating the supply of hot air to said mixing boxes and the withdrawal of air from said casing to said furnace.

2. A drying oven for metal lithographic plates or the like comprising a housing, means for conveying said plates or the like through said housing, a furnace, a duct leading from said housing to said furnace for conducting to said furnace volatiles given off by said plates in said housing, means for heating said furnace to the auto-ignition temperature of said volatiles, an indirect heat interchanger in said furnace, means for drawing air through said heat interchanger and delivering the same to different zones in said housing, a mixing box for each zone, a main hot air distributing duct leading from said indirect heat interchanger to said mixing boxes, ducts for delivering air from each mixing box to its associated housing zone and for returning air from said zone to said mixing box, dampers for regulating the supply of hot air to said mixing boxes and the withdrawal of air from said casing to said furnace, and means responsive to the temperature in each zone for operating the hot air damper for such zone.

3. A drying oven for metal lithographic plates or the like comprising a housing, means for conveying plates or the like through said housing, said housing being divided into zones, a mixing box for each zone, a main hot air distributing duct communicating with said mixing boxes, ducts for delivering air from each mixing box to its associated housing zone and for returning air from said zone to said mixing box, dampers for regulating a supply of hot air to said mixing boxes, means responsive to the temperature of each zone for operating the hot air damper for said zone, a furnace, an indirect heat exchanger in said furnace communicating with said main distributing duct for supplying hot air thereto, a duct leading from said housing to said furnace for conducting to said furnace volatiles given off by the metal plates in said housing, and means for heating said furnace to the auto-ignition temperature of said volatiles.

RALPH BYRON.