July 6, 1926. 1,591,683

C. G. PREIS

DRYING OVEN

Filed Jan. 6. 1923 3 Sheets-Sheet 1

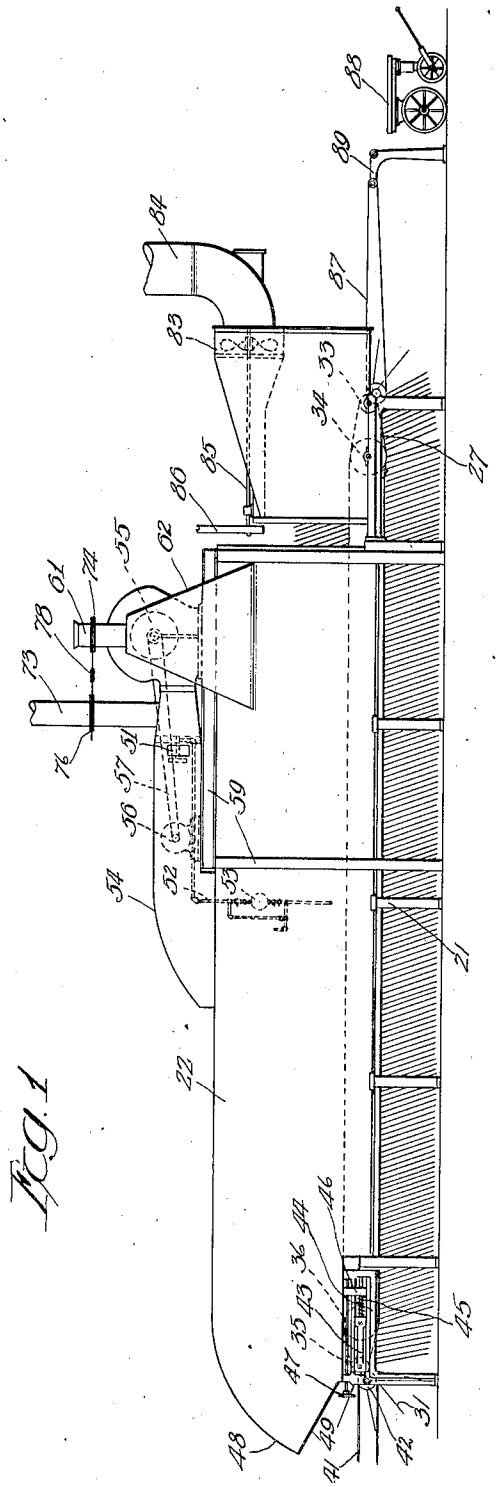


Fig. 1

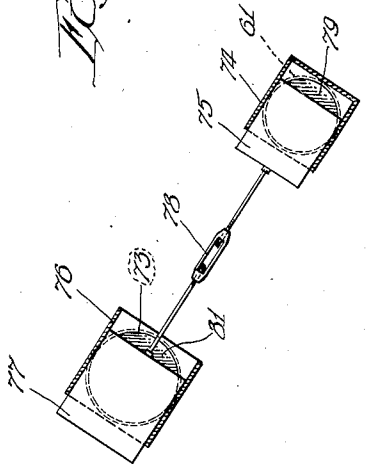


Fig. 4

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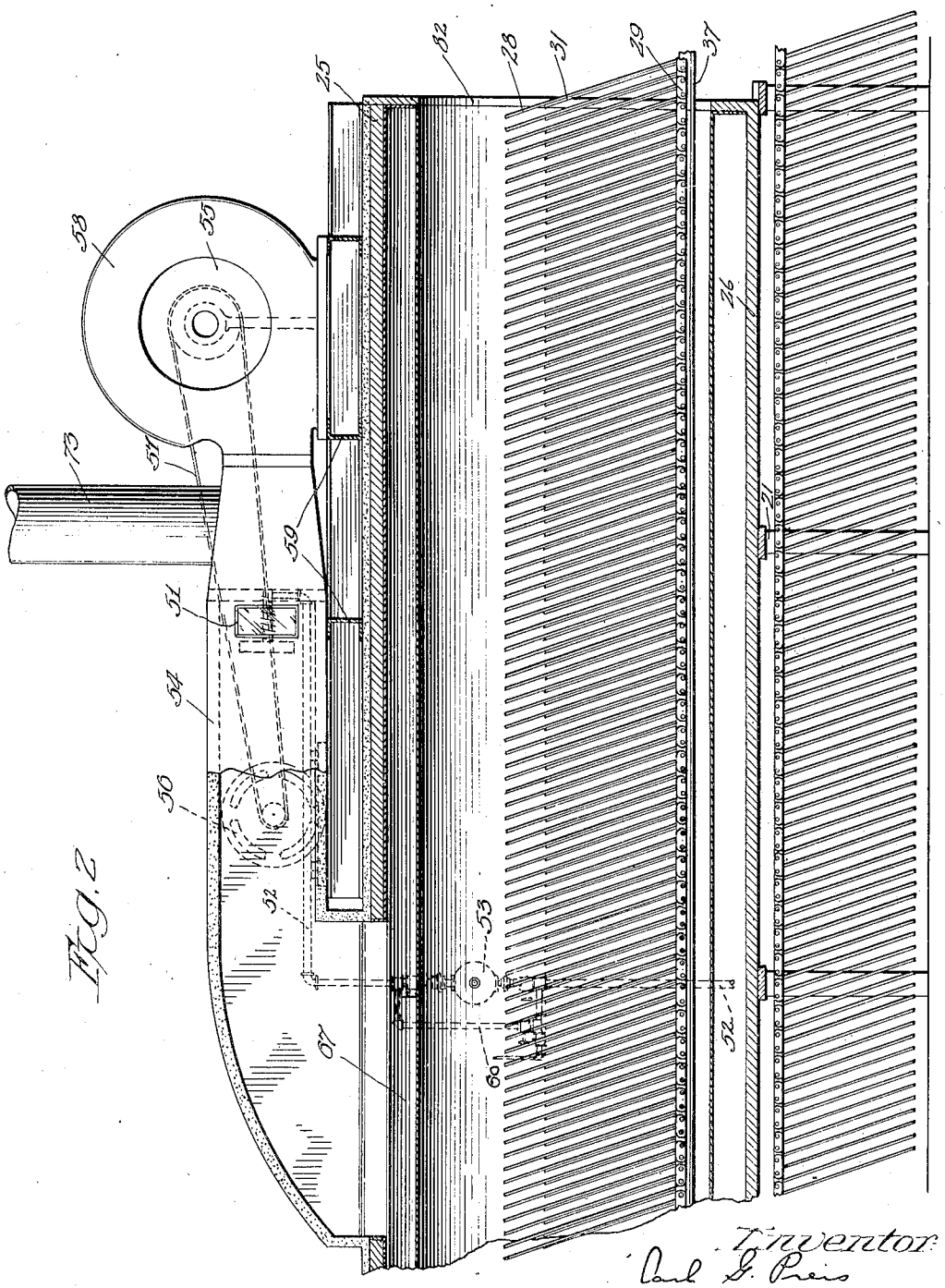


Fig. 2

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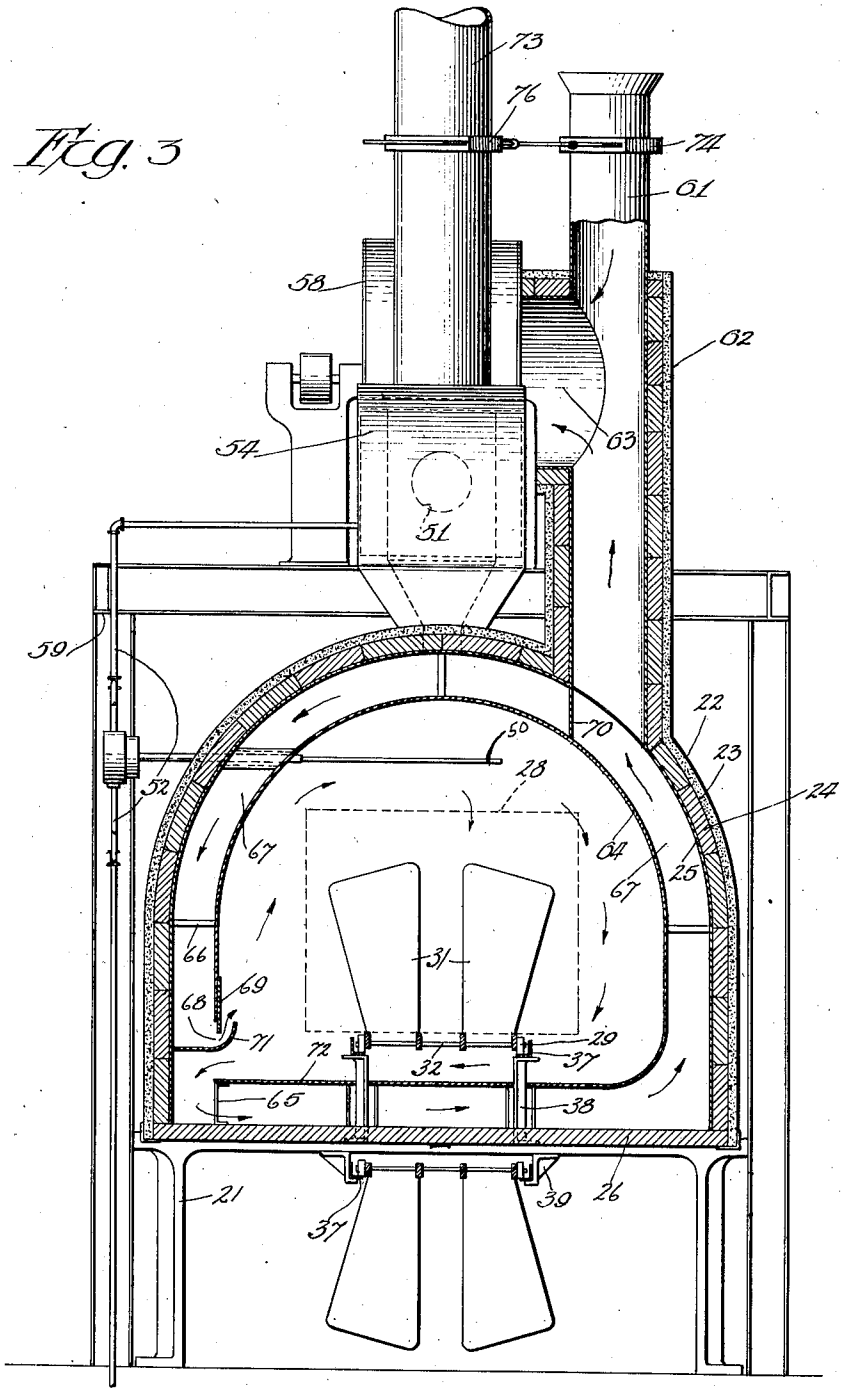
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DRYING OVEN

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Fig. 3



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UNITED STATES PATENT OFFICE.

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DRYING OVEN.

Application filed January 6, 1923. Serial No. 611,008.

This invention relates to drying ovens, particularly of the character which are used for drying or baking lithographed or lacquered sheets of metal.

An important object of the invention is the provision of a drying oven for this purpose in which the heated air is caused to circulate in a manner producing maximum drying action in a limited space, thus reducing the floor space required for the installation of an apparatus of this character.

The invention has for another object the provision of means for proportionately controlling the admission and escape of air from the oven which will result in an approximately balanced air pressure at the ends of the enclosed passageway through which the sheets are moved as they are being dried.

A further object is the provision of an automatic feed for delivering the sheets to a conveyer by which they are moved through the drying oven, in combination with a heating chamber of the foregoing type which accomplishes an effective drying action in a minimum of time, as well as space.

Another feature of the invention relates to a device for rapidly cooling the dried sheets as they emerge from the heating chamber with the result that they may be handled by attendants without being moved through an extended space of lower temperature either within or without the oven casing.

Other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings,

Figure 1 is a side elevation, somewhat in outline, of a drying oven and associated apparatus in which my invention is embodied;

Fig. 2 is an enlarged partial section, taken longitudinally through the oven;

Fig. 3 is an enlarged transverse view, looking toward the right in Fig. 1; and

Fig. 4 is a sectional detail, taken through the damper construction by which the admission and escape of air is proportionately controlled.

The apparatus illustrated in the drawings comprises a supporting frame 21, upon which is mounted a casing 22, which, in the present instance, is of arched formation and comprises an outer asbestos-cement wall 23 and a series of blocks 24, which may be of magnesia, or other heat insulating material, and are supported from within by a metal sheet 25. This casing, with a base 26, provides an enclosed heating chamber through which a conveyer 27 is adapted to move carrying lithographed sheets 28, or the like, which are to be dried.

Said conveyer comprises links 29 to each of which are secured prongs 31, these being separately mounted, in the present instance, on a transverse rod 32. The links 29 form an endless chain which is directed around sprockets 33 and 34 at one end and sprockets 35 and 36 at the opposite end, said chain being driven from a suitable source of power which is connected to rotate one of said sprockets. An angle iron track 37 is provided upon supports 38 extending up from the base 26 and upon hangers 39 depending from the frame 21.

By means of the sprockets heretofore described, said chain is directed along the tracks 37 and the conveyer, carrying the lithographed sheets in spaced relationship and slightly inclined position, as shown in Fig. 2, is moved through the drying chamber. It will be noted, in this connection, that the prongs of the conveyer are mounted in such manner as to extend at an angle with respect to the vertical when moving through the oven and this causes the individual sheets to rest against the particular prongs by which they are carried and prevents the coated surfaces from coming into contact with adjacent prongs or sheets.

One pair of the prongs 31 is connected with each of the links 29 so that when the conveyer chain is directed around the sprockets at the end of the oven, the prongs are disposed radially with the outer ends of adjacent prongs in widely separated relationship. The sheets to be dried are delivered by means of a conveyer 41, which is supported at one end upon the frame 21, a sprocket 42 being provided at this end and arranged so that the conveyer extends between the prongs 31 as they are directed around and opened by the sprocket 35. The operation of this conveyer 41 is so timed that one sheet is delivered for each prong

and is lifted and carried by said prong as it turns into the oven. In this manner, an automatic feed is provided which eliminates the necessity of manual delivery of the sheets to the dryer conveyer and which positions them in the conveyer without the likelihood of their being jarred, or having the edges or surfaces thereof in any way damaged.

For the purpose of tightening the conveyer chain 27, I provide a device, illustrated at the left in Fig. 1. A slide 43 carries the sprockets 35 and 36 and is held under the tension of a spring 44 mounted on a rod 45 between said slide and a block 46. The block 46 may be adjusted by a screw operable by a hand wheel 47 and it will be manifest that, upon movement of the sprockets 35 and 36 away from the sprockets 33 and 34, at the opposite end of the conveyer, the chain will be tightened, taking up any slackness which may result from the stretching of the chain in service.

The oven wall at this end is curved downwardly, as indicated at 48, and cut away angularly, as shown at 49, to provide an opening through which the conveyer and sheets may pass without leaving the end of the heating chamber entirely open. It will be manifest that this construction will tend to prevent escape of the heat within the chamber so that a relatively uniform temperature may be maintained and the sheets immediately subjected to this temperature upon entrance into the oven.

For the purpose of heating the air which is circulated through the oven in a manner to be hereinafter described, I provide any suitable heating means, such, for example, as a burner 51. Said burner is served with gas supplied through supply pipes 52, the feed being suitably regulated by valves generally indicated at 53. A thermostat is positioned on the interior of the oven at 50 and is connected to operate the regulating valves in such manner as to control the amount of gas fed to the burner, thus insuring substantially uniform temperature within the oven. A by-pass 60 is provided for independent control of the gas supply. Said burner 51 is disposed in a housing 54, through which the air is directed by a fan 55 driven by a motor 56 and a belt 57, or in any other approved manner. A housing 58 for said fan 55 is mounted upon a frame 59 which extends up at opposite sides of the oven and across the top, providing also a support for the motor 56 and a portion of the housing 54.

A fresh air intake pipe 61 is provided above and slightly to one side of the fan and is mounted in an extension 62 of the oven wall 22. A passageway 63 leads from the intake pipe into the fan housing and the air delivered through said intake pipe and passageway is directed past the burner 51 and into the heating chamber at the top.

An inner shell, or wall part, 64 is arranged within the oven and spaced from the inner wall by means of supporting channel irons 65 and spacing members 66.

The air thus introduced is circulated through the oven in a novel manner, which will now be described and which may be most clearly understood by reference to Fig. 3. The incoming air is directed downwardly in the passageway 67 formed by the inner shell, or casing, 64, as indicated by the arrows in said Fig. 3. It is then introduced at the side through an opening 68, the extent of which may be regulated by a slide 69 and is directed upwardly by a deflector 71 disposed across the passageway 67 and extending upwardly within the opening 68. The circulation in the chamber within the wall 64 follows generally the direction of the arrows in Fig. 3, from which it will be observed that the course is upwardly at one side and down across the sheets 28 and back therebeneath to the opening 68 beneath the deflector 71. From this opening, the course followed is across beneath the lower wall 72 of the casing 64, upwardly through the passageway 67 at the right of Fig. 3, through the pipe 61 and through the lateral passage 63, this outward flow being caused by the suction fan. The lower end 70 of the pipe 61, it will be observed, extends across the passageway 67 and serves to direct the upwardly moving air out of the casing. The air which has thus been circulated through the oven is again directed into the fan housing 58 and in part directed back around the same course, it being understood that the circulation is largely continuous and that the air is kept heated by the burner 51. With the foregoing construction and method of circulating the air, the sheets 28 are subjected to intensified drying heat produced by radiation from the wall 64 and bottom 72, and also by direct circulation of the heated air between said sheets.

A discharge pipe 73 is provided between the fan 55 and the burner 51 and permits the escape of foul air and gases in amount to be hereinafter explained in detail. Said pipe 73 extends through a vent in the roof and is designed to carry off all discharge from the oven and to prevent the escape of any foul air or gases into the room.

I provide a damper control for regulating both the intake and discharge openings in the pipes 61 and 73, respectively, the damper mechanism being illustrated in detail in Fig. 4. Arranged upon the pipe 61 is a damper box 74, in which a damper 75 is positioned and adapted to slide through an opening in the pipe. A similar damper box 76 is arranged upon the pipe 73 and contains a damper 77, which is connected by an adjust-

able connection 78 with the damper 75. The areas of the pipes 61 and 73 are such as to cause proportional variation between the inlet and outlet openings by the movement of the unitary damper mechanism. It will thus be seen that when the intake opening 79 admits a certain amount of air, the outlet opening 81 will allow the escape of an amount which is in predetermined proportion to that admitted and that movement of the damper mechanism toward the left in Fig. 4 will cause an increasing difference between the amount of air entering and escaping. When moved in the opposite direction, this mechanism, which may be called a compound damper or valve, cuts down the outflow in predetermined ratio to the inflow, there being a progressively decreasing difference in the volume passing through the two openings. In this manner, the air pressure at the ends of the oven is kept in approximately balanced condition, preventing the escape of foul air, or the intake of cold air, with the result that the temperature within the oven may be maintained substantially uniform throughout.

As the sheets emerge from the drying chamber through an opening 82 at the right of the oven, as shown in Figs. 1 and 2 they are cooled by means of a blower 83 which draws cool air past the sheets and out through an exhaust pipe 84. The blower may be driven by means of a shaft 85 and a driving belt 86 from any suitable source of power. By means of this device, the sheets are cooled very rapidly so that they are capable of being handled by attendants without the necessity of their being carried a very great distance beyond the heating chamber, there being a consequent reduction in the floor space required for the apparatus.

Sheets are delivered from between the prongs of the conveyer 27 onto a short delivery conveyer 87, from which they are removed and stacked upon a portable support 88, this being accomplished preferably by means of a stacker and flyer arm mounted in a frame 89, this arm and the operation thereof being more particularly illustrated in my co-pending application, Serial No. 611,009, filed on Jan. 6, 1923.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts, without departing from the spirit and scope of the invention, or sacrificing all of the material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. A drying oven, comprising a casing providing a heating chamber, a conveyer adapted to receive lithographed sheets, or the like, in spaced relationship and to move them through said chamber in substantially upright position, a heating wall spaced from said casing and forming therewith an air passage extending substantially around the outer part of said chamber, and means for directing heated air through said passage and causing circulation thereof within said chamber immediately about the sheets on said conveyer.

2. A drying oven, comprising a casing providing a heating chamber, a conveyer adapted to receive lithographed sheets, or the like, in spaced relationship and to move them through said chamber in substantially upright position, a heating wall spaced from said casing and forming therewith an air passage extending substantially around the outer part of said chamber, and means for directing heated air downwardly in said passage at one side, into and through the space immediately around said sheets and thence out and around substantially the remainder of said passageway and out of the casing.

3. A drying oven, comprising a casing providing a heating chamber, a conveyer adapted to receive lithographed sheets, or the like, in spaced relationship and to move them through said chamber in substantially upright position, a heating wall spaced from said casing and forming therewith an air passage extending substantially around the outer part of said chamber, and means for directing heated air through said passage and through the space surrounding the sheet whereby the latter are subjected to the heat radiated from said wall and resultant from the direct currents of air.

4. A drying oven, comprising an outer casing, a shell disposed within said casing and spaced therefrom, a conveyer adapted to carry lithographed sheets or the like through said shell, and means for directing heated air through the passage between said casing and shell and through the space through which said sheets are passed.

5. A drying oven, comprising a casing providing a heating chamber, an endless chain conveyer for conveying lithographed sheets, or the like, through said chamber to be dried, means for causing circulation of heated air within said chamber, and single damper means for proportionately regulating the supply of fresh air to and discharge of foul air from said chamber.

6. A drying oven, comprising a casing providing a heating chamber, an endless chain conveyer for conveying articles to be dried through said chamber, means for supplying heated air in the chamber, means for proportionately regulating the supply of fresh air to and discharge of foul air from said chamber, and means for maintaining the circulation into and out of said chamber

of the heated air which is not replaced by fresh air.

7. A drying oven, comprising a casing, a shell disposed within said casing and spaced therefrom, means for causing circulation of heated air about the outside of and also into said shell, and a conveyer having article-holding means for moving articles to be dried through said shell.

8. A drying oven, comprising a casing, a shell disposed within said casing and spaced therefrom, means for causing circulation of heated air about the outside and within said shell, a conveyer for moving lithographed sheets, or the like, through said shell to be dried, sprockets at opposite ends of the casing about which the conveyer is adapted to be directed, said conveyer comprising a chain with successively arranged prongs secured to individual links thereof whereby said links open in fanlike manner as the chains move about said sprockets, and means for automatically feeding the sheets to be dried between the separated prongs as they are moved about a sprocket.

9. A drying oven, comprising a casing, means for causing a substantially uniform and relatively high temperature in said casing, a conveyer moving through the casing, means for circulating heated air in directions crosswise of the casing and around the conveyer, means for automatically delivering sheets to be dried to said conveyer, and means for cooling the dried sheets as they emerge from the conveyer.

10. A drying oven, comprising an elongated casing, a conveyer adapted to convey lithographed sheets, or the like, through said casing to be dried, means for circulating air about said casing and maintaining the temperature thereof substantially uniform and relatively high, and means for cooling the sheets as they are delivered from said casing.

11. In an oven for drying lithographed sheets and the like, the combination of an outer heat insulated casing, a metal shell disposed within and spaced from said casing, means for conveying sheets to be dried through said shell, and means for causing circulation of heated air around the exterior of said shell and directly about the sheets therewithin.

12. In an oven for drying lithographed sheets and the like, the combination of a casing having an outer heat insulating wall and an inner heating wall spaced therefrom, means for moving the sheets through said casing within said heating wall, and means for heating said wall from without and circulating heated air on the interior thereof immediately about said sheets.

13. A drying oven, comprising an elongated casing, a conveyer for moving lithographed sheets, or the like, through said casing, a housing positioned above said casing and communicating therewith, a burner in said housing, and means for directing air through said housing to be heated and causing circulation of the heated air about said casing.

14. A drying oven, comprising an elongated casing, a conveyer for moving lithographed sheets, or the like, through said casing, a housing positioned above said casing and communicating therewith, a burner in said housing, means for directing air through said housing to be heated and causing circulation of the heated air about said casing, and means for admitting and discharging air from said housing.

15. A drying oven, comprising an elongated casing, a conveyer for moving lithographed sheets, or the like, through said casing, a housing positioned above said casing and communicating therewith, a burner in said housing, means for directing air through said housing to be heated and causing circulation of the heated air about said casing, and means for admitting and discharging air from said housing in predetermined variable proportions.

16. A drying oven, comprising a casing providing a heating chamber, means for conveying lithographed sheets, or the like, through said chamber to be dried, means for causing circulation of heated air through said chamber, and means for causing recirculation of a portion of said air with a substantially continuous flow.

17. A drying oven comprising an elongated casing forming an oven chamber, an endless chain conveyer for moving lithographed sheets or the like through said chamber, a single burner at the upper part of said chamber, and means for directing the heated air through said chamber.

18. A drying oven comprising an elongated casing forming an oven chamber, an endless chain conveyer for moving lithographed sheets or the like through said chamber, a burner at the upper part of said chamber and means for directing the heated air downwardly in said chamber, said air thereafter rising naturally in said chamber and a portion of it being reheated by said burner and again directed downwardly in said chamber.

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