April 5, 1960 J. STRAUSS 2,931,882

DRYING OVEN APPARATUS

Original Filed Feb. 6, 1957 2 Sheets-Sheet 1

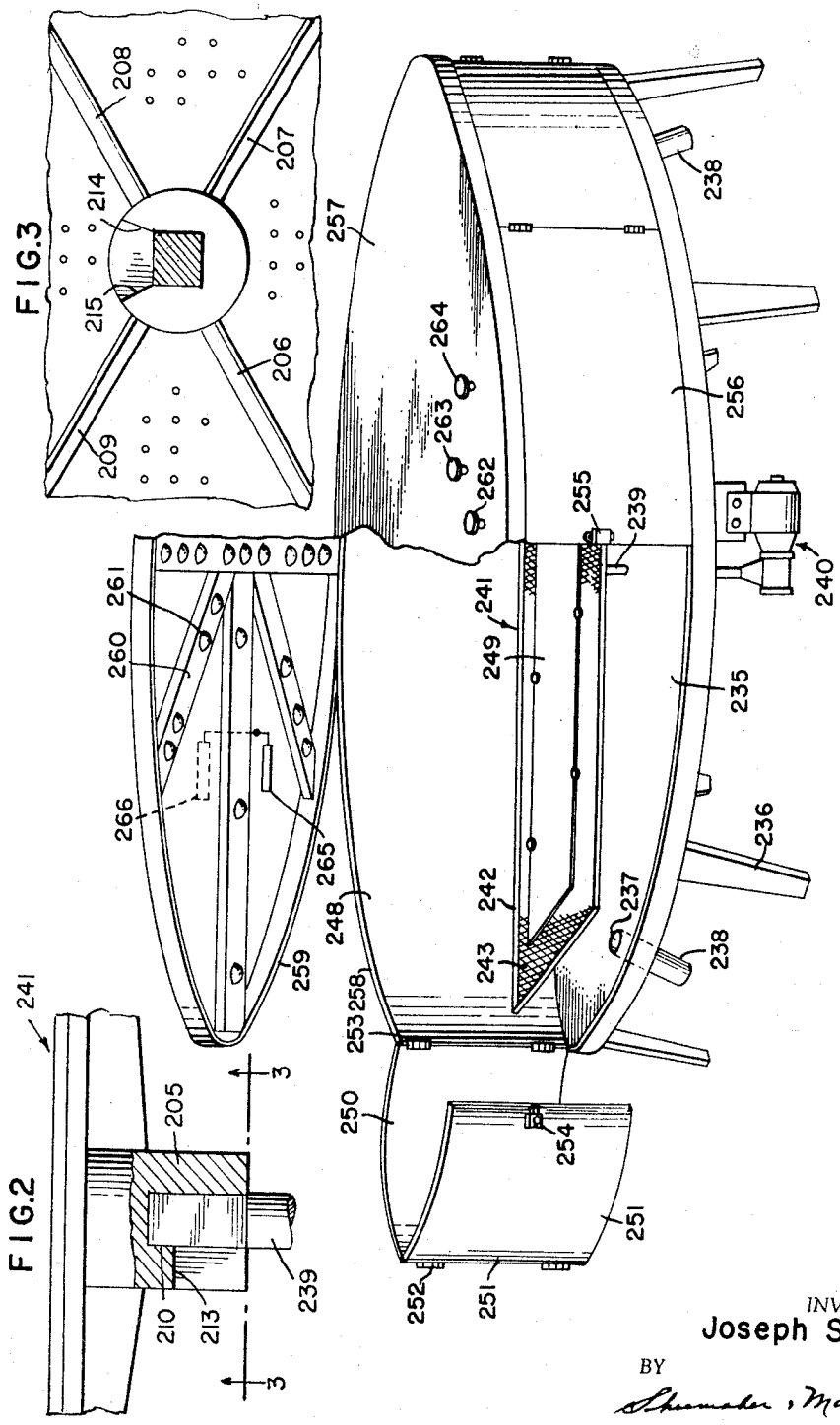


FIG.3

FIG.1

FIG.2

INVENTOR.
Joseph Strauss

BY

Schmeiser, Mattare

ATTORNEYS

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FIG.4

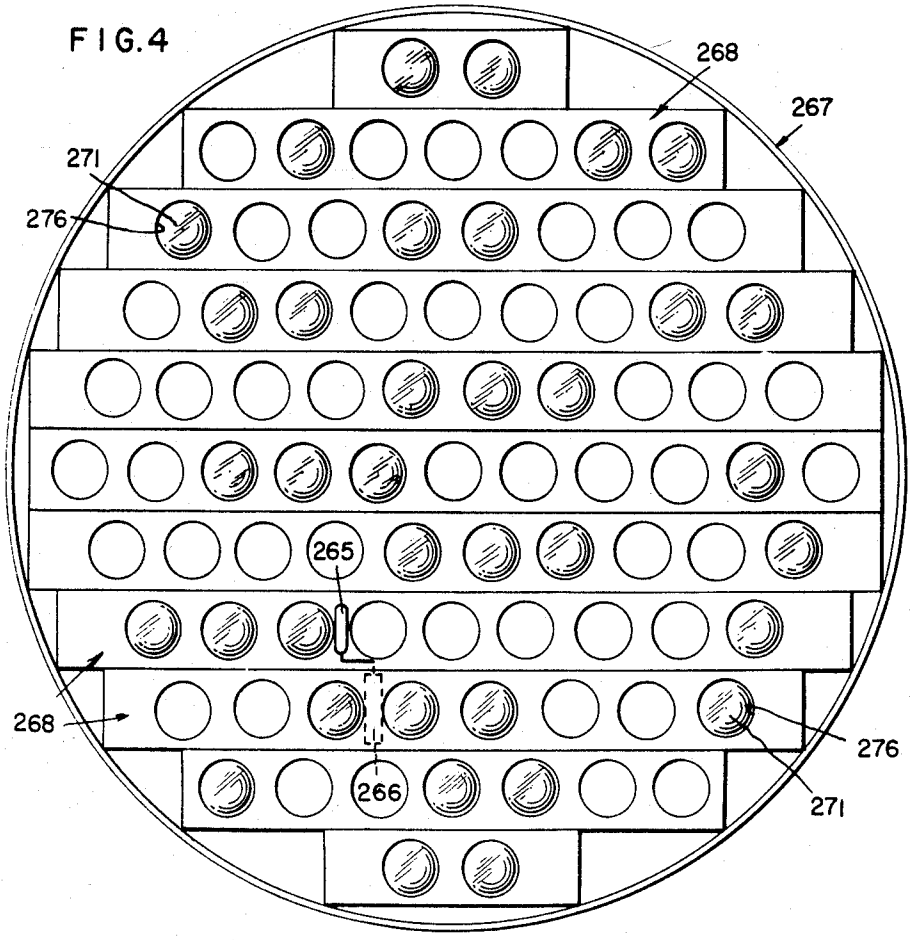


FIG.5

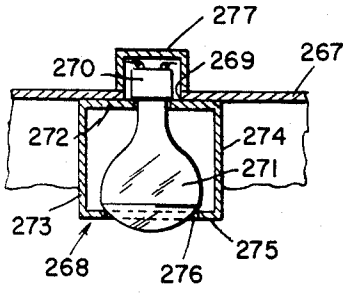
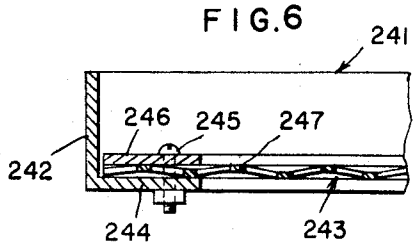


FIG.6



INVENTOR.

Joseph Strauss

BY

Schroeder & Mattare

ATTORNEYS

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DRYING OVEN APPARATUS

Joseph Strauss, Hopewell, N.J., assignor to Trenton Times Corporation, Trenton, N.J., a corporation of Delaware

Original application February 6, 1957, Serial No. 638,509. Divided and this application April 22, 1958, Serial No. 730,185

5 Claims. (Cl. 219—35)

The present invention relates to a new and novel drying oven apparatus, and more particularly to a drying oven especially adapted for use in drying or burning-in operations in connection with printing plates and the like.

The present application is a division of U.S. patent application Serial No. 638,509, filed February 6, 1957.

The present invention has general utility for performing drying operations, but is particularly suited for drying printing plates formed, for example, of magnesium in carrying out drying or burning-in operations on such plates as disclosed in my copending application Serial No. 638,509. When drying operations are performed on magnesium plates, distortion or buckling of the plates is a serious problem. Prior art ovens utilized for drying printing plates subject the plates to non-uniform heating producing undesirable results. In addition, prior art constructions allow foreign material and dust to settle into the interior of the oven. This is highly disadvantageous when magnesium plates having a cold-top enamel surface are dried in the oven apparatus since this type of a surface is especially prone to accumulate foreign matter.

The present invention employs a structure wherein the disadvantages of the prior art are overcome. The printing plates are supported within the invention oven upon a support assembly including a main body portion of mesh-like configuration whereby a small area of the surface of the printing plate is in contact with the body portion. In this manner the printing plate is uniformly heated, and the heat transferred from the plate to the supporting body is minimized. The invention oven apparatus is also constructed so as to have a rigid top and a plurality of hinged door members which enable the front portion of the oven to be opened. In this manner the support assembly and the associated printing plate may be inserted horizontally through the front portion of the oven. The printing plate will be protected at all times by the rigid top of the oven, thereby substantially eliminating the possibility of foreign material or dust accumulating on the soft cold-top enamel of a magnesium plate or the like.

An object of the present invention is the provision of a new and novel drying oven apparatus which is especially adapted for performing drying or burning-in operations with magnesium plates having a soft cold-top enamel surface thereon.

Another object of the present invention is the provision of a drying oven apparatus which provides substantially uniform heating to a printing plate or the like.

A further object of the present invention is to provide a drying oven wherein the accumulation of dust or foreign matter therein is minimized.

A still further object of the present invention is to provide an oven apparatus which is simple and inexpensive, yet efficient and reliable in operation.

Other objects and many attendant advantages of the present invention will become more apparent when considered in connection with the accompanying specification and drawings wherein:

Fig. 1 is a perspective view of the drying oven with a portion of the top broken away and elevated to more clearly illustrate details of internal construction;

Fig. 2 is an enlarged sectional view of the support assembly mounting means;

Fig. 3 is a sectional view, taken on line 3—3 of Fig. 2, looking in the direction of the arrows;

Fig. 4 is a plan view of the heating element system embodied in the burning-in oven top;

Fig. 5 is an enlarged sectional view illustrating details of the oven heating elements; and

Fig. 6 is an enlarged sectional view showing a portion of the supporting bed for the burning-in oven.

Referring now to the drawings wherein like reference characters designate corresponding parts throughout the several views, Fig. 1 illustrates the construction of a special drying oven utilized in practicing the novel method for preparing magnesium plates as disclosed in my copending U.S. patent application Serial No. 638,509. In this figure, the drying oven will be seen to include a generally flat bottom wall **235** supported by a suitable number of legs **236** and having one or more drain openings **237** therein having drain pipes **238** issuing therefrom for a purpose which will be presently apparent. Projecting upwardly through the center of the bottom wall **235** is a drive shaft **239** driven by a suitable gear box and motor assembly indicated generally by the reference character **240** located beneath the bottom wall **235**. A support assembly **241** is mounted upon the upper end of drive shaft **239** in a novel manner. As seen most clearly in Fig. 2, a hub **205** is secured to the lower portion of the support assembly and is provided with a bore **210** of non-circular cross section, shown as being square, bore **210** receiving the upper end of drive shaft **239** which is also of complementary square configuration and is received within bore **210**. Hub **205** is also provided with a notch **213**, the side walls **214** and **215** of which flare outwardly from the bore **210**. The notch, as seen most clearly in Fig. 2, is not as deep as the bore **210** so that when the support assembly is engaged upon the upper end of drive shaft **239**, the upper end of the shaft will be firmly seated within the square socket portion defined by the bore **210** above notch **213**, and the support assembly, due to its weight and the printing plate mounted thereon, will accordingly be locked upon the upper end of the drive shaft.

The purpose of notch **213** is to permit the support assembly to be easily engaged with the upper portion of the drive shaft since the divergent walls **214** and **215** serve as a guide for the upper end of the shaft as the support assembly is moved horizontally into engagement therewith until the parts are aligned so that the support assembly drops down as the blind socket portion in the hub aligns with and receives the upper end of the drive shaft **239**.

The support assembly **241** includes a rigid bordering frame **242** which is connected at the four corners thereof to ribs **206**, **207**, **208**, and **209** radiating outwardly from the hub as seen most clearly in Fig. 3. These ribs may be of conventional angle type, or any other suitable shape as desired. The rigid bordering frame **242** supports a main body portion formed of suitable mesh-like material **243** which preferably is constructed of stainless steel and is of the type which is conventionally referred to as "expanded metal."

The construction of this expanded metal and the rigid bordering frame is shown more clearly in Fig. 6 wherein an enlarged cross section through a portion of the support assembly **241** is illustrated. In this figure, it

will be seen that the bordering frame 241 is preferably of angle configuration with the lower horizontal leg 244 thereof serving to edge support the expanded metal 243. This leg portion 244 is provided with a series of openings to receive fasteners 245 which serve to clamp the edge portions of the expanded metal 243 between the previously mentioned leg 244 and the overlying strip 246 as shown. The expanded metal has the advantage of providing relatively widely spaced supporting points 247 which are relatively widely spaced and contact very little surface area of the supported magnesium plate. By this construction, there is less likelihood of distortion or buckling of the magnesium plate when the same is subjected to heat within the drying oven since the plate will be uniformly heated rather than being subjected to a non-uniform heating effect as would be occasioned where large surface area portions of the plate contact with the metal of the support assembly 241, causing a great deal of heat to be transferred from the plate to the support assembly in those portions in which the two are in contact. This excessive heat transfer is largely obviated by the use of the expanded metal construction since a very small percentage of the surface of the magnesium plate is actually in contact with the expanded metal body.

Referring back to Fig. 1, the oven apparatus is provided with a fixed back wall 248 which is upstanding from the bottom wall 235 and rigidly affixed thereto. Preferably, the back wall 248 extends throughout less than half the total circumference of the bottom wall 235 to permit free and ready access to the interior of the oven and to permit the support assembly 241 and its boss to be easily engaged with the drive shaft 239.

The front portion of the side wall of the oven is constructed so as to form a plurality of hinged door members which will enable the entire front portion of the oven to be opened to allow the support assembly 241, and the associated plate 249 to be placed in the interior of the oven. Preferably, each door is of the same length and is divided into two portions hingedly connected together as is indicated by the reference characters 250 and 251 in Fig. 1, the point of pivotal connection between these sections being indicated by the hinges 252. The rear edge of the section 250 is hinged to the leading edge of the back wall portion 248 by means of hinges 253 and the free edge of the front section 251 is provided with a suitable latch assembly 254 which cooperates with the latch assembly 255 on the section 256 of the other door assembly so that the two may be joined and held in closed position.

The oven also includes a rigid top member 257 which is fixed to the upper edge 258 of the back wall 248, although in Fig. 1 a portion of the top has been shown broken away from the remainder and lifted up to illustrate details of the heating element construction. It is to be understood that in actual practice the top will be at all times rigid with the back wall 248 and in that position shown in the right hand portion of Fig. 1. The reason for this is that the drying oven is particularly useful in drying the resist image and by providing a fixed top and inserting the support assembly 241 and the associated plate 249 horizontally through the front of the assembly, the presence of dust is largely eliminated and there is little chance for foreign material and dust to accumulate on the still soft cold-top enamel. In conventional constructions of this type, the lid or top is hinged so as to swing up to permit the plate to placed inside the oven and then the lid is swung down to close the oven. This type of conventional construction is prone to admit a great deal of foreign material into the interior of the oven and actually the act of closing the cover tends to forcibly project foreign material onto the cold-top enamel surface.

The top 257 is preferably provided with a rigidifying, circumferential, depending rib 259, the lower edge of which is fixed to the previously mentioned upper edge 258 of the back wall 248 and fixed to the undersurface of the top 257 are a series of heating units such as that indicated by the reference character 260. For the purpose of heating the oven, it is preferred that the arrangement of heating units 260 be substantially as is shown in Fig. 1 wherein the elements 261 designate heating bulbs or lamps.

The particular arrangement of the heating units 260 and the number of heating elements 261 embodied therein is, of course, determined by the amount of heat required to properly dry the cold top on the plates, while at the same time maintain the temperature at such a point as not to bake the enamel or dry it beyond the point which will permit it to readily take on the ink top when the latter is applied. Operating in conjunction with the particular number and arrangement of heating units, are certain control elements designated by the reference characters 262, 263 and 264 which are preferably, as shown, mounted on the top of the oven assembly so as to be readily accessible. These control elements include a starting or off and on switch 262, a temperature control 263 and a r.p.m. control 264. The temperature control element 263 is connected with the heating units and controls the amount of energy applied thereto, whereas the r.p.m. control 264 is similarly connected to the motor and gear box assembly 240 for controlling the same. Also operating in connection with the heating units is a thermostatic control mechanism including a bulb 265 mounted in a suitable manner on the undersurface of the top 257 and a control switch 266 preferably mounted on the upper face of the top 257. The purpose of the thermostatic control is to shut off the heating units should a prescribed temperature be reached.

All of these control elements operate cumulatively to produce the desired results. That is, the r.p.m. in conjunction with the heat control operates to produce an even and uniform drying action on the plate 249 and the cold-top solution applied thereto. For this purpose, it is preferred that the r.p.m. control be set to rotate the plate initially at about 90 to 95 r.p.m. for 30 seconds with the heat control set at approximately 95° F. The r.p.m. control is then adjusted to approximately 70 r.p.m. for 1 minute, then reduced to about 30 r.p.m. for 2 minutes and finally to about 6 to 8 r.p.m. for not less than 15 minutes. This procedure produces a uniformly and properly dried magnesium plate having a cold-top enamel surface.

Referring now more particularly to Fig. 4, a modified form of top assembly is shown which is to be utilized in conjunction with burning-in operations, that is, for fusing the etching powder of a plate when necessary. In this case, the top, which is indicated generally by the reference character 267 and which is constructed identically with that described in connection with Fig. 1, is provided with a far greater number of heating units 268 than the assembly shown and described in connection with Fig. 1. The reason, of course, is that for the burning-in operations, a much greater amount of heat is required to produce the proper results, although the principle of operation remains the same. Each of the heating units 268 as well as those previously mentioned and indicated by the reference character 260 are formed in a manner shown most clearly in Fig. 5 wherein the top 267 will be seen to be provided with slots 269 through which socket members 270 project for receiving the bulbs 271. Each of the heating units 268 includes a base portion 272 affixed to the undersurface of the top and a removable cover portion formed of the two side walls 273 and 274 and the associated bottom wall member 275 which is provided with circular openings 276 through which the lower portions of the individual bulbs 271 project. The sockets 270 are carried by the base portion 272 and the sockets themselves are provided with a covering member 277 which is preferred to be of the removable type for ease of servicing.

When the oven apparatus as disclosed in Fig. 4 is employed in a burning-in operation, the plate is first powdered in a conventional manner. In the method as disclosed in my aforementioned copending application, the burning-in oven is energized for 45 seconds while the temperature inside the oven is controlled by a thermostat at approximately 140° F. while the plate is rotated at a speed of approximately 1 r.p.m. This procedure will produce a very even burning-in and the etching powder will be fused properly and to the correct degree against the powdered side of the plate when using magnesium plates or the like.

It is apparent from the foregoing that there is provided a new and novel oven apparatus for drying or burning-in operations which is especially adapted for use with magnesium printing plates having a cold-top enamel surface. The apparatus provides a substantially uniform heating of plates utilized therewith, and minimizes the accumulation of dust or foreign material therein. The apparatus is simple and inexpensive in construction, yet efficient and reliable in operation.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, and since the scope of the invention is defined by the appended claims, all changes that fall within the metes and bounds of the claims or that form their functional as well as conjointly cooperative equivalents are therefore intended to be embraced by those claims.

I claim:

1. A drying or burning-in oven for use in making printing plates, comprising a housing having vertically spaced bottom and top walls, vertical side walls rigidly fixing the top and bottom walls with respect to each other, a substantial portion of said side walls being hinged to the remaining portion thereof to form a swingable closure gaining access into the interior of said housing, a horizontal support disposed within said housing, means for rotatably mounting said support within said housing for rotation about a vertical axis therein, and a plurality of heating units mounted on the undersurface of said top wall, the means for rotatably mounting said support comprising a rotatable shaft projecting vertically upwardly into said housing and terminating in a squared upper end, said support having a hub fixed to its undersurface and provided with a square recess receiving the upper end of said shaft, said hub having a horizontal notch therein opening upon the lower end of the hub and extending vertically therefrom to terminate short of the upper end of said hub recess, providing a horizontal entrance opening into said recess so that the support may be slid horizontally into engagement with said shaft while retaining a socket-like portion of the recess above the notch to fixedly receive the upper end of said shaft, the opposite sides of said notch being divergent outwardly from the recess to guide said shaft into the recess.

2. A drying or burning-in oven for use in making printing plates comprising a housing having vertically spaced bottom and top walls, vertical side walls rigidly fixing the top and bottom walls with respect to each other, a substantial portion of said side walls being hinged to the remaining portion thereof to form a swingable closure providing access into the interior of said housing, a substantially horizontal support disposed within said housing, said support including a rigid border frame and a substantially open main body portion within and fixed to said border frame, said main body portion comprising expanded metal to provide relatively widely and equidistantly spaced coplanar portions of small area to support a printing plate resting thereon to obviate appreciable conductive transfer of heat from the plate and to provide a substantially uniform heat distribution within the plate, a substantially vertically extending drive shaft rotatably mounted within said oven, means connected to said drive shaft within said oven, means connected to said drive shaft for selectively driving the drive shaft at predetermined speeds of rotation, means removably securing said support to the upper portion of said drive shaft, and a plurality of heating units mounted on the undersurface of said top wall.

3. An oven as defined in claim 2 wherein said side wall portion defining the access closure into said housing comprises greater than half the extent of said side wall.

4. An oven as defined in claim 2 wherein said closure portion of the side wall includes four separate elements, one of said elements being hingedly connected to each of the opposite edge portions of the remaining side wall portion, the other two separate elements each being hingedly connected to said one separate elements and being adapted to be positioned in abutting relationship to seal the interior of the oven, said closure portion comprising greater than half the extent of said side wall.

5. A drying or burning-in oven for use in making printing plates comprising a substantially cylindrical housing having vertically spaced bottom and top walls, a vertical side wall rigidly connected between said top and bottom walls, a major portion of said side wall comprising a closure means, said closure means including a plurality of sections hingedly connected to one another whereby said closure section may be completely opened for gaining access into the interior of said housing, a substantially horizontally disposed support means within said housing, said support means including a hub portion, a rigid border frame and a substantially open main body portion within and fixed to said border frame, said main body portion comprising expanded metal to provide relatively widely and equidistantly spaced coplanar portions of small area to support a printing plate resting thereon to obviate appreciable conductive transfer of heat from the plate and to provide a substantially uniform heat distribution within the plate, a substantially vertically extending drive shaft rotatably mounted within said oven, means connected to said drive shaft for selectively driving the drive shaft at predetermined speeds of rotation, means removably securing said support means to the upper portion of said drive shaft, and heating means secured to the undersurface of said top wall for applying a substantially uniform heat to the interior of said oven.

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