

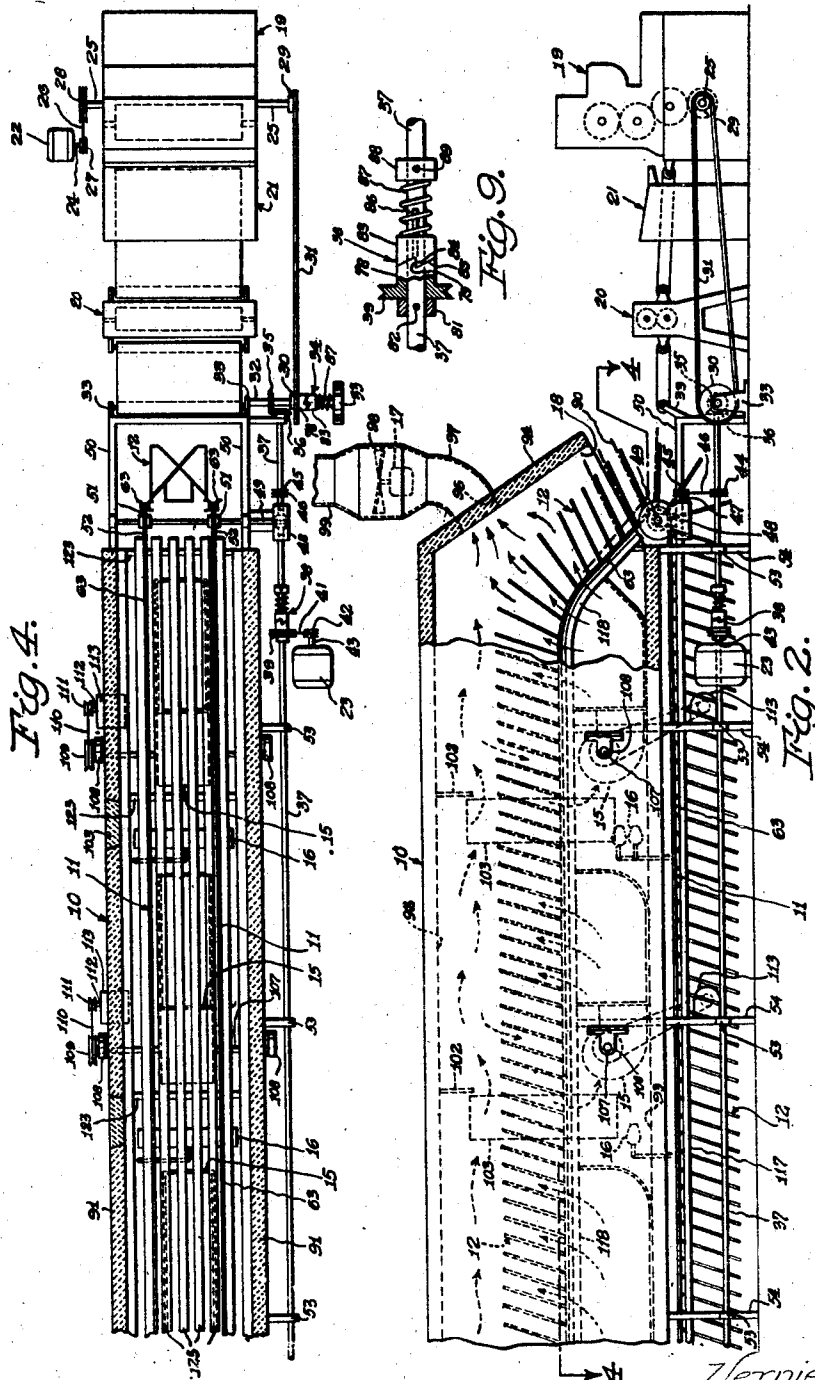
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CONTROL SYSTEM AND MECHANISM FOR HEAT PROCESSING MACHINES

Original Filed Feb. 20, 1942 4 Sheets-Sheet 2



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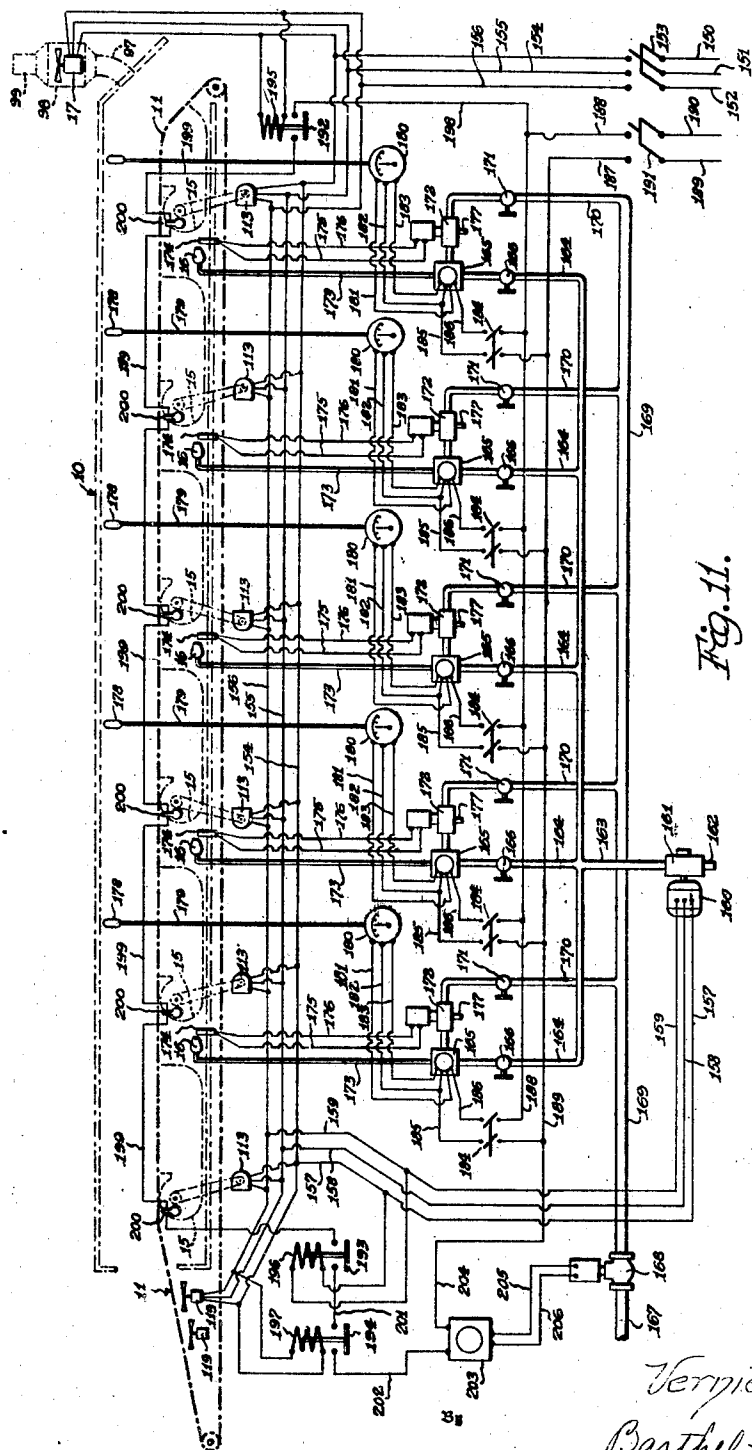


Fig. 11.

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UNITED STATES PATENT OFFICE

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CONTROL SYSTEM AND MECHANISM FOR
HEAT PROCESSING MACHINES

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432,541. Divided and this application February
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19 Claims. (Cl. 263—8)

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This invention relates to heat processing machines, and in particular to conveyor-type heat processing machines.

One object of this invention is to provide a heat processing machine for automatically conveying and heat-processing sheets or plates of material such as lithographed plates.

Another object is to provide a heat processing machine wherein the sheets of material to be heated are conveyed in carriers through an oven wherein they are subjected to heated air currents proceeding upwardly and downwardly in a zigzag path in the opposite direction to the direction of travel of the sheets.

Another object is to provide a heat processing machine with an endless conveyor which is normally driven from a source of power which also drives other machinery, such as coating and/or printing machinery, automatic means being provided for connecting in an auxiliary source of power when this machinery ceases operation.

Another object is to provide a heat processing machine having an oven into which articles are conveyed upwardly at the inlet and downwardly toward the outlet, thereby conserving heat by reducing the escape of the heated air normally occupying the upper portions of the oven.

Another object is to provide a heat processing machine as set forth in the previous object wherein means is provided at the outlet end of the machine for momentarily advancing the lower edge of the sheet faster than the upper edge so that when the sheet falls as it nears the end of the conveyor it will not be damaged by slicing or buckling.

Another object is to provide a heat processing machine having a travelling conveyor with sheet carriers spaced at intervals therealong, these sheet carriers being constructed and arranged with elongated central supports to convey either large or small sheets without leaving the lower edge unsupported at its ends.

Another object is to provide a heat processing machine including an oven having an air circulating system and a heating system, automatic means being provided for delaying the starting of the heating system a predetermined time period after the starting of the air circulating system, so that all explosive or inflammable gases will be automatically cleared out of the oven before heating commences.

Another object is to provide a carrier for sheets of material consisting of a framework of rods or bars adapted to be carried by a conveyor and having provisions for leaving portions of the

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lower edge accessible for engagement by other portions of the machine yet providing an elongated central support for several different sizes of sheets or plates.

Another object is to provide a heat processing machine as set forth in the preceding objects wherein cooling devices are provided adjacent the outlet of the machine for cooling the heated sheets or plates being processed by the machine.

In the drawings:

Figure 1 is a side elevation, partly in section, of the outlet end of a heat processing machine according to a preferred embodiment of the present invention;

Figure 2 is a view similar to Figure 1, but showing the inlet end and adjacent machinery;

Figure 3 is a horizontal section along the line 3—3 in Figure 1, with the sheet carriers removed to disclose the construction more clearly;

Figure 4 is a horizontal section similar to Figure 3 but taken along the line 4—4 in Figure 2;

Figure 5 is a cross section along the line 5—5 in Figure 1;

Figure 6 is a side elevation of a portion of a conveyor chain with the sheet carriers mounted thereon;

Figure 7 is a horizontal section along the line 7—7 in Figure 6;

Figure 8 is a vertical section along the line 8—8 in Figure 6;

Figure 9 is a detailed view of the clutch shown in the lower central portion of Figures 2 and 4;

Figure 10 is a diagrammatic side elevation of the conveyor at the outlet end of the machine, showing the means whereby the lower edge of the sheet or plate is momentarily advanced more rapidly than the upper edge so as to make it fall without injury; and

Figure 11 is a circuit diagram of the electrical, fuel and air circulation systems.

General arrangement

In general, the heat processing machine of this invention includes an oven within downwardly-inclined ends for conserving heated air which is circulated through the oven by fans or blowers. An endless conveyor moves through the oven and is provided with spaced sheet carriers at intervals therealong. The sheet carriers consist of open frames (Figure 5) having gaps at the bottom thereof to permit engagement of the sheet with other conveying apparatus yet having a downwardly depending central support for the mid-portion of the lower edge of a large sheet or the end portion of a small sheet, thereby

adapting the conveyor for conveying various sizes of sheets without changing the sheet carriers.

The machine conveyor is normally driven from a main motor which also drives other processing machinery, such as printing and/or coating machines. Such printing and coating machines are employed where it is desired to imprint a design or message upon the sheets, and preferably to varnish these, the oven being employed to dry the sheets after they have been thus treated. An auxiliary motor is also provided for driving the conveyor, together with automatically operative mechanism which immediately connects the auxiliary motor when the main motor is halted, thereby permitting the printing and/or coating machine to be operated intermittently while the conveyor operates continuously over a given period of time.

The spacing of the carriers along the conveyors and the mounting of the carriers at their opposite ends on a pair of parallel conveyors enables the central portions to be maintained comparatively free from obstructions. Heaters and blowers are provided for circulating heated air upward and downward between the sheets on their carriers in a zigzag path, this heated air being finally exhausted from the oven by an exhaust fan located near the inlet of the oven, thereby causing the heated air to travel in the opposite direction to the conveyor and sheets. An electrical circuit is provided whereby the heaters are delayed from starting in operation a predetermined time after the fans are started, so that the latter may remove any inflammable gases which may have collected within the oven, thereby preventing accidental fires or explosions from such gases being ignited by the heaters. Cooling fans are provided adjacent the outlet of the machine for cooling the sheets so that they may be removed by hand if desired.

An auxiliary conveyor is provided at the outlet end of the machine for temporarily moving the lower edges of the sheets ahead of the upper edges, so that as the carriers swing downward at the ends of the conveyor, the sheets will fall gently and without shock, thereby preventing damage to the sheets and possible injury to the machine and operators. A withdrawal conveyor is provided adjacent this auxiliary conveyor for carrying away the sheets as they are unloaded from the oven conveyor.

Machine driving mechanism

Referring to the drawings in detail, Figures 1 to 4 inclusive show the heat processing machine of this invention as consisting of an oven generally designated 10 containing an endless conveyor generally designated 11 having sheet carriers generally designated 12 mounted thereon and moving in an orbital path. An auxiliary conveyor, generally designated 13 and a withdrawal conveyor generally designated 14 are provided adjacent the left-hand or outlet end of the machine (Figures 1 and 3). Air circulation fans 15 are provided for circulating air heated by burners 16 through the spaces between the sheet carriers 12 and in a direction opposite the direction of travel of the conveyor 11 toward an exhaust fan 17 located near the inlet 18 of the oven 10 (Figure 2).

Also located adjacent the oven inlet 18 is a printing machine 19, a coating machine 20 and a feeder 21 located therebetween. The machines 19, 20 and 21 in themselves form no part of the present invention, except as to their main driv-

ing motor 22 which cooperates with an auxiliary driving motor 23 to drive the machines 19, 20 and 21 together with the conveyor 11 by the motor 22, or optionally to drive the conveyor 11 alone by means of the auxiliary motor 23. The drive from the main motor shaft 24 is conveyed to the shaft 25 of the machine 19 by a belt or chain 26 interconnecting the pulleys or sprocket 27 and 28 (Figure 4).

The shaft 25 carries a pulley or sprocket 29 which drives a pulley or sprocket 30 by means of a chain or belt 31. The sprocket or pulley 30 is loosely mounted upon a shaft 32 mounted in brackets 33 and drives the shaft 32 through a jaw clutch 34. The shaft 32 carries a bevel gear 35 meshing with a bevel gear 36 mounted on a shaft 37. The latter is connected by means of a jaw clutch 38 to the auxiliary driving motor 23 by means of a sprocket or pulley 39 mounted loosely upon the shaft 37. The shaft 37 extends lengthwise of the machine and the pulley or sprocket 39 is driven by a chain or belt 41 from a pulley or sprocket 42 mounted on the shaft 43 of the auxiliary motor 23. The shaft 37 also carries a sprocket or pulley 44 driving a sprocket or pulley 45 by means of a chain or belt 46. The sprocket or pulley 45 is mounted upon the input shaft 47 of a reduction gear set 48, the output shaft 49 of which is mounted transversely in the machine frame members 50 and carries a pair of sprockets 51 meshing with the conveyor chains 52. The shaft 37 (Figure 1) is rotatably supported in brackets 53 mounted on the oven supports 54 and upon the outlet support 55, and at its outer end carries a sprocket or pulley 56 driving a sprocket or pulley 57 by means of a chain or belt 58. The sprocket or pulley 57 is mounted upon the input shaft 59 of a reduction gear set 60, the output shaft 61 of which carries a pair of sprockets 62 driving the outlet ends of the main conveyor chains 63 of the conveyor 11, the inlet ends of which are driven by the sprockets 51 upon the shaft 49. The shaft 61 is likewise mounted transversely upon the outlet frame members 64. The shaft 62 also carries a pair of auxiliary conveyor sprockets 65 driving the sprockets 66 upon the shaft 67 by means of the belts or sprocket chains 68 of the auxiliary conveyor 13 (Figure 3). The auxiliary conveyor shaft 67 is mounted in brackets 69 supported upon the outlet frame members 64. The latter also carry brackets 70 rotatably supporting the shafts 71 carrying pulleys or sprockets 72 driving the belts or chains 73 of the withdrawal conveyor 14. The latter is also provided with an intermediate sprocket or pulley 74 mounted upon a shaft 75 (Figure 10) supported in brackets 76 and driving an intermediate belt or chain 77.

The jaw clutches 34 and 38 are of similar construction in that they are arranged to drive their particular shaft in one direction and to slip relatively thereto in the opposite direction. Accordingly a single description suffices for each of the clutches 34 and 38 (Figure 9), the clutch 38 being selected for this purpose. The clutch 38 consists of a driving member 78 connected to the pulley 39 and having jaw portions 79 interconnected by inclined portions 80. The pulley 79 is loosely rotatable upon the shaft 37, and seats against a collar 81 pinned as at 82 to the shaft 37. Cooperating with the clutch member 78 is a clutch member 83 having driving shoulders or jaws 84 interconnected by inclined portions 85, the clutch member 83 being keyed or splined to the shaft 37 as at 86 so as to be slidable longitudinally along

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the shaft 37 by means of a spring 87 seated against a collar 88 pinned as at 89 to the shaft 37. In this manner each clutch 34 or 38 drives its shaft 32 or 37 in one direction but slips and clicks without driving connection when the drive is in the opposite direction.

The purpose of the clutches 34 and 38, as described in connection with the operation of the machine, is to permit the conveyor 11 to be driven normally by the main driving motor 22 when the machines 19 and 20 are in operation, yet to permit the auxiliary driving motor 23 to drive the conveyor 11 when the main driving motor 22 is halted and the machines 19 and 20 are shut down. In this way the sheets or plates 90 (Figure 10) which have been printed and possibly coated are carried through the oven 10 and dried even after the machines 19 and 20 and their driving motor 22 have ceased operation.

Oven construction

The oven 10 is an elongated box-like structure with side walls 91 (Figures 3 and 5), a top 92 and a bottom 93. The oven also has inlet and outlet ends 94 and 96 respectively (Figures 1 and 2). The inlet end 94 for the purpose of conserving heat is directed downwardly toward the inlet 18. The inlet end 94 is provided with a port 96 communicating with the conduit 97 in a casing 98 containing the exhaust fan 17 for creating a suction to remove air which has traversed the oven and to discharge this air into the discharge conduit 99.

The outlet end 95 of the oven 10 (Figure 1) is provided with an outlet 100 communicating with a hood or vestibule 101 likewise for the purpose of conserving heat and minimizing the escape of the heated air. Baffles 102 are distributed at intervals along the interior of the oven 10 for impeding the direct passage of the air from one end of the oven to the other so as to force it downwardly between the sheets 90 as they are carried along by the conveyor 11 upon the carriers 12. One of the walls 91 of the oven is provided with doors 103 for permitting access to the burners 16 and other portions of the interior of the machine.

The burners 16 are shown as gas burners but other types may obviously be employed. The air heated by the burners is circulated by the fans or blowers 15, which are located in casings 104 having inlets 105 and outlets 106. The blowers 15 are operated by shafts 107 mounted in brackets 108 (Figure 5) secured to the walls 91. The shafts 107 carry pulleys 109 driven by belts 110 from pulleys 111 upon the shafts 112 of motors 113. The latter are mounted upon brackets 114 beneath the longitudinal frame members 115 interconnecting the oven supports 54. The brackets 114 are also matched by corresponding brackets 116 on the opposite side of the machine (Figure 5) and these together support the angle guide rails 117 upon which the conveyor chain 63 travels on its return path.

The interior of the oven is likewise provided with angle guide rails 118 which support the conveyor 63 in its travel through the oven, and these guide rails 118 are inclined downwardly at the opposite ends of the oven. Cooling fan motors 119 provided with fans 120 in casings 121 are located near the outlet end 95 of the oven so as to cool the sheets or plates 90 as they emerge from the vestibule or hood 101.

Near the oven outlet 100 the guide rails 118 are supported by a cross member 122 and elsewhere within the oven by cross members 123 (Figure 5).

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The latter are connected to longitudinal angle members 124 and also carry spaced longitudinal members 125 between which the air may circulate freely.

Conveyor and carrier construction

The conveyor 11 and carriers 12 include the conveyor chains 63 mounted upon the guide rails 118 and 117 as previously described. The conveyor chains 63 consist of links 126 and 127 pivotally connected to pivot pins 128 carrying rollers 129 which roll along the top edges of the guide rails 117 and 118. The pivot pins 128 are provided on one side with heads 129 and on the other side are held in place by cotter pins 130. Mounted adjacent the links 127 are angle members 131 which extend out over the links 127 and provide rests for the lower edges of the sheets or plates 90 which form the work pieces handled by the machine. Adjacent the opposite links 126 are mounted channel members 132 having aligned apertures 133 and 134 (Figure 8) through which pass the side portions 135 of the carriers 12. These side portions 135 are bifurcated as at 136 and spread apart after their insertion so as to prevent their accidental withdrawal.

The side portions 135 are bent inwardly to form top portions 136 and 137. The top portion 137 is bent downwardly in a diagonal portion 138 (Figure 5) to the portion 135 in any suitable way, as by spot welding. The top portion 136 is bent diagonally downwardly in a portion 140 which is secured at the top portion 141 to the diagonal portion 138. A diagonal portion 142, also secured at the top portion 143 to the diagonal portion 138, continues downwardly to a junction at the top portion 144 with the other side member 135. Secured at its opposite ends 145 to the diagonal members 138 and 142 is a U-shaped downwardly-extending frame 146 having side portions 147 and a cross portion 148 at the bottom thereof. Secured to the bottom portion 148 at the corners of the frame 146 are sheet supports 149. The sheet supports are inclined upwardly as at 149a (Figure 6) and serve to support the lower edges of the sheets 90.

The carriers 12 are thus spaced at intervals along the chain 63 and are inclined upwardly so that the sheets or plates 90 rest in inclined positions as they travel through the oven (Figure 6). The downwardly extending frame 146 with its supports 149 enables sheets smaller than the maximum size sheets to be conveyed, hence there is no necessity for changing the carriers 12 for different sizes of sheets. Moreover, the open spaces between the side members 135 and 146 permit the lower edges of the plates to be engaged by the auxiliary conveyor 63 (Figure 10) which passes through these spaces and serves to advance the lower edges of the sheets 90 ahead of their upper edges as previously described above.

Heating, driving, and air circulating systems

Figure 11 shows diagrammatically the system whereby the various motors are energized and the various burners and blowers controlled. The system consists broadly of an electrical circuit for energizing the various blower motors 17, 113 and 119, a fuel supply system consisting of piping controlled by a magnetically operated master valve and magnetically operated burner valves, and an electrical safety circuit controlled by thermostatic switches so that the gas burner valves remain open only while the temperature is high

and close when the temperature drops. A time-delay relay inserted in the circuit of the master magnetic valve delays the opening of this valve until the blower motors 113 have been in operation a predetermined length of time so as to clear the oven of inflammable or explosive gases before the burners can be ignited.

In particular, the electrical system consists of power current supply lines 150 to 152 having a single throw switch 153. This controls the energization of the blower motor energization lines 154, 155 and 156 leading to the blower motors 113 and 119 and also to the exhaust fan motor 17. Consequently when the switch 153 is closed, the blower motors 17, 113 and 119 start in operation, permitting the blowers to clear the interior of the oven of all explosive gases. Leading from the power lines 154, 155 and 156 are auxiliary power lines 157, 158 and 159 for energizing the air compressor motor 160 which operates the air compressor 161. The latter has an intake 162 and a discharge conduit 163 leading by branch lines 164 to electrically controlled proportional mixers 165 from the gas supply line 167 by way of the magnetically operated valve 168, the gas supply line 169, the branch lines 170, the manual gas valves 171 and the magnetically operated gas valves 172. From the proportional mixers 165 the conduits 173 lead to the burners 16. Associated with each burner 16 is a thermocouple 174 which generates current when it is heated by the burner 16. This current is conveyed through the lines 175 and 176 to the operating coil of the normally closed gas valve 172 to maintain it open while the burners 16 are alight but to permit the gas valves 172 to close when the burners are not lighted. The normally closed magnetic valves 172 are provided with manually operated valve members 177 by which the valves 172 may be manually opened when the burners 16 are ignited.

The proportional mixers 165 are under the control of thermostatic bulbs 178 connected by the lines 179 to the temperature control instruments 180 which in turn are connected by the lines 181, 182 and 183 to the proportional mixers 165. The latter are likewise under the control of the switches 184 connecting the lines 185 and 186 to the lines 187 and 188. The lines 187 and 188 are energized from the current supply lines 189 and 190 under the control of the single throw switch 191.

The electrical circuit (Figure 11) includes the contactor switches 192, 193 and 194 having operating coils 195, 196 and 197 respectively connected either to the power lines 154 and 156 or to the power lines 157 and 159. The contactor switches 192, 193 and 194 are normally open, and are closed by the energization of their operating coils 195, 196 and 197 in response to the closing of the switch 153. The latter, when closed, energizes the blower motors 113 and causes the blowers to operate.

Running from the current line 188 is a line 198 which continues in the line 199 beyond the contactor switch 192. The line 199 is provided with a series of normally open air-responsive switches 200 which are closed automatically when the blower motors 113 are operating, thereby permitting current to be transmitted to the contactor 193, thence through the line 201 through the contactor 194 to the line 202 leading to the time-delay relay 203, from the opposite pole of which a line 204 leads to the current supply line, 187. Thus, when the blower motors 113 are operated, the contactor switches 192, 193 and 194 close and

the switches 200 likewise close to permit current to energize the time-delay relay 203. After the latter has run through its cycle, it energizes the operating coil of the gas supply valve 168 through the lines 205 and 206 opening this normally closed valve. Thus, gas is not admitted to the gas line 169 until the blower motors 113 have been operating a predetermined time.

Operation

In the operation of the machine of this invention, the main and auxiliary driving motors 22 and 23 are energized to cause the conveyor 11 to pursue its orbital path through the oven 10 and also to drive the printing press 19 and coating machine 20. The switches 153 are then closed, energizing the blower motors 17, 113 and 119 and causing air to flow through the oven in a circuitous path opposite the direction travel of the conveyor 11. The baffles 102 cause the air to move up and down between the carriers 12, so that the air follows a zigzag path as indicated by the arrows in Figures 1 and 2.

The operator now closes the switches 191 and 184 to energize the control circuit. The air operated valves 200 then close under the influence of the blast of air from the blowers, thereby closing the circuit to the time-delay relay 203 through the contactor switches 192, 193 and 194, which have been closed since the blower motors 113 were energized by the closing of the switch 153. After a predetermined time, the gas valve 168 opens after being energized by the time-delay relay at the end of its cycle and fuel gas passes from the conduit 167 into the conduits 169 and 170. Meanwhile, air has been supplied by the compressor 161 to the conduits 163 and 164 leading to the proportional mixers 165. It is, of course, assumed that the manual valves 166 and 171 have been opened.

The operator now opens the normally closed gas valves 172 by pressing upward on the valve members 177, permitting gas to flow from the conduits 170 into the proportional mixer 165. The motors of the latter have been energized through the lines 185 and 186 by the closing of the switches 184, and consequently mixed gas is supplied to the burners 16 through the conduits 173. The operator lights the burners 16, holding up the valve members 177 manually until the heating of the thermocouples 174 generates enough current to energize the operating coils of the magnetic gas valves 172, a sufficient amount to hold them open. If the temperature rises and falls in the oven, the thermostatic bulbs 178 and the temperature control instruments 180 so regulate the proportional mixers 165 that the ratio of air to gas remains the same while the volume is varied in order to maintain a substantially constant temperature within the oven 10.

In the meantime, the printing machine 19 and coating machine 20 have been imprinting designs on the sheets 90 of the tin or other material, and these have been deposited upon the carriers 12 as the conveyor 11 moves them through the oven. The heated air circulates in a zigzag path through the spaces between the carriers and the sheets, and follows a general direction opposite to the direction of travel of the conveyor 11, due to the operation of the exhaust fan 98. As the sheets or plates 90 emerge from the vestibule 101, they are cooled by the drafts of cool air coming from the cooling fans 120 operated by the motors 119.

It is to be noted that the fan 120 and blower 15

adjacent the outlet of the oven are arranged so that cool air will be directed upwardly through and between the plates 12 and will be further directed into the oven by reason of the hood 191 so as to be forced or drawn downwardly through the sheets 12 to the intake of said blower 15. In this manner, the heat from the oven may be prevented from escaping to the surrounding atmosphere so that operation of the oven may be carried out during summer months without unduly heating the atmosphere in the building in which the oven is installed.

While the carriers 12 move over the auxiliary conveyors 68, the latter extend into the spaces in the bottom edges of the carriers 12, engaging the bottom edges of the sheets 90. Since the auxiliary conveyors 68 are moving more rapidly than the main conveyor chains 63, the bottom edges of the sheets or plates 90 are moved ahead of their top edges (Figure 10) so that as the carriers 12 swing downwardly around the shaft 62 as an axis, the sheets 90 lie flat against the back of each carrier, until they arrive at the withdrawal conveyors 72 and 77. The latter conveyors then convey the sheets to the next stage of operations such as the forming of cans from the sheets.

If at any time the gas supply is accidentally interrupted, the thermocouples 174 immediately cease to generate current and the magnetic valves 172 automatically close. This cuts off the supply of gas to the burners 16 which cannot thereafter be lighted until the switches 172 are manually opened as previously described. Meanwhile, the auxiliary driving motor 23 has also been operating but it has failed thus far to drive the shaft 37 since the automatic body clutch 38 prevents this by the slippage of the clutch members 78 and 83 relative to each other (Figure 9).

If now the desired quantity of sheets or plates have been printed and coated and the main driving motor 22 is shut down to halt the machines 19 and 20, the shaft 25 and the pulley or sprocket 30 immediately come to rest. Due to the provision of the automatic jaw clutches 34 and 38, however, the auxiliary driving motor 23 now drives the shaft 37 through the jaw clutch 38 while the clutch members of the jaw clutch 34 slip relatively to each other.

This is a division of my application filed February 20, 1942, for Heat processing machine, Serial No. 432,541.

While a specific embodiment of the invention has been described and illustrated, it will be understood that various modifications may be made within the scope of the appended claims without departing from the spirit of the invention.

What I claim is:

1. In a heat processing machine, an oven, a burner in said oven, means for supplying fuel to said burner, normally closed means for controlling the flow of fuel through said fuel supplying means, an air circulator positioned to move heated air from said burner through said oven, means for driving said air circulator, time delay means responsive to the lapse of a predetermined time period following the starting of said air circulator driving means for opening said fuel flow controlling means, and means for additionally delaying the opening of said fuel flow control means whereby to remove inflammable gases from said oven before permitting igniting of said burner.

2. In a heat processing machine, an oven, a burner in said oven, means for supplying fuel to

said burner, normally closed means for controlling the flow of fuel through said fuel supplying means, an air circulator positioned to move heated air from said burner through said oven, means for driving said air circulator, means for controlling the normally closed fuel flow control means mounted adjacent said air circulator responsive to the flow of air at said circulator for opening said fuel flow controlling means a predetermined time period after said air circulators have been set in operation, and temperature responsive means for controlling said fuel flow means subsequent to the ignition of said fluid flowing through said burner.

3. In a heat processing machine, an oven, a burner in said oven, means for supplying fuel to said burner, normally closed means for controlling the flow of fuel through said fuel supplying means, an air circulator positioned to move heated air from said burner through said oven, means for driving said air circulator, time delay means responsive to the lapse of a predetermined time period following the starting of said air circulator driving means for opening said fuel flow controlling means whereby to remove inflammable gases from said oven before permitting igniting of said burner, and means responsive to the flow of air at said circulator for rendering said time delay means operative.

4. In a heat processing machine, an oven, a burner in said oven, electro-magnetically controlled means for controlling the flow of fuel to said burner, normally closed manually controlled valve means interposed between said burner and electro-magnetically controlled means, means adjacent the burner responsive to ignition of said burner for maintaining said valve means open, blower means for supplying air to said burner and creating a forced draft in said oven, electric power means for driving said blower means, an electric circuit connected with a source of electrical energy for said electric power means, and means in said electric circuit for permitting operation of said blower means prior to the energization of said electro-magnetically controlled fuel supply means and the flow of fuel to said burner.

5. In a heat processing machine, an oven, a series of fan blowers in said oven for directing air therethrough, a burner located in said oven, electromagnetically controlled valve means for controlling the flow of fuel to said burner, a manually controlled normally closed valve interposed between said burner and electromagnetically controlled valve means, an electric circuit connecting said blowers and electromagnetic valve means, a source of electric energy for operating said blowers, time delay switch means in said circuit to permit energization of said electromagnetically controlled valve means after the blower means has been in operation for a predetermined time period, switch means in said circuit controlled by the operation of said blowers for interrupting said circuit when the blowers are in operation, and electrical means mounted adjacent the burner for maintaining said manually controlled normally closed valve means open when said burner is ignited.

6. In a heat processing machine, an oven, a series of fan blowers in said oven for directing air therethrough, a burner located in said oven, electromagnetically controlled valve means for controlling the flow of fuel to said burner, a manually controlled normally closed valve interposed between said burner and electromagnetically controlled valve means, an electric circuit connecting

said blowers and electromagnetic valve means, a source of electric energy for operating said blowers, time delay switch means in said circuit to permit energization of said electromagnetically controlled valve means after the blower means has been in operation for a predetermined time period, switch means in said circuit controlled by the operation of said blowers for interrupting said circuit when the blowers are in operation, electrical means mounted adjacent the burner for maintaining said manually controlled normally closed valve means open when said burner is ignited, and means in said oven responsive to the temperature of the heated air to regulate the fuel and air supply to said burner.

7. In a heat processing machine, an oven, a series of blowers arranged in said oven for directing air therethrough in a zigzag path, a series of burners mounted in said oven arranged adjacent each blower, an electric circuit, motor means connected in said circuit for driving said blowers, a fuel flow path for supplying said burners with fuel, electromagnetic valve means in said fuel flow path, time delay means in said circuit adapted to be energized upon energization of said blower, motor means for operating said electromagnetic valve means and controlling fuel flow along said fuel flow path, a manually controlled normally closed valve means between the fuel flow path and each burner, and means adjacent each burner responsive to the temperature therein for maintaining said manually controlled valve means in an open position.

8. In a heat processing machine, an oven, a series of blowers arranged in said oven for directing air therethrough in a zigzag path, a series of burners mounted in said oven arranged adjacent each blower, an electric circuit, motor means connected in said circuit for driving said blowers, a fuel flow path for supplying said burners with fuel, electromagnetic valve means in said fuel flow path, time delay means in said circuit adapted to be energized upon energization of said blower, motor means for operating said electromagnetic valve means and controlling fuel flow along said fuel flow path, a normally closed manually operable valve means interposed between the fuel flow path and each burner, means adjacent each burner responsive to the temperature thereof for maintaining said valve means open, air mixing means associated with each burner, and temperature responsive means in said oven for regulating the proportion of air and gas directed to each burner.

9. In a heat processing machine, an oven, a series of blowers arranged in said oven for directing air therethrough in a zigzag path, a series of burners mounted in said oven arranged adjacent each blower, an electric circuit, motor means connected in said circuit for driving said blowers, a fuel flow path for supplying said burners with fuel, electromagnetic valve means in said fuel flow path, time delay means in said circuit adapted to be energized upon energization of said blower, motor means for operating said electromagnetic valve means and controlling fuel flow along said fuel flow path, a normally closed manually operable valve means in said fuel flow path between the electromagnetic valve means and each burner, and temperature responsive means adjacent each burner adapted to maintain said last-named valve means in an open position.

10. In a heat processing machine, an oven, a series of blowers arranged in said oven for directing air therethrough in a zigzag path, a series of

burners mounted in said oven arranged adjacent each blower, an electric circuit, motor means connected in said circuit for driving said blowers, a fuel flow path for supplying said burners with fuel, electromagnetic valve means in said fuel flow path, time delay means in said circuit adapted to be energized upon energization of said blower, motor means for operating said electromagnetic valve means and controlling fuel flow along said fuel flow path, a manually controlled normally closed valve means between the fuel flow path and each burner, means adjacent each burner responsive to the temperature therein for maintaining said manually controlled valve means in an open position, a control circuit for said electric circuit, and normally open switch means in said circuit adapted to be closed by the increased air pressure from said blowers for maintaining said electric circuit closed.

11. In a heat processing machine, an oven, a series of blowers mounted in said oven for directing heated air through said oven, a series of burners mounted in said oven adjacent said blowers, a series of air and gas mixers, blower means for supplying said mixers with air, a source of fuel connected with each of said mixers, an electromagnetically controlled valve interposed in the flow path between the source of fuel and said air and gas mixers, normally closed valve means adapted to be manually opened interposed in the fuel flow path between the electromagnetically controlled valve and each air and gas mixer, an electric circuit for supplying current for operation of said blowers and blower means, a control circuit for said electric circuit, relay switch means in said electric circuit for energizing said control circuit, time delay means in said control circuit for energizing said electromagnetically controlled valve after said electric circuit has been closed a predetermined time period, pressure responsive switch means in said control circuit located adjacent each of said blowers for maintaining said electromagnetically controlled valve energized, and means adjacent each burner for maintaining said normally closed valve means open when the temperature adjacent each burner has reached a predetermined temperature degree.

12. In a heat processing machine, an oven, a series of blowers mounted in said oven for directing heated air through said oven, a series of burners mounted in said oven adjacent said blowers, a series of air and gas mixers, blower means for supplying said mixers with air, a source of fuel connected with each of said mixers, an electromagnetically controlled valve interposed in the flow path between the source of fuel and said air and gas mixers, normally closed valve means adapted to be manually opened interposed in the fuel flow path between the electromagnetically controlled valve and each air and gas mixer, an electric circuit for supplying current for operation of said blowers and blower means, a control circuit for said electric circuit, relay switch means in said electric circuit for energizing said control circuit, time delay means in said control circuit for energizing said electromagnetically controlled valve after said electric circuit has been closed a predetermined time period, pressure responsive switch means in said control circuit located adjacent each of said blowers for maintaining said electromagnetically controlled valve energized, means adjacent each burner for maintaining said normally closed valve means open when the temperature adjacent each burner has reached a predetermined temperature degree, and temperature

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responsive means in said oven for regulating said air and gas mixers.

13. In a heat processing machine, an oven, a series of blowers mounted in said oven for directing heated air through said oven, a series of burners mounted in said oven adjacent said blowers, a series of air and gas mixers, blower means for supplying said mixers with air, a source of fuel connected with each of said mixers, an electromagnetically controlled valve interposed in the flow path between the source of fuel and said air and gas mixers, normally closed valve means adapted to be manually opened interposed in the fuel flow path between the electromagnetically controlled valve and each air and gas mixer, an electric circuit for supplying current for operation of said blowers and blower means, a control circuit for said electric circuit, relay switch means in said electric circuit for energizing said control circuit, time delay means in said control circuit for energizing said electromagnetically controlled valve after said electric circuit has been closed a predetermined time period, pressure responsive switch means in said control circuit located adjacent each of said blowers for maintaining said electromagnetically controlled valve energized, and means adjacent each burner for maintaining said normally closed valve means open when the temperature adjacent each burner has reached a predetermined temperature degree, said last-named means comprising a thermocouple disposed adjacent each burner for generating electric energy to maintain said normally closed valve means open.

14. In a heat processing machine, an oven, a series of blowers mounted in said oven in spaced apart relation along said oven for directing air therethrough, an exhaust blower mounted adjacent the entrance of said oven, a series of fuel burners mounted in said oven adjacent said first-mentioned blowers, a fuel supply manifold having one end connected to a source of fuel and the branch pipe thereof connected to said burners, an electromagnetically controlled valve interposed between said source of fuel and said manifold, a series of gas and air mixers interposed in the branch pipes of said fuel supply manifold, a second manifold for supplying air to said burners having the branch pipes thereof connected to said air and gas mixers, blower means associated with said last-named manifold, a normally closed manually operable valve interposed in each of the branch pipes of the fuel supply manifold between the electromagnetically controlled valve and said air and gas mixers, electric motors for each of said blowers and blower means, an electric circuit for supplying electric energy to said electric motors whereby air will be admitted to said mixers and oven simultaneously, electromagnetic relay switch means in said circuit, a control circuit adapted to be closed upon energization of said electric circuit and said electromagnetic switch means, time delay switch means in said control circuit for controlling the energization of said electromagnetically controlled valve means, and air pressure operated switch means in said control circuit mounted adjacent said first-named blowers for interrupting said control circuit in the event of failure of said series of blowers.

15. In a heat processing machine, an oven, a series of blowers mounted in said oven in spaced apart relation along said oven for directing air therethrough, an exhaust blower mounted adjacent the entrance of said oven, a series of fuel burners mounted in said oven adjacent said first-

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mentioned blowers, a fuel supply manifold having one end connected to a source of fuel and the branch pipe thereof connected to said burners, an electromagnetically controlled valve interposed between said source of fuel and said manifold, a series of gas and air mixers interposed in the branch pipes of said fuel supply manifold, a second manifold for supplying air to said burners having the branch pipes thereof connected to said air and gas mixers, blower means associated with said last-named manifold, a normally closed manually operable valve interposed in each of the branch pipes of the fuel supply manifold between the electromagnetically controlled valve and said air and gas mixers, electric motors for each of said blowers and blower means, an electric circuit for supplying electric energy to said electric motors whereby air will be admitted to said mixers and oven simultaneously, electromagnetic relay switch means in said circuit, a control circuit adapted to be closed upon energization of said electric circuit and said electromagnetic switch means, time delay switch means in said control circuit for controlling the energization of said electromagnetically controlled valve means, air pressure operated switch means in said control circuit mounted adjacent said first-named blowers for interrupting said control circuit in the event of failure of said series of blowers, and thermoelectric means mounted adjacent each burner for maintaining said normally closed oven in an open position after the burners have been ignited.

16. In a heat processing machine, an oven, a series of blowers mounted in said oven in spaced apart relation along said oven for directing air therethrough, an exhaust blower mounted adjacent the entrance of said oven, a series of fuel burners mounted in said oven adjacent said first-mentioned blowers, a fuel supply manifold having one end connected to a source of fuel and the branch pipe thereof connected to said burners, an electromagnetically controlled valve interposed between said source of fuel and said manifold, a series of gas and air mixers interposed in the branch pipes of said fuel supply manifold, a second manifold for supplying air to said burners having the branch pipes thereof connected to said air and gas mixers, blower means associated with said last-named manifold, a normally closed manually operable valve interposed in each of the branch pipes of the fuel supply manifold between the electromagnetically controlled valve and said air and gas mixers, electric motors for each of said blowers and blower means, an electric circuit for supplying electric energy to said electric motors whereby air will be admitted to said mixers and oven simultaneously, electromagnetic relay switch means in said circuit, a control circuit adapted to be closed upon energization of said electric circuit and said electromagnetic switch means, time delay switch means in said control circuit for controlling the energization of said electromagnetically controlled valve means, air pressure operated switch means in said control circuit mounted adjacent said first-named blowers for interrupting said control circuit in the event of failure of said series of blowers, and thermostatic means mounted in said oven for controlling the air and gas mixers to thereby maintain the proportion of gas and air admitted to said burners equalized.

17. In a heat processing machine, an oven, a series of blowers mounted in said oven in spaced apart relation along said oven for directing air therethrough, an exhaust blower mounted ad-

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jacent the entrance of said oven, a series of fuel
 burners mounted in said oven adjacent said first-
 mentioned blowers, a fuel supply manifold having
 one end connected to a source of fuel and the
 branch pipe thereof connected to said burners,
 an electromagnetically controlled valve inter-
 posed between said source of fuel and said mani-
 fold, a series of gas and air mixers interposed in
 the branch pipes of said fuel supply manifold,
 a second manifold for supplying air to said burn-
 ers having the branch pipes thereof connected to
 said air and gas mixers, blower means associated
 with said last-named manifold, a normally closed
 manually operable valve interposed in each of the
 branch pipes of the fuel supply manifold between
 the electromagnetically controlled valve and said
 air and gas mixers, electric motors for each of
 said blowers and blower means, an electric circuit
 for supplying electric energy to said electric mo-
 tors whereby air will be admitted to said mixers
 and oven simultaneously, electromagnetic relay
 switch means in said circuit, a control circuit
 adapted to be closed upon energization of said
 electric circuit and said electromagnetic switch
 means, time delay switch means in said control
 circuit for controlling the energization of said
 electromagnetically controlled valve means, air
 pressure operated switch means in said control
 circuit mounted adjacent said first-named blow-
 ers for interrupting said control circuit in the
 event of failure of said series of blowers, thermo-
 electric means mounted adjacent each burner for
 maintaining said normally closed valve in an open

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position after the burners have been ignited, and
 thermostatic means mounted in said oven for con-
 trolling the air and gas mixers to thereby main-
 tain the proportion of gas and air admitted to
 said burners equalized.

18. In a heat processing machine, an oven,
 means for heating said oven, a conveyor movable
 through said oven, main driving means including
 a drive shaft, motor and reduction gearing, means
 connecting said drive shaft and gear reduction,
 electric means connecting said motor and shaft
 to drive said conveyor, auxiliary driving means
 drivingly engaging said shaft operable to drive
 said conveyor, and a clutch connecting said shaft
 and auxiliary driving means responsive to the ces-
 sation of operation of said main driving means
 for rendering said auxiliary driving means op-
 erative to drive said conveyor.

19. In a heat processing machine, an oven,
 means for heating said oven, a conveyor movable
 through said oven, main driving means including
 a drive shaft, motor and reduction gearing unit,
 means connecting said drive shaft and gear re-
 duction unit, clutch means connecting said motor
 and shaft, said driving means being operable to
 drive said conveyor, auxiliary driving means op-
 erable to drive said conveyor, and automatic op-
 erable clutch mechanism connecting said shaft
 and auxiliary driving means responsive to the ces-
 sation of operation of said main driving means
 for rendering said auxiliary driving means op-
 erative to drive said conveyor.

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