Jan. 24, 1956 L. J. GRINER 2,731,733

MATRIX DRYING APPARATUS AND MACHINE

Filed April 20, 1951

4 Sheets-Sheet 1

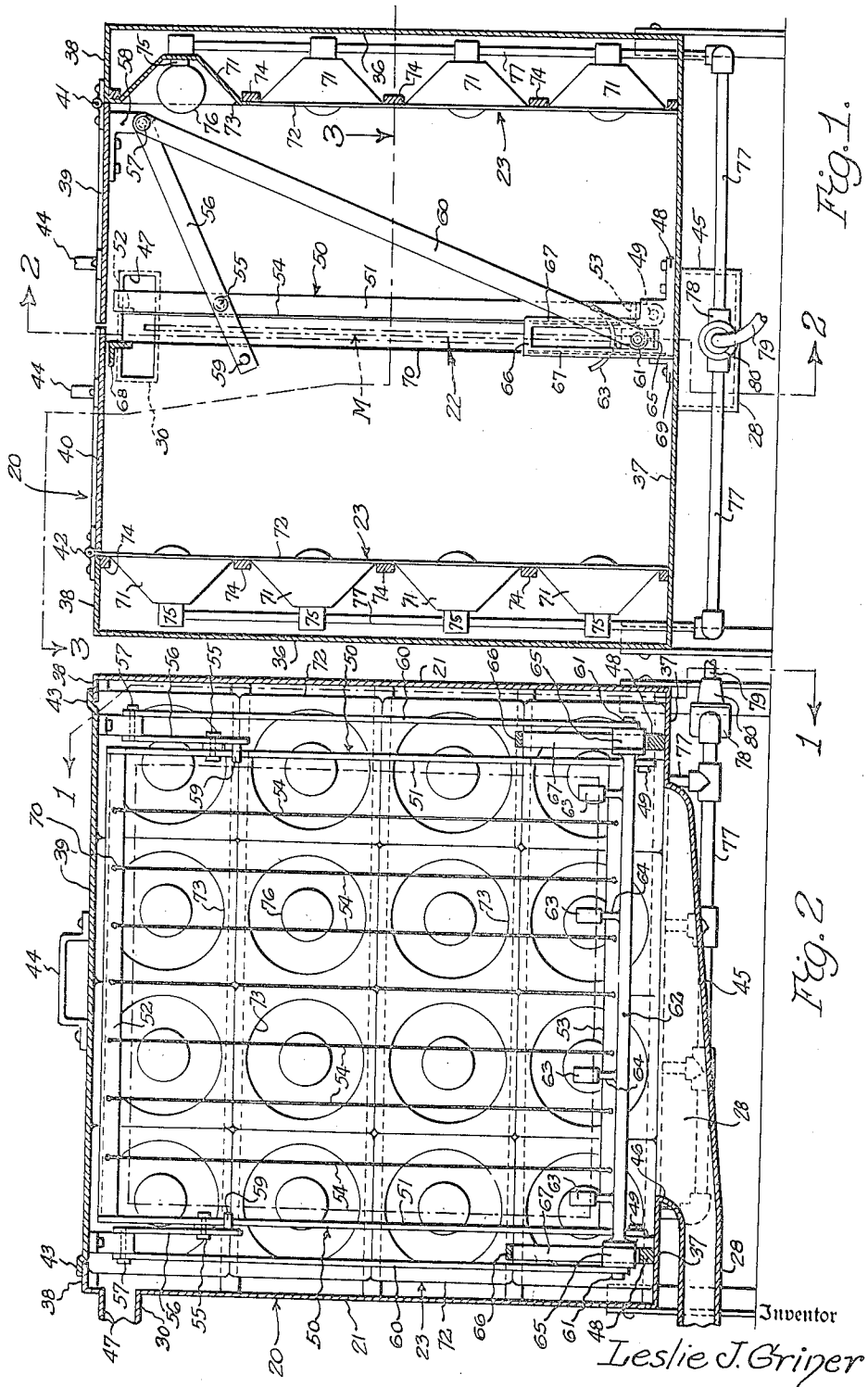


Fig. 1.

Fig. 2

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Jan. 24, 1956 L. J. GRINER 2,731,733

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4 Sheets-Sheet 2

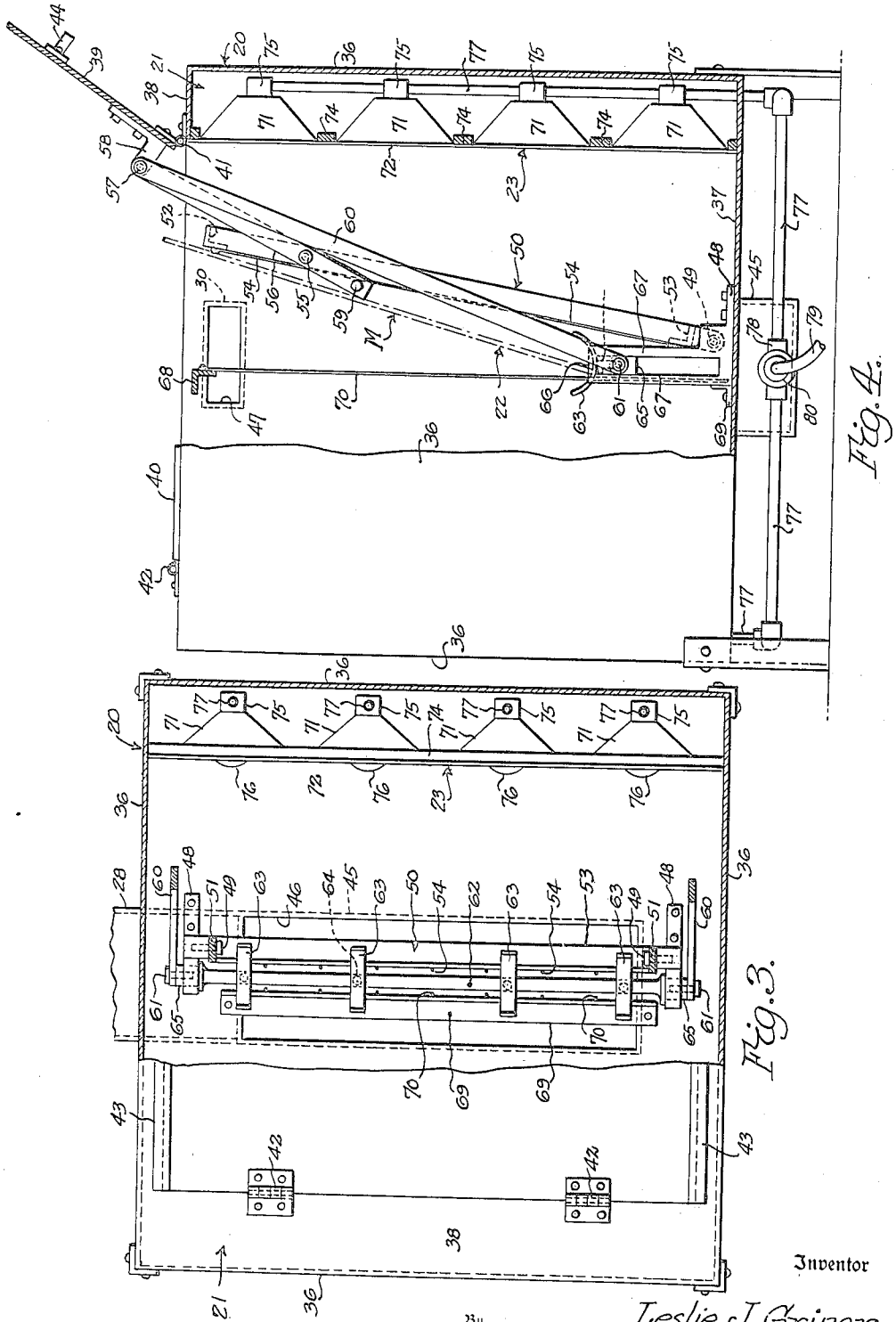


Fig. 4.

Fig. 3.

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4 Sheets-Sheet 3

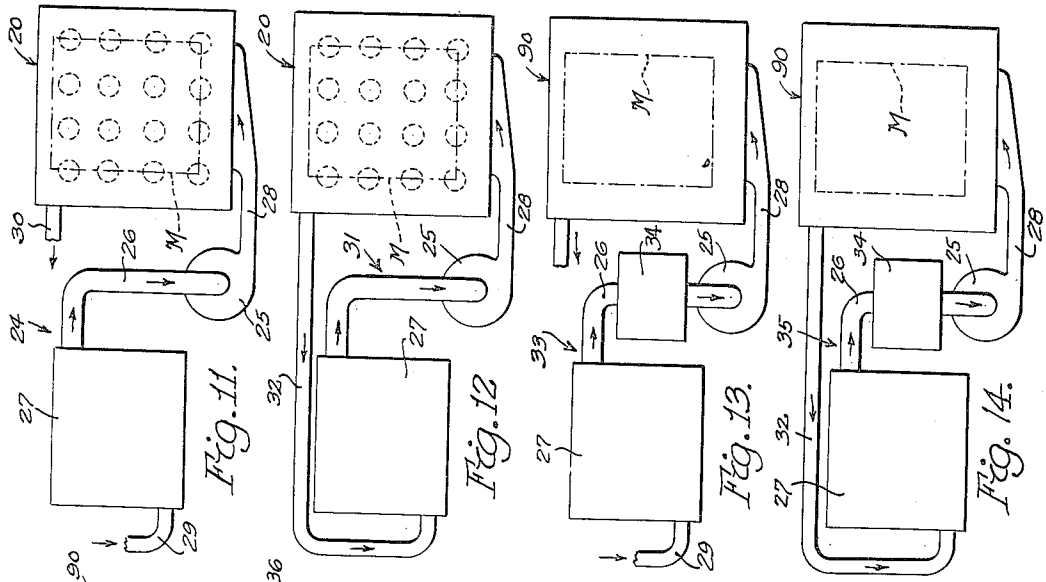


Fig. 11.

Fig. 12.

Fig. 13.

Fig. 14.

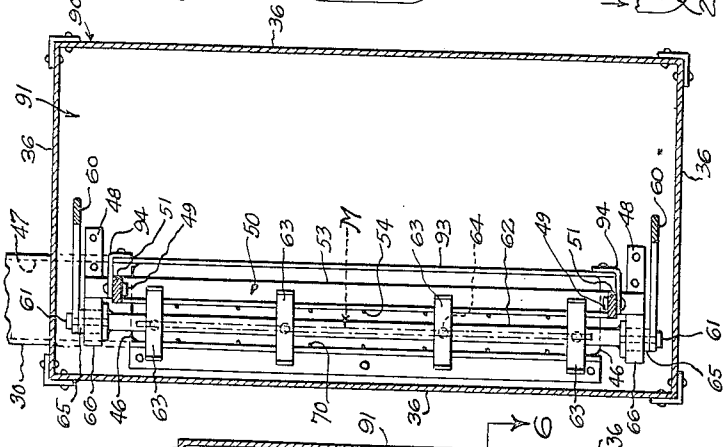


Fig. 6.

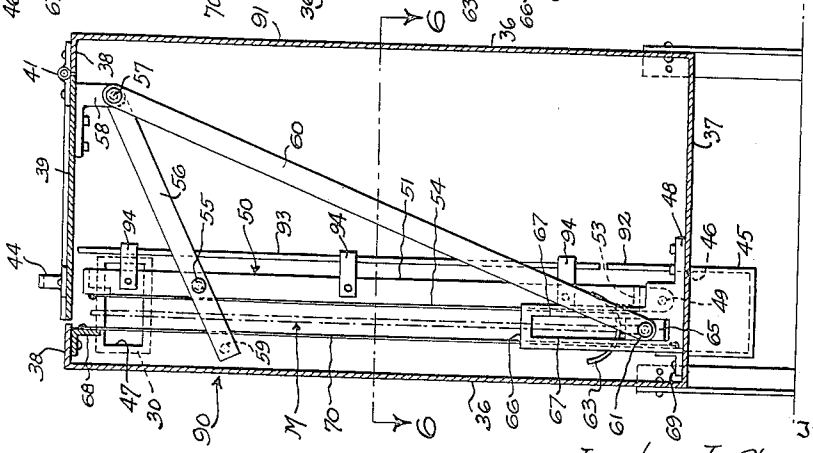


Fig. 5.

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Jan. 24, 1956 L. J. GRINER 2,731,733

MATRIX DRYING APPARATUS AND MACHINE

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4 Sheets-Sheet 4

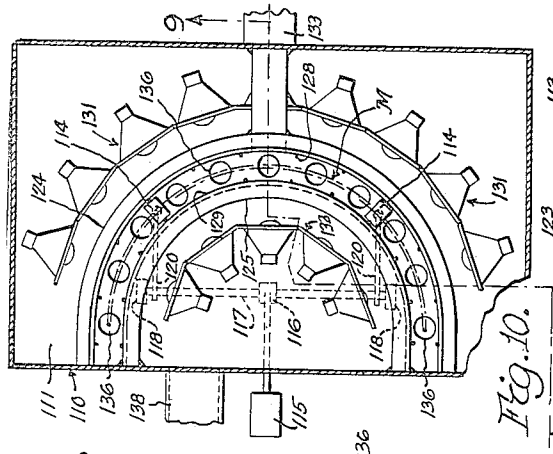


Fig. 10.

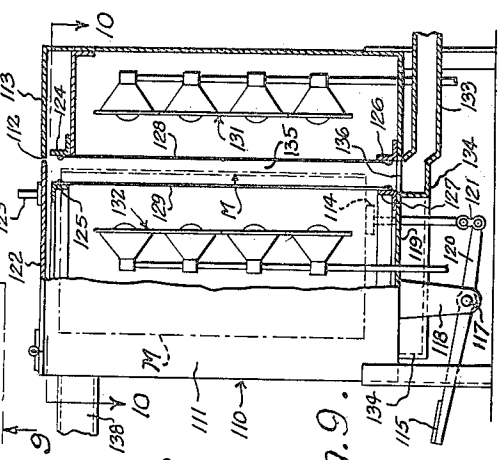


Fig. 9.

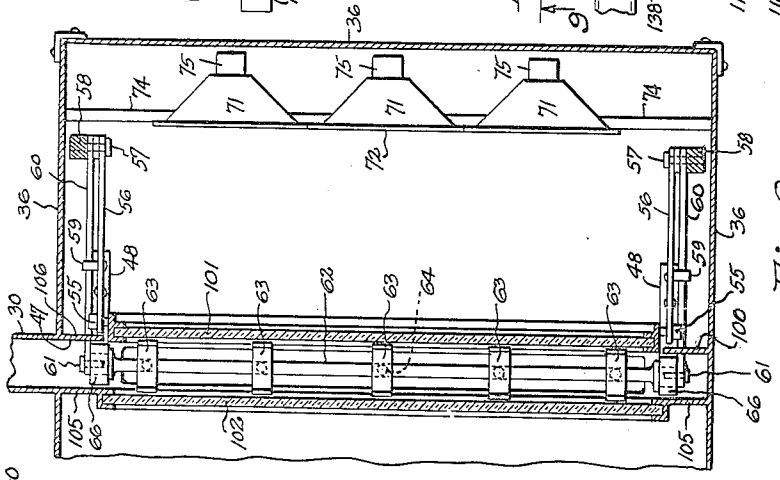


Fig. 8.

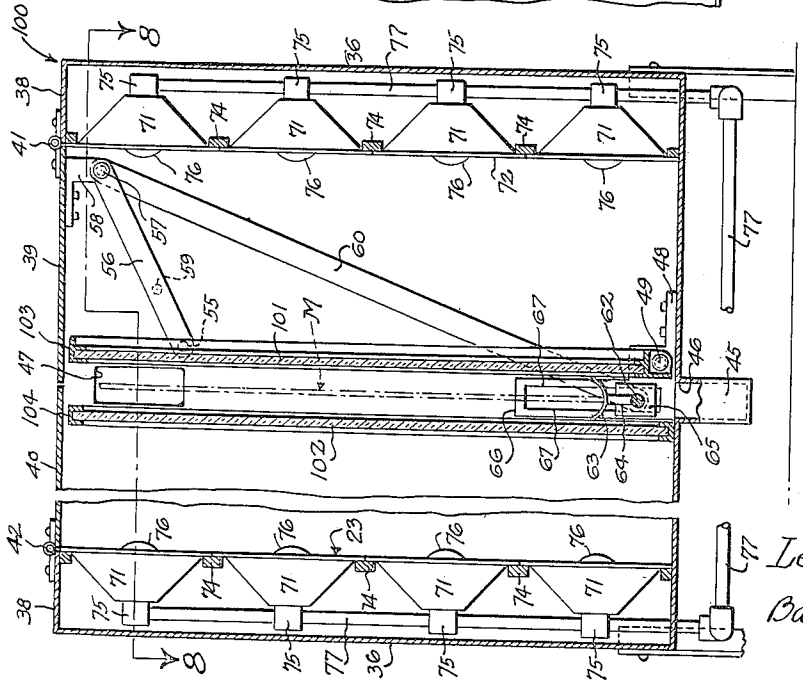


Fig. 7.

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2,731,733

MATRIX DRYING APPARATUS AND MACHINE

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Application April 20, 1951, Serial No. 222,074

5 Claims. (Cl. 34—60)

This invention relates to drying machines and, in particular, to machines for drying newspaper matrices or the paper composition plates from which the curved plates are cast for the printing of newspapers.

In the printing of newspapers, the so-called matrix is made of cardboard-like material of cellulose from the type set by the Linotype machine, and this is used for casting the curved type plates which are used in rotary presses. The matrix must be dry before it is put into the casting machine. Approximately 22% of the matrix as originally made is moisture. In removing this moisture, the matrix shrinks and, if care is not taken, distortion occurs. The shrinking of the matrix is regarded as desirable because it makes the printed page smaller and consequently uses less newsprint. Present shrinkage is about an inch on a matrix approximately sixteen inches wide. The shrinkage obtained depends upon the moisture content of the matrix. The saving of newsprint paper becomes considerable for a large newspaper.

One object of the present invention is to provide a matrix drying machine which will dry and shrink a matrix in the minimum time with a minimum of distortion.

Another object is to provide a matrix drying machine having an action which is unaffected by the humidity of the atmosphere or by other outside conditions.

Another object is to provide a matrix drying machine wherein the damp matrix is held in a vertical position while it is subjected either to the action of infra-red rays or to a blast of dry air which is optionally heated.

Another object is to provide a matrix drying machine of the foregoing character wherein the machine is additionally provided with quickly operable means for moving the matrix into a position from which it is conveniently removed when the drier cabinet is opened.

Another object is to provide a matrix drying machine of the foregoing character wherein the damp matrix is held between vertical wire frames or between transparent panels or plates so as to confine the hottest portion of the heated air to the region immediatelly around the matrix, thereby achieving a higher efficiency and economy in the operation of the machine.

Another object is to provide a modified matrix drying machine which holds the matrix in an arcuately bent position while it is being dried and shrunk, thereby readying it for immediate insertion in the casting machine in which the curved type plates of the rotary presses are cast.

Other objects and advantages of the invention will become apparent from the following description of the accompanying drawings, wherein:

Figure 1 is a vertical section through a matrix drying machine according to one form of the invention, with the machine in its closed position, taken along the line 1—1 in Figure 2;

Figure 2 is a vertical section taken approximately at right angles to the vertical section of Figure 1, along the line 2—2 in Figure 1;

Figure 3 is a view partly in top plan and partly in horizontal section taken along the zigzag line 3—3 in Figure 1;

Figure 4 is a vertical section similar to Figure 1 but partly in side elevation and showing the machine in its open position ready for the insertion or removal of a matrix, shown in dotted lines;

Figure 5 is a vertical section similar to Figure 1, but showing a modified matrix drier employing hot air instead of infra-red rays for drying the matrix;

Figure 6 is a horizontal section taken along the line 6—6 in Figure 5;

Figure 7 is a vertical section similar to Figure 1 but showing a second modification in which the matrix is held between parallel transparent plates or panels which confine the moist heated air to the immediate vicinity of the matrix;

Figure 8 is a horizontal section taken along the line 8—8 in Figure 7;

Figure 9 is a vertical section partly in side elevation, similar to Figure 1 but showing a third modification wherein the matrix is dried and shrunk in a curved or arcuate position;

Figure 10 is a horizontal section taken along the line 10—10 in Figure 9;

Figure 11 is a diagrammatic side elevation showing the connections between the drier, blower and air desiccator of the complete apparatus shown in the foregoing figures wherein the moisture-laden air follows an open circuit from which it is discharged directly into the atmosphere;

Figure 12 is a view similar to Figure 11 but showing a modification wherein the moisture-laden air follows a closed circuit in which it is returned to the desiccator for recirculation;

Figure 13 is a view similar to Figure 11, but showing a further modification employing an open circuit with an additional dry air heater; and

Figure 14 is a view similar to Figure 12, but showing a still further modification employing a closed circuit with an additional dry air heater.

Referring to the drawings in detail, Figures 1 to 4 inclusive show a matrix drier, generally designated 20, according to one form of the invention, as consisting generally of a cabinet or housing 21 containing a matrix holder, generally designated 22, in which the matrix is subjected to heat radiation from parallel heat-radiation sources, generally designated 23, while the cabinet 21 is subjected to the passage of dry air from an air-drying and circulating apparatus, generally designated 24. The latter apparatus (Figure 11) consists of a blower 25 having an inlet conduit 26 leading thereto from a conventional desiccator 27 and a discharge conduit 28 leading from the outlet of the blower 25 to the machine 20. An air inlet pipe 29 is connected to the inlet of the desiccator 27 and a moist air discharge pipe 30 leads from the machine 20 to the atmosphere.

In the modified air drying and circulating apparatus 31 of Figure 12, the inlet and outlet pipes 29 and 30 are replaced by a single pipe 32 which recirculates the moist air discharged from the drying machine 20 directly back to the desiccator 27. The further modified air drying and circulating apparatus 33 of Figure 13 is the same as the open circuit air drying and circulating apparatus 24 of Figure 11 with the addition of a conventional air heater 34 in the pipe 26 for the purpose of heating the dry air coming from the desiccator. The still further modified air drying and circulating apparatus 35 of Figure 14 is like the closed circuit apparatus 31 shown in Figure 12 with the same addition of a conventional air heater 34 in the same pipe 26. It will be evident that the heater 34 of Figures 13 and 14 could also be placed in the discharge pipe 28 of the blower 25 rather than in the inlet pipe 26 and still heat the dry air coming into the drying and shrinking machine 20.

The desiccator 27 may be of any suitable conventional

type, employing either a drying agent, such as silica gel, calcium chloride or other well-known drying agents, or it may employ air conditioning apparatus which cools the air in order to dehydrate it. Such drying agents and devices are well-known in the chemical and ventilation industries and therefore require no detailed discussion. The result of any of the four types of air drying and circulating apparatus 24, 31, 33 and 35 is to forcibly deliver dry air to the matrix drying machine 20 either by taking it from the atmosphere and returning it to the atmosphere without heating the air (as in Figure 11) or heating the air (Figure 13), or by recirculating the moisture-laden air from the matrix drying machine 20 back to the desiccator 27, either wtihout heating the air (Figure 12) or heating the air (Figure 14).

The matrix drying machine 20 is of box-like form with side walls 36, a bottom wall 37 and a top wall 38 having lids or doors 39 and 40 hinged thereto as at 41 and 42 respectively. The lateral edges of the lids or doors 39 and 40 are flanged upwardly as at 43 (Figure 2) so as to cause them to rest upon the top wall 38 at the edge of the opening 39, with the lids 39 and 40 lying in substantially the same plane as the top wall 38. Handles 44 are attached to the doors 39 and 40 to permit them to be easily raised and lowered.

The air discharge conduit 28 at its end has an elongated portion 45 which fits into an elongated opening or port 46 in the bottom wall 37 of the cabinet 21, so that dried incoming air is supplied to the elongated opening 46 immediately beneath the matrix holder 22. Near the top wall 38 at the top of the matrix holder 22, one of the side walls 36 of the cabinet 21 is provided with an outlet opening 47 (Figure 1) to which the pipe 30 or 32 for the discharge of the moisture-laden air is connected, as the case may be.

The matrix holder 22 is mounted upon base members 48 bolted or otherwise secured to the bottom wall 37 at opposite sides of the cabinet 21 (Figure 1). Pivotally mounted upon pivot pins or bolts 49 in the base members 48 is a swinging frame 50 formed of vertical bars 51 interconnected by upper and lower horizontal angle members 52 and 53 respectively (Figure 1). Stretched between and secured at their opposite ends to the horizontal angle members 52 and 53 are laterally-spaced vertical wires 54 which serve to prevent the matrix M from falling through the frame 50.

Pivoted as at 55 to the opposite side bars 51 are side links 56 which are pivoted as at 57 to angle brackets 58 bolted to the undersides of the door 39 and extending downwardly therefrom. The inner or lower end of each link 56 is extended beyond the pivot pin 55 and carries a stop pin 59 (Figure 1). Also pivoted to the pivots 57 are the upper ends of links 60, the lower ends of which are pivoted as at 61 to the opposite ends of a matrix rest supporting bar 62 having U-shaped matrix rests 63 spaced at intervals therealong (Figure 2), the U-shaped rests 63 having stems 64 between them and the bar 62. The opposite ends of the bar 62 carry flanged side blocks 65 of rectangular form which slide up and down in rectangular guide slots 66 in guide portions 67 extending upward from each base 48.

Spaced laterally away from the angle members 52 and 53 in the vertical position of the frame 50 are stationary upper and lower angle members 68 and 69, the upper angle member 68 being secured at its opposite ends to the side walls 36 and the lower angle member 69 being bolted or otherwise secured at its opposite end (Figure 3) to the bottom wall 37 near the opposite ends of the elongated opening or port 46. Laterally-spaced vertical wires 70 are stretched between and secured to the upper and lower angle members 68 and 69 for the same purpose as the wires 54.

In order to provide heat for drying the matrix M in its position between the matrix holder 22, the interior of the cabinet 21 is provided with the parallel heat-radiation

sources 23 which consist of parallel vertically-disposed banks of approximately conical reflectors 71 secured to vertical plates 72 adjacent circular openings 73 (Figure 1). The plates 72 are mounted on and secured to cross bars 74 extending between opposite side walls 36 of the cabinet 21, each plate 72 being approximately square and provided with a single opening 73. Mounted in each of the reflectors 71 is an electric light socket 75 in which is inserted an incandescent light bulb 76, preferably of the infra-red type providing a powerful source of heat radiation. The sockets 75 are interconnected by cables or conductor conduits 77 which are connected at a junction box 78 to a flexible conductor cable 79 leading to a suitable source of electric current. The cable 79 makes a connection with the junction or outlet box 78 by means of a conventional plug 80 which is removably inserted therein.

In the operation of the form of the invention shown in Figures 1 to 4 inclusive, to insert a damp matrix M upon which the type impressions have been pressed, the lid or door 39 is raised by means of its handle 44 to the position shown in Figure 4. When this is done, the angle brackets 58 swing upward, carrying their pivots 57 upward and consequently exerting upward pulls on the links 56 and 60. The upward pull on the links 56 when transmitted through the pivot 55 to the movable frame 51, swings the frame 50 from its vertical or closed position (Figure 1) to its inclined or open position (Figure 4). The upward pull on the links 60, when transmitted through the pivot pins 61 to the bar 62, raises the matrix rests 63 to the position shown in Figure 4, the blocks 65 moving upward to the top of the guide slots 66. The matrix M may then be easily inserted through the opening 39 in the top wall 38 of the cabinet 21 and positioned with its lower edge standing on the rests 63.

The operator now swings the cover or door 39 downward into its closed position (Figure 1), the consequent swinging of the links 56 and 60 swinging the movable frame 50 into its vertical or closed position and at the same time lowering the bar 62 and matrix rests 63 to their lowered positions. Meanwhile, the banks 23 of infra-red bulbs 76 have been energized by energizing the conductor cable 79 and the blower 25 has been started in operation. The blower 25 draws air from the atmosphere into and through the desiccator 27 where its moisture is removed by the dehydrating agent, such as silica gel or calcium chloride, or by the refrigerating apparatus of the air conditioning system, whereupon the dried air is drawn through the pipe 26 into the inlet of the blower 25, either directly (Figure 11) or through the air heater 34 (Figure 13), the dried air being discharged through the pipe 28 and elongated portion 45 through the elongated opening 46 into the interior of the cabinet 21 immediately beneath the matrix M. The dry air, either heated or unheated, passes upward to the outlet opening 47 and discharge pipe 30, absorbing moisture from the matrix M as it passes upward along its opposite surfaces. The heat radiated from the infra-red bulbs 76 against the opposite side of the matrix M accelerates the drying thereof and the drying brings about the desired shrinkage of the matrix M. If the moisture-laden air is recirculated, as in the system shown in Figures 12 and 14, it reenters the desiccator 27 which again removes its moisture before it is returned to the drying machine 20 by the blower 25.

When the matrix M is sufficiently dry, the operator again swings the door or lid 39 upward to the position of Figure 4, tilting the swinging frame 50 into its inclined position while raising the matrix rests 63, lifting the upper edge of the matrix M above the level of the opening 39 in the top of the cabinet 21. The operator then grasps the projecting edge of the matrix M and removes it from the machine 20, replacing it with the next damp matrix to be dried.

The modified matrix drying machine, generally designated 90 (Figures 5 and 6) is of similar construction to

the machine **20** of Figures 1 to 4 inclusive and similar parts are designated with the same reference numerals. In the modified machine **90**, however, the banks **23** of heat-radiating bulbs **76** have been omitted, and the cabinet **91** has been correspondingly reduced in size. Moreover, a partition member in the form of a vertical plate **92** is secured to and rises from the brackets **48** adjacent the edge of the opening **46**, and cooperates with a closure panel **93** or movable partition which is secured by the brackets **94** to the movable or swinging frame **50**. The action of the modified drying machine **90** is substantially the same as that of the machine **20** of Figures 1 to 4 inclusive, except that the open system of Figure 13 or the closed system of Figure 14 would be used since these are equipped with air heaters **34**. The use of these air heaters **34** is of course preferable where there is no heating arrangement within the cabinet itself.

The modified matrix drying machine, generally designated **100** (Figures 7 and 8) is likewise similar in most respects to the machine **20** of Figures 1 to 4 inclusive, and similar parts are likewise designated with the same reference numerals. In the modified machine **100**, however, the wires **54** and **70** are replaced by transparent panels or plates **101** and **102**, preferably spaced just far enough apart (Figure 7) to form a closed chamber for the matrix M. These transparent plates or panels **101** and **102** are mounted in channel frames **103** and **104**, rather than the angle members of Figure 1, and may be of glass, transparent plastic or other material which is transparent to infra-red radiation from the banks **23** of infra-red bulbs **76**. The channel frame **102** is connected to the cabinet side walls **36** by partitions **105** (Figure 8) whereas partitions **106** extend inward from the side walls **36** to close the gap between the latter and the swinging transparent panel **101**. The operation of the modified matrix drying machine **100** is similar to that described for the machine **20** of Figures 1 to 4 inclusive except that the moist heated air is confined between the transparent plates or panels **101** and **102**, rather than being permitted to permeate the entire interior of the cabinet **21**.

The modified matrix drying machine, generally designated **110** (Figures 9 and 10) follows similar principles of operation but is of different construction in order to mount the matrix M in a curved or arcuate position while it is being dried and shrunk. For this purpose, the cabinet **111** is provided with an arcuate opening **112** in its upper wall **113** and the matrix M is supported on plungers **114** which raise and lower it by means of a foot pedal **115** which is secured at **116** to a pivot shaft **117**, the opposite ends of which are journaled in brackets **118** secured to and extending downward from the bottom wall **119** of the cabinet **111**. The pivot rod **117** carries spaced crank arms **120** which are pivotally connected by the links **121** to the lower ends of the plungers **114**. Consequently, when the foot pedal **115** is depressed by the operator, the consequent rotation of the pivot shaft **117** and upward swinging of the arms **121** lifts the plungers **114** and with them the matrix M, causing the upper edge thereof to project through the opening **112** when the hinged cover **122** thereof is opened by lifting the handle **123**.

The matrix M is supported between pairs of concentric upper arcuate angle members **124** and **125**, and similar lower arcuate angle members **126** and **127**, spaced wires **128** and **129** extending between these in a manner similar to that of the wires **54** and **70** of Figures 1 to 4 inclusive. Arcuate banks **130** and **131** of heat lamp reflectors with incandescent bulbs **132** cause heat rays to be projected upon the opposite sides of the matrix M mounted in the arcuate space between the outer and inner wires **128** and **129**. Dry air is supplied to this space by a conduit **133** which connects with an arcuate duct **134** extending around the bottom of the arcuate space **135** for the matrix M, spaced holes or openings **136** admitting the dry air to the interior of the cabinet **111**. The dry air passes upward

through the arcuate space **135** and outward to the atmosphere by way of an outlet pipe **137**.

The mode of operation of the modified matrix drying machine **110** is generally similar to that of the machine **20** shown in Figures 1 to 4 inclusive, except in the details mentioned, resulting from the fact that the matrix M is dried and shrunk in an arcuate position rather than in a flat position. The matrix M is inserted and removed by raising the door or lid **122** by the handle **123** and at the same time depressing the foot pedal **115** to raise the plungers **114**. If a matrix is to be removed, the plungers **114** lift the upper edge of the matrix M above the level of the opening **112** in the top **113**, making it easily accessible to grasp by an operator. The plungers **114** are maintained in their raised position by keeping the foot pedal **115** depressed until the next damp matrix M is inserted in the arcuate space **135**, whereupon the release of the foot pedal **115** and the consequent descent of the plungers **114** cause the lowering of the matrix M into the position shown in Figure 10. The cover or door **122** is then moved downward into its closed position, the arcuate banks **130** and **131** of infra-red bulbs **132** are energized to cause radiant heat to impinge against the opposite sides of the matrix M, simultaneously drying and shrinking the latter at a rapid rate. The matrix is then removed and its curved form permits it to fit easily into the curved space in the casting machine without requiring it to be bent into arcuate form.

The electrical circuit has not been shown beyond the cable **79** and plug **80** (Figures 1 and 2) because it is outside the scope of the present invention, as set forth in the claims herein. For the purposes of better understanding the invention and its background, however, it may be said that an electronically-operated control circuit is provided which is energized by a switch operated by the door or lid **39**. When the door **39** is closed, it closes this switch which in turn energizes the electrical control circuit. The electrical control circuit, when thus energized, turns on the heating bulbs **76** or air heater **34**, turns on the blower **25** and starts an automatic timer (not shown) in operation. When this timer has completed the time cycle for which it was set, it opens the control circuit. The latter then turns off the heating bulbs **76** or air heater **34** (Figures 13 and 14), turns off the blower **25** and energizes a signal, such as a bell, to warn the operator, or causes the door **39** to spring open.

What I claim is:

1. A matrix drying machine comprising a cabinet having a matrix drying chamber therein, a matrix holder in said chamber having a vertically-disposed matrix-retaining device adapted to hold said matrix in a substantially vertical position, heaters disposed in said drying chamber on opposite sides of said matrix in said holder, an air inlet port in the lower part of said cabinet disposed beneath said holder, an air outlet port in the upper part of said cabinet disposed adjacent the upper portion of said retaining device, said cabinet having an access opening adjacent said holder, a closure disposed in closing relationship with said opening, a portion of said matrix-retaining device being mounted for motion between open and closed positions relatively to the remainder thereof, and mechanism operatively connecting the movable portion of said matrix-retaining device to said closure, said mechanism being responsive to the opening motion of said closure for shifting said movable matrix-retaining portion to its open position relatively to said remainder thereof.

2. A matrix drying machine comprising a cabinet having a matrix drying chamber therein, a matrix holder in said chamber having a vertically-disposed matrix-retaining device adapted to hold said matrix in a substantially vertical position, heaters disposed in said drying chamber on opposite sides of said matrix in said holder, an air inlet port in the lower part of said cabinet disposed beneath said holder, an air outlet port in the upper part

of said cabinet disposed adjacent the upper portion of said retaining device, said cabinet having an access opening adjacent said holder, a closure member disposed in closing relationship with said opening, a portion of said matrix-retaining device being mounted for motion between open and closed positions relatively to the remainder thereof, a handle member shiftably mounted on the outside of said cabinet and mechanism operatively connecting said movable matrix-retaining device portion to one of said members and responsive to the shifting of said one member to move said movable portion to its open position.

3. A matrix drying machine comprising a cabinet having a matrix drying chamber therein, a matrix holder in said chamber having a vertically-disposed matrix-retaining device adapted to hold said matrix in a substantially vertical position, heaters disposed in said drying chamber on opposite sides of said matrix in said holder, an air inlet port in the lower part of said cabinet disposed beneath said holder, an air outlet port in the upper part of said cabinet disposed adjacent the upper portion of said retaining device, said cabinet having an access opening adjacent said holder, and a closure disposed in closing relationship with said opening, said matrix-retaining device including a fixed retaining structure stationarily secured to said cabinet and a movable retaining structure movably mounted relatively to said fixed retaining structure, said movable retaining structure being accessible for actuation through said access opening for shifting to open and closed positions relatively to said fixed retaining structure whereby to effect loading and unloading of said matrix holder without removing it from said cabinet.

4. A matrix drying machine comprising a cabinet having a matrix drying chamber therein, a matrix holder in said chamber having a vertically-disposed matrix-retaining device adapted to hold said matrix in a substantially vertical position, heaters disposed in said drying chamber on opposite sides of said matrix in said holder, an air inlet port in the lower part of said cabinet disposed beneath said holder, an air outlet port in the upper part of said cabinet disposed adjacent the upper portion of said retaining device, said cabinet having an access opening adjacent said holder, a closure disposed in closing relationship with said opening, said matrix-retaining device including a fixed retaining structure and a movable retaining structure movably mounted for motion between open and closed positions relatively to said fixed retaining structure, and mechanism operatively connecting said movable retaining structure to said closure and responsive to the opening motion of said closure for shifting said movable retaining structure to its open position.

5. A matrix drying machine comprising a cabinet having a matrix drying chamber therein, a matrix holder in said chamber having a vertically-disposed matrix-retaining device adapted to hold said matrix in a substantially vertical position, heaters disposed in said drying chamber on opposite sides of said matrix holder and arranged to direct heat against the opposite sides of said matrix in said holder, an air inlet port in the lower part of said cabinet disposed beneath said holder, an air outlet port in the upper part of said cabinet disposed adjacent the upper portion of said retaining device, said cabinet having an access opening adjacent said holder, and a closure disposed in closing relationship with said opening, said matrix-retaining device including a fixed retaining structure and a movable retaining structure movably mounted relatively to said fixed retaining structure, said structures comprising panels of heat-radiation transparent material disposed in spaced parallel relationship defining a matrix space therebetween.

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