H. B. GALE.

ELECTRICALLY HEATED MATRIX PRESS.

APPLICATION FILED FEB. 10, 1910.

987,293.

Patented Mar. 21, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

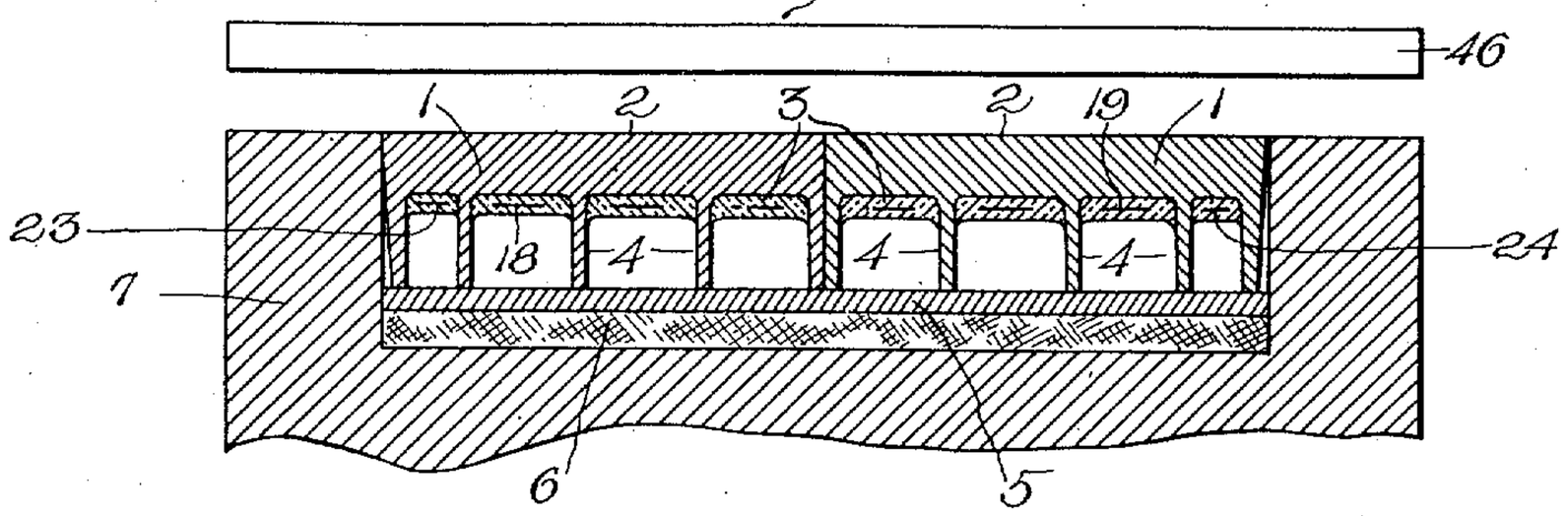
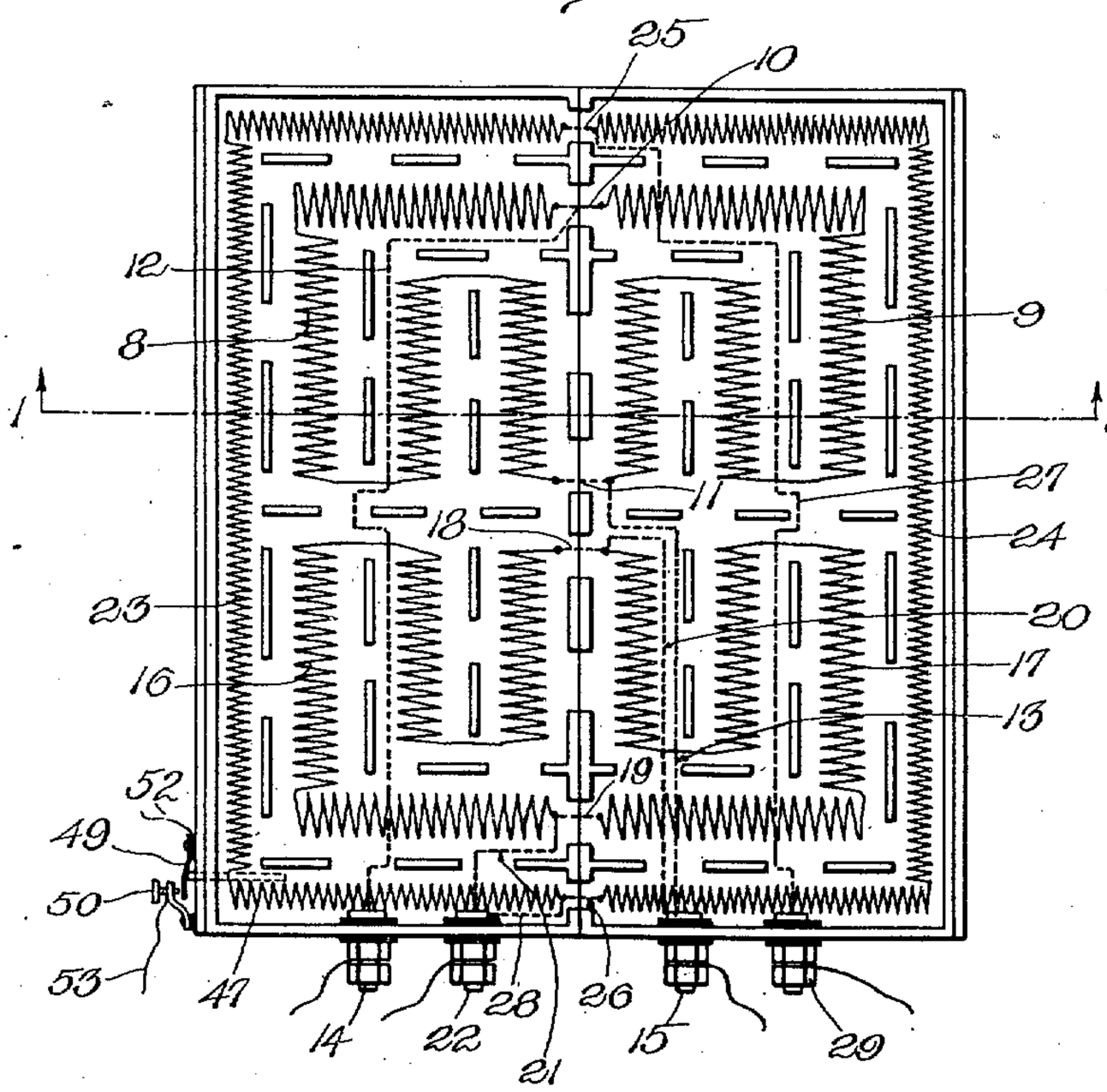


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

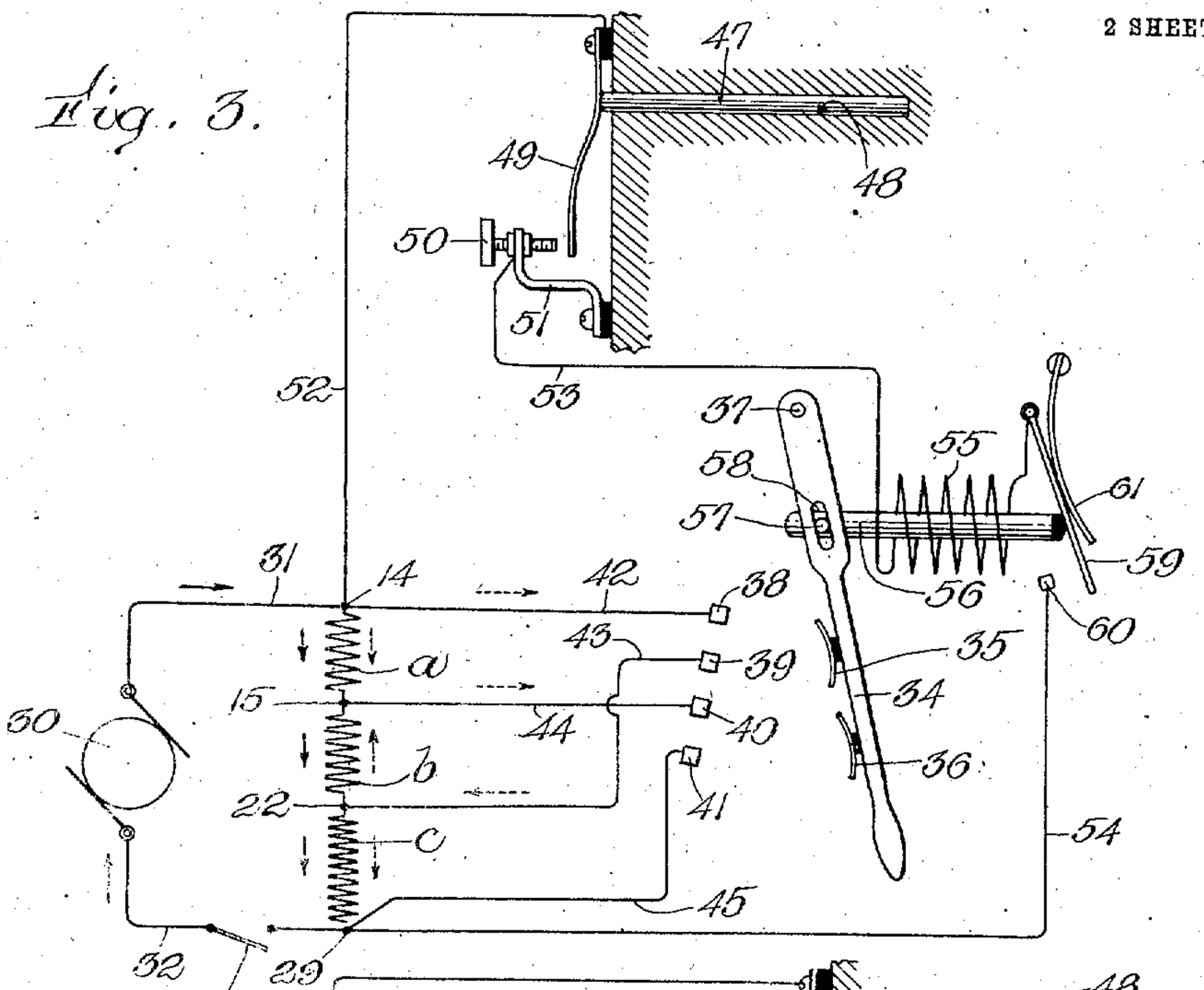
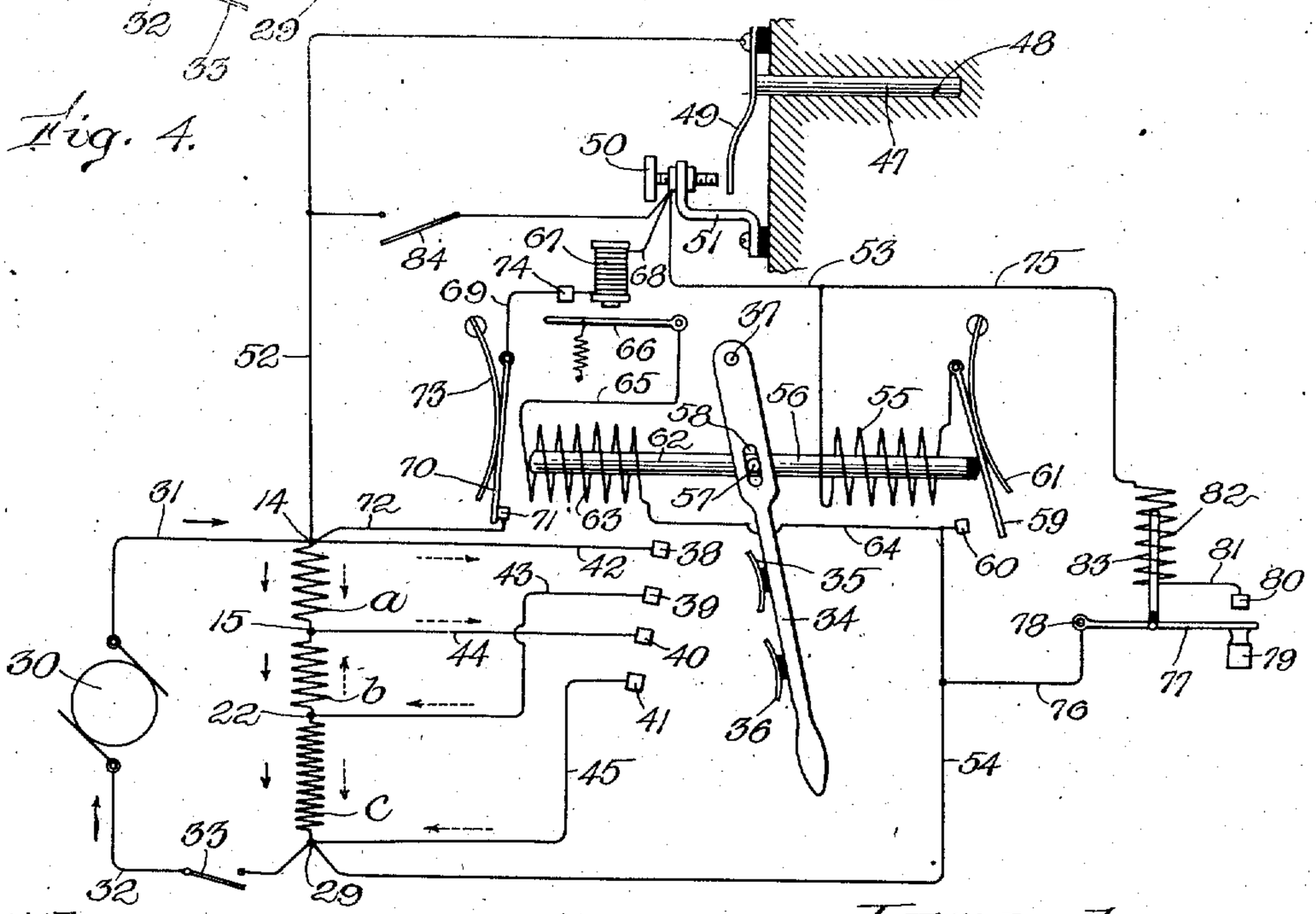


Fig. 4.



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UNITED STATES PATENT OFFICE.

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ELECTRICALLY-HEATED MATRIX-PRESS.

987,293. Specification of Letters Patent. Patented Mar. 21, 1911.

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To all whom it may concern:

Be it known that I, HORACE B. GALE, a citizen of the United States, and resident of Natick, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Electrically-Heated Matrix-Presses, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention has for its object the provision of electric means for quickening the process of drying a type matrix, combined with increased speed and economy in operation and simplicity of construction.

I secure quick operation by providing improved regulation of the current supplied to the plate on which the type-form is placed, whereby the plate is kept at the highest temperature possible without danger of melting the type, and by providing means for greatly increasing the current when the cold type-form is first placed in the press. Increased safety is secured by providing automatic means for diminishing the current whenever the plate approaches an overheated condition. Increased economy of operation is secured by the special construction and combination of parts hereinafter set forth, whereby the heat of the heating resistance is confined to the heating plate and is prevented from being dissipated to the table and adjacent parts, and whereby the apparatus is rendered substantially automatic so that it requires less attention than heretofore.

For a clear understanding of my invention, it may be well to set forth a brief statement of the requirements of such an apparatus. The type having been set and locked in a form, the latter is placed on a press table in position to receive, on top of the face of the type, the matrix material, consisting of a large number of sheets or layers of specially prepared tissue paper, moistened, and pressed down upon the type in impression-receiving relation thereto, and on this moistened layer of matrix paper are laid several thicknesses of woolen blankets, in position to be pressed down by the top plate of the press, which is ordinarily screwed down or held by pneumatic or hydraulic pressure, compelling the matrix to be firmly pressed into all the recesses of the type, making a clear, sharp impression. While the matrix is thus held under heavy pressure, heat is applied to the press table and conducted therefrom to the moistened matrix by the type-form, the woolen blankets absorbing the steam arising from the drying. Especially in newspaper work, it is necessary that this drying process shall be accomplished very quickly, or in other words, that the press table shall be kept at the highest temperature possible without danger of melting the type metal, which ordinarily melts at about 480 degrees F.; and accordingly it is the object of my invention to maintain the press, when drying the matrix, within reasonable safety limits of this temperature, say at 400 to 450 degrees F.

In the drawings, in which I have shown a preferred embodiment of my invention, Figure 1 is a vertical cross section of the apparatus on the line 1—1, Fig. 2, showing particularly the constructional details of the table; Fig. 2 is a bottom plan view of the heating plate, before the enamel is run thereon; and Figs. 3 and 4 are views, largely diagrammatic, showing further constructional details of the apparatus, Fig. 3 showing the same largely for hand operation, and Fig. 4 showing the most complete embodiment thereof.

As herein shown, the heating plate consists of a cast-iron body 1 made in sections of convenient size, having a smooth, flat top 2, the sections being provided on their under side with slender bearing lugs 4 which preferably rest upon an iron plate 5 supported upon or above a heat-insulating pad 6 of asbestos or other non-conductive material, the whole being retained by a bed piece or press table 7. The bearing lugs 4 are as small as possible, *i. e.* have a small sectional area relatively to the whole area of the plate so as to reduce to a minimum the downward heat conduction and interfere as little as possible with the arrangement and distribution of the heat resistance on the under side of the plate. This resistance is preferably in the form of reflexed wire, as illustrated at

23, 24, Figs. 1 and 2, sealed on the iron plate 1 by vitreous enamel 3 which holds the wire in intimate heat-conductive relation to the plate, while insulating it electrically therefrom.

In order to secure the best conduction of heat from the electric resistance, it is necessary to distribute the reflexed resistance wire as nearly as possible over the entire under surface of the heating plate, and it is also desirable that the bearing lugs 4 shall be correspondingly distributed substantially in lines between the sections of the resistance, so as to conform with the desired arrangement of the latter over the surface of the plate and in order properly to support the plate and prevent its being distorted from a true level under the heavy pressure to which it is subjected when heated, the plate 5 aiding in distributing this pressure over the insulating pad 6.

In order to give the lugs sufficient bearing surface with the least possible encroachment on the space required for the heating wire, I make them in the form of relatively long and narrow blades or fins, disposed lengthwise between the lines of reflexed conductor, and arranged with reference to the desired division thereof, as shown. The lugs thus arranged, not only furnish the necessary support for the plate while minimizing the heat losses, but coöperate further with the vitreous enamel in firmly attaching the heating wire to the plate. The division of the enameled surface into narrow strips by these knife-like projections tends to prevent the flaking off of the enamel due to the expansion of the wire when suddenly heated.

While the resistance wires may have various arrangements, they are preferably divided into several sections or circuits, preferably three, so disposed as to keep the plate 1 continuously at about its working temperature ready to receive the type-form so that there may be no delay in heating it. When the plate is standing idle, the heat escapes from it only by radiation and conduction to the surrounding masses of metal, and hence the loss of heat is much greater at the edges than in the center of the plate. Hence, to keep the plate at a uniform temperature over its whole surface, so that it will be fully heated at the edges and also not overheated in the center, it is necessary, while the plate is idle, to supply more heat around the outside edge than in the central portion of the plate. On the other hand, when in use, as the type-form of cold lead is placed upon the plate, it withdraws the heat uniformly and very rapidly from the entire surface of the heating plate, quickly lowering its temperature and checking the loss of heat from the edges to the surrounding portions of the press, it being understood that the rate of this loss is relatively very small in proportion to the rapid outgo of heat to the cold type form.

My invention provides means for introducing more watts per square inch around the edge than in the central portion of the plate when the inactive low-heating conditions are being maintained, with the result that the entire plate, including its edges, is kept at a practically uniform temperature, but when the active high heat conditions are being maintained, that is, when nearly the whole heat delivery is to the cold type form, the heating effect should be substantially uniform throughout the entire plate, and I therefore provide an arrangement whereby at this time the same number of watts is delivered per square inch in the central portion as at the edges of the plate, because then the matrix or type body which receives nearly the whole heat delivery is in place to withdraw the same amount of heat at one place as at another. To accomplish these results, I have herein shown one section of the resistance wire as consisting of two similar portions 8, 9 connected in multiple at the opposite terminals 10, 11 and thence respectively by conductors 12, 13 to binding posts 14, 15, a second section of resistance wire as consisting of a pair of resistances 16, 17 connected in multiple at 18, 19 and thence by wires 20, 21 to binding posts 15, 22, and a third section of resistance wire as consisting of a pair of resistances 23, 24 connected in multiple at 25, 26 and thence by wires 27, 28 to binding posts 22, 29. In the preferred arrangement, as herein shown, the inner sections, or first two mentioned above, cover each a somewhat larger area of the plate than the outside section 23, 24, and the latter is made of higher resistance than either of the other two, approximately in inverse ratio to the areas covered. Thus, when the three sections are connected in multiple, the current taken by each section will be approximately proportional to the area of the plate heated by that section, and the supply of heat to the plate will thus be practically uniform over its entire surface, this being the arrangement of the circuits used when a matrix is being dried, and hence when the maximum supply of heat is called for. When, however, the plate is standing idle, and hence less current is required, the three sections of the heating resistance are connected in series, so that the total current supply is thereby cut down to a relatively small proportion, preferably about one-tenth of the maximum current supply. As the heat generated in any section of the resistance when the sections are in series is proportional to the resistance of that section, the heat supplied to the edge of the plate will necessarily be greater than that supplied in the central portion of the plate, as

the outside section is made of higher resistance and covers less area than the interior sections. It will therefore be apparent that my arrangement of the heating resistance, in which a single high resistance circuit extends around the edge of the plate, combined with the special form and spacing of the bearing lugs, and the subjacent air spaces between the body of the plate 1 and the supporting plate 5, will maintain, with minimum current, a uniform temperature over the entire surface of the plate while the press is idle, and will also maintain like uniformity of temperature under conditions of maximum current and heat supply while the matrix is being dried.

The preferred means whereby the heating operations of the press are effected, is shown in its more simple hand-operated embodiment in Fig. 3, and in its more complete, and preferably automatic, embodiment, in Fig. 4. Resistance section 8, 9 is indicated at *a*, section 16, 17 at *b*, and section 23, 24 at *c*, current being derived from any suitable source 30 connected to the binding posts 14 and 29 by conductors 31, 32, a switch 33 being preferably interposed in the latter. A double-pole switch 34, provided with two contact-makers 35, 36, is mounted to swing from its pivot 37 into closing relation with contacts 38, 39, 40, 41 connected with the four binding posts of the apparatus by wires 42, 43, 44, and 45. Thus, when the switch 34 is open, the current flows through the resistances in the direction of the full-line arrows, whereas, when the switch 34 is closed, it flows in the direction of the dotted-line arrows, or, in other words, by closing the single switch 34, the resistance connections of the three sections of the resistance are changed from series relation to multiple relation. This special combination of three circuits is unique in permitting the change from series to multiple or the reverse, by the simple closing or opening of one double-pole switch; and it also furnishes about the required ratio (ten-fold to twenty-fold, according to relative resistance of the sections) of the high heat to the low heat current. The entire combination of structure of heater, circuits, and controlling devices, is thus specially adapted to produce the desired effect in the special apparatus for which it is designed.

When the type-form is placed in the press, and the top (indicated in Fig. 1 at 46) is clamped down thereon, the switch 34 is closed, placing the heater circuits in multiple, thus supplying a relatively large current to the heater. The cold type-form is thus rapidly brought up to the limiting temperature, and, if the supply of current were continued, would become overheated and ruined. Accordingly, to prevent this result and render the mechanism and operation safe, I provide a thermostatic mechanism adapted to open the switch 34 when the temperature of the plate reaches the limit of safety. The preferred form of thermostat herein shown consists of a rod or bar 47, of brass or other material having a higher rate of thermal expansion than the cast-iron of which the heater is composed, held in direct contact with the heating plate in any suitable manner, as by being inserted in a hole or cavity 48 in the plate, as best shown in Figs. 3 and 4. This rod rests against the bottom of the hole at one end and against a contact spring 49 at its other end, to cooperate with an adjustable screw contact 50 held in a bracket 51 for closing a circuit 52, 53, 54 whenever the heating plate reaches its maximum temperature. A solenoid 55 is interposed in this circuit adjacent the switch lever 34, whose armature core 56 is operatively connected to said lever, as by a pin 57 and slot 58, said core at its opposite end serving to open a switch 59, 60 when the handle 34 is in open position, said switch 59 being normally closed by gravity or a spring 61. Thus, when the handle switch is open and the heating plate is idle, the resistances are in series, thereby maintaining the plate continuously at proper temperature for receiving the type-form and matrix, and the moment the latter are put in place to be pressed and dried, the simple closing of the switch 34 changes the resistances from series to multiple, thereby introducing a much larger current to the heater, which rapidly raises the cold type-form, etc., to the maximum temperature, and, as soon as this point is reached, the thermostat 47, by closing its circuit, energizes the coil of the automatic circuit-breaker, which opens the switch 34, thereby cutting down the supply of current to the heater so that the temperature ceases to rise, while yet maintaining a proper flow of current thereto to hold the heater at the limit fixed by the smaller current, which is below the danger point. The same movement of the automatic circuit breaker operates to break its own circuit and thereby prevent waste of current while the thermostat is in its circuit-closing position, and prevents sparking when the contacts 49 and 50 separate, due to the cooling of the rod 47. The matrix having been dried, the type-form is removed from the press, and the latter is held at the safe limit of temperature with the sections of the resistance in series until another type-form is placed in the press, when the switch 34 is again closed, and the operation repeated.

In the more complete embodiment of my invention, as shown in Fig. 4, I provide for still more convenience and safety in the operation of the apparatus, the armature 56 being extended at 62 within a solenoid 63 connected by a wire 64 to the conductor 54

at one end and at its opposite end by a wire 65 to the switch armature 66 of a relay coil or automatic switch whose electro-magnet 67 is connected at one end by a conductor 68 to the circuit wire 53 and at its other end by a wire 69 to a switch lever 70 normally in closing relation to a contact 71 connected by a wire 72 to the adjacent side of the feed circuit, the switch 70 being held closed by gravity or a spring 73. The switch 66 coöperates with a contact 74. Connected around the solenoid 55 by conductors 75, 76 is a pilot switch 77 pivoted at 78 and operated by a push button 79 to close against a contact 80 connected by a wire 81 to a solenoid 82 which actuates an armature 83. This pilot switch promotes convenience in operating, as it is easier to work than the main switch 34 and may be placed in a more convenient position than would ordinarily be practicable for said main switch. Another switch 84 is preferably connected across from the wire 52 to the contact 50, which operates to close the circuit the same as the thermostat and is provided as a convenient means of opening the main switch at any time when it may be desired to do so without waiting for the plate to heat up to its maximum temperature.

In use, the apparatus being in the position shown, the work is placed in the press in the manner before stated. If now the button 79 is pressed so as to close the pilot switch, the circuit is thereby established through the switch 70, thus holding the pilot switch closed, and at the same time energizes the electro-magnet 67 which closes the switch 66, thus allowing current to flow in the solenoid 63, and, the latter being thereby energized, draws the armature 62 to the left and closes the main switch 34. In finishing said closing movement, the armature 62 strikes the switch 70 and moves it into open position, breaking the circuit through the coils 67 and 82, thereby permitting the opening of the switches 66 and 77. The motion of the armature 62 to the left also releases the switch 59, which thereupon closes against its contact 60. The apparatus is now in condition so that the circuit can be automatically opened by the thermostat 47 or by the hand switch 84. The result of the closing of the main switch 34 is that the resistances of the heating plate are changed from series to multiple, and this condition remains until the type-form is raised to its maximum temperature, whereupon the expansion of the thermostatic rod or bar 47 closes the circuit at 49, 50, thereby energizing the solenoid 55 which draws the armature 56 to the right and opens the main switch 34. This changes the resistances of the heating plate back from multiple to series relation. If, after this has occurred, the attempt is made again to close the switch 34 by pressing the button 79 while the temperature of the plate is still at its maximum, no current will flow through the solenoid 67 because the thermostat forms a short circuit around it from the point 14, or in other words, as long as the spring 49 makes contact with the adjusting screw 50, the main switch 34 cannot be closed by pressing the button 79, but the current in this case will follow the circuit 14, 52, 49, 50, 53, 75, 82, 81, 80, 77, 76, 54, 29. This energizes the solenoid 82 and holds the pilot switch 77 closed until the heating plate 1 has cooled sufficiently to open the circuit at the thermostat, thereby permitting the current to flow through the switch 70 and coil 67, as before described, thus closing the switch 66, energizing the solenoid 63 and again closing the main switch 34. This combination therefore allows the apparatus to be set for maximum-heating position by the closing of the switch 77, but prevents the closing of said switch 77 from bringing the parts into maximum-heating relation when said relation would be unsafe and prevents restoring said parts to said relation until the heater has cooled sufficiently to avoid danger. If while the temperature is at the upper limit and the thermostat circuit is closed from 49 to 50, the attempt should be made to close the main switch by moving the handle 34 to the left, the effect of the first slight movement would be to close the auxiliary switch 59, 60, thus energizing the solenoid 55. This would powerfully oppose any further movement to the left of the handle 34, which would, on being released, immediately fly back to the position shown in Fig. 4. At any time that it is desired to open the main switch without waiting for the plate to heat to its maximum temperature, this may be done either by the switch 84 or by moving the switch 34 manually.

It will be understood that my invention is not restricted to the mechanical details and arrangements of the preferred mechanism herein set forth except as otherwise required by certain of the more restricted claims.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a matrix press, an electric heater comprising a metal plate having a plane top surface adapted to receive a type form, an electric heating resistance consisting of a plurality of sections of reflexed conductor attached close to the bottom of the plate and insulated therefrom by vitreous enamel, and a plurality of relatively narrow knife-shaped bearing lugs projecting from the under side of the plate downward through the enamel near the sections of the heating resistance, said lugs being disposed lengthwise between the lines of reflexed conductor

and distributed over the surface of the plate so as to support it, substantially as set forth.

2. In a matrix press, an electric heater plate, comprising a metal plate having a plane top surface adapted to receive the type-form, and a plurality of bearing lugs of relatively small area depending from the bottom of the plate at intervals throughout the entire area thereof, an electric heating resistance in a plurality of sections enameled to the under surface of the heating plate, one of said sections having greater resistance than any of the others and being located adjacent the outer edge of the plate, and means for connecting the resistance sections in series for normal heat and in multiple for maximum heat.

3. In a matrix press, the combination of an electric heater, comprising a metal plate having a plane top surface adapted to receive the type-form, an electric heating resistance for the under side of the plate, a supply circuit, connections from the opposite ends of the resistance to said supply circuit, connections from two intermediate points of said resistance to said supply circuit, and switching means for reversing the polarity of the intermediate portion of the resistance between said two points whereby the current may be permitted to flow through the entire resistance in series or through the intermediate portion thereof in an opposite direction to that of the end portions.

4. In a matrix press, the combination of an electric heater, comprising a metal plate, resistance for heating said plate, a supply circuit connected to said resistance, a switch controlling the supply of current to the heater, a thermostat having a pair of contacts for opening and closing a circuit responsively to changes in the temperature of the plate, and means controlled by said thermostat for opening the switch and hindering the closure thereof, or permitting such closure, accordingly to whether the circuit through said pair of contacts is open or closed, substantially as set forth.

5. In a matrix press, the combination of an electric heater, comprising a metal plate, and a heating resistance therefor, a switch for controlling the supply of current to the heater, means to close said switch by hand, a thermostat responsive to the temperature of the plate to open the switch when the temperature of the plate reaches a predetermined limit, and thermostatic-controlled means for hindering the manual closing of the switch except when the temperature of the plate is below a predetermined limit.

6. The combination with a heater plate, of an electric heating resistance element arranged adjacent thereto, said element composed of separate sections adjacent respectively to the peripheral and central portions of the plate, and means whereby the relative proportions of current energy per square inch of surface disturbed to said peripheral and central portions may be varied, substantially as set forth.

7. The combination with a heater plate, of an electric heating resistance element arranged adjacent thereto and having separate sections adjacent respectively to the peripheral and central portions thereof, connections whereby a relatively small total current energy for heating may be distributed unevenly to the said portions of the plate, the peripheral portion receiving more watts per square inch of horizontal plane area than the central portion, and means for shifting said connections to supply a larger total current energy with a relatively greater share to the central portion of the plate, substantially as described.

8. In a matrix press, the combination with a plate, of an electric resistance element arranged adjacent thereto, having varying resistance coefficients per unit of plane area in different portions thereof, controllable means for directing current through said resistance element so as to uniformly apportion heating energy to all parts of the plate, and other means for optionally diverting an excess of current energy to selected portions of the plate.

9. In a matrix press, the combination with a plate, of heating resistance arranged adjacent thereto, said resistance composed of separate sections of different resistance coefficients per unit of plane area for the peripheral and central portions of the plate respectively, and means for directing current through said sections in series or in multiple, at option.

10. In a matrix press, the combination with a plate, of a heating resistance arranged adjacent thereto, said resistance comprising a section of relatively high resistance adjacent a relatively small peripheral part of the plate, and a section of relatively low resistance adjacent a relatively large central part of the plate, and connections for directing current through said sections in series or in multiple, at option.

11. In a matrix press, the combination with a plate, of a heating resistance element arranged adjacent thereto, said resistance element comprising a section of relatively high resistance adjacent a relatively small peripheral area of the plate, and a section of relatively low resistance adjacent a relatively large central part of the plate, means for connecting said sections in multiple at will, the resistance of said sections being so proportioned that the current then taken by each section will be approximately proportional to the area of the plate heated by that section, and means for connecting said sections in series at will.

12. In a matrix press, the combination

with a plate, of a heating resistance element disposed adjacent thereto, said resistance element composed of an outer section of relatively high resistance covering a relatively small peripheral portion of the plate, and two sections of relatively low resistance covering a relatively large central area of the plate, connections for joining said three sections in multiple, and means for shifting said connections to join said sections in series.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

HORACE B. GALE.

Witnesses:

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