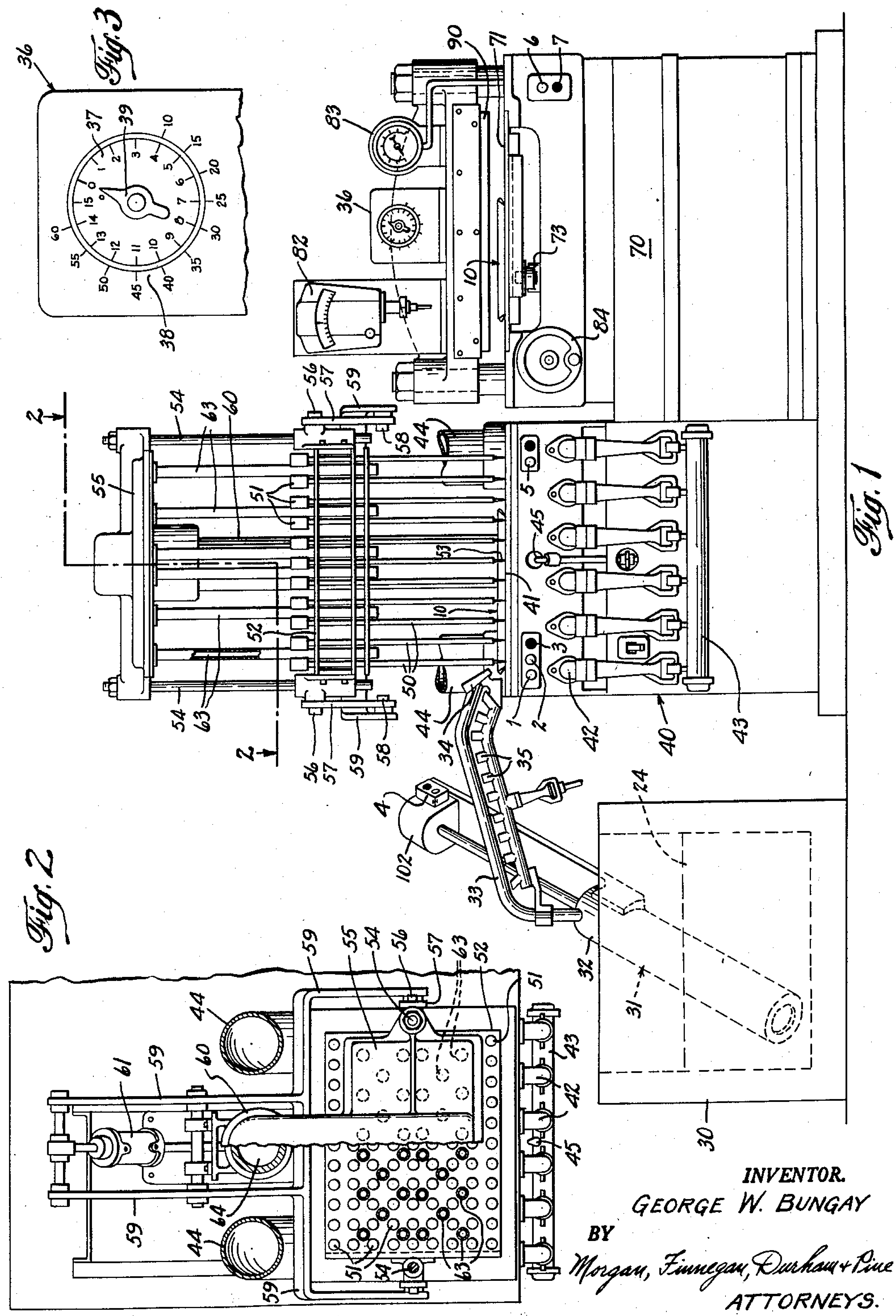
Sept. 2, 1958 G. W. BUNGAY 2,849,768

METHOD AND APPARATUS FOR BACKING-UP ELECTROTYPE SHELLS

Filed Dec. 3, 1953 5 Sheets-Sheet 1



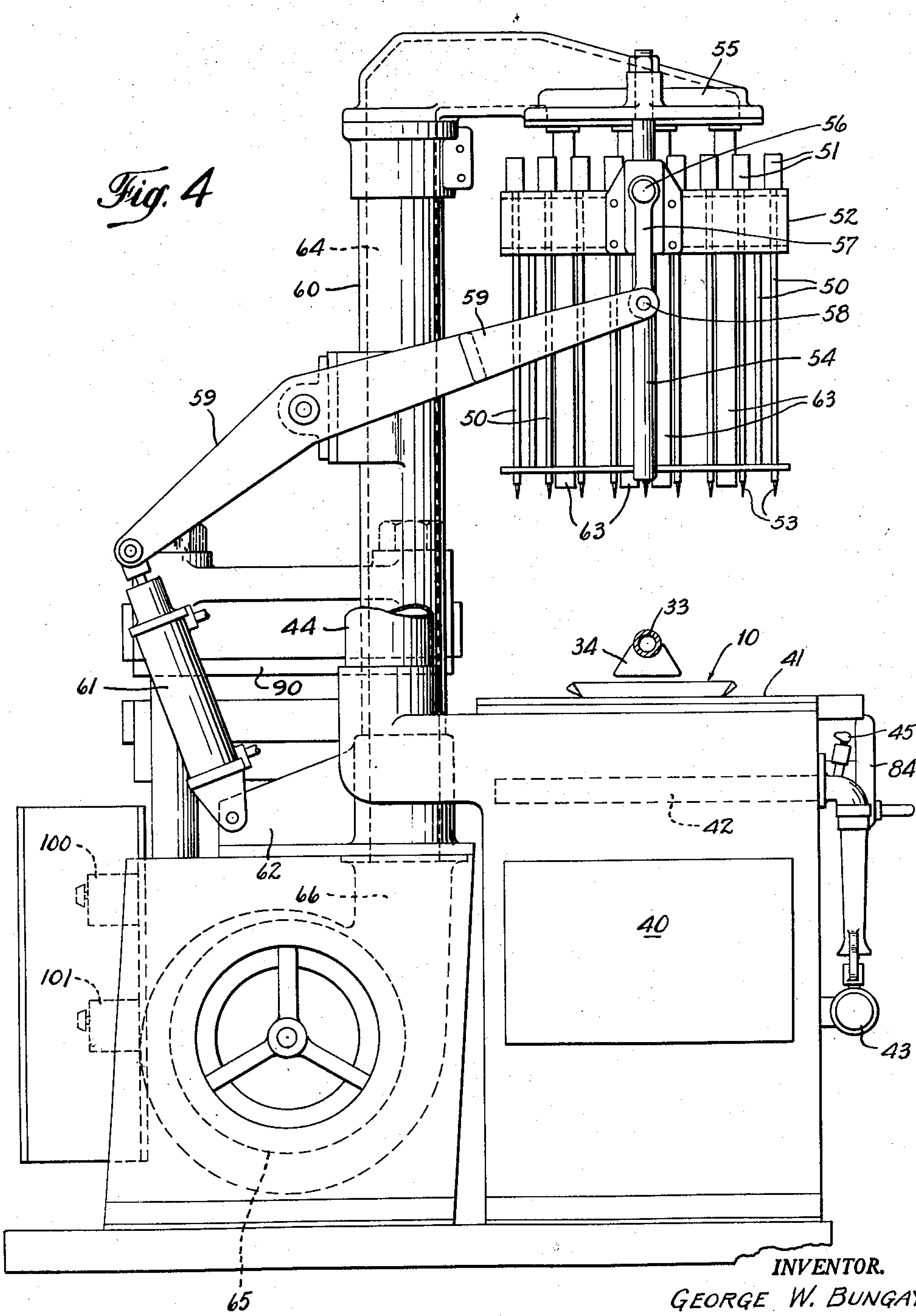
INVENTOR.
GEORGE W. BUNGAY
BY
Morgan, Finnegan, Durham & Pine
ATTORNEYS.

Sept. 2, 1958 G. W. BUNGAY 2,849,768

METHOD AND APPARATUS FOR BACKING-UP ELECTROTYPE SHELLS

Filed Dec. 3, 1953 5 Sheets-Sheet 2

Fig. 4



INVENTOR.
GEORGE W. BUNGAY
BY
Morgan, Finnegan, Durham & Pine
ATTORNEYS.

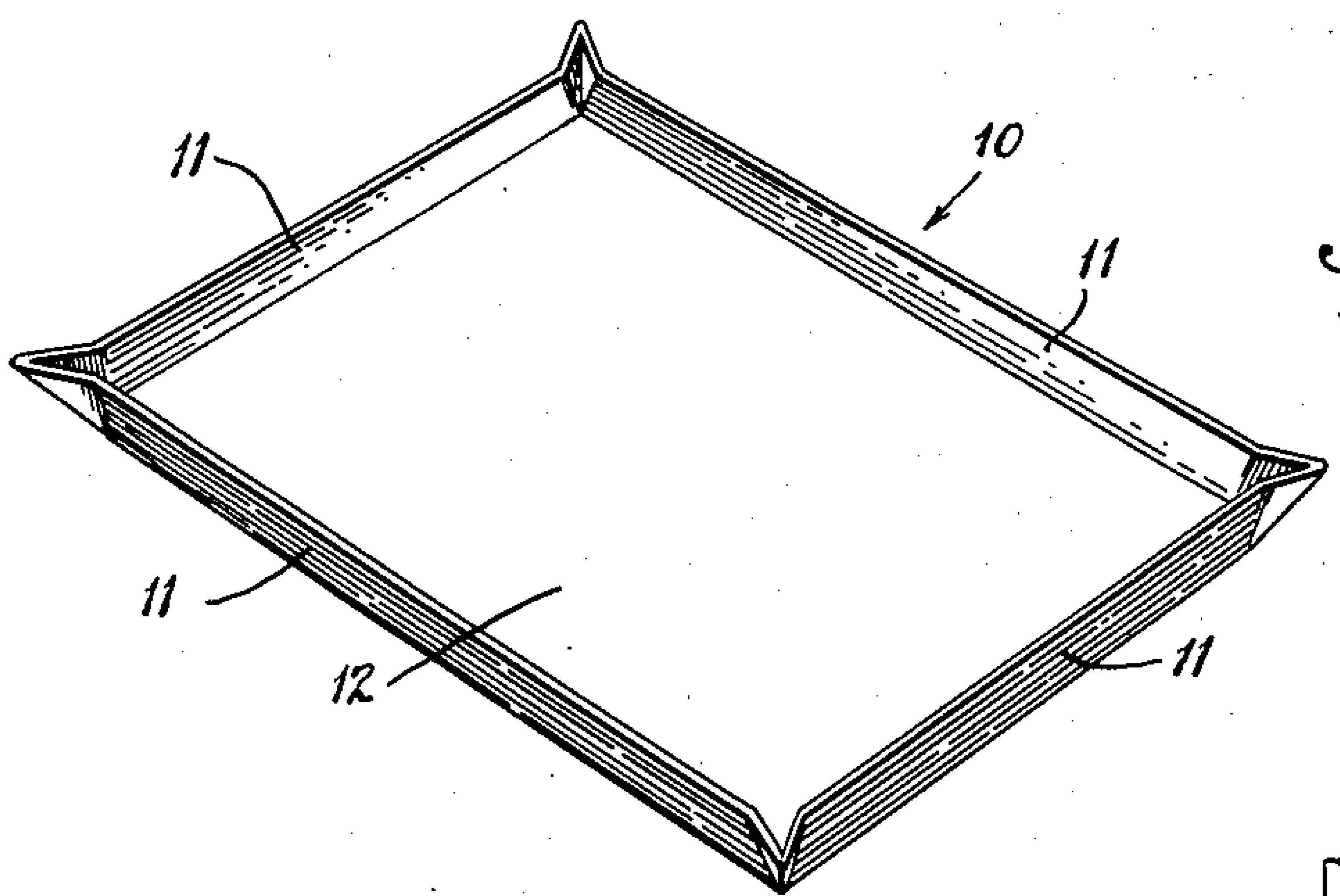


Fig. 5

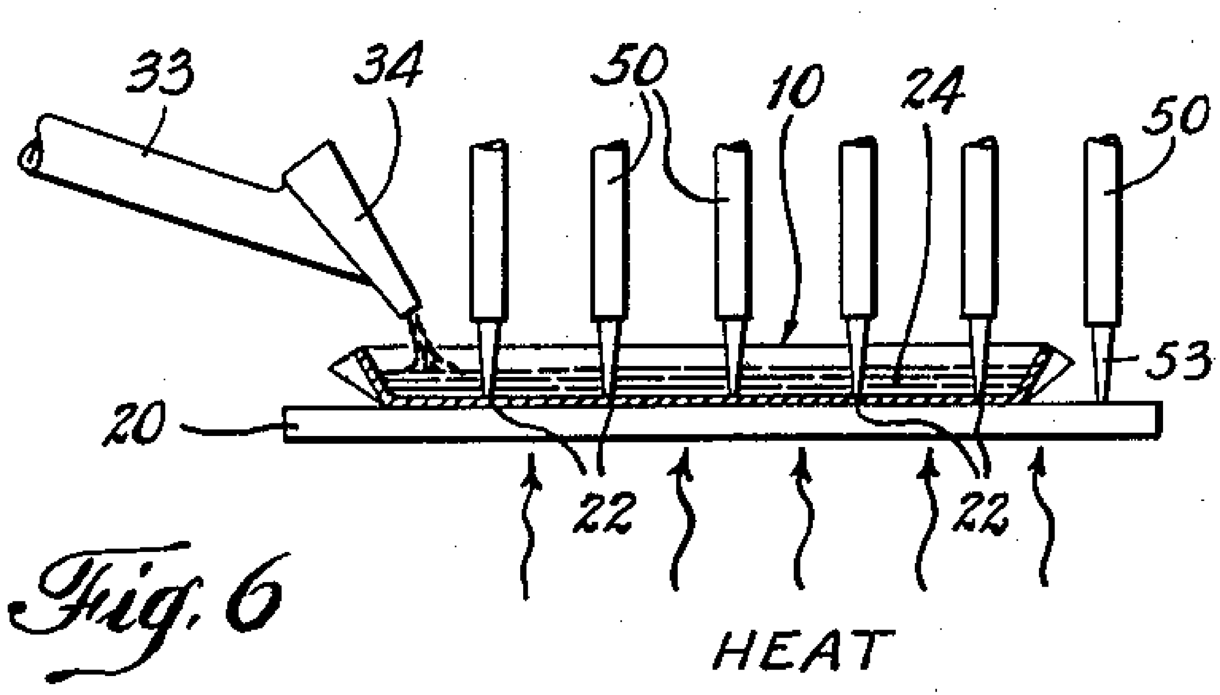
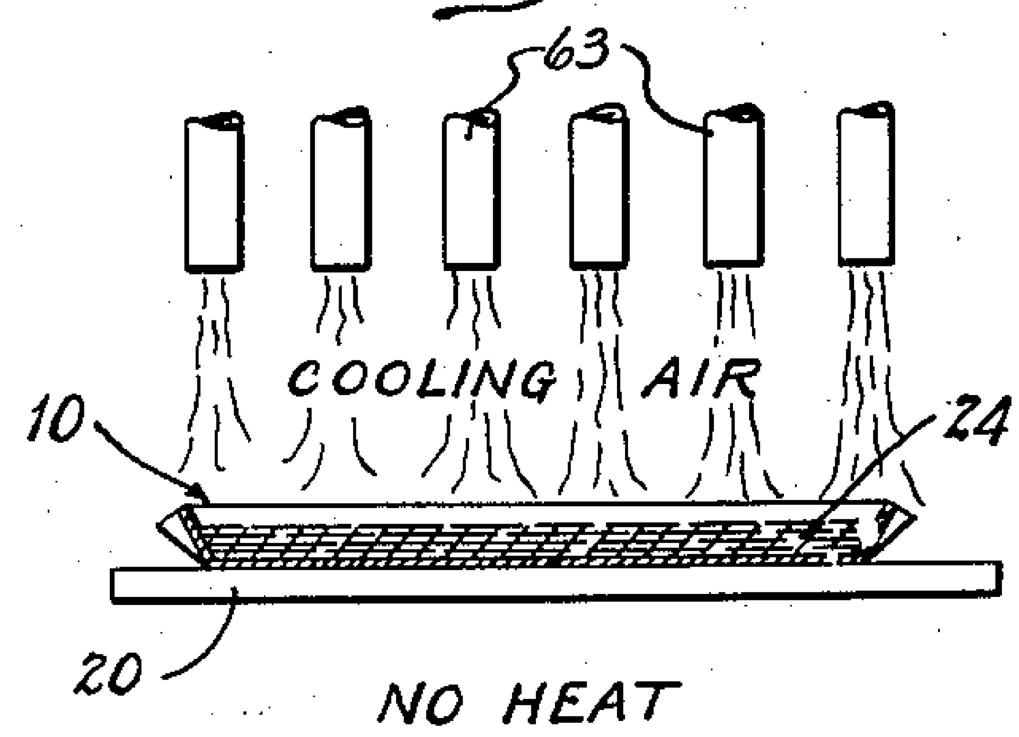


Fig. 6

Fig. 7



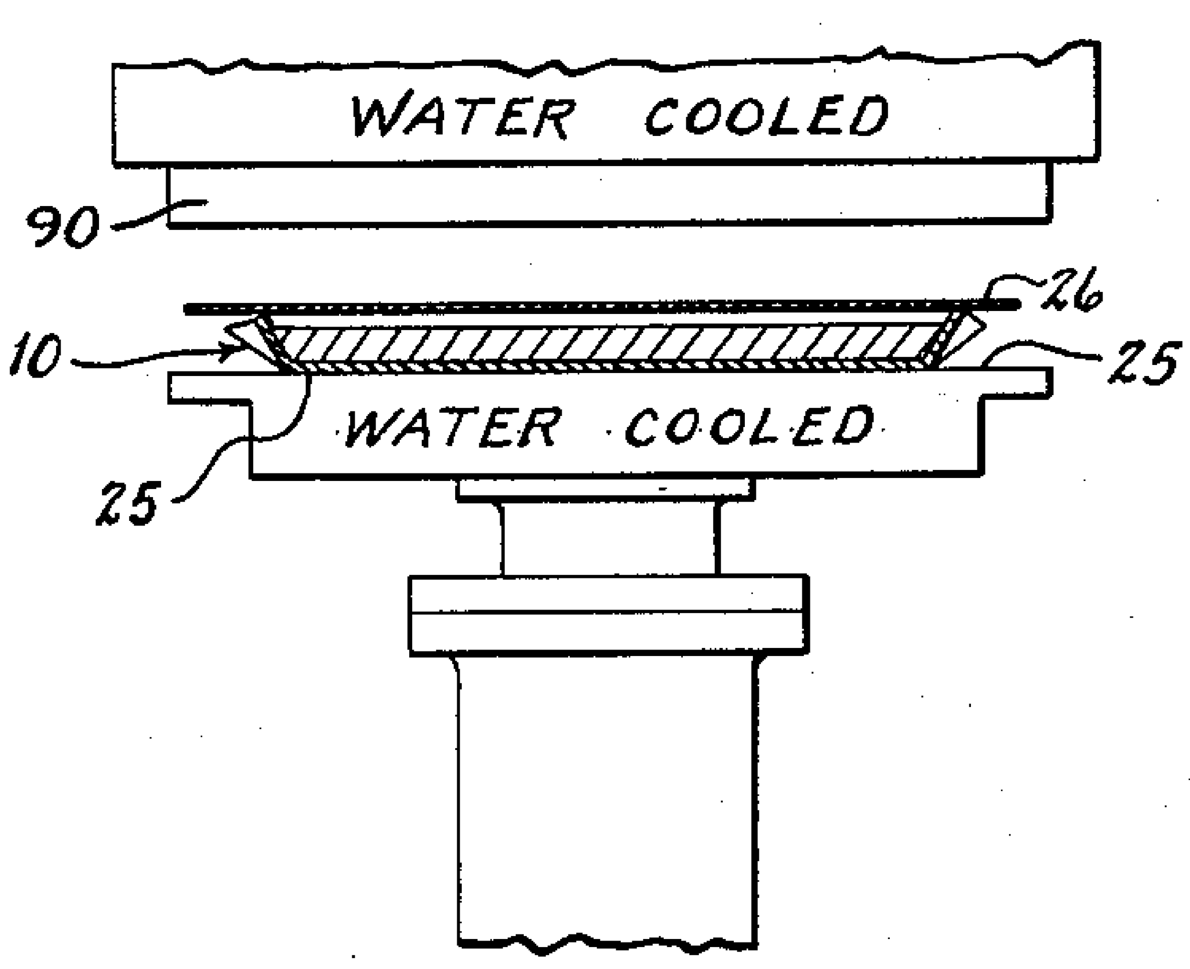


Fig. 8

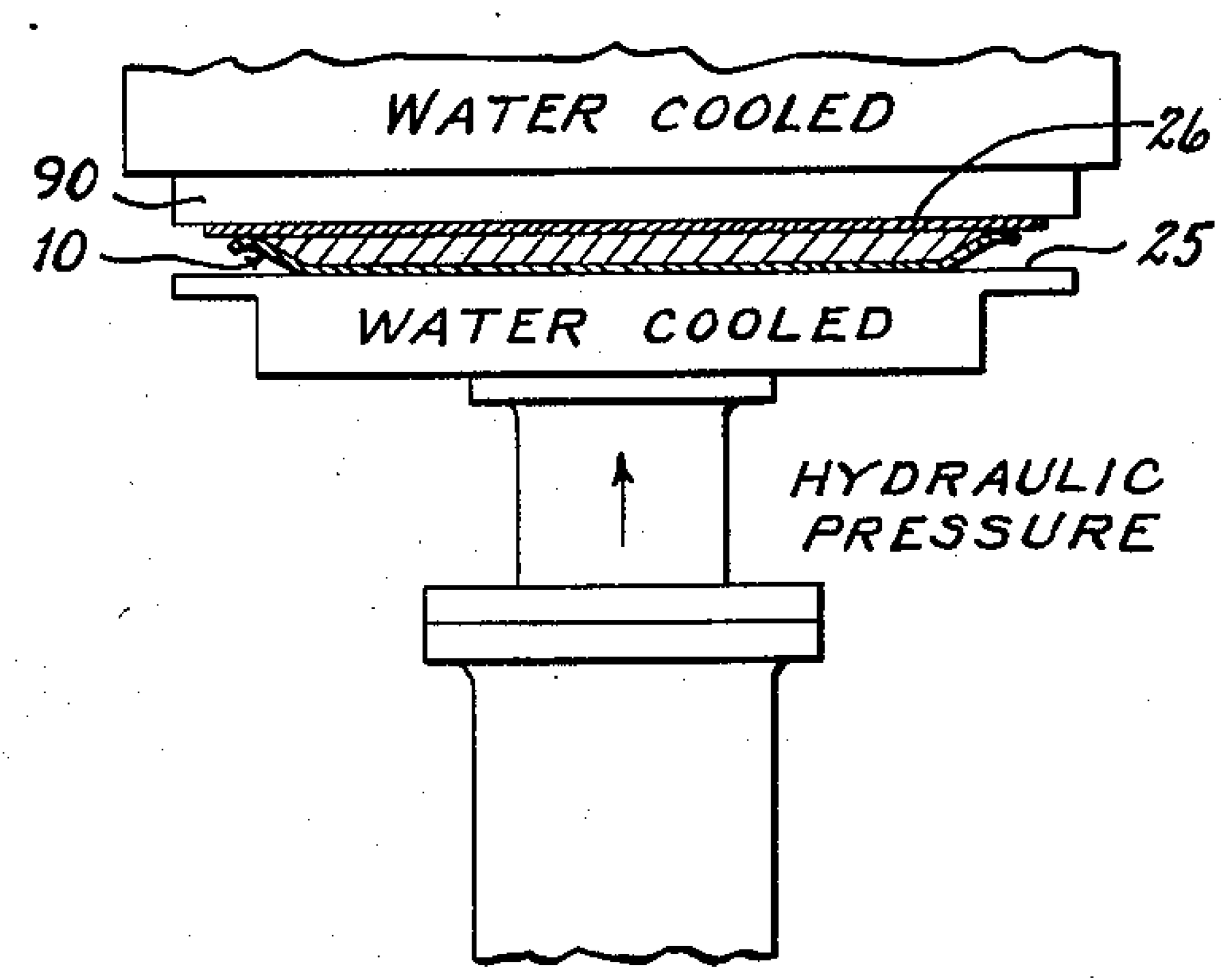


Fig. 9

INVENTOR.
GEORGE W. BUNGAY
BY
Morgan, Finnegan, Durham & Pine
ATTORNEYS.

Sept. 2, 1958 G. W. BUNGAY 2,849,768

METHOD AND APPARATUS FOR BACKING-UP ELECTROTYPE SHELLS

Filed Dec. 3, 1953 5 Sheets-Sheet 4

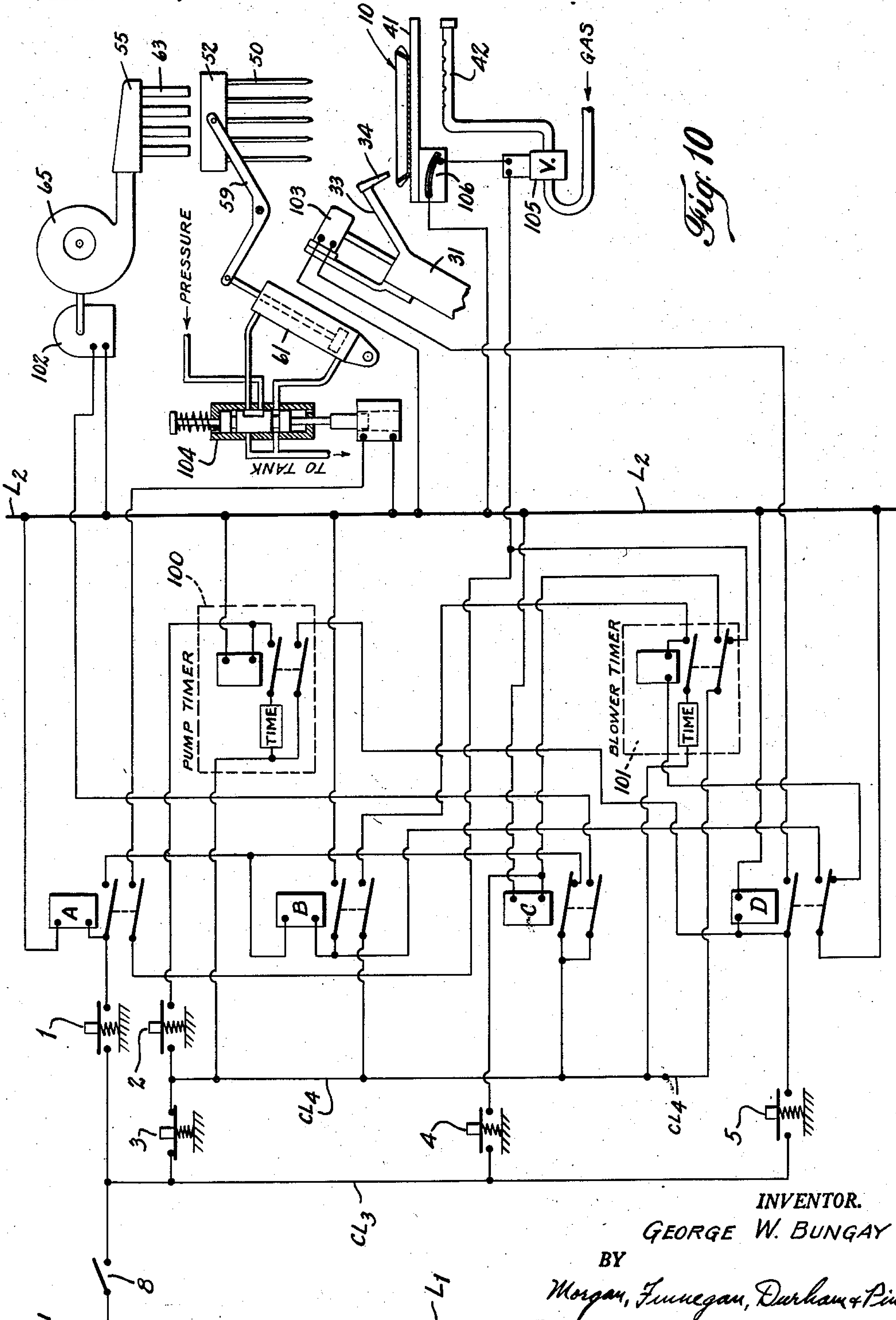


Fig. 10

INVENTOR.
GEORGE W. BUNGAY
BY
Morgan, Finnegan, Durham & Pine
ATTORNEYS.

Sept. 2, 1958 G. W. BUNGAY 2,849,768

METHOD AND APPARATUS FOR BACKING-UP ELECTROTYPE SHELLS

Filed Dec. 3, 1953 5 Sheets-Sheet 5

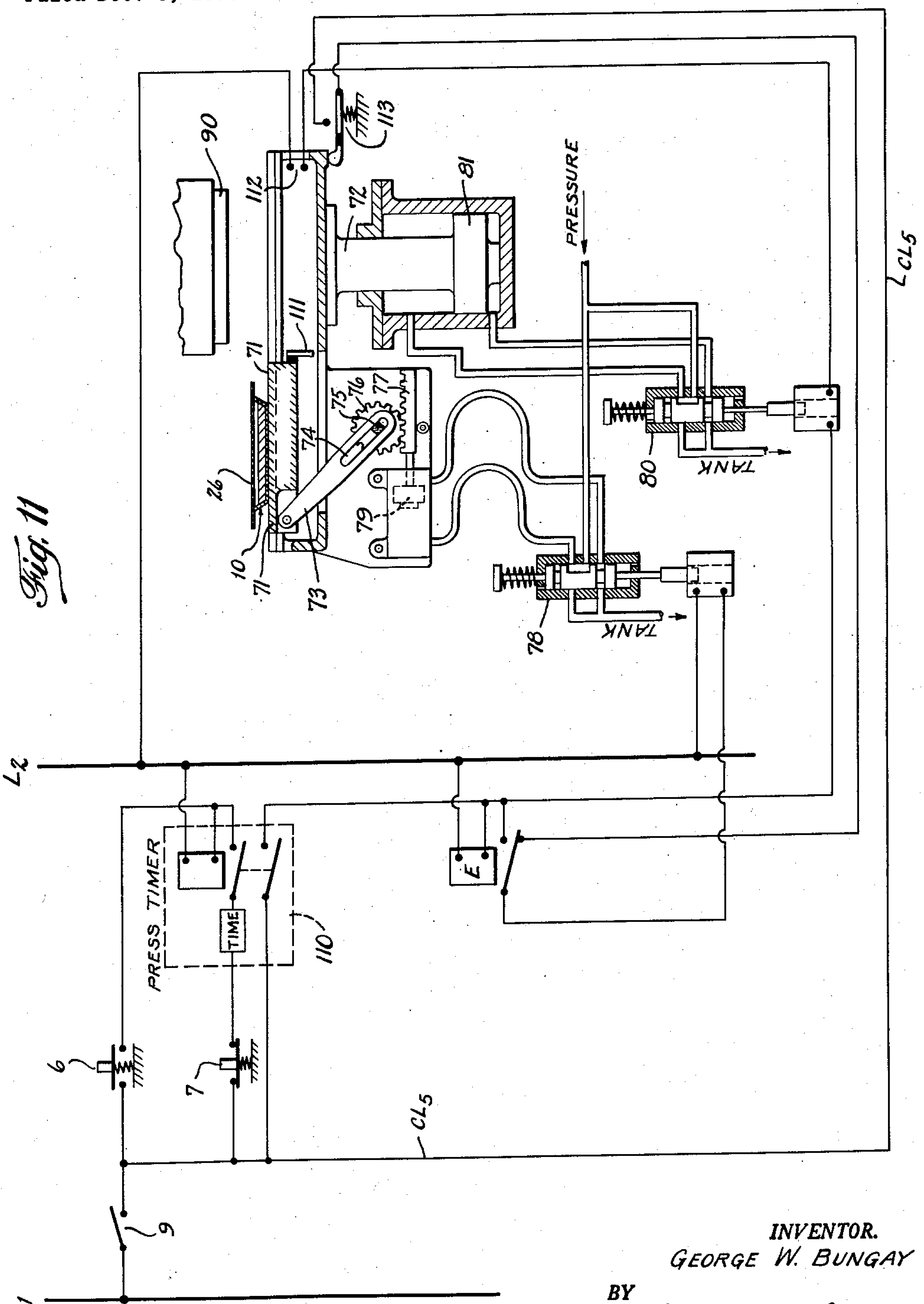


Fig. 11

INVENTOR.
GEORGE W. BUNGAY
BY
Morgan, Finnegan, Durham & Pine
ATTORNEYS.

2,849,768

METHOD AND APPARATUS FOR BACKING-UP ELECTROTYPE SHELLS

George Waldemar Bungay, New York, N. Y., assignor to Electrographic Corporation, New York, N. Y., a corporation of Delaware

Application December 3, 1953, Serial No. 395,995

5 Claims. (Cl. 22—58)

The invention relates to a novel method and apparatus for "backing-up" electrotype shells for letter press printing.

Heretofore great difficulty has been encountered in properly "backing-up" electrotype shells for letterpress printing. In order to obtain a high quality impression from an electrotype shell the face of the shell must be unwarped. Due to the rapid changes in temperature to which the thin copper electrotype shells are subjected in the "backing-up" process, and to the difference in thermal expansion between the shell and the backing metal, a considerable amount of warpage occurs which causes the face of the shell to be uneven, thereby requiring excessive work on the plate to render its face flat before it is made-ready. Presently known methods and apparatus for "backing-up" electrotype shells do not completely prevent this warpage and large amounts of time and effort are required to correct the defects caused thereby, often to the serious injury of the printing face.

In addition to the above-mentioned requirements it is also desirable that the density of the "backed-up" shells be uniform, and that all of the plates be "backed-up" with only a slight excess of metal so as to prevent overflow of the backing metal. In order to obtain such uniformity it is present practice to apply a considerable excess amount of backing metal to the shell and to shave the plate to the proper thickness afterward. This assures uniform thickness but also often introduces another step into the process. As a result of these additional operations and because of other time consuming operations (i. e. hand pouring, slow cooling) present methods and apparatus for "backing-up" electrotype shells are time consuming and costly.

Accordingly, it is an object of the present invention to provide a method for "backing-up" electrotype shells which avoids warpage of the electrotype shell, produces substantially uniformly thick electrotypes, and produces the electrotype shells more quickly than presently known methods at lower cost, also avoiding the need for cleaning backing metal from the face of the shell or plate.

A further object of the invention is to provide apparatus which will perform the functions of the above method either automatically or under manual control.

More specifically it is an object of the invention to provide a machine which will insure uniform heating of the electrotype shell prior to receiving the molten backing metal.

Another object of the invention is to provide a machine which will automatically pour a predetermined variable amount of backing metal onto the electrotype shell.

It is another object of the invention to provide a machine which will apply pressure to the electrotype shell prior to and during the pouring of the molten backing metal to prevent warpage.

Another object of the invention is to provide an improved holding device for "backing-up" machines which will apply pressure to the shell at a plurality of individual points during the pouring operation.

A further object of the invention is to provide a machine which will rapidly solidify the backing metal after it has been poured onto the shell.

Still another object of the invention is to provide a machine which will apply pressure to the backed shell during the cooling operation to prevent warpage.

Another object of the invention is to provide control means on the machine which will regulate the amount of backing metal poured onto the electrotype shell and which will at the same time indicate to the operator the proper amount of pressure which should be applied to the "backed-up" shell during the cooling operation.

Other objects of the invention will be in part obvious and in part pointed out hereinafter.

The applicant's method includes, briefly, placing an electrotype shell upon a supporting surface which is preferably heated but which need not be, pressing downwardly upon the shell at a plurality of spaced points to hold the face of the shell in contact with the supporting surface, pouring the molten backing metal onto the shell and withdrawing the pressure after the pouring is complete. If it is desired to speed the process a predetermined amount of air may be directed at the shell to bring the molten metal to a plastic sandy condition. In addition, the backed shell may be cooled by placing it upon a cooled surface and pressure may be applied to the backed shell or plate to prevent warpage during cooling.

Applicant's apparatus for carrying out the above method comprises a table having a supporting surface for an electrotype shell preferably heated from underneath by suitable heating means. A plurality of retractable, downwardly acting rods, or fingers, for exerting a downward pressure on the supporting surface at a plurality of individual points, are located above the supporting surface. Suitable cooling means are also provided for rapidly bringing the backing metal to a plastic sandy state after it has been poured onto the shell, said means comprising a plurality of air tubes interspersed among the downwardly acting fingers and located directly above the supporting surface for the electrotype shell. A conduit in the supporting structure for the retractable fingers communicates the tubes with the output of a blower mounted at the rear of the table. A pot for holding and heating the backing metal is preferably located immediately adjacent the table and a pump is mounted on the pot and provided with a heated conduit leading to the supporting surface on the table to pump molten backing metal onto an electrotype shell placed on the surface.

Applicant's preferred apparatus also includes a press having a cooled, movable supporting surface for the backed electrotype shell. In the embodiment shown and described the press is of the variable pressure hydraulic type having a water cooled supporting surface mounted on the forward portion thereof. Suitable control mechanisms are provided to cause the cooled surface to carry the electrotype shell into the press portion where pressure is applied to the shell during the cooling operation. Other suitable control mechanisms are also provided for automatically timing the operation of the pump, the blower, the retractable fingers, the heating means for the supporting table and for the hydraulic press. The pump timer control is constructed and indexed in such a manner that it indicates the proper hydraulic pressure to be used for the amount of molten backing metal pumped onto the electrotype shell. The apparatus may also be manually operated whenever such operation is desired.

It will be understood that the foregoing general description and the following detailed description as well are exemplary and explanatory of the invention but are not restrictive thereof.

The accompanying drawings, referred to herein and constituting a part hereof, illustrate one form of apparatus for carrying out the applicant's method and one embodiment of the apparatus, and together with the description, serve to explain the principles of the invention.

In the drawings, in which similar references numerals refer to similar parts,

Figure 1 is a front elevation of the apparatus showing the general arrangement of the various parts,

Figure 2 is a plan view, partly in section, taken along the line 2—2 in Fig. 1, of the supporting table showing a preferred arrangement of the air tubes amid the retractable fingers,

Figure 3 is a front view showing the face of the control mechanism for the pump,

Figure 4 is a side elevation of the apparatus showing the arrangement of the blower apparatus, the actuating mechanism for the retractable fingers, and the path of the air from the blower to the air blast tubes,

Figure 5 is a perspective view of an electrotype shell prior to being "backed-up."

Figures 6–9 illustrate the various steps of the applicant's method of "backing-up" electrotype shells,

Figure 10 is the electrical control circuit diagram for the supporting table apparatus, and

Figure 11 is the electrical control circuit diagram for the hydraulic press apparatus.

Referring now to the drawings for a detailed description of the applicant's method and apparatus and turning particularly to Figures 5–9 there is shown in Figure 5 an electrotype shell **10** prior to the "backing-up" operation. Although the applicant's method may be utilized with any type of electrotype shell the type of shell shown in Figure 5 is a type which is particularly suited for the applicant's method. In this type of shell, the edges **11** of the shell **10** are bent upwardly so as to form a tray-like member, the outside bottom of the tray being formed by the face of the shell and containing the printing type which will be impressed upon the paper. In order to insure a proper bond between the inside bottom **12** of the shell **10** and the backing metal which is to be applied thereto a suitable flux may be applied to the inner surface of the shell, but this is not essential.

The shell is placed upon a smooth perfectly flat supporting surface **20** which is preferably, but not necessarily, heated from underneath to melt the flux on the inner surface thereof. When the shell is placed upon the supporting surface **20** downwardly acting pressure is applied at a plurality of individual points **22** uniformly spaced over the entire inner surface of the shell to force all portions of the face of the shell into intimate and firm contact with the supporting surface to evenly heat the shell throughout and rapidly. When the flux is in a proper condition to receive the molten backing metal the predetermined, required amount of backing metal **24** is poured onto the tray-like shell. When the pouring operation has been completed the downwardly acting pressure is withdrawn and the heat under the supporting surface is reduced or discontinued.

If it is desired to speed up the operation a predetermined amount of cooling air may be directed at the molten metal in the shell to quickly bring it to a plastic "sandy" state. If the molten backing metal is electrotype metal this "sandy" condition will occur in the range of 510° to 550° F. The stoppage of the air indicates to the operator that the backing metal has been brought to the plastic "sandy" condition and acts as a signal to tell the operator to place the shell **10** upon a cooled supporting surface **25** to effect further cooling of the backing metal and shell while maintaining them against warpage. A cardboard sheet **26** may also be placed on the shell to form a backing therefor. During the cooling operation a forceful, even pressure is applied on the entire surface of the shell by a resilient pad to prevent the shell from warping.

Even heating of the electrotype shell reduces the warpage which would occur if the shell were unevenly heated. The application of pressure to the shell at a number of individual points during the heating and pouring operations holds the shell in proper alignment, speeds up the heating of the shell and prevents any warpage of the shell from occurring. By predetermining the amount of molten backing metal to be poured into each shell the applicant's method prevents overflow, achieves uniform thickness, avoids waste, and the addition of the solidifying and cooling steps speeds up the operation. By applying pressure to the shell during the cooling operation warpage in this operation is also eliminated. The end result is a product which is uniform and in perfect alignment.

In Figures 1–4, there is shown a preferred embodiment of an apparatus constructed in accordance with the teachings of the applicant's invention and designed to carry out the method outlined above. The apparatus includes three principal parts; a pot **30** for holding and heating the backing metal, a supporting table **40** upon which the principal steps of the method are carried out and a press **70** in which the "backed-up" electrotype shell may be further cooled under pressure.

The supporting table **40** includes a supporting surface **41** for the electrotype shell approximately waist high for the convenience of the operator and finished so as to be perfectly flat and smooth. Underneath the supporting surface **41** there is provided suitable heating means for heating the supporting surface. In the form of the invention shown the heating means comprises parallel series of gas burners **42** situated a short distance underneath the supporting surface. The burners communicate with a gas header **43** mounted on the front of the supporting table **40** and the entire area underneath the supporting surface is provided with a pair of chimneys **44** which direct the hot gases upwardly and away from the apparatus. A pilot light **45** is provided to ignite the gas escaping from the burners. The heating apparatus is controlled by suitable devices (to be described hereinafter) so as to be normally on except when cooling air is being directed at the shell.

The table **40** is also provided with a plurality of rod-like retractable fingers **50** mounted so as to be capable of exerting downwardly acting pressure upon the supporting surface **41**. Each of the fingers is individually weighted **51** and yieldably mounted in a frame **52** in order to conform to any irregularities in the electrotype shell **10**. The terminal portions **53** of the fingers **50** are sharply pointed to minimize the amount of heat conducted away from the shell during the heating and pouring operations. The frame **52** is mounted to slide upon a pair of parallel rods **54** depending from an air header **55** located above the supporting surface **41** and is provided with a pin **56** at each end having a lever arm **57** pivoted thereon. Each lever arm is in turn pivoted at its opposite end to suitable pins **58** mounted on the arms of a yoke **59**. The yoke is pivotally mounted on a supporting column **60** located at the rearward portion of the table and is actuated upwardly and downwardly by means of a hydraulic piston and cylinder **61** secured to the opposite end of the yoke **59** and pivoted on the base **62**.

Interspersed among the fingers **50** are a plurality of evenly spaced air blast tubes **63** through which cooling air is directed at the electrotype shell **10**. The tubes **63** are attached to an air header **55** which is mounted on the upper end of the supporting column **60** for the finger structure. The header **55** and the supporting column **60** are hollow so as to form a conduit **64** by which cooling air may be conveyed to the air blast tubes **63**. A centrifugal blower **65** is located behind the supporting table **40** and is so positioned that its discharge conduit **66** communicates with the bottom of the hollow supporting structure and communicates through the column **60** and the air header **55** with the air tubes.

A pot 30 for holding and heating the backing metal is preferably located immediately adjacent the supporting table. A motor driven pump 31 is mounted on the pot for pumping molten metal to the supporting surface 41 on the table. To this end, the casing 32 of the pump 31 is provided with a long discharge conduit 33 terminating in a nozzle 34 a short distance above the supporting surface 41 of the table 40. In order to prevent the molten metal from being cooled during its passage through the conduit 33 a series of gas burners 35, communicating with the main gas header 43, are provided at spaced intervals along the discharge conduit.

Immediately adjacent the table 40, on a side opposite to that of the pot 30, there is provided a variable pressure hydraulic press 70 having a water cooled platen, or supporting surface 71, for the shell. The platen, or supporting surface 71, comprises the forward portion of the apparatus while the press occupies the rearward portion. The press comprises a ram 72 and an upper, water-cooled resilient pad 90 preferably made of silicone rubber. The platen is movable rearwardly so as to lie within the plane of the ram 72 and the resilient pad 90 of the hydraulic press (Fig. 11). To this end, the water cooled platen 71 is provided with a rod 73 having an elongated slot 74 to receive a rectangular shaft 75 mounted on a pinion 76. A hydraulically actuated rack 77 engages the pinion 76 to rotate the pinion and move the platen 71 rearwardly into the path of the hydraulic ram 72. A spring biased solenoid actuated valve 78 controls the flow of hydraulic fluid to the actuating piston 79 for the rack 77. A similar spring biased solenoid actuated valve 80 controls the flow of hydraulic fluid to the ram piston 81. Each of the valves is controlled by suitable electrical mechanism (to be described hereinafter). A temperature gauge 82 for indicating the temperature of the metal in the pot 30 is mounted on the outer portion of the press 70. A gauge 83 for indicating the hydraulic pressure of the system, is also mounted on the press and a manually operable handle 84 is provided at the front of the press by which the pressure of the press may be varied.

In order to render the apparatus capable of use with various sizes of electrotype shells a timing device 36 is mounted on the press 70 by which the output of the pump 31 may be varied. Since the amount of pressure to be applied to the shell during the cooling operation varies in accordance with the size of the shell being backed and, hence, with the amount of metal poured onto the shell, the face of the pump timing device 36 is provided with a dual set of calibrations 37—38 (see Fig. 3). The inner set 37 of calibrations represent time in seconds while the outer set 38 of calibrations represent pressure in tons. Prior to starting the apparatus the operator sets the timer pointer 39 according to the area of the shell which is to be "backed-up" and reads off the corresponding pressure for the hydraulic press which he sets by means of the handle 84 and the gauge 83. The apparatus is then ready to start the cycle of operation.

The operation of the apparatus is as follows: the tray shaped electrotype shell 10 is first placed upon the supporting surface 41 of the table 40, the gas burners 42 are ignited and the supporting surface and the electrotype shell are heated from below. At the same time the operator pushes button 1 thereby causing the fingers 50 to move downwardly and exert an evenly distributed pressure on the shell to hold the shell in firm and intimate contact with the supporting surface. When the flux is in proper condition to receive the backing metal, the operator pushes button 2 which starts the pump 31 and causes the predetermined amount of backing metal 24 to be poured onto the electrotype shell. When the pouring operation is completed the fingers 50 are automatically retracted and the gas automatically turned off. At the same time, the blower is started and a blast of cooling air is directed at the shell through the air tubes 63 thereby quickly bringing the backing metal to a plastic "sandy" condition. When the blower goes off the operator is signalled to transfer the shell 10 to the water cooled platen 71 of the press 70 and he presses the button 6 to start the press cycle. The platen is moved inwardly to a position immediately above the hydraulic ram 72 and when it is in its innermost position completes a control circuit for the ram and causes the ram to rise upwardly thrusting the shell and cardboard backing against the water-cooled resilient pad 90 thereby exerting an even pressure on the entire surface of the shell during the cooling operation. When the operation is completed the ram retracts and the platen is returned to its original forward position.

Figure 10 shows the electrical control circuit diagram for the operations performed at the supporting table. The control circuit includes four double relays, marked A, B, C and D, two automatic timers 100, 101 together with double acting relays, one 100 for the pump, and one 101 for the blower, an electric motor 102 for driving the centrifugal blower 65, and electric motor 103 for driving the pump 31, a spring biased solenoid actuated valve 104 for valving a hydraulic fluid to the finger actuating cylinder 61, a solenoid valve 105 for controlling the flow of gas to the heating means and a thermocouple 106 to regulate the temperature of the heat supplied to the supporting surface 41 of the table 40.

The control circuit must first be alerted by closing the manual switch 8 which places the circuit in a starting condition and which also starts the gas burners 42 by energizing the solenoid valve 105 through the manual switch 8, stop button 3, control line 4 (CL4), the lower relay in the blower timer 101, through the thermocouple 106 and across to L2. The thermocouple 106 is set to keep the temperature of the supporting surface 41 at a level which will insure proper heating of the shell 10 but which will not prevent the cooling air from quickly bringing the backing metal to a plastic "sandy" state. After the operator closes the switch 8 he places an empty electrotype shell 10 on the supporting surface 41 and thereafter pushes control button 1. When button 1 is pushed the coil in relay A is energized closing both the relay switches. The top switch completes a holding circuit for the coil thorugh CL4, the top normally closed relay in relay C, top relay A, coil A across to L2. The closing of the bottom relay in A energizes the finger solenoid valve, the circuit being through CL4, the normally closed relay in the blower timer, lower relay A, the finger solenoid and L2. When the finger solenoid is actuated the valve 104 is thrust to its downward position and hydraulic pressure fluid is valved to the underside of the piston in the actuating cylinder 61 and the fluid on the upper side of the piston is exhausted to the return tank thereby moving the piston upwardly and lowering the fingers 50. When the operator sees that the flux in the shell is ready to receive the backing metal he pushes button 2 thereby energizing the coil of the pump timer 100 and closing the relay. The closing of the upper relay completes a holding circuit for the coil through the circuit CL4, the timing mechanism, the upper relay in the pump timer, the coil in the pump timer over to L2. The closing of the lower relay in the pump timer energizes the coil in relay D through the circuit CL4, the lower relay in the pump timer, coil in relay D, over to L2. When the coil in relay D is energized both the upper and lower relays are closed, the closing of the upper relay completing a circuit to the pump motor through CL4, the lower relay in the pump timer, the upper relay in relay D, the pump motor, over to L2. The closing of the lower relay energizes the coil in relay D completing a circuit through CL4, the normally closed upper relay in relay C, coil in relay B, the lower relay in relay D over to L2. When relay B is energized the upper relay completes a holding circuit for the coil B through CL4, the upper normally closed relay in relay C, coil B, upper relay B, over to L2. The closing of the lower relay in B puts the blower timer coil in a condition to be energized upon the de-energizing of relay D.

When the pump timer mechanism breaks the holding circuit of the pump timer coil the relay of the timer is de-energized thereby de-energizing relay D. When relay D is de-energized the lower relay assumes its normally closed position and completes the blower timer circuit through CL4, the lower relay in relay B, the blower timer coil, the lower normally closed relay in D over to L2. The closing of the upper relay in the blower timer completes a holding circuit for the blower timer coil through CL4, the timing mechanism, the upper relay in the blower timer, the blower timer coil, the lower normally closed relay in D, over to L2. At the same time, the normally closed relay in the blower timer assumes its open position thereby de-energizing the solenoid gas valve **105** and the finger solenoid valve **104** turning off the gas and raising the fingers. In its open position the lower relay completes a circuit through coil C through CL4, the lower relay in the timer, coil C and over to L2. When relay C is energized the upper normally closed relay is broken thereby de-energizing relay A and the lower relay in C completes a circuit to the blower motor **102** through CL4, lower relay C, the blower motor, over to L2. After a proper interval of time the timing mechanism in the blower timer interrupts the holding circuit for the coil thereby de-energizing the relay in the blower timer and de-energizing the relay C. When the relay C is de-energized the blower motor is turned off and the control circuit is in condition to repeat the cycle.

If it is necessary to stop the operation of the apparatus quickly the operator pushes the stop buton **3**. When this button is pushed the entire control circuit is isolated from L1 and all operations come to a halt. Button **5** is pushed by the operator when it is desired to operate the pump manually. Button **5** completes a circuit from CL3 through the upper relay D to the pump motor and operates the motor as long as the operator continues to push on the button **5**. Button **4** operates in a similar manner for the blower, the relay C and the blower motor being energized by the operator as long as he pushes on the button.

The press control circuit diagrammed in Fig. 11 includes a press timer **110** with a double relay, a single relay E, a spring biased, solenoid actuated valves **78** for controlling the flow of hydraulic fluid to the actuating cylinder for the water cooled platen **71**, a second spring biased, solenoid actuated valve **80** for controlling the flow of hydraulic fluid to the piston for the ram **72**, a contact **111** on the rearward end of the platen **71** for closing a normally opened gap **112** in the circuit at the end of its rearward travel, a normally closed spring contact **113** opened by the hydraulic ram **72** at the limit of its downward travel, and a stop button **7** and a starting button **6**. To put the control circuit in a ready condition the operator first closes the manually actuated knife switch **9**. He then places the electrotype shell **10** on the water cooled platen **71** at the forward portion of the press **70**. Starting button **6** is then pushed to initiate the cycle of operation.

When the start button **6** is pushed the actuating circuit for the coil in the press timer relay is energized and both relays in the timer **110** are closed. The closing of the top relay completes a holding circuit for the coil from CL5, through the timing mechanism, the upper relay, the press timer coil, and over to L2. Closing the bottom relay in the timer energizes the relay E through the circuit, CL5, lower relay in the press timer, coil in relay E, over to L2. When the coil E is energized the relay E is closed and the coil circuit for the platen solenoid valve is completed from CL5, lower relay in the press timer, relay E, solenoid coil, and over to L2. Under the influence of the solenoid the valve **78** is moved downwardly to valve hydraulic fluid from the pressure line to the right hand side of the piston **79** in the platen actuating cylinder and the fluid on the left hand side of the piston is exhausted to the return tank of the hydraulic system. As the piston moves leftwardly the rack **77** secured thereto rotates the pinion gear **76** which in turn rotates the square stud **75**. The stud **75** causes the slotted lever arm **73** to rotate also and to move the platen **71** rearwardly toward the hydraulic ram **72**.

The closing of the lower relay in the press timer also alerts the solenoid in the ram solenoid valve **80** and puts it in a condition to be energized upon the closing of the normally opened gap **112** in the coil circuit. When the platen **71** has moved to the limit of its rearward travel a contact **111** on the rearward end of the platen closes the gap **112** and energizes the ram solenoid valve **80**. Under the urging of the solenoid the valve **80** moves downwardly and valves hydraulic fluid from the pressure line to the underside of the ram piston **81**. At the same time fluid on the upper side of the piston is exhausted to the return tank of the hydraulic system. As the piston moves upwardly to exert a pressure on the electrotype shell **10** during the cooling operation the normally closed spring contact **113** is allowed to close. The closing of this contact **113** alerts a second holding circuit for the platen solenoid valve **78** to be energized upon the de-energizing of the press timer relay and relay E thereby holding the platen in its rearward position during the lowering of the hydraulic ram **72**.

The hydraulic ram exerts a pressure on the shell for a predetermined time set in the timing mechanism of the press timer **110**. When the time is up the time mechanism de-energizes the press timer coil and relays and also de-energizes relay E. When the lower relay in the press timer returns to its normally opened position the solenoid in the ram solenoid valve **80** is returned to its normal position by the spring and hydraulic fluid from the pressure line is valved to the top of the ram piston **81** while the fluid on the underside of the valve is returned to the tank thereby lowering the ram to its normal position. During the lowering of the ram the platen **71** has been held in its rearward position by the circuit CL5, normally closed spring contact **113**, normally closed relay E, solenoid coil and L2. When the ram **72** reaches its downwardly limiting position it opens the spring contact **113** and de-energizes the platen solenoid valve **78**. The spring then returns the valve to its normal position, valving fluid to the left hand side of the piston and exhausting fluid from the right hand side of the piston thereby moving the piston rightwardly, rotating the pinion **76** leftwardly and moving the platen **71** to its forward position.

It is to be understood that the form of the invention shown and described is merely a preferred embodiment and that the invention in its broader aspects is not limited to the specific mechanisms shown and described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

I claim:

1. Apparatus for "backing-up" electrotype shells including a stationary heated, thermostatically-controlled supporting surface for the electrotype shell, a plurality of individually movable, downwardly acting, yieldable fingers for pressing the face of the electrotype shell in contact with said surface, a pump for supplying molten backing metal to the electrotype shell during the time the shell is held in contact with the supporting surface, and timing means for automatically controlling the volume of metal delivered by the pump.

2. Apparatus as set forth in claim 1 in which the fingers are retractable.

3. Apparatus for "backing-up" electrotype shells said machine including a stationary thermostatically controlled supporting surface for the electrotype shell, a plurality

of downwardly pressing individually yieldable fingers for engagement with the shell to hold the shell in contact with the supporting surface during tthe pouring of backing metal onto the shell, supporting structure for the fingers, and blower apparatus in said supporting structure for directing a flow of cooling air to the backing metal in the shell.

4. Apparatus as set forth in claim 3 having heating means for the supporting surface for the electrotype shell and control means for actuating said heating means during the pouring of the backing metal onto the shell and thereafter for turning off the heating means and starting said blower apparatus for cooling air flow.

5. Apparatus for "backing-up" electrotype shells including a stationary supporting surface for the electrotype shell, a plurality of downwardly pressing individually yieldable fingers for holding the face of the shell in contact with the supporting surface, heating means underneath the supporting surface for the heating thereof, a pump for pumping molten backing metal directly onto the electrotype shell, adjustable control means for automatically controlling the volume of metal delivered by the pump, a plurality of tubes above the supporting surface for directing a flow of cooling air at the electrotype shell to cool the backing metal, and a second control means for turning off the heat and for starting and automatically timing the flow of air to the electrotype shell upon the termination of pump operation.

References Cited in the file of this patent

UNITED STATES PATENTS

387,644	Jackson	Aug. 14, 1888
672,859	Ringler	Apr. 23, 1901
1,164,078	Dunton	Dec. 14, 1915
1,183,105	Nocheck	May 16, 1916
1,205,952	Keefe	Nov. 21, 1916
1,219,289	Gounley	Mar. 13, 1917
1,559,231	Eckersall	Oct. 27, 1925
1,601,378	Slade	Sept. 28, 1926
1,768,990	Loesser et al.	July 1, 1930
1,779,253	Temmen	Oct. 21, 1930
1,964,367	Smith	June 26, 1934
2,182,114	Bungay	Dec. 5, 1939
2,222,013	Atwood	Nov. 19, 1940
2,236,212	Huck	Mar. 25, 1941
2,504,080	Myers	Apr. 11, 1950
2,532,256	Holmes et al.	Nov. 28, 1950
2,674,640	Tama	Apr. 6, 1954
2,782,474	Bishop	Feb. 26, 1957
2,790,217	Tyler	Apr. 30, 1957