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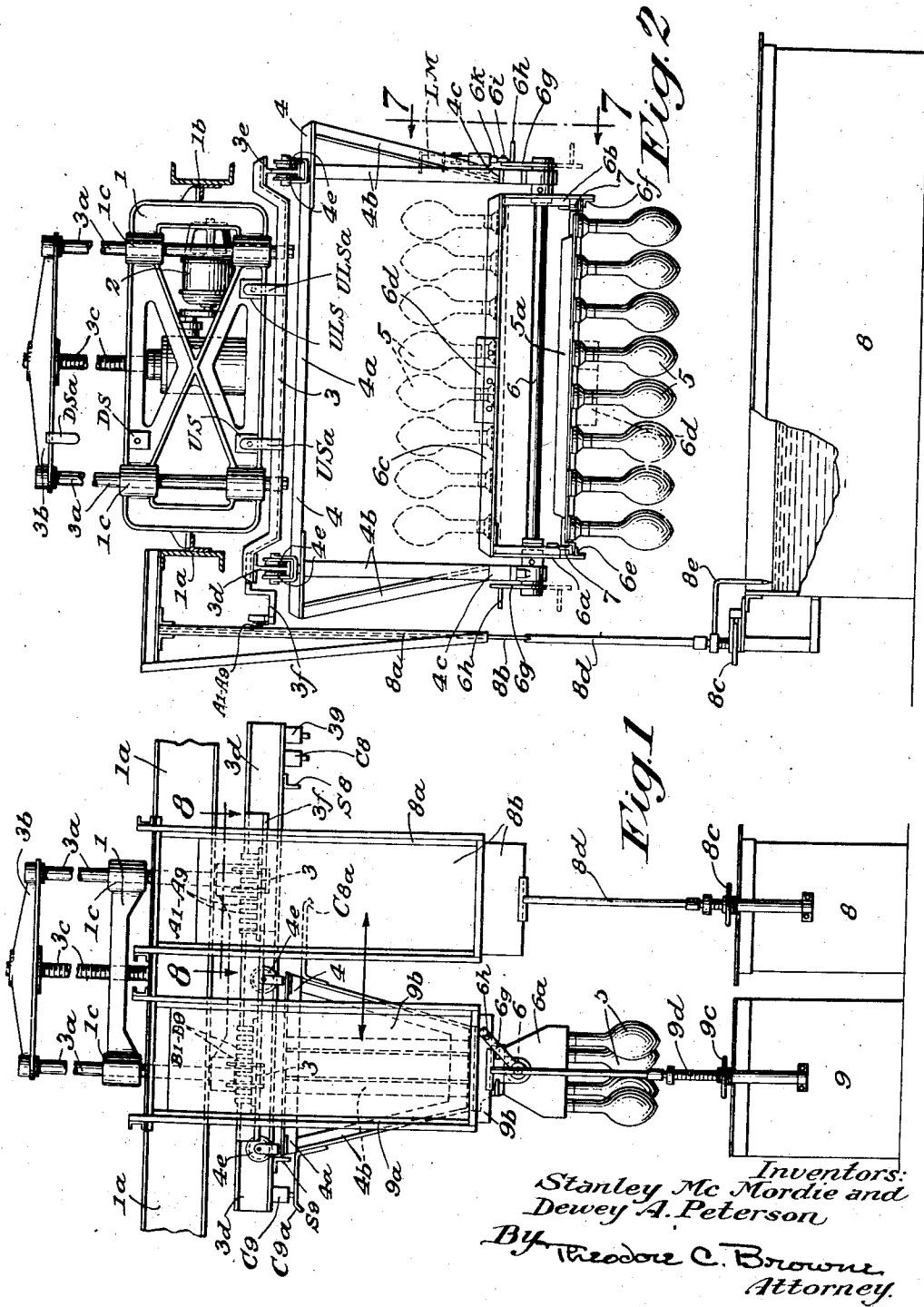
S. McMORDIE ET AL

2,389,319

DIPPING MACHINE

Filed Nov. 10, 1941

12 Sheets-Sheet 1



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DIPPING MACHINE

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12 Sheets-Sheet 2

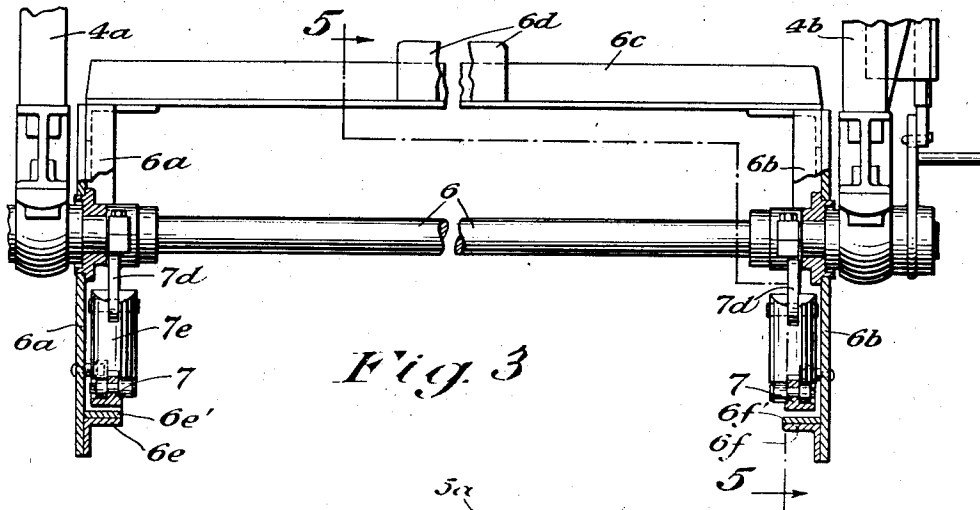


Fig. 3

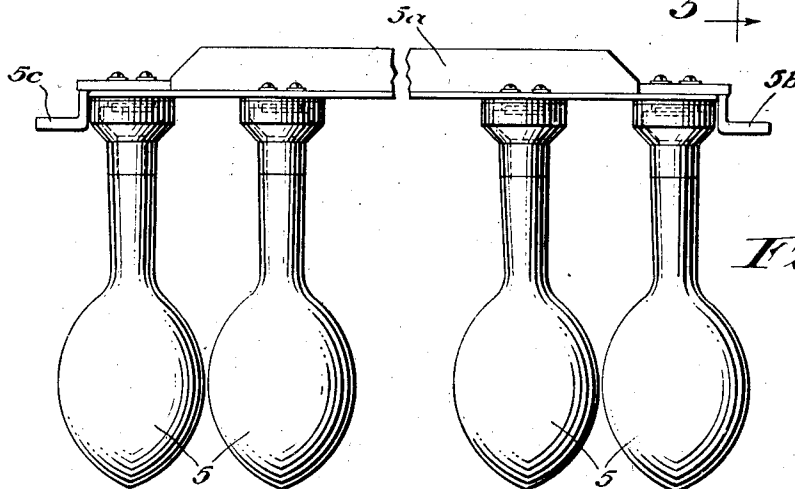


Fig. 4

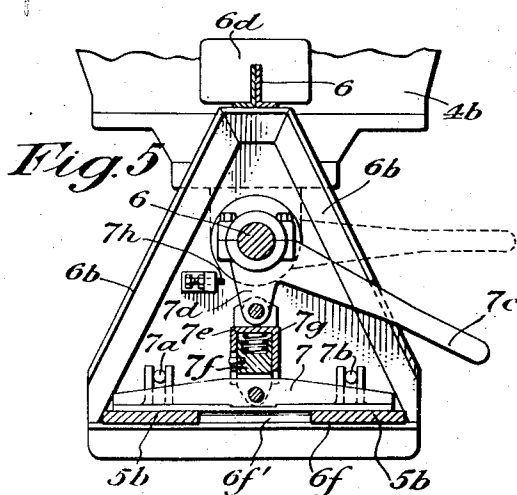


Fig. 5

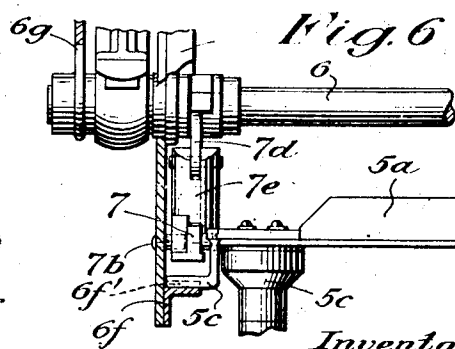


Fig. 6

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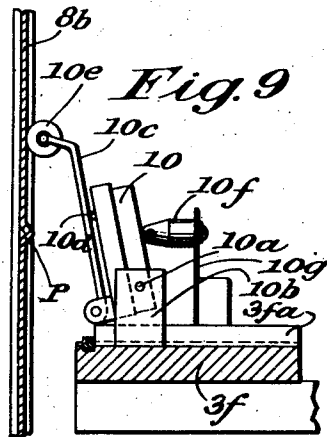
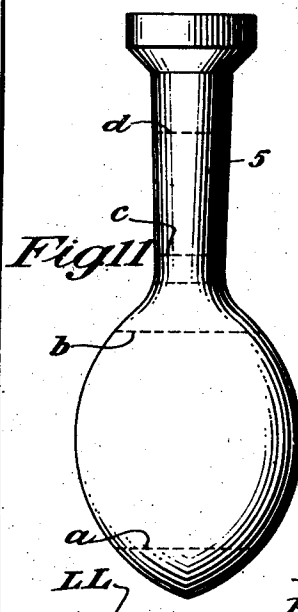
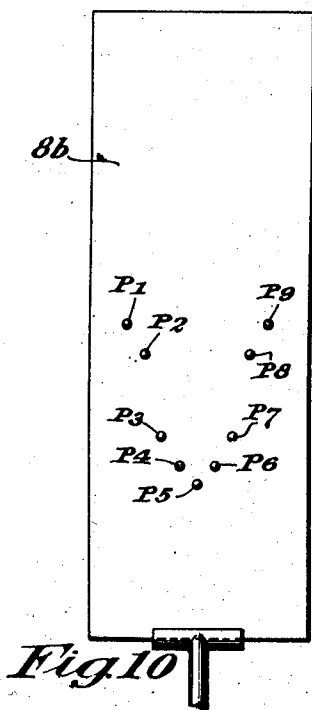
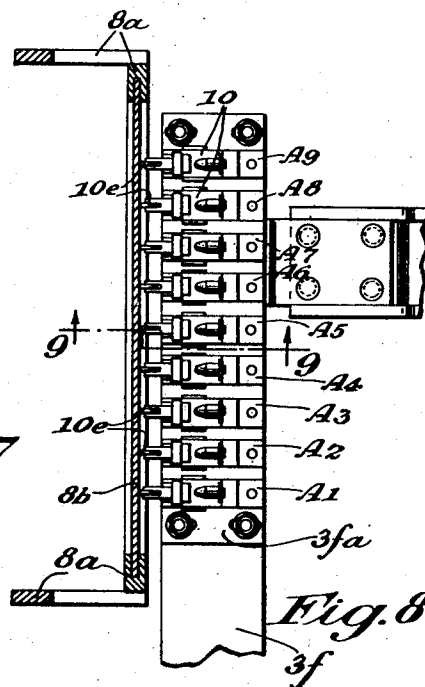
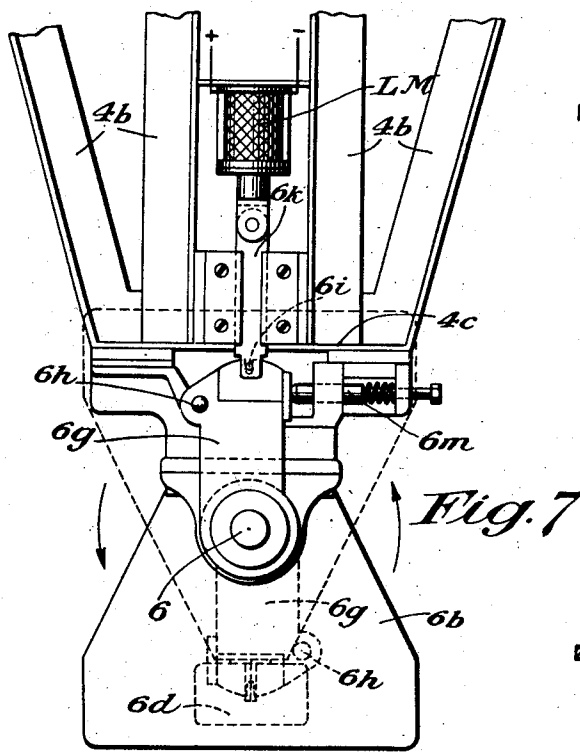
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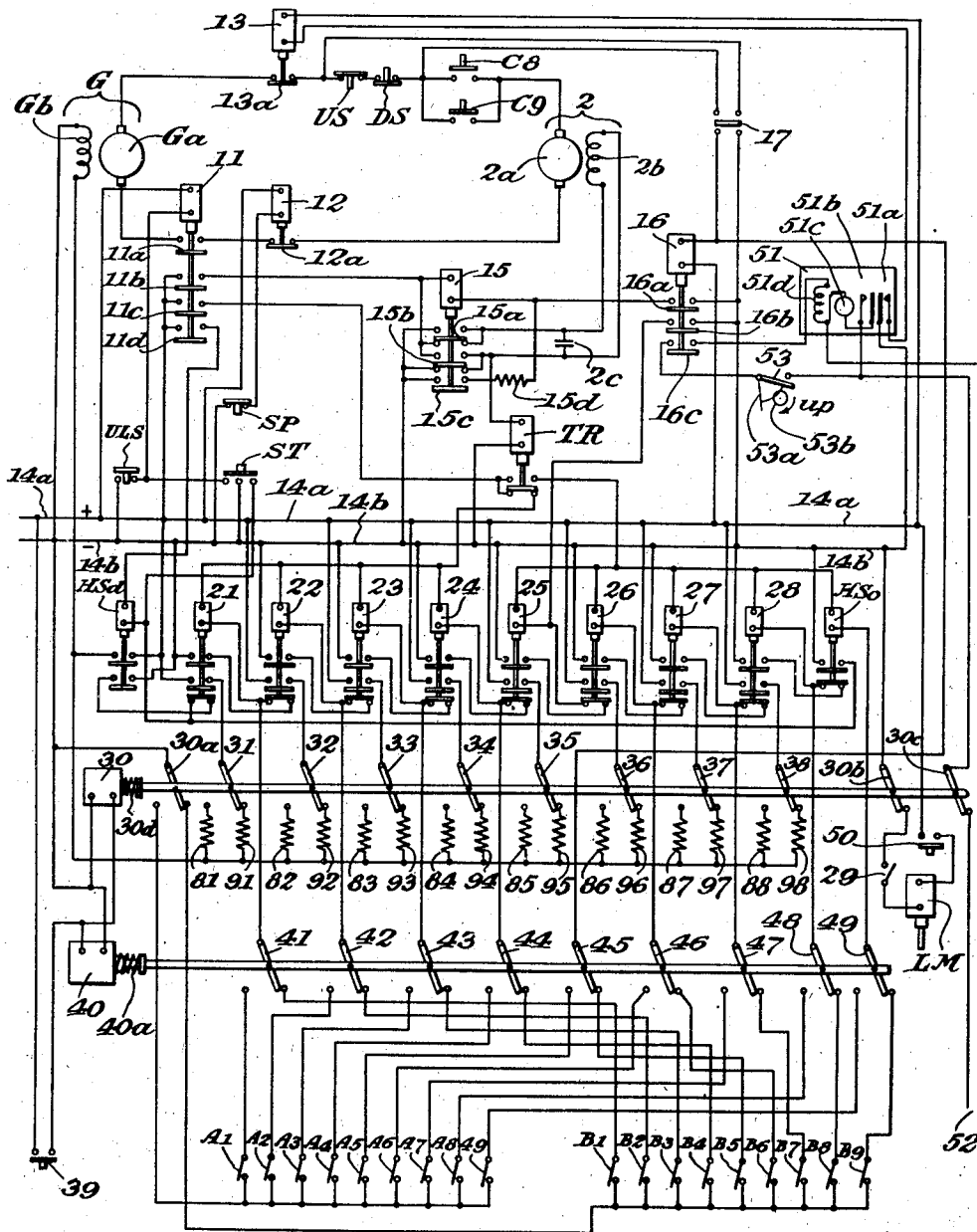
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Tank 8

Tank 9

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Fig. 12

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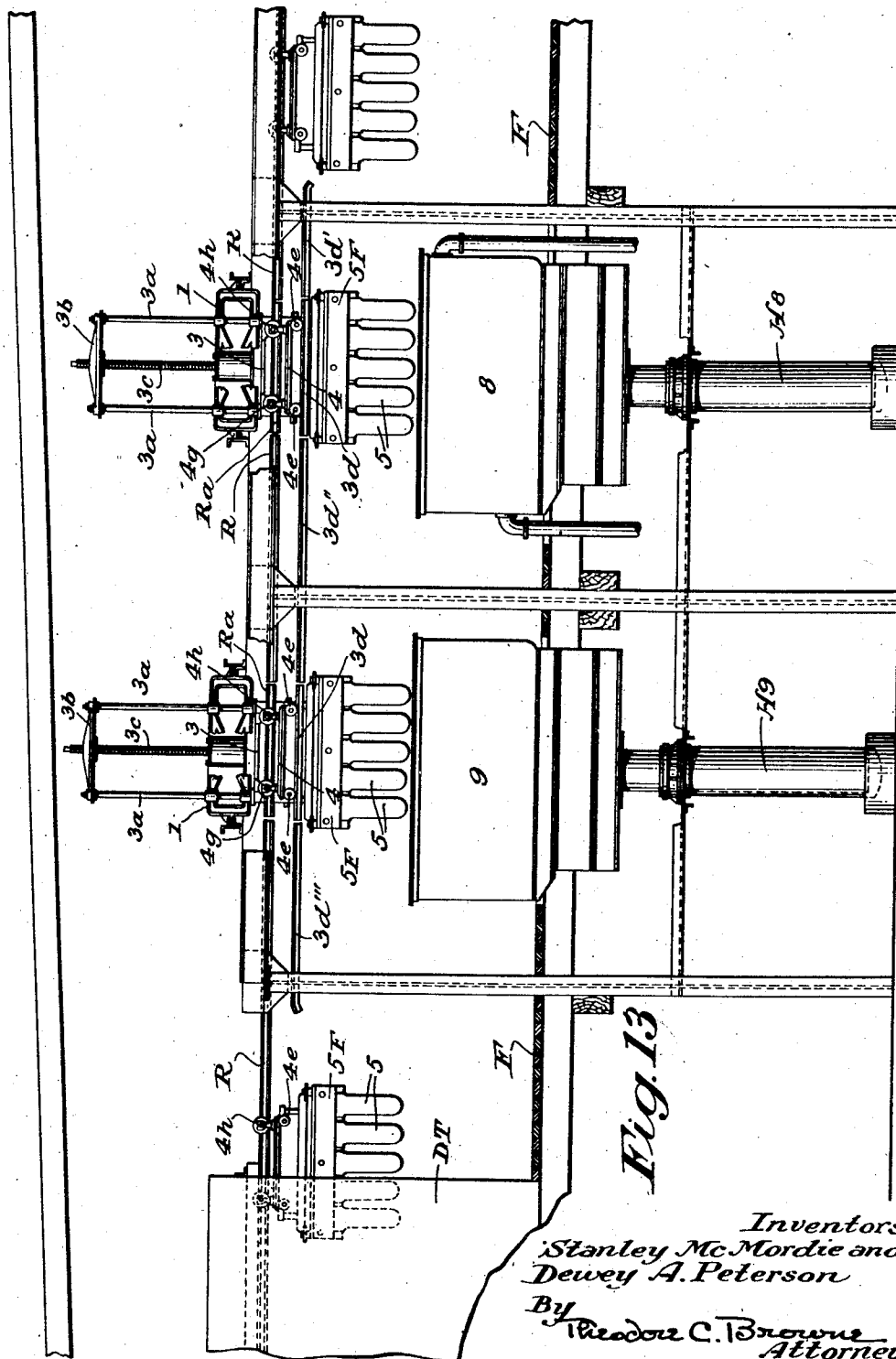
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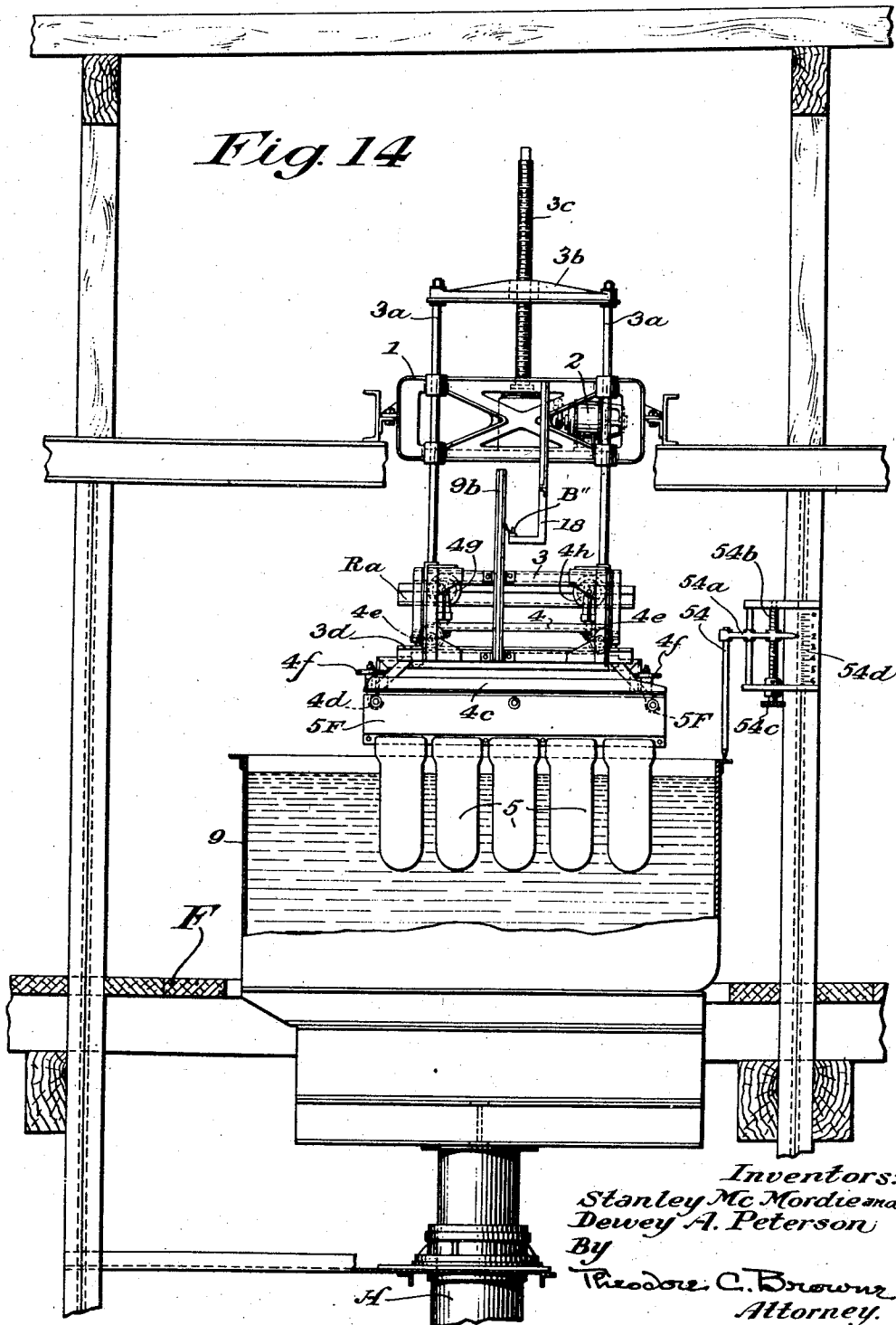
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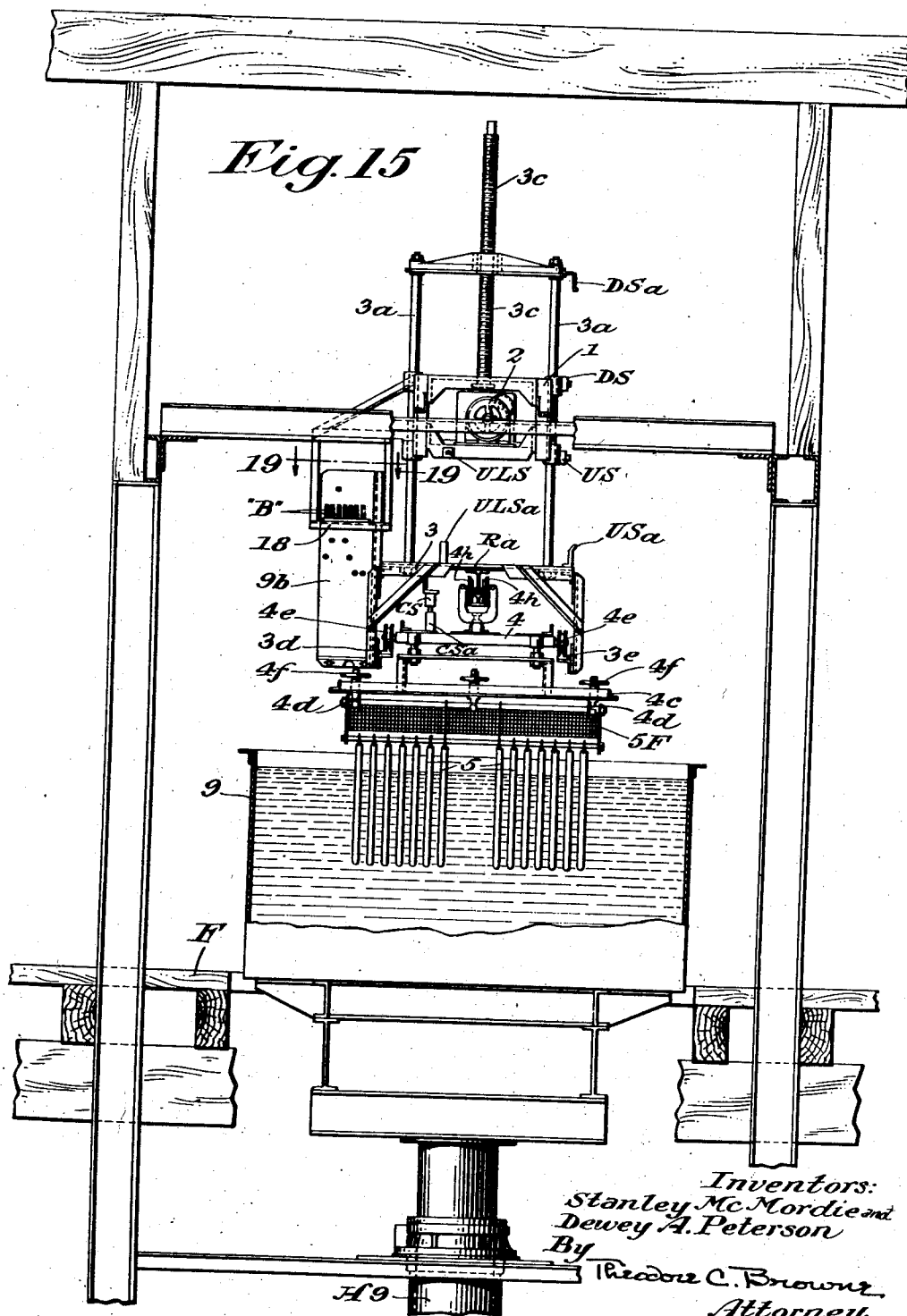


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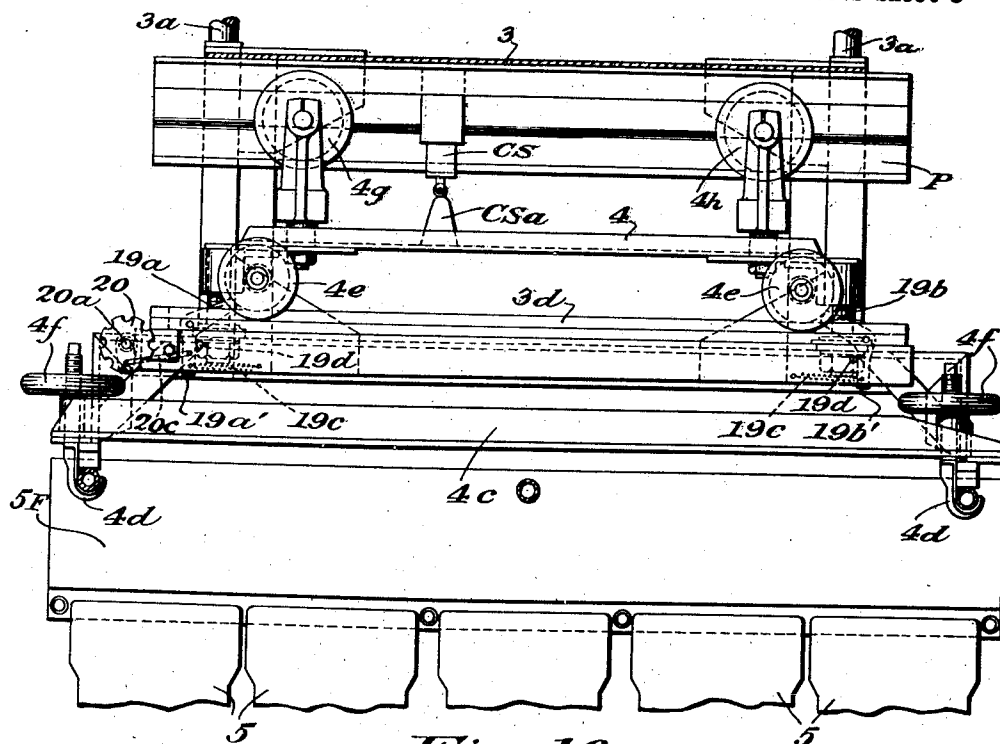


Fig. 16

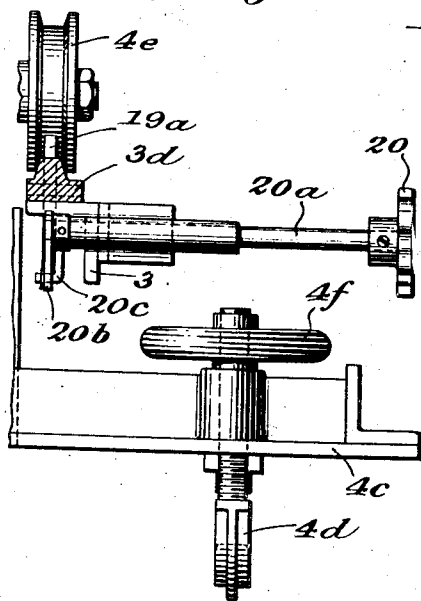
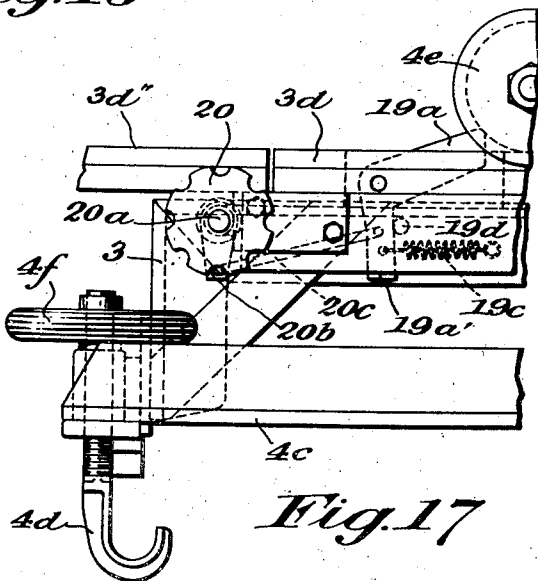


Fig. 18



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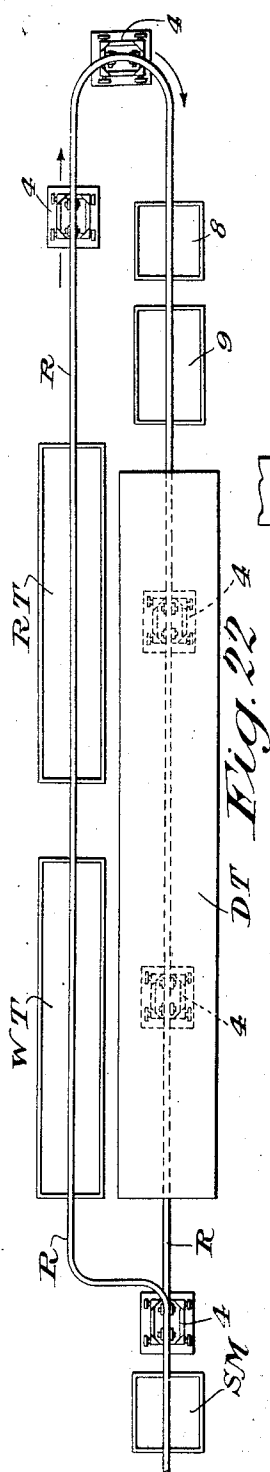


Fig. 22

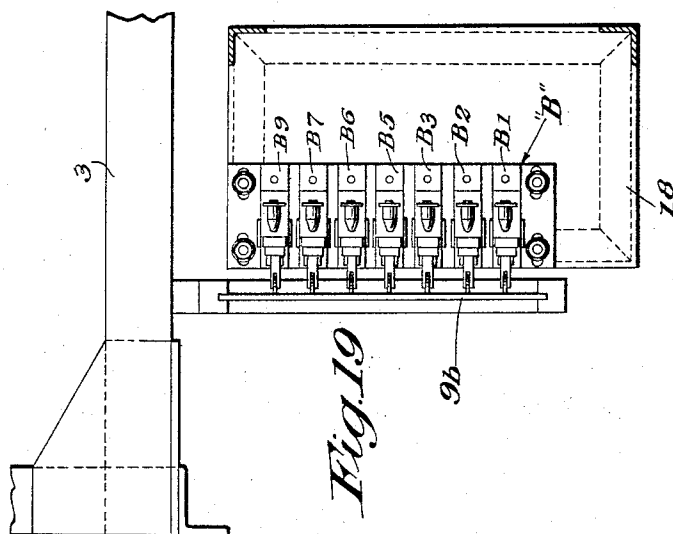


Fig. 19

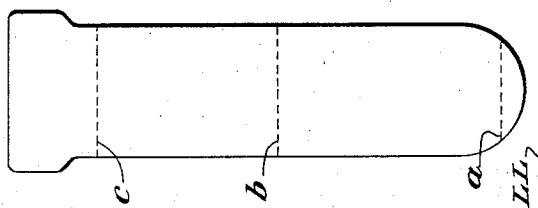


Fig. 20

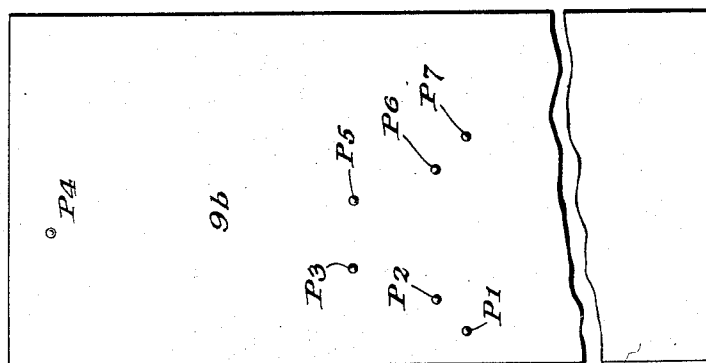


Fig. 21

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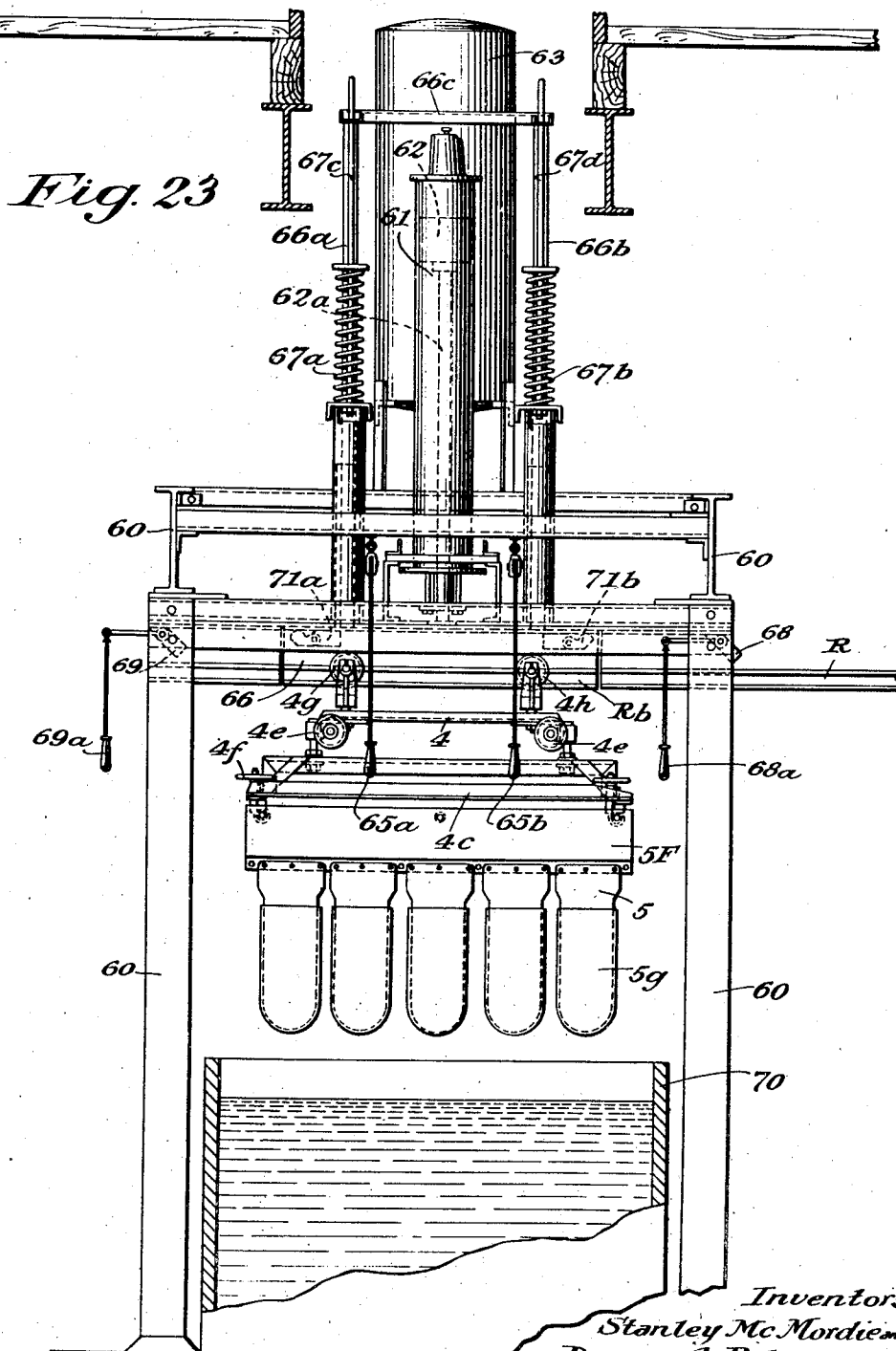
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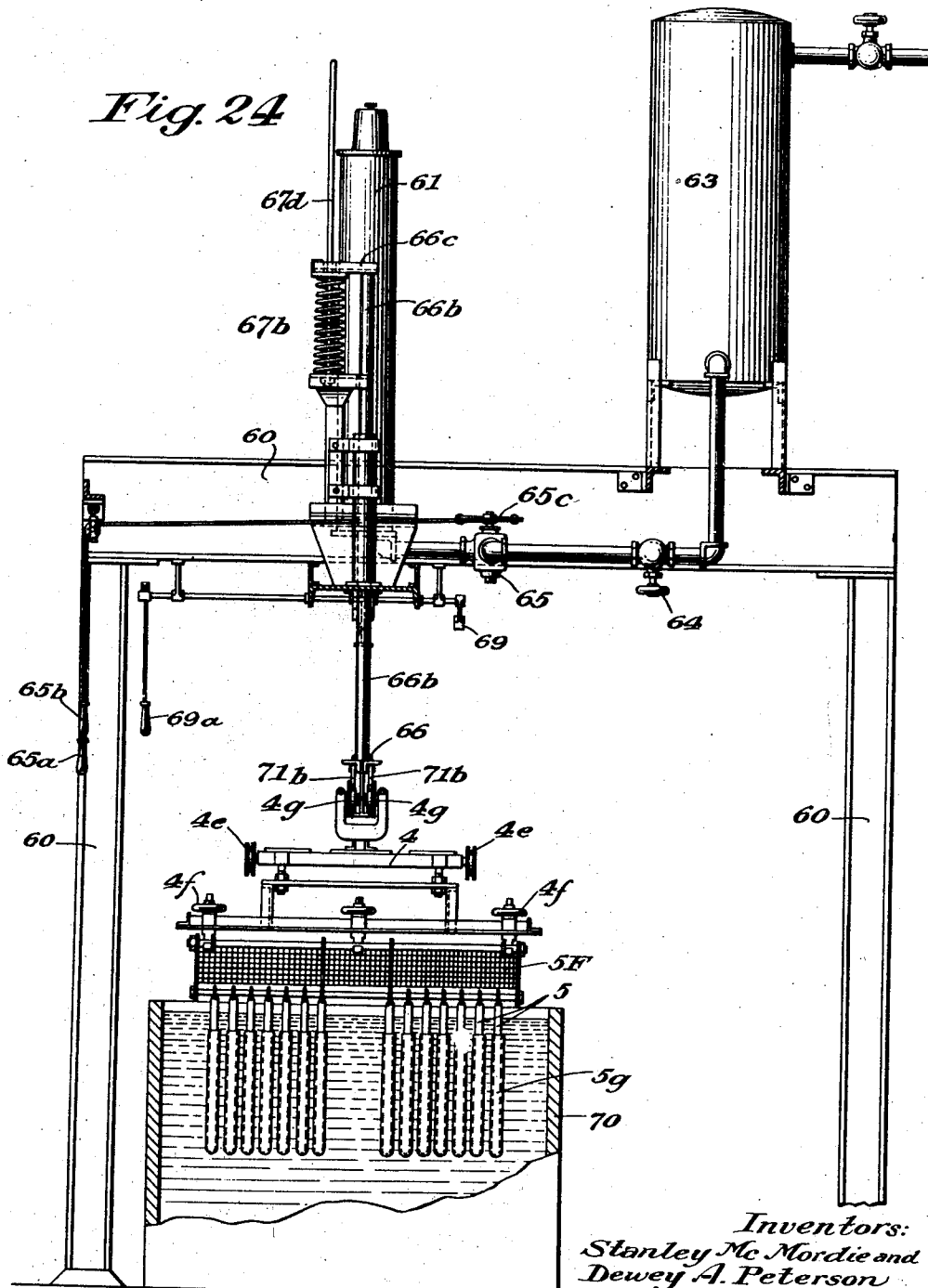
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Fig. 25

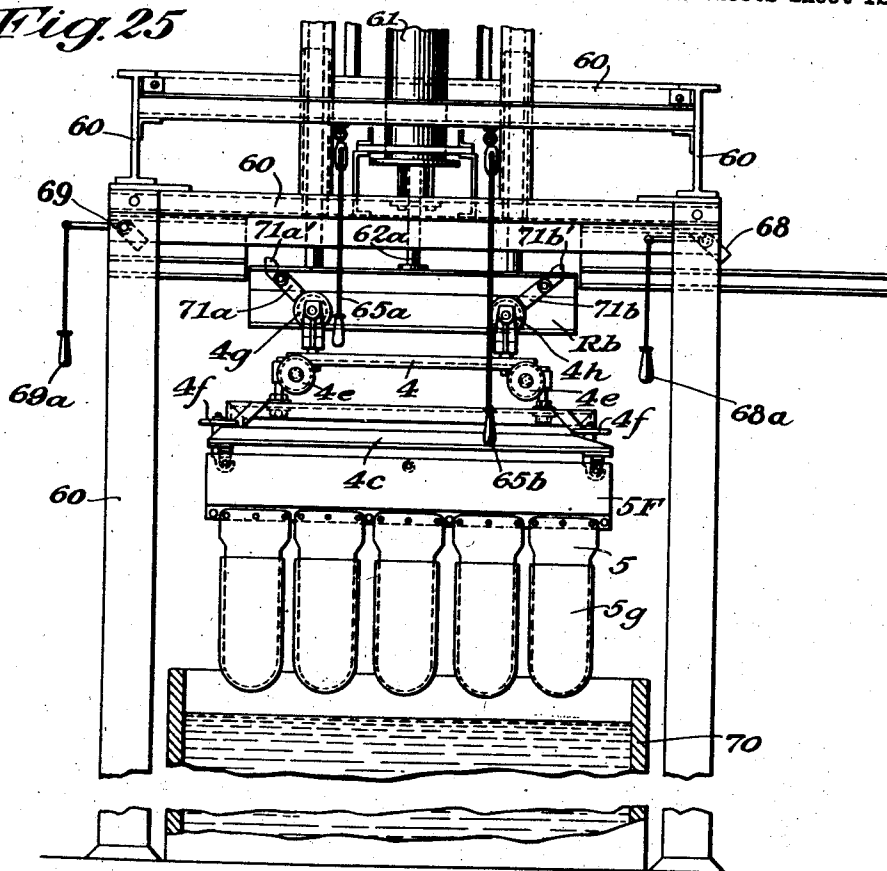


Fig. 26

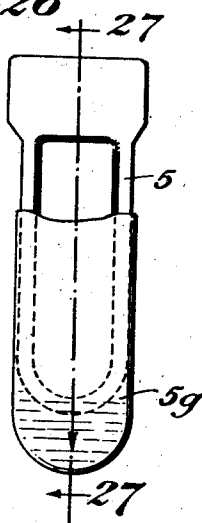
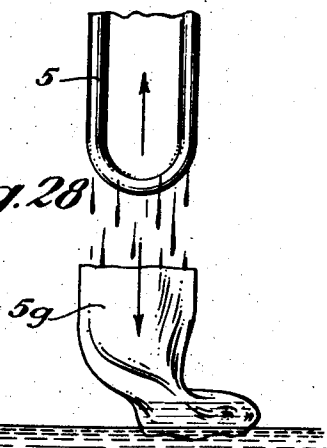


Fig. 27



Fig. 28



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UNITED STATES PATENT OFFICE

2,389,319

DIPPING MACHINE

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Application November 10, 1941, Serial No. 418,598

22 Claims. (Cl. 18—24)

The present invention relates to processes for forming articles by dipping and to apparatus for carrying out the processes.

The invention has particular application to the forming of rubber articles by dipping processes in which forms or molds are dipped into a liquid to form a coating thereon which is subsequently stripped from the mold. It is to be understood, however, that the apparatus is useful generally wherever a dipping operation is required.

The specific apparatus illustrated and described herein is used to form rubber bags or balloons by a dipping process in which the mold is successively dipped into two different baths, one of which is a liquid latex compound and the other a coagulant for the latex, or an exhauster for overcoming the effect of a stabilizing agent in the latex compound, to form on the mold a layer of rubber of the thickness desired. For a disclosure of the process of the latter type see application of Neiley and Habib, Serial No. 290,252, filed August 15, 1939. As used herein after the term "coagulant" includes exhausters as defined in said application.

An object of the invention is to provide dipping apparatus which will secure a uniform deposit on molds of various shapes. In particular, one object of the invention is to provide a control system for varying the speed of dipping of the mold in accordance with the shape of the mold whereby the line of contact between the surface of the dipping liquid and the mold moves along the surface of the mold at a substantially uniform rate.

A further object of the invention is to provide safety devices to prevent operation of the dipping apparatus except when the mold carriage is in proper position in the apparatus.

A further object is to provide dipping apparatus driven by an electric motor, and to provide control means for stopping the operation of the motor for a predetermined dwell period when the dipping forms are completely immersed, and for automatically restarting the motor at the end of the dwell period.

Still another object is to provide control means for preventing coasting of the dipping apparatus at the beginning of the dwell period.

Another object is to devise apparatus to facilitate the stripping of the molded articles from the molds.

Still another object is to devise a conveyor system to facilitate movement of the mold carriages from one station to another.

Apparatus embodying the present invention is

illustrated in the accompanying drawings, in which,

Figure 1 is a side elevational view showing one embodiment of our dipping machine employing one vertically movable frame and one driving motor for dipping the molds into any one of a plurality of tanks;

Figure 2 is a front elevational view of the apparatus shown in Figure 1;

Figure 3 is a fragmentary, vertical, sectional view, to an enlarged scale, taken through the center of the rotary mold frame;

Figure 4 is a side elevation of the mold bar for supporting the molds;

Figure 5 is a sectional view taken along line 5—5 of Figure 3;

Figure 6 is a fragmentary view showing the manner of mounting the mold bar in the rotary mold frame;

Figure 7 is an end view of the mold carriage taken in the direction of the arrows 7—7 in Figure 2;

Figure 8 is a sectional view of one of the control panels and the control switches associated therewith taken along the line 8—8 of Figure 1;

Figure 9 is a sectional view taken along line 9—9 of Figure 8;

Figure 10 is a front elevational view of one of the control panels;

Figure 11 is an elevational view of one of the molds with appropriate markings for indicating the points of change in dipping speed;

Figure 12 is a circuit diagram showing the power circuit and the control circuits for operating the machine illustrated in Figures 1 to 10 inclusive;

Figure 13 is a side elevational view showing a modified arrangement of our dipping machine wherein each dipping tank is provided with a separate, vertically movable frame and driving motor for raising and lowering the mold carriage, and wherein the mold carriages are moved from one tank to the other on a trolley system;

Figure 14 is a side elevational view on an enlarged scale showing the details of construction of the arrangement associated with the tank;

Figure 15 is an end elevational view taken from the right-hand side of Figure 14, the front end of the dipping tank being broken away;

Figure 16 is a side elevational view on an enlarged scale showing the details of construction of the mold carriage employed in Figures 13, 14 and 15;

Figure 17 is a fragmentary view on an enlarged scale showing the details of a centering stop and

the clamp for clamping the mold supporting frame to the mold carriage.

Figure 18 is an end view of the arrangement shown in Figure 17;

Figure 19 is a sectional view taken along line 19-19 in Figure 15 showing a plan view of the control panel and the cooperating control switches;

Figure 20 is a diagram illustrating one mold shape for forming rubber bags, appropriate markings being applied for indicating the points of change in dipping speed;

Figure 21 is a front elevational view of a control panel suitable for controlling the dipping of the mold shown in Figure 20;

Figure 22 is a plan view showing the general arrangement of the entire apparatus for forming vulcanized rubber bags from latex and employing the apparatus illustrated in Figures 13 to 21, 23, 24 and 25;

Figure 23 is a side elevational view showing a stripping mechanism for stripping rubber bags or other dipped articles from the molds;

Figure 24 is an end elevational view of the stripper shown in Figure 23;

Figure 25 is a fragmentary view similar to Figure 23, but showing the mold carriage in a slightly different position in its operation;

Figure 26 is a side view of one of the mold forms showing a molded bag partly stripped from the mold;

Figure 27 is a sectional view taken along line 27-27 of Figure 26, and

Figure 28 is a fragmentary view illustrating a molded bag completely stripped from the mold on which it was formed.

Referring first to Figures 1 and 2, the main supporting frame 1 for the dipping mechanism is supported between two fixed beams 1a and 1b which may be provided especially for the purpose or may form part of the building structure enclosing the machine. The main frame 1 is of rectangular construction and forms the support for a driving motor 2 mounted therein. Arranged immediately below the frame 1 is a substantially horizontal frame 3 supported at the lower ends of four vertically slidable guide rods 3a passing through suitable guide bearings 1c formed in frame 1. A crosshead 3b is secured to the upper ends of guide rods 3a, and the crosshead 3b is supported upon a threaded lead-screw 3c having threaded engagement with the crosshead. The lead-screw 3c is driven through suitable speed-reducing gearing from motor 2 to raise and lower the supporting frame 3.

Supported on opposite sides of vertically-movable frame 3 are two horizontal track elements or rails 3d and 3e which conveniently may be formed of two lengths of I-beam.

A horizontally movable mold carriage 4 consisting of a horizontal frame-like section and end frame sections 4a and 4b, is supported from rails 3d and 3e by suitable trolley wheels 4c arranged at the four corners of the horizontal frame section 4a.

A number of dipping forms or molds 5 are suitably suspended from a mold bar or plate, generally indicated at 5a in Figures 2 and 4. The mold plate is removably supported in a rotary mold frame which is mounted on a horizontal shaft 6 suitably journaled in bearings provided at the lower ends of frame portions 4a and 4b. The rotary mold frame is formed of end portions 6a and 6b secured to shaft 6 and extending both

above and below the shaft. The upper parts of end portions 6a and 6b are joined by a suitable bar 6c which carries a counter weight 6d of sufficient weight to make the entire rotary mold frame, together with the supported molds, top heavy.

A pair of horizontal shelves 6e and 6f are supported on end portions 6a and 6b, and a mold bar 6a is suitably supported on these shelves by means of bracket pieces 6b and 6c secured to the ends of bar 6a. Preferably two mold bars are supported between shelves 6e and 6f, and these bars are maintained in spaced relation by suitable spacer blocks 6e' and 6f' secured to the top face of shelves 6e and 6f, respectively. The mold bars are clamped in position on shelves 6e and 6f by identical clamp structures provided immediately above each shelf, only one of which will be described. The clamp construction consists of a clamping bar 7 arranged transversely of the mold bars and being guided for vertical movement by a pair of pins 7a and 7b extending between spaced guide members carried on each end of the clamping bar, the pins 7a and 7b being suitably supported in the web portion of the adjacent end-section of the rotary mold frame. Clamping bar 7 is moved vertically by a suitable toggle connection to hand lever 7c the inner end of which is journaled on shaft 6. The toggle connection between the bar 7 and the lever 7c includes an arm 7d secured to the lever 7c and rotating about the axis of shaft 6, and an extensible link pivotally connected at one end to the arm 7d and at the other end to the center of bar 7. The extensible link comprises a sleeve 7e pivotally secured to the arm 7d and a cooperating plunger 7f pivotally secured to the center of the bar 7 with a compression spring 7g positioned in the sleeve 7e and acting against the end of plunger 7f tending to force the plunger out of the sleeve. When the hand lever 7c is in the position shown in dotted lines in Figure 5, the clamping bar 7 is in its raised position. When the lever is moved downwardly to the position shown in solid lines in Figure 5, the bar 7 is moved into contact with brackets 7b-7b and pressure is applied to the bar through the spring 7g. Upon further movement of the lever 7c downwardly, the arm 7d passes beyond the dead center position of the toggle connection. An adjustable stop 7h is provided to prevent further movement beyond the dead center position and in this manner the toggle connection serves to lock the bar 7 in clamped position under the pressure of spring 7g.

While we have described a specific form of clamping device, any other suitable clamping mechanism may be employed.

On each end of the shaft 6 is provided a crank arm 6g carrying a handle 6h for manually rotating the rotary mold frame to any desired position. One of the crank arms 6g is provided with a notch in the end thereof, as shown in Figure 7, for receiving a locking pin 6i carried in the lower end of a reciprocating locking bar 6k supported in a suitable guide way on end-section 4c of the mold carriage. The locking bar 6k is normally biased to its lower, or locking position and is operated vertically to the unlocking position by means of a suitable electro magnet I.M. A spring pressed plunger 6m is provided to move the arm 6g out of its dead center position when the locking bar is moved to its upper position, and the rotary mold frame rotates through 180° by reason of the action of counterweight 6d.

As shown in Figures 1 and 2, a pair of elongated dipping tanks 8 and 9 are positioned below the vertically movable frame 3 and transversely of the rails 3d and 3e. The mold carriage 4a—4b—4c which is movably mounted upon the rails 3d and 3e may be moved into position over either tank, and suitable stop elements S8 and S9 are provided on one of the rails to stop the carriage in proper position over either tank. The mold carriage is moved from one position to another manually.

Individual control devices are provided to control the dipping movement with respect to each of tanks 8 and 9. The control devices will be described for tank 8, and it will be understood that similar devices are provided for tank 9 and are identified in the drawings by reference numerals 9 having the same subscripts as the numeral 8. The control apparatus for tank 8 involves a vertical frame 8a mounted adjacent one end of the tank and preferably supported from one of the supporting beams 1a or 1b. The frame 8a is an open frame, and the vertical members of the frame are provided with inwardly facing channels to receive a control panel 8b which may be vertically adjusted in the frame 8a by means of hand wheel 8c suitably journaled in a fixed support carried by the end of tank 8 and having threaded engagement with the lower end of the rod 8d which supports panel 8b.

A horizontal shelf 3f is supported from vertically-movable frame 3 and is positioned adjacent control panels 8b and 9b and moves vertically with respect to these panels as the frame 3 is moved up or down. A series of control switches A1 to A9 are mounted upon shelf 3f adjacent panel 8b, while another series of control switches B1 to B9 are mounted on shelf 3f adjacent control panel 9b. These control switches may be of any suitable construction but we prefer to employ switches of the micro-switch type which may be operated by small mechanical movement of the operating member. One switch element and the mounting therefor has been illustrated in Figure 9. Each switch structure is mounted in a suitable insulating casing 10 which is pivotally mounted at 10a between suitable brackets 10b supported on a base plate 3/a which is adjustably supported on shelf 3f. An operating arm 10c is pivotally supported on the casing 10 and engages the operating pin 10d which extends out of the casing 10. The upper end of the operating arm 10c is provided with a roller 10e which normally engages the inner face of the control panel 8b. A resilient stop is provided to engage the back of the casing 10 and to hold the arm 10c lightly into contact with the control panel. This resilient stop is preferably formed of a rubber finger 10f mounted on a resilient support 10g. Each group of switches is provided with its own base plate which is mounted on shelf 3f for adjustment to and from the associated control panel, for example, in Figure 8 the switches of the "A" group are mounted on base plate 3/a which is adjustable towards panel 8b. The control switches preferably are in open position when positioned as shown in Figure 9, and may be operated to closed position by providing suitable projections P carried by the associated control panels and positioned in the paths of travel of the operating rollers 10e. It will be understood that if desired the switches may be normally closed and arranged to be operated to open position by action of the projections P.

The operating projections on the control

panels may be formed in any desired manner, such as by embossing or prick punching the projections on the body of the panel, or they may be formed of separate elements secured to one face of the panel and adjustable along the path of travel of the associated switch operating element. The function of the switches which are operated by the control panels is to control the speed of dipping, and the spacing of projections P on the panels will be determined by the particular shape of the molds being used. The object in controlling the speed of dipping is to move the mold into and out of the liquid at such speed that the line of contact of the liquid with the mold moves along the mold surface at a substantially uniform rate. In the case of a mold of the shape shown in Figure 11, a large number of steps of speed variation would be required to maintain a constant immersion rate, but a satisfactory approximation can be obtained in a relatively small number of steps. For example, in the case of the mold shown in Figure 11, the mold may be lowered at a relatively fast rate until it approaches the liquid level indicated by the line L—L, and then the lowering rate is changed to a slower rate until the mold is immersed to the line a at which time the rate would be increased and maintained constant until the mold is immersed to the line b, and then a lower speed is established until the mold is lowered to the line d, where the mold is either stopped for a dwell period or it is reversed in direction for withdrawal from the liquid. On withdrawal of the mold from the liquid, the same variation in speed of withdrawal must be employed as in the case of immersion.

In Figure 10 we have illustrated a control panel with properly spaced projections for controlling the dipping of a mold form like that shown in Figure 11. In this case, nine control switches are provided, and panel 8b is provided with nine projections, P1 to P9, for operating the nine control switches A1 to A9 respectively, shown in Figure 8. The number of control switches required will be determined by the number of speed steps required for a particular shape of mold.

On the downward movement projection P1 is arranged to operate switch A1 when the mold reaches the position with respect to the liquid level L—L shown in Figure 11. As the liquid level rises to the lines a, b, c, projections P2, P3 and P4 successively operate switches A2, A3 and A4, respectively, to establish the proper dipping speeds, and when the liquid level reaches the line d, projection P5 operates switch A5 to either stop the downward motion for a predetermined dwell period, or, as desired, to reverse the direction of movement and start withdrawal of the mold from the liquid. On the upward movement of the vertically movable frame 3, projections P6, P7 and P8 cause the successive operation of switches A6, A7 and A8 to establish the proper speeds for withdrawal. After the mold leaves the liquid, projection P9 operates switch A9 to establish a high speed of movement of the frame 3 to its upper position. The upward movement of the frame 3 is stopped by means of an "up" limit switch ULS mounted on frame 1 and operated by a finger ULSa carried by frame 3.

The electric circuits for supplying power to operate the motor 2, and the control circuits for controlling the speed of the motor are illustrated in Figure 12. We prefer to employ a direct cur-

rent generator G as a source of current for driving motor 2 and this generator may be driven from any suitable source of power. The armature G_a of the generator is connected to supply current to the armature 2_a of the motor 2, through a circuit extending from armature G_a through contact 11_a on relay 11, contact 12_a on relay 12, through armature 2_a, through carriage operated switch C₈ when the mold carriage is over tank 8, or through carriage operated switch C₉ when the mold carriage is over tank 9, through "down" safety switch DS, through "up" safety switch US and through contact 13_a of relay 13 back to armature G_a. The generator field G_b and the motor field 2_b, and the control circuits therefor, are separately excited from a suitable source of direct current represented by supply lines 14_a and 14_b.

The energizing circuit for relay 11 is completed through normally closed "up" limit switch ULS which is mounted on frame 1 (see Figure 2) and is adapted to be operated to open position by a finger ULS_a carried by frame 3 when this frame reaches a predetermined position in its upward travel. The circuit of relay 11 may also be completed through normally open, manually operated starting button ST. The normally closed "up" safety switch US is also mounted on frame 1 and is operated to open position by finger USA carried by frame 3 in case the limit switch ULS fails to operate. The "down" safety switch DS is mounted on frame 1 as shown in Figure 2, and is operated to open position by finger DSA carried by cross-head 3_b in the event that the reversing relay fails to operate. The switch DS is adjusted to stop the downward movement of the mold carriage before the molds reach the bottom of the tank. Safety switches DS and US remain closed during normal operation and are opened only in case of improper operation of the control circuits.

Relay 12 is normally energized through a normally closed, manually operated "stop" switch SP.

The field 2_b of motor 2 is supplied with energizing current from circuit 14_a—14_b through the contacts of a reversing relay 15. A condenser 2_c is connected in shunt to the field winding to reduce the sparking at the contacts of relay 15. In the normally de-energized position of relay 15, the motor field 2_b is connected in a direction to lower the mold carriage, and when relay 15 is energized, the carriage is raised. Relay 15 is energized through a circuit completed from conductor 14_a through contact 11_b on relay 11, through relay 15, and through contact 16_a on relay 16, back to conductor 14_b. A holding circuit for relay 15 is completed through contact 15_c and resistance 15_d. A manually operable two-position switch 17 is provided to by-pass safety switches US and DS in one position and to energize relay 16 from conductors 14_a—14_b in the other position, it being understood that switch 17 is normally open.

The generator field G_b is connected directly across conductors 14_a and 14_b through the upper contact on relay HS_d, which is known as the "high-speed down" relay, or the circuit for field G_b may be completed through any one of a number of adjustable resistance elements 81, 82, 83, 84, 85, 86, 87, 88 when the mold carriage is in position over tank 8, or through any one of a series of adjustable resistance elements 91, 92, 93, 94, 95, 96, 97, 98 when the mold carriage is in position over tank 9. These resistance ele-

ments control the value of the generator field current and thereby control the generator voltage which in turn controls the speed of motor 2. A separate adjustable resistance is provided to fix the speed of the motor for each step in the dipping operation.

Since the speeds required for dipping in tank 8 may be different from the speeds required for dipping in tank 9, two sets of speed controlling resistances are provided, resistances 81 to 88 being employed for tank 8 and resistances 91 to 98 for tank 9. The circuits through the various speed controlling resistances are controlled by a relay 30 having switch elements 31 to 38 inclusive controlled by a common operating member which is normally biased by a spring 30_d to the position shown in Figure 12 where the resistance elements 91 to 98 are connected in circuit. Relay 30 is energized by a circuit connected to conductors 14_a—14_b and controlled by a normally open switch 39 which is mounted upon frame 3 and adapted to be moved to closed position by finger C_{8a} mounted on the mold carriage when the carriage is in position over tank 8. Accordingly, when switch 39 is closed, relay 30 is energized and operates to shift the circuit connections to speed controlling resistances 81 to 88 and to break the circuit connections to resistances 91 to 98 inclusive.

The circuit connections from relay switch elements 31 to 38 inclusive are controlled by normally open contacts on control relays 21 to 28 respectively. Relays 21 to 24 are employed to control the "in" or down speeds of dipping, and these relays are supplied with energizing current through a common circuit extending from conductor 14_a through contact 11_c on relay 11, through the lower contact on transfer relay TR to the four relay windings. The individual circuits for the relay windings are then completed through switch elements 41, 42, 43 and 44 of a relay 40 (which is normally biased by spring 40_a to the position shown in Figure 12), through control switches B1 to B4, respectively, associated with tank 9, and from here the circuits are completed through a common connection, including switch-element 30_a on relay 30, to supply conductor 14_b. Relay 40 is energized in parallel circuit relation with relay 30, whereby when the mold carriage is in position over tank 8, relay 40 is operated to transfer the energizing circuits of relays 21 to 24 from control switches B1, B2, B3, B4 to control switches A1, A2, A3, A4 associated with tank 8. The energizing circuit for transfer relay TR extends from supply conductor 14_a through contact 11_b on relay 11, through the normally open contacts controlled by plate 15_b on relay 15, through the winding of relay TR and back to supply conductor 14_b.

Control relays 25 to 28 inclusive are employed for controlling the "out" or upward speed of the mold carriage, and these relays are supplied with energizing current through a common circuit extending from conductor 14_a through contact 11_c on relay 11 and through the upper contact on transfer relay TR to the windings of the four relays. The individual circuits for relays 26, 27 and 28 are completed through switch elements 46, 47 and 48 on relay 40, through control switches B6, B7 and B8 associated with tank 9, and from here the circuits are completed through a common connection, including switch-element 30_a on relay 30, to supply conductor 14_b. When relay 40 is energized, the circuits for relays 26, 27 and 28 are completed through control switches

A6, A7 and A8 associated with tank 8. The energizing circuit for relay 25 is completed through contact 16b of relay 16 having an energizing circuit controlled by switch element 45 on relay 40 and by control switch B5 when relay 40 is de-energized or by control switch A5 when relay 40 is energized.

The energizing circuit for the "high-speed down" relay HSD is controlled through normally open contact 11d on relay 11, and a holding circuit for this relay is completed through a normally closed contact on relay 21 and a normally open contact on its armature. Holding circuits for relays 21 to 27 inclusive are completed through normally open contacts on each relay and through normally closed contacts on each succeeding relay. For example, the holding circuit for relay 21 is completed through the normally closed bottom contact on relay 22 and through the normally open upper contact on relay 21. A holding circuit for relay 28 is completed through the normally open upper contact on this relay and through the normally closed contact on the "high-speed out" relay HSO. The normally open upper contact on relay HSO is connected to energize the relay HSD which in turn connects the generator field Gb directly across supply conductors 14a—14b. The energizing current for relay HSO is supplied over the same common circuit with relays 24 to 28 and is controlled by switch member 49 on relay 40 to complete the circuit through control switch B9 associated with tank 9 when relay 40 is de-energized, or to complete the circuit through the control switch A9 associated with tank 8 when relay 40 is energized.

Locking magnet LM is energized from supply conductors 14a—14b through a circuit which is controlled by switch member 30b of relay 30 through a manually controlled switch 29 and through a normally open switch 50 which is mounted on frame 1 and adapted to be operated to closed position when the mold carriage reaches a pre-determined position in its upward travel.

The energizing circuit of relay 13 is supplied from conductors 14a—14b through normally closed contacts 51a of a time relay represented in the rectangle 51. This relay may be of any suitable construction, but simply by way of example, we have illustrated a relay of the type disclosed in United States Patent No. 2,175,865. This relay involves a normally open contact 51b for controlling the circuit to a motor 51c for driving the timing mechanism, and also a clutch coil 51d for connecting the motor to the timing mechanism and for operating contacts 51a and 51b to latched positions.

The time delay relay is energized from an alternating current circuit 52 which is controlled by switch element 30c on relay 30, the switch element 30c being in closed position when the mold carriage is over tank 9. The circuit through clutch magnet 51d is controlled by a switch 53, which is responsive to the direction of operation of the motor 2, and also by a normally open contact 16c on relay 16. Switch 53 may be of any suitable construction, but, for the purpose of illustration, the switch has been shown as comprising a pivoted switch element having a sector member 53a secured thereto and a rotary shaft 53b having frictional contact with the curved outer edge of sector 53a. Shaft 53b is driven from the motor 2, and the arrangement is such that the switch 53 is maintained in open position when the motor is running in a direction to lower the mold carriage, but is driven to closed position

by shaft 53b when the motor 2 is running in a direction to raise the mold carriage. When the clutch coil 51d is energized, contacts 51a and 51b are operated and are latched in operated position. Operation of contact 51a opens the circuit to relay 13, while operation of contact 51b closes the circuit to relay motor 51c. These contacts remain in latched position until the motor 51c has counted off the dwell period and operates a latch member to release the contacts 51a and 51b.

Operation of the arrangement shown in Figures 1 to 11 will now be described, reference being had to Figure 12. The operation will be described for a process of forming molded articles from rubber. In this case, tank 8 would be provided with a coagulating or exhaustor solution, while tank 9 contains the latex compound. It will be assumed that suitable molds, such as those illustrated in Figures 1, 2, 4 and 11 for forming rubber balloons, have been mounted in the rotary mold frame and the rotary frame is locked in its normal position by locking lever 6k engaging the notch on the arm 6g as shown in Figure 7, whereby the molds 5 extend downwardly in the position shown in Figures 1 and 2. The mold carriage 4a—4b—4c is now moved into position over the tank 8, and finger C8a operates to close switch C8 in the armature circuit connecting the generator with the motor 2, and also closes switch 39 which energizes relays 30 and 40. Operation of relay 30 switches the field circuit of the generator G from speed resistances 91, 92, etc. to resistances 81, 82, etc. Switch element 30a on relay 30 also opens the common circuit to control switches B1, B2, etc., associated with tank 9, and closes the common circuit to control switches A1, A2, etc., associated with tank 8. Switch elements 30b and 30c are opened by relay 30, since the dip into tank 8 does not require a dwell period and does not require rotation of the rotary mold frame into vertical position. Relay 13 is energized and contact 13a is in closed position, but the generator-motor circuit is opened at contact 11a on relay 11 due to the fact that upper limit switch ULS is in open position from the previous upward movement of the mold carriage.

Before starting the machine into operation, the operator will adjust the hand wheel 8c until the end of the indicator arm 8e comes in contact with the upper surface of the liquid in tank 8. The indicator arm 8e is carried by the rod 8d which supports control panel 8b, and this adjustment involves a corresponding up or down movement of the panel 8b, whereby the control panel maintains a fixed relation with respect to the surface of the liquid in the tank, and the control switches are thereby operated at the proper positions in the cycle of movement of the mold carriage. While we have shown the indicator arm 8e as extending downwardly into contact with the liquid surface, it will be understood that the arm may extend below the surface and the point of the arm may be directed upwardly, so the proper adjustment of the arm is obtained by observing the small cone of liquid which forms around the tip of the pointer as it begins to rise above the level of the liquid.

When all proper adjustments have been made, the operator depresses the starting button ST, which closes the circuit through relay 11 to close the generator armature circuit, and also closes a circuit through relay HSD which in turn connects the generator field directly across conductors 14a and 14b. The generator G becomes

fully excited and drives the motor 2 at high speed in a direction to lower the mold carriage, and the initial movement of the carriage causes the closing of "up" limit switch ULS. The motor continues to run at high speed until control switch A1 is operated by the projection on the control panel 8a, and this switch energizes relay 21 which opens the holding circuit of relay H5d and closes its own holding circuit through the normally closed contacts of relay 22. Relay 21 also completes a circuit for the generator field through resistance 81 which preferably has been set at a value to give a predetermined motor speed. Referring to Figure 11, control switch A1 is operated before the molds reach the liquid level LL, and the molds are then lowered at a slow rate until the liquid level reaches the line a in Figure 11 when control switch A2 is operated by the control panel, and this switch energizes relay 22 to connect in resistance 82 and disconnect relay 21. Resistance 82 establishes a definite speed of dipping until the liquid level reaches line b in Figure 11. At this time control switch A3 is operated by the panel 8a, and this switch connects in resistance 83 and de-energizes relay 22. Resistance 83 establishes a definite dipping speed until the liquid level reaches the line c at which time control switch A4 operates to energize relay 24 which connects in resistance 84 and de-energizes relay 23. This establishes a proper dipping speed from line c to line d in Figure 11, and when the liquid level reaches the line d, control switch A5 operates to energize relay 16 which in turn energizes reversing relay 15 to reverse the motor field 2b, and also energizes relay 25 which connects in resistance 85 and de-energizes relay 24. Operation of relay 15 closes the energizing circuit to transfer relay TR through the upper contacts controlled by plate 15b. Reversal of the motor field 2b causes reversal in the direction of rotation of the motor 2 and the mold carriage is driven upwardly at a speed determined by resistance 85. On the upward movement of the mold carriage, control switches A6, A7, A8 and A9 are operated by the control panel when the liquid level reaches the lines c, b, a, and LL respectively, as shown in Figure 11, to establish the proper speeds of withdrawal of the molds from the tank. Operation of control switch A9 energizes "high-speed out" relay H5d which in turn energizes relay H5d to fully excite the generator G and thereby drive the mold carriage at high speed to its upper position. The carriage continues to rise until "up" limit switch ULS is opened by the finger ULSa, and this de-energizes relay 11 to open the generator-motor circuit.

If a second dip is required, another cycle may be carried out by simply pressing starting button ST.

The next step in the molding operation is to move the mold carriage 4a-4b-4c into position over tank 9, and this results in opening of switches C8 and C9, and the closing of switch C9. The opening of switch C9 de-energizes relays 30 and 40 to restore these relays to the position shown in Figure 12 whereby the control circuits are switched from the control switches associated with tank 8 to the control switches associated with tank 9, and resistances 91, 92, etc., are connected in circuit instead of resistances 81, 82, etc. Also, the circuits to locking magnet LM and to the time delay relay 51 are rendered effective. The operator makes proper adjustment of hand

wheel 3c until the pointer 3e is just touching the surface of the latex in tank 9.

Upon pressing the starting button ST, relays 11 and H5d are again energized and the mold carriage is lowered at high speed until the mold reaches the position shown in Figure 11 with respect to the liquid level LL, and at this time control switch B1 operates to establish a slower dipping speed until the liquid level reaches the line a in Figure 11. The dipping operation from this point on until the liquid level reaches the line d is the same as described above in connection with tank 8. During the downward movement of the mold carriage, the switch 53 is maintained at open position by rotation of the motor 2. When control switch B5 operates relays 16 at the point d in Figure 11, relay 16 energizes reversing relay 15 to reverse the motor 2 as explained hereinbefore, and the initial reverse movement of motor 2 causes switch 53 to move to closed position and to thereby energize clutch magnet 51d of time delay relay 51. Magnet 51d opens contact 51a to thereby de-energize relay 13 and also closes contact 51b to energize relay motor 51c, and these contacts are latched in operated position. Thus the motor 2 is stopped in a position where the liquid level is approximately at the line d in Figure 11, and the molds are allowed to remain immersed in the latex for a predetermined time which may be controlled by the setting of the relay 51. The purpose of using the rotation responsive switch 53 for starting the dwell period is to insure starting of the dwell period at a time when there is no possibility that the momentum of the driving motor 2 will cause coasting of the mold carriage during the dwell period.

As soon as relay motor 51c counts off the dwell time, contacts 51a and 51b are released and returned to their normal position to re-energize relay 13 which in turn closes the generator-motor circuit to start raising the mold carriage. During upward movement of the mold carriage, control switches B6, B7, B8 and B9 operate at proper times to establish the desired speeds of withdrawal, and the upward movement of the carriage is stopped by opening of the "up" limit switch ULS when the carriage reaches its upper position. At the same time, switch 50 is operated to energize locking magnet LM which releases locking bar 6k, and the rotary mold frame moves from the position shown in solid lines in Figure 2 to the position shown in dotted lines in Figure 2. The molds are allowed to stand in this position for a certain period in order to prevent the formation of thickened tips on the dipped articles due to the action of gravity on the coating when the molds are in the full line position shown in Figure 2. When the molds are rotated to the dotted line position, there is no tendency for thickened portions to form on the ends of the articles.

It is not always necessary to rotate the molds in the manner described immediately above, and in this case the switch 29 may be left in open position so that the magnet LM will not be energized. Also, in case it is desired to have the molds rotated to "up" position over both tanks, the switch element 30b may be dispensed with and the circuit to magnet LM may be completed through switches 29 and 50 independently of the relay 30.

Switch blade 30a may be operated by relay 40 instead of relay 30, or it may be omitted entirely, and the leads controlled by this switch may be permanently connected to supply conductor 14b.

Since relays 30 and 40 are energized in parallel and operate simultaneously, only one relay may be employed to control all of the contacts which are now controlled by relays 30 and 40.

Relay 12 may be omitted, and "stop" push button SP may be inserted in the energizing circuit of relay 13.

A separate relay need not be employed to perform the function of transfer relay TR, but the contacts which are controlled by this relay may be controlled by relay 15.

In the arrangements shown in Figures 13 to 28, the same reference numerals are employed to indicate elements having the same functions as corresponding elements in Figures 1 to 11 inclusive.

In Figure 13 the tank 8 is mounted upon hydraulic lift H8 for vertical adjustment through a limited range, the tank being positioned within an opening in the floor F of a suitable building. The tank 9 is also mounted for vertical adjustment upon a hydraulic lift, H9. Lifts H8 and H9 may be pneumatic lifts if desired, and it will be understood that these lifts are operated from a suitable source of fluid under pressure and by suitable control devices to adjust tanks 8 and 9 to any desired vertical position within the range of movement.

The dipping tank 9 must be maintained at a predetermined level or elevation during the dipping operation, and for this purpose we employ an adjustable finger 54 mounted in the path of movement of the rim of the tank as shown in Figure 14. The finger 54 may be supported in any suitable manner for vertical adjustment such as by the index arm 54a mounted for vertical sliding movement on a suitable frame and being adjustable vertically by means of a lead screw 54b provided with an operating wheel 54c. The free end of the index arm 54a is provided with an index pointer co-operating with a suitable stationary index scale 54d. For any given mold, the index arm 54a will be set in a predetermined position, and the tank 9 will be maintained in contact with the lower end of finger 54. For molds of short length, the arm 54a will be adjusted in the upper range of its adjustment, while for molds of greater length, the arm 54a will be adjusted at lower positions.

Instead of having the finger 54 engage the rim of the tank 9, the finger may extend over the tank and be maintained in contact with the upper surface of the liquid in the tank.

Tank 8 may also be provided with an arrangement for setting the tank at a predetermined elevation in the same manner as tank 9.

Mounted directly above each of tanks 8 and 9 is dipping apparatus generally like that described in connection with Figures 1 and 2. Since this apparatus is identical for both tanks 8 and 9, only one installation will be described. The arrangement includes a fixed frame 1 which supports motor 2 for driving vertically movable frame 3 upwardly and downwardly through lead screw 3c, cross-head 3b and guide rods 3a. A pair of horizontal track elements 3d and 3e are supported on opposite sides of vertically movable frame 3 by a construction illustrated in Figure 15, this construction being somewhat different from that shown in Figures 1 and 2. A mold carriage 4 is mounted for movement on track elements 3d and 3e by suitable wheels 4e mounted at the four corners of the carriage.

For the purpose of supporting the molds from the carriage 4, a horizontal frame 4c is supported

from the carriage 4 below the track elements 3d and 3e as shown in Figure 15. The molds 5, of a different shape from the molds shown in Figures 1 and 2, are secured to a suitable frame generally indicated at 5F which is detachably secured to horizontal frame 4c by means of a number of clamping hooks 4d having their threaded shanks extending upwardly through suitable guide bearings in frame 4c and provided with hand wheels 4f for clamping the frame 5F to the frame 4c, see Figures 17 and 18.

The mold carriages are brought into position over tanks 8 and 9 by means of an overhead trolley rail R mounted on suitable supports. The rail R is provided with a gap over each of the dipping tanks, and a section Ra of the rail, carried by vertically movable frame 3, is provided to bridge the gap when the frame 3 is in its upper limit of travel for normal operation. Each mold carriage 4 is provided with two sets of swivel-mounted wheels 4g and 4h for supporting the carriage on rail R when the carriage is being brought up to and moved away from the tanks. For example, in the case of the two mold carriages shown at the extreme right and left ends of Figure 13, the carriages are being supported on rail R by wheels 4g and 4h, while the two carriages which are located immediately above tanks 8 and 9 are supported on track sections 3d and 3e by wheels 4e. Track sections 3d and 3e are positioned to take the load of the mold carriage and to relieve the load from wheels 4g and 4h when the mold carriage is in position over either tank. By this arrangement, each mold carriage has four points of support which are widely separated and will thus prevent swaying of the molds during the dipping operation.

For the purpose of guiding the mold carriages into proper position within the vertically movable frame above each tank, stationary extensions of horizontal rails 3d and 3e are provided in front of tank 8, to the rear of tank 9, and also in the space between the two tanks. One rail extension in front of tank 8 is shown at 3d' in Figure 13, the extension between the two tanks is shown at 3d'', and the rail extension at the rear of tank 9 is shown at 3d'''. These stationary rail sections are all at the same level as the rails 3d and 3e carried by the vertically movable frames when these frames are in their proper upper position of rest. Accordingly, when the mold carriage is moved on to rail extensions 3d' and 3e', the weight of the mold carriage is taken by these rails and relieved from rail R. When the carriages are moved beyond rail extensions 3d''' and 3e''', the weight of the carriage is again taken by rail R which leads into a drying chamber or tunnel DT.

It will be understood that dipping mechanism of the type shown in Figures 1 and 2 may be used in the system shown in Figure 22.

Provision must be made to keep the mold carriage centered in the vertically-movable frame 3 and to prevent the carriage from rolling out of the frame during the dipping operation. For this purpose two latch elements 19a and 19b are pivotally supported in slots formed in and near the ends of rail 3d on the frame 3, and these latch elements are positioned to engage the front and rear wheels 4e of the mold carriage 4 and to prevent the carriage from moving out of the frame 3 until one of the latch elements is released. The latches are shown in operative position in Figure 16, and the details of the latches and of the releasing mechanism are shown in Figures 17

and 18. As will be seen, the latches are provided with arm extensions 19a' and 19b', and each latch is biased towards its latching position by a spring 19c holding arms 19a' and 19b' against a fixed stop 19d. By this arrangement, the latch element 19b may be depressed by the weight of the mold carriage as it is rolled into the vertically-movable frame 3, but as soon as the carriage comes into center position, the latches will prevent the carriage from being moved in either direction. The arrangement for releasing latch 19a, so that the carriage may be moved out of the frame 3, involves a hand-wheel 20 mounted on a rotary shaft 20a journaled on frame 3 and having a crank arm 20b secured to the end thereof. A link element 20c connects the arm 20b with the arm 19a' on latch 19a. The hand wheel 20 extends out into a position within convenient reach of the operator. By a partial turn of wheel 20 in a clockwise direction, as seen in Figure 17, the latch 19a is moved to depressed position, and the carriage 4 may then be rolled out of the frame 3.

A normally open centering switch CS is mounted on vertically-movable frame 3 and is adapted to be operated to closed position by a cam-finger CSa carried by mold carriage 4 when the carriage is in its proper "centered" position on the frame 3, as shown in Figure 16. This switch is connected in the generator-motor armature circuit and prevents operation of the motor unless a mold carriage is properly centered in the frame 3.

Each vertically movable dipping frame is driven by a separate motor which is controlled from a suitable control panel of the same type as shown in Figures 1 and 2, but in Figures 14 and 15, the control panel is mounted to move with the dipping frame 3 while the control switches are supported on a stationary bracket. In Figures 14 and 15 the control panel 9b for the compound tank is shown supported at one side of the vertically movable frame 3, and the series of control switches B are supported on stationary bracket 18. As shown in Figure 19, the switches are supported in generally the same manner as they are supported on shelf 3f in Figures 1 and 2, so that the operating elements of the switches may be actuated by the projections on panel 9b as the panel moves up and down. It will be understood that the panel 9b is removable and a panel having the desired arrangement of projections may be readily mounted in position for operating the control switches. Also, while only seven control switches are shown in the arrangement illustrated in Figures 14, 15 and 19 to control the relatively simple molds shown in Figure 20, any desired number of switches may be employed for controlling the dipping rate of other shapes of molds.

In operation of the arrangement shown in Figures 13, 14 and 15, the mold carriages with molds properly attached are brought in from the right end and first dipped in the tank 8, then moved into position for dipping in tank 9, and, after dipping in tank 9, the carriages are moved into the drying tunnel DT, which is maintained at proper temperature and conditions for drying the articles formed on the molds 5. Vulcanization of the articles may also be effected in the tunnel when desired, if a vulcanizable compound is used. Preferably, the mold carriages are automatically driven through tunnel DT by any suitable conveyor system, such as an endless chain or band which engages the carriages and moves them

along at a constant rate selected to dry the articles or dry and vulcanize them if desired.

After the carriages leave the drying tunnel DT, they are conveyed on rail R (see Figure 22) to a stripping machine generally indicated at SM (one specific form being illustrated in Figures 23 to 25) where the articles are removed from the molds 5 in a manner to be described later. After the articles have been stripped from the molds, the carriages are then conducted by rail R along a path which passes over a washing tank WT, then over a rinsing tank RT and are then returned for reuse in subsequent cycles. A number of mold carriages 4 are shown in various positions along the closed path of travel of the carriages in Figure 22. As the mold carriages pass over washing tank WT and rinsing tank RT, the rail R is positioned at a lower level to permit the molds 5 to become immersed in the washing and rinsing liquids so the molds will be thoroughly clean for a new dipping operation. A suitable conveyor system is employed for conveying the mold carriages through these two tanks.

The track section located above the stripper shown in Figure 22 is formed as a spur whereby each mold carriage is reversed end-for-end as it leaves the stripper and proceeds to the washing tank. With this arrangement, the carriages must be provided with two symmetrically located cam elements to operate the centering switches where the switches are not located in the center of the track. If desired, the stripper may be located under a section of the track included directly in the track loop, whereby the carriages always run with the same end forward.

The control systems for the two driving motors associated with the dipping frames for tanks 8 and 9 in Figure 13 are fundamentally the same as the control system shown in Figure 12. In the case of tank 8, if it is not desired to have a dwell period at the bottom position of the dipping frame, the time relay 51 and relay 13 are omitted. Also, since each motor has its own control panel, relays 30 and 40 are omitted, and only one set of speed controlling resistances corresponding to resistances 81 to 88 will be used. Control switches B1 to B8 are not provided for tank 8. Also, locking magnet LM and its controlling circuit is omitted for both tanks. Otherwise, the control circuit for tank 8 corresponds to that shown in Figure 12, except that, for the simple form of mold shown in Figures 13 and 20, only six speed-controlling resistances and seven control switches are used. In this case, relays 24 and 28, control switches A4 and A8, and resistances 84 and 88 are not required and may be omitted. It will be understood that "up" limit switch ULS and safety switches DS and US are provided to control the operation of the dipping in the same manner as in Figures 1 and 2, and centering switch CS serves the function of switch C8 in Figure 12. Switch C9 of Figure 12 is omitted for tank 8 of Figure 13.

The control circuit for the motor which controls the dipping in tank 9 corresponds to the arrangement shown in Figure 12, except that the following elements are omitted: locking magnet LM and its circuit; relays 30 and 40; switches 39 and C8; control switches A1 to A8 and resistances 81 to 88. Also, for the simple mold shown in Figure 20, relays 24 and 28, switches B4 and B8, and resistances 84 and 88 are not required and may be omitted. As in the case of tank 8, limit switch ULS and safety switches DS and US are also provided for tank 9, and

centering switch CS serves the function of switch C9 in Figure 12, that is, to close the generator-motor circuit when the mold carriage is in proper position over tank 9.

The manner of operation of the control circuit for a mold of the shape shown in Figure 20 is believed to be clear from the foregoing description of operation of Figures 1 and 2. In this case, only seven projections are required on the control panel shown in Figure 21; projections P1 to P7 inclusive are arranged to control switches B1, B2, B3, B5, B6, B7 and B9, respectively, shown in Figure 19. The operation of the control circuit for Figure 20 is the same as for Figure 11, except that one speed step is omitted in both the "in" and "out" movements. On the downward or "in" movement, the mold carriage is lowered at high speed until the mold reaches a position above the liquid level LL as shown in Figure 20, at which time projection P1 operates switch B1 to establish a slower speed of dipping until the liquid level reaches the line a; at this time projection P2 operates switch B2 to establish a different rate of dipping until the liquid level reaches line b, then projection P3 operates switch B3 and establishes the proper dipping speed until liquid level reaches the line c; at this time projection P4 operates switch B5 to reverse the direction of rotation of the motor 2, and, in the case of the dipping tank 9, the timing relay will interrupt operation of the motor for a predetermined dwell period, and will then start the motor to withdraw the mold from the liquid. On the upward movement, projection P5 operates switch B6 when the liquid level reaches the line b to establish proper dipping speed until the liquid level reaches the line a, at which time projection P6 operates switch B7 to establish a slower speed until the molds have been completely withdrawn from the liquid level to the position shown in Figure 20, and then projection P7 operates switch B9 to continue the upward movement of the mold carriage at high speed until the "up" limit switch stops the motor.

The machine for stripping the bags or other molded articles from the molds is illustrated in Figures 23, 24 and 25. The machine comprises a suitable frame 60 supporting the end of rail R leading from the drying tunnel DT. An air cylinder 61 is also mounted on frame 60 above rail R, and this cylinder is provided with a piston 62 which supports a movable section Rb of rail R by means of a piston rod 62a, whereby the rail section Rb may be raised or lowered by applying a fluid under pressure to the cylinder 61. We prefer to employ compressed air for raising the rail section, and to allow the section to move to lower positions by gravity. For this purpose a compressed air storage tank 63 is provided and connected through a cut-off valve 64 and a control valve 65 to the lower end of cylinder 61. In one position of valve 65, compressed air is admitted to the lower head space of cylinder 61; in another position of the valve, the connection to tank 63 is cut off and the lower end of cylinder 61 is connected for exhaust to the atmosphere. Valve 65 is controlled by suitable pull-cords 65a and 65b secured to opposite ends of the operating lever 65c of the valve.

Rail section Rb is supported from piston rod 62a by an intermediate cross-head member 66 which has two guide rods 66a and 66b secured thereto and extending upwardly through suitable guide bearings provided on frame 60. These guide rods are connected at their upper ends by a suitable frame 66c which extends over the upper ends

of a pair of buffer springs 67a and 67b, the lower ends of which are supported on a suitable base secured to frame 60. Buffer springs 67a and 67b are guided or maintained in proper position by a pair of guide rods 67c and 67d passing through the center of the springs and extending through guide passages formed in frame 66c. These buffer springs are provided to assume the weight of all parts connected to rail section Rb when the lower head space of cylinder 61 is connected to exhaust.

A pivoted stop 68 is mounted on frame 60 in a position to engage the front wheels (4g or 4h) of the mold carriage to prevent the carriage from entering the stripping machine until the proper time. This latch may be released by a pull-cord 68a. A similar pivoted latch 69 is provided to prevent removal of a mold carriage from the stripping machine on the opposite side, and this latch may be released by pull-cord 69a.

A mold carriage with molds attached has been shown in Figure 23 in proper position for a stripping operation. A stripping tank 70 is located immediately below the mold carriage and contains a suitable liquid for softening the dried residue of the coating on the molds. The carriage 4 is initially centered on the rail section Rb by means of suitable depressions in the lower flange of the rail section for receiving the carriage wheels 4g and 4h as shown in Figure 23. For the purpose of maintaining the carriage properly centered during the stripping operation, a pair of latch elements 71a and 71b are pivotally mounted on cross-head 66, as shown in Figures 23 and 24, and are adapted to move by gravity into the positions shown in Figure 25 for engaging carriage wheels 4g and 4h to prevent movement of the carriage in either direction. Latches 71a and 71b are provided with cam extensions 71a' and 71b' on the opposite side of the pivotal axis, and these extensions extend through slots formed in the upper flange of cross-head 66 and cooperate with the end of the slots to limit the downward movement of the latch elements. The cam extensions 71a' and 71b' also act as cam elements which engage a fixed surface on the frame 60 when the cross-head is in its upper position to move the latch elements out of the path of wheels 4g and 4h, as shown in Figure 23. From the foregoing it is clear that the latch elements 71a and 71b are automatically moved into operative position when the cross-head 66 begins to move downwardly, and are automatically returned to inoperative position when the cross-head 66 is returned to its upper position.

Operation of the stripping machine shown in Figures 23 to 25 is as follows:

A mold carriage is brought from the drying tunnel and placed in center position on the rail section Rb as shown in Figure 23. By operation of pull-cord 65a, cylinder 61 is connected to exhaust, and the mold carriage is lowered into position where the coated molds 5 are immersed in the stripping liquid contained in tank 70, as shown in Figure 24. The molds are allowed to remain immersed in the liquid for a time sufficient to permit the liquid to penetrate the space between the articles 5g and the molds 5. When the dried residue of the coating on the molds 5 becomes wet, the moistened residue forms a slippery coating on the molds 5 and by quickly withdrawing the molds from the stripping solution, the articles will be stripped from the molds by reaction of the stripping liquid against the articles as the molds move upwardly. The molds are moved quickly in an upward direction by pulling;

pull-cord 65b to admit compressed air to the lower end of cylinder 61. The stripping action is facilitated by the tendency of the water to enter between the upper edges of the mouth of the article and the mold 5. In Figure 26 we have shown a molded article 5g partly stripped from a mold 5, and the sectional view of Figure 27 clearly shows the liquid collected in the bottom of the article. In Figure 28 the article 5g is shown dropping from the mold 5 back into the stripping bath. More than one stripping operation may be required to remove all of the articles from the molds. After all of the articles have been stripped from the molds, they are recovered from the stripping bath, and the mold carriage is returned along rail R to the washing tank WT.

In the control system shown in Figure 12 the speed of the motor is varied by varying the field current of the generator which supplies the motor. We prefer this system because of certain inherent advantages, although it is to be understood that the motor 2 may be controlled in other ways. For example, if desired, the motor may be supplied with current from a constant voltage source, and the speed may be varied by inserting the speed controlling resistances directly in the armature circuit of the motor instead of in the field circuit of the generator, using the same control system shown in Figure 12.

While the apparatus shown and described herein is especially useful for forming articles which may be stripped from the molds, it is obvious that the apparatus may be employed for dipping other articles where the coating is to remain on the articles. For example, the apparatus may be employed for applying protective coatings of paint or the like to articles of special shape, or for similar purposes. Accordingly, the term "dipping form" as employed in the attached claims is to be interpreted broadly to apply either to a mold from which the coating is to be stripped or to an article on which the coating is to remain.

We claim:

1. Dipping apparatus comprising, in combination, a dipping frame mounted for vertical movement, a dipping form carried by said frame, means including an electric motor for raising and lowering said frame, speed varying means for said motor, and means for operating said speed varying means in timed relation with the movement of said dipping frame to vary the speed of said motor in accordance with the vertical position of said form.

2. Dipping apparatus comprising, in combination, a dipping frame mounted for vertical movement, means including an electric motor for raising and lowering said frame, and means controlled by the movement of said frame for changing the speed of said motor at predetermined points in the vertical movement of said frame.

3. Dipping apparatus comprising, in combination, a dipping frame mounted for vertical movement, a dipping form carried by said frame, means including an electric motor for raising and lowering said frame, and means controlled by the vertical movement of said frame for varying the speed of said motor in accordance with the vertical position of said form.

4. Dipping apparatus comprising, in combination, a dipping frame mounted for vertical movement, means including an electric motor for raising and lowering said frame, an energizing circuit for said motor including a plurality of speed-determining control devices carried by said frame, and operating elements for said control devices

mounted on a relatively stationary support and positioned in the path of travel of said devices, whereby the speed of operation of said motor is varied at predetermined points in the vertical movement of said frame.

5. Dipping apparatus comprising, in combination, a dipping frame mounted for vertical movement, means including an electric motor for raising and lowering said frame, an energizing circuit for said motor including a plurality of speed-determining control devices mounted on a relatively fixed support adjacent said frame, and operating elements for said devices carried by said vertically movable frame, and operating to change the speed of said motor at predetermined points in the vertical movement of said frame.

6. Dipping apparatus comprising, in combination, a dipping tank containing liquid, a dipping frame mounted for vertical movement above said tank, a dipping form carried by said frame, means including an electric motor for raising and lowering said dipping frame, an energizing circuit for said motor including a plurality of control devices for fixing the speed of said motor at predetermined values, and means controlled by the vertical movement of said frame for operating said control devices in a predetermined sequence at predetermined points in the vertical movement of said frame to secure an approximately constant rate of movement of the line of contact between the surface of said liquid and said form.

7. Dipping apparatus comprising, in combination, a dipping frame mounted for vertical movement, means including an electric motor for raising and lowering said frame, an energizing circuit for said motor including a plurality of control devices for fixing the speed of said motor at predetermined values, means controlled by the vertical movement of said frame for operating said control devices at predetermined points in the vertical movement of said frame, said control devices being divided into two groups, and means for rendering one group of control devices effective to control said motor on the downward movement of said frame, and for rendering the other group of said control devices effective to control the said motor on the upward movement of said frame.

8. Dipping apparatus according to claim 7 wherein said control devices comprise two groups of control relays for controlling the current supplied to said motor, and the energizing circuit for said motor includes a reversing relay for reversing the direction of operation of said motor, and means controlled by said reversing relay in one position thereof for completing the energizing circuits of one group of said control relays, and for completing the energizing circuits of the other group of said control relays in the other position of said reversing relay.

9. Dipping apparatus comprising, in combination, a dipping frame mounted for vertical movement, means including an electric motor for raising and lowering said frame, a circuit for energizing said motor to drive said frame downwardly, means controlled by the downward movement of said frame for interrupting said circuit at a predetermined point in the downward movement thereof, and time-delay means controlled by movement of said dipping frame and rendered effective a predetermined time after interruption of said circuit for establishing an energizing circuit for said motor to drive said frame upwardly.

10. Dipping apparatus comprising, in combination, a dipping frame mounted for vertical move-

ment, power means for raising and lowering said frame, means to energize said power means to drive said frame downwardly, means for reversing said power means at a predetermined point in the downward movement of said frame, means responsive to the initial reverse movement of said frame for stopping said power means, and time-delay means rendered effective a predetermined time after stopping of said power means for re-energizing said power means to drive said frame upwardly.

11. Dipping apparatus comprising, in combination, a dipping frame mounted for vertical movement, rotary power means for raising and lowering said frame, means for energizing said power means to drive said frame downwardly, means for reversing the direction of operation of said power means at a predetermined point in the downward movement of said frame, means responsive to the initial reverse operation of said power means for de-energizing said power means, and means rendered effective a predetermined time after de-energization of said power means for re-energizing said power means to drive said frame upwardly.

12. Dipping apparatus comprising, in combination, a dipping frame mounted for vertical movement, means including an electric motor for raising and lowering said frame, a circuit for energizing said motor to drive said frame downwardly, a reversing relay for reversing the direction of operation of said motor, means for energizing said reversing relay at a predetermined point in the downward movement of said frame, means responsive to the initial reverse rotation of said motor for interrupting the energizing circuit of said motor, and time-delay means rendered effective a predetermined time after interruption of said motor circuit for closing said motor circuit to drive said frame upwardly.

13. Dipping apparatus comprising, in combination, a dipping tank containing a liquid, a dipping frame mounted for vertical movement above said tank, power means for raising and lowering said frame, means for controlling the speed of operation of said power means including control means carried by said frame and operating means therefor supported on a relatively stationary frame adjacent said tank, and means for adjusting said relatively stationary frame in vertical direction to a predetermined position with respect to the level of the liquid in said tank.

14. Dipping apparatus comprising, in combination, a first tank, a second tank arranged adjacent said first tank, a dipping frame including an overhead trolley rail arranged above said tanks and mounted for vertical movement, a mold carriage suspended from said trolley rail and having dipping molds suspended therefrom, an electric motor for raising and lowering said frame, control means associated with each of said tanks for changing the speed of said motor at predetermined points in the vertical movement of said frame, and switch means controlled by said mold carriage for rendering the respective control means of said tanks effective to control said motor when said mold carriage is in position over either of said tanks.

15. Dipping apparatus according to claim 14 wherein the control means embodies a series of control switches associated with each dipping tank and being operated by vertical movement of said frame, and including a transfer relay for normally rendering one group of control switches effective to control said motor, when said car-

riage is over one of said tanks, and means controlled by said carriage when positioned over the other tank for energizing said transfer relay to render said other group of control switches effective to control said motor.

16. Dipping apparatus according to claim 14 wherein said control means embodies two groups of adjustable speed-controlling resistance elements, a relay normally connecting one group of said resistance elements in circuit for controlling said motor when said carriage is in position over one of said tanks, and means controlled by said carriage when in position above the other tank for energizing said relay to thereby connect said other group of resistance elements in circuit to control said motor.

17. Dipping apparatus according to claim 14 wherein said control means embodies two groups of adjustable speed-controlling resistance elements and a series of control switches associated with each dipping tank and being operated by vertical movement of said frame, and switching means controlled by said carriage for connecting one group of resistance elements in circuits to be controlled by one series of control switches when said mold carriage is over one of said tanks and for connecting the other group of resistance elements in circuits to be controlled by the other series of control switches when said mold carriage is in position over the other tank.

18. Apparatus for forming molded rubber articles comprising, in combination, an overhead trolley rail, a dipping tank containing a rubber liquid located beneath one section of said rail, a stripper tank containing a stripping liquid located under another section of said rail, a mold carrier having a number of dipping molds suspended therefrom and being movably supported upon said rail, said rail having vertically movable sections located above each of said tanks, and individual means for raising and lowering the movable rail sections associated with each of said tanks whereby when said mold carriage is positioned upon either of said movable sections said molds are dipped into the liquid in said tanks, said means for raising the movable rail section associated with the stripper tank comprising means for effecting withdrawal of the molds from the liquid in said tank at a speed sufficient to effect stripping of the articles from said molds by the reaction of the stripping liquid against said articles.

19. Apparatus for stripping molded rubber articles from molds comprising, in combination, a stripping tank containing a stripping liquid, an overhead trolley rail positioned above said stripping tank and having a section thereof mounted for vertical movement above said tank, a mold carriage suspended from said rail and being vertically movable to dip said molds in the stripping liquid when positioned on the vertically movable section of said rail, and power means for quickly raising said movable rail section to withdraw said molds from the stripping liquid at a speed sufficient to effect stripping of the articles from said molds by the reaction of the stripping liquid against said articles.

20. Dipping apparatus comprising, in combination, a dipping tank, a dipping frame mounted for vertical movement above said tank, a dipping form carried by said frame, means including an electric motor for raising and lowering said dipping frame, speed varying means for said motor, and means for operating said speed varying means in timed relation with the movement of

said dipping frame to vary the speed of said motor and thereby vary the rate of movement of said dipping frame so that the line of intersection between said dipping form and a predetermined horizontal plane within said dipping tank travels along the surface of said form at an approximately constant rate of movement.

21. In apparatus for dipping molds the surfaces of which are curved, the combination of power means for lowering the mold into the dipping liquid, a plurality of control devices for controlling said power means to vary the dipping speed in a plurality of steps, and means to selectively operate said control devices at predeter-

mined points in the lowering movement of said mold to vary the speed of dipping so as to approximate a uniform rate of travel of the line of contact between the dipping liquid and the mold along the surface of the mold.

22. Dipping apparatus comprising, in combination, a dipping frame mounted for vertical movement, means including a motor for raising and lowering said frame, and means controlled by the movement of said frame for changing the speed of said motor at predetermined points in the vertical movement of said frame.

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