

Dec. 16, 1930.

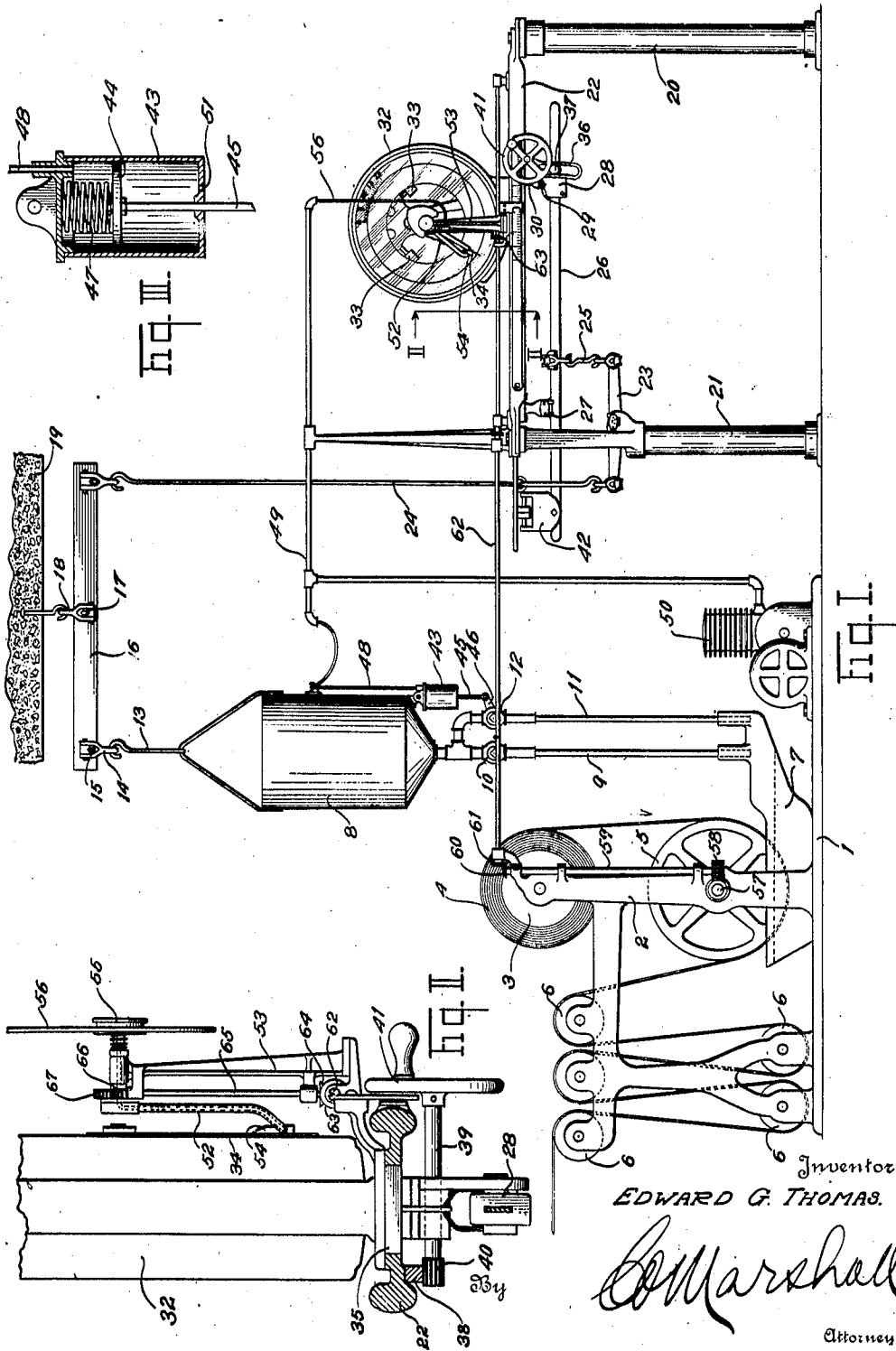
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FLOW CONTROLLING SCALE

Filed Sept. 10, 1923

3 Sheets-Sheet 1



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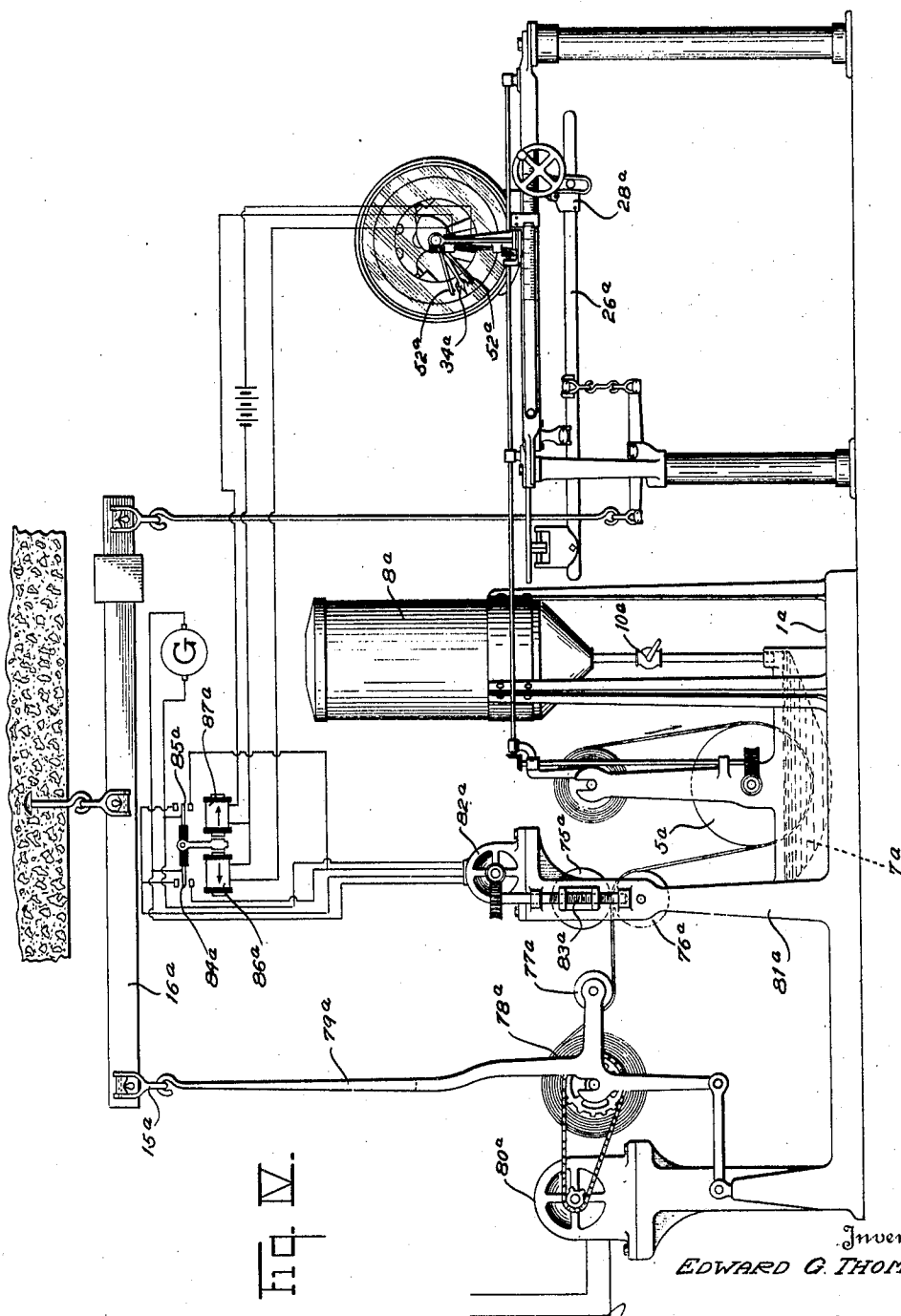
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3 Sheets-Sheet 3

Fig. V.

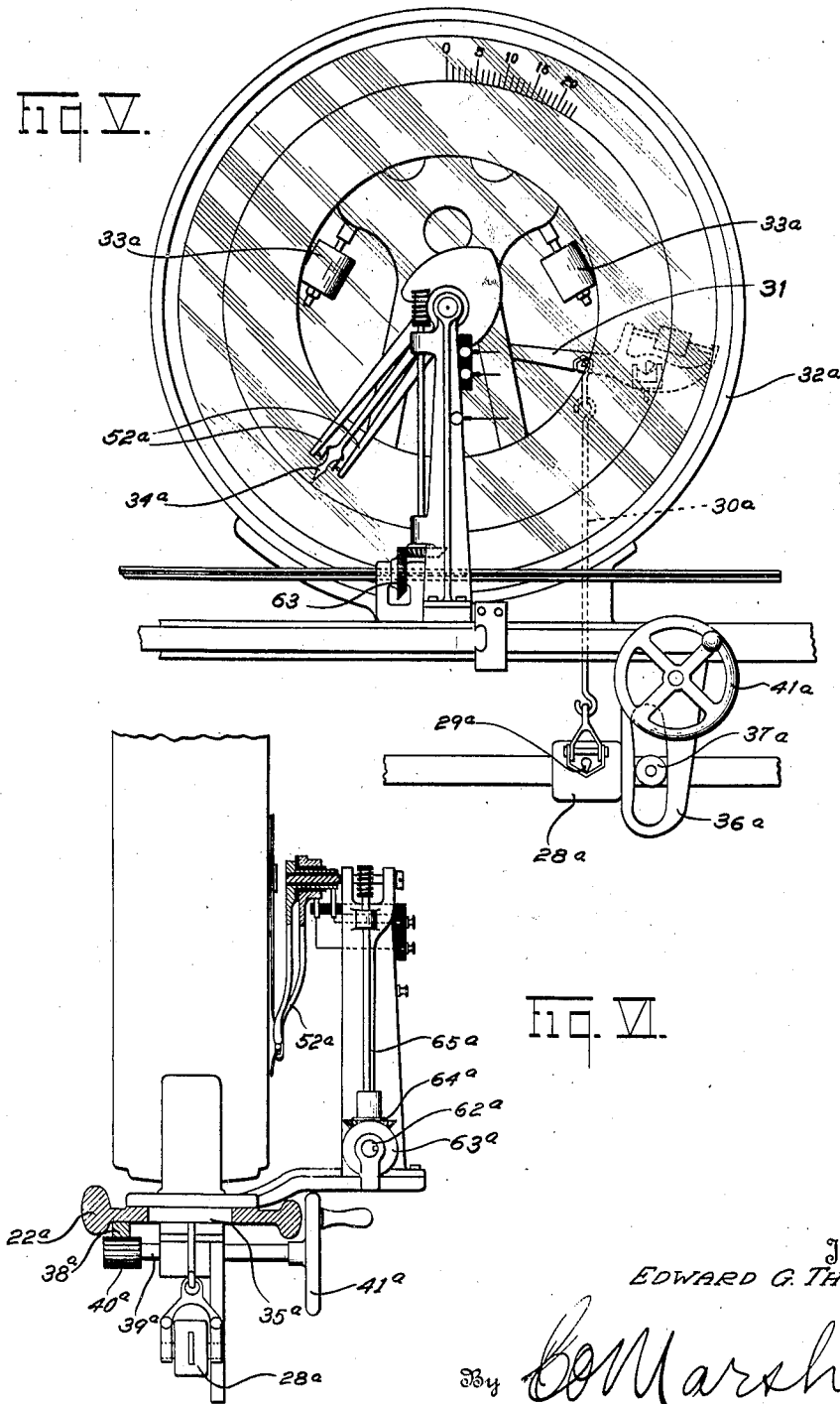


Fig. VI.

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FLOW-CONTROLLING SCALE

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This invention relates to devices for securing uniformity of product, and particularly to devices for producing uniformly coated or impregnated material. In the manufacture of such products as, for example, oil cloth, coated fabrics, artificial leathers, and the like, it is desirable to coat or impregnate a continuously moving strip of fabric with a definite amount of compound per yard so that the finished product will be of uniform weight and character. In many processes for manufacturing such products continuous gaging and checking of the amount of compound being applied depends wholly upon the skill of the operator, who estimates from the appearance of the product in course of manufacture whether or not the amount of compound to be fed should be increased or decreased. The principal object of my invention is to provide automatic means for insuring the incorporation in each unit of material of a definite quantity of coating or impregnating compound. It is to be understood, however, that my invention is not limited to devices for treating sheet material with liquids, but that it is also applicable for use in treating body material of other forms, such as cordage, and series of separate pieces, and for the application to body material of flowable material of any kind. It may be used, for example, for controlling the rate of supply of granular material for application to sand paper or the supply of comminuted mineral to be applied to sheet roofing.

Another object of the invention is the provision of means for automatically controlling the flow of coating or impregnating compound whereby the rate at which said compound is supplied is kept in definite ratio to the rate at which the product is turned out.

Another object of the invention is the provision of means whereby the flow-controlling apparatus may be set to supply the compound at a rate in any desired ratio to the rate at which the product is delivered.

Still another object is the construction of mechanism of this character in which weighing and indicating mechanism which has been already developed to a state of high efficiency may be employed, thereby cutting down the

cost of development, the cost of manufacture, the cost of field service, and rendering the success of the new device in practical operation more certain.

In the drawings:—

Figure I is a front elevational view of a device embodying my invention; Figure II is an enlarged fragmentary side elevational view of some of the parts shown in Figure I, the view being partly in section according to the lines II—II of Figure I; Figure III is an enlarged detail vertical sectional view through a pneumatic regulating cylinder employed in the device of my invention; Figure IV is a front elevational view showing a device embodying my invention in modified form; Figure V is an enlarged fragmentary front elevational view showing an indicating device forming a part of the mechanism shown in Figure IV; and Figure VI is a still further enlarged side elevational view partly in section showing some of the parts illustrated in Figure V.

In the form of device shown in Figures I to III inclusive, a base 1 is provided upon which are fixed standards 2 that serve to support a reel 3 upon which is wound the fabric or other sheet material 4 to be treated. The material 4 is led from the reel 3 downwardly around a dipping drum 5 and thence around a series of guide drums 6.

Supported upon the base 1 in such position that the sheet material 4 moves through it as it passes around the dipping drum 5 is a pan or trough 7 adapted to contain liquid coating or impregnating compound to be applied to the sheet material 4. The quantity of coating compound that will cling to the sheet material 4 as it passes through the trough 7 depends upon the depth to which the dipping drum 5 sinks in the compound and the consequent length of the passage of the sheet material therethrough. The length of the passage of the sheet material 4 through the compound depends in turn upon the level at which the surface of the compound within the trough 7 is maintained. In order to maintain the surface of the compound at a constant level, it is, of course, necessary to re-

plenish it at the same rate that it is carried away by the sheet material 4.

In the form of my device shown in Figures I to III inclusive, the compound in the trough is replenished from a supply tank 8, from the lower end of which a pipe 9 leads to the trough. The pipe 9 is provided with a valve 10 which is opened to an extent to permit compound to pass from the tank 8 to the tank 7 at a rate somewhat less than the rate at which it is carried away by the sheet material 4. A second pipe 11 also extends from the lower end of the tank 8 to the trough 7 and this second pipe is provided with a valve 12 which, unlike the valve 10, is not adapted to be set in any fixed position but is controlled by a device, the purpose of which is to cause material to be discharged from the tank 8 at a rate proportional to the rate at which the sheet material 4 passes around the dipping drum 5. The supply tank 8 is hung, by means of a link 13, clevis 14 and knife edge pivot 15, from one end of a lever 16 which is fulcrumed by means of a knife edge pivot 17 on a stirrup 18 suspended from the ceiling 19 or other suitable fixed support. The opposite end of the lever 16 is connected to automatic load-counterbalancing mechanism, which in turn is connected to the valve 12 and to the dipping drum 5 in such a way that the valve 12 is kept open to an extent that will permit the compound to flow from the supply tank and thus decrease the weight in the tank at a rate in constant ratio to the rate of movement of the dipping drum. It is to be understood that the lower ends of the pipes 9 and 11 are not in any way fastened to the trough 7, so that the weight of the tank 8 is entirely supported by the lever 16.

The automatic load-counterbalancing mechanism is supported upon a pair of columns 20 and 21 connected by a frame 22. a lever 23 being fulcrumed upon the column 21 and connected at one end by means of linkage 24 to the lever 16 and at its other end by means of linkage 25 to a beam 26 which is fulcrumed on a bracket 27 depending from the frame 22.

Mounted for longitudinal adjustment on the beam 26 is a slide 28 carrying a knife edge pivot 29 which is connected by means of a link 30 to a lever 31 fulcrumed within a substantially watch-case-shaped housing 32 and connected to automatic load-counterbalancing pendulums 33. The automatic load-counterbalancing pendulums 33 are connected in the usual way by means of a rack and pinion (not shown) to a hand 34 so that the angular position of the hand 34 is dependent upon the weight of the compound within the supply tank 8.

A portion of the weight of the tank 8 and its contents is counterbalanced by means of a weight 42 adjustably mounted on the beam 26. It is evident that the pull upon the lever 31 and the consequent pull on the pendulums 33

exerted by a given weight in the supply tank 8 is dependent upon the position of the slide 28 upon the beam 26. The less the distance between the pivot 29 and the fulcrum of the beam 26, the greater the pull exerted by a given weight in the supply tank 8 and the greater the angular movement of the hand 34 for a given decrease in the weight of the contents of the supply tank 8. By moving the slide 28 along the beam 26 the device may, therefore, be set to cause the rate of movement of the hand 34 to be in any desired ratio to the rate of decrease of the contents of the supply tank 8.

In order that the connection 30 between the beam 26 and the automatic load-counterbalancing mechanism in the housing 32 may be plumb in all positions of the slide 28 on the beam 26, I have mounted the housing 32 upon a carriage 35 slidably supported on the frame 22. Depending from the carriage 35 is a slotted roller guide 36 which receives a roller 37 mounted upon the slide 28. Thus, as the housing 32 is moved along the frame 22, the slide 28 is, by means of the roller guide 36 and roller 37, moved along the beam 26 and the connection 30 remains plumb in all positions of adjustment.

To provide convenient means for moving the housing 32 and slide 28, a rack 38 is fixed beneath the frame 22 and a shaft 39 provided with a pinion 40 which meshes with the rack 38, and a hand wheel 41 by means of which it may be turned is journaled in a depending portion of the carriage 35. By turning the hand wheel 41 the housing 32 and slide 28 may be adjusted to increase or decrease the multiplication of the beam 26 and the consequent effect of the given weight on the automatic load-counterbalancing mechanism.

In order to maintain the rate of discharge of compound from the tank 8 at a constant ratio to the rate at which the sheet material 4 is drawn under the dipping drum 5, I have provided in this form of the device pneumatic control for the valve 12. Suspended from the tank 8 is a cylinder 43 within which operates a plunger 44, the plunger rod 45 being pivotally connected to the operating arm 46 of the valve 12. An expansive spring 47 constantly urges the plunger 44 in a direction tending to close the valve 12 and thereby restrict the discharge of compound from the tank 8. A flexible tube 48 leads from the chamber above the plunger 44 to a pipe 49 which is connected to an air pump 50 that constantly exhausts air from the pipe 49, the tube 48 and the part of the cylinder 43 above the plunger 44. The lower end of the cylinder 43 contains a vent 51, so that atmospheric pressure may act upon the lower side of the plunger 44 and force it upwardly against the expansive force of the spring 47. Exhaustion of air from the pipe 49 hence operates to open the valve 12 and thus increase the rate

of discharge of the compound from the tank 8. The state of rarification of the air within the pipe 49 and the cylinder 43 is controlled by means of a revoluble hollow arm 52 so journaled in the bracket 53, which is attached to the carriage 35, that its axis of movement is coincident with the axis of movement of the indicator hand 34. The hollow arm 52 has an opening at its tip and the hand 34 carries a closure 54 which, when it is engaged with the tip of the arm 52, closes the opening. The interior of the arm 52 is connected with the interior of the pipe 49 by means of a passage extending from the interior of the arm 52 axially through its hub and thence to the periphery of a reel 55 from which a flexible tube 56 extends to the pipe 49, so that when the closure 54 is out of engagement with the tip of the arm 52 the air may enter the opening 53 and pass by way of the pipe 49 to the upper end of the cylinder 43, thus neutralizing in part the pressure of the air on the lower side of the plunger 44 and permitting the spring 47 to expand and force the plunger downwardly to close or partially close the valve 12.

For the purpose of turning the hollow arm 52 as the hand 34 turns under the influence of the diminishing weight in the tank 8, I have connected it with the dipping drum 5 by means of mechanism which, in the form of device shown in Figures I to III inclusive, consists of a worm 57 secured to the dipping drum shaft which meshes with a worm-wheel 58 fixed upon the lower end of a vertically extending rotatable shaft 59, the shaft 59 having at its upper end a beveled gear 60 that meshes with a beveled gear 61, fixed upon one end of a shaft 62 which is provided in one side with a longitudinally extending groove or keyway adapted to slidably receive a key by means of which the beveled gear 63 carried by the shaft 62 is permitted to move longitudinally thereof but is held to rotate therewith. The beveled gear 63 meshes with a similar gear 64 which is fixed to the lower end of an upwardly extending rotatable shaft 65, a worm 66 being fixed upon the upper end of the shaft 65 and meshing with a worm-wheel 67 fixed to the hollow arm 52.

Turning of the dipping drum 5 thus causes the hollow arm 52 to swing about its axis of movement at a rate proportional to the rate of movement of the dipping drum.

Operation.—With the device constructed as above described, the arm 52 will make a complete revolution when a predetermined number of yards of sheet material pass around the dipping drum 5, while the hand 34 will make a complete revolution when the amount of compound in the tank 8 decreases in an amount dependent upon the position of the slide 28 on the beam 26. If, therefore, the rate of flow of compound out of the tank

8 is uniform and the time necessary to discharge an amount which will cause the hand 34 to travel from full capacity position to zero position is equal to the time required for a revolution of the arm 52, the hand 34 and the arm 52 will rotate at the same rate of speed, and if the tip of the arm be out of engagement with the closure 54, the opening in the tip of the arm will remain open and thus prevent the creation within the pipe 49 and the cylinder 43 of a vacuum sufficient to permit the raising of the plunger 44 against the expansive force of the spring 47 and the consequent opening of the valve 12.

For the purpose of insuring that the level of the compound in the trough 7 be kept at a height just sufficient to cause the required amount of compound to be taken up by the sheet material 4, the slide 28 may be set at a position on the beam at which the discharge of the required quantity of compound per unit of length of sheet material will cause the hand 34 to move at the same speed as the arm 52. The valve 10 may then be closed to restrict the discharge from the tank 8 to a rate slightly less than that required. As the hand and arm move under the influence of the change in weight in the tank and the movement of the drum 5 respectively, the arm 52 will overtake the hand 34 and the tip of the arm will be brought into engagement with the closure 54, thus enabling the pump 50 to relieve the pressure on the upper side of the plunger 44 so that it may be raised against the expansive force of the spring 47 by atmospheric pressure. The valve 12 will thus be opened and the rate of flow from the tank 8 increased until the hand 34 begins to draw away from the arm 52, uncovering the opening at the tip of the arm and admitting air to the top of the plunger 44, wholly or partially closing the valve 12 and reducing the rate of discharge from the tank 8 until the hand 34 is again overtaken by the arm 52 and the valve 12 again opened. In practice, the mechanism soon reaches a condition of equilibrium in which the arm 52 follows the hand 34 very closely and the rate of flow through the valves 10 and 12 is substantially uniform and within the commercial tolerance of the average rate, which is exactly determined by the setting of the slide 28.

In the form of device shown in Figures IV to VI inclusive, the amount of compound applied per unit of length of material is controlled by the increasing weight of the treated product rather than by the diminishing weight of the supply of compound. In this form of the device the tank 8^a is supported upon the base 1^a and the compound is admitted to the trough 7^a through a valve 10^a which is manually controlled to keep the material in the trough 7^a at a level somewhat above that required for proper saturation of the sheet material. After the sheet material

passes beneath the dipping drum 5^a, however, it is drawn between a pair of wringer rolls or squeezing rolls 75^a and 76^a, which may be adjusted to permit only the desired amount of compound to remain in the material which passes between them. From the squeezing rolls the saturated material passes beneath a roller 77^a, the lower side of which lies in substantially the same horizontal plane as the adjoining sides of the squeezing rolls and is thereafter wound upon a reel 78^a. The reel 78^a and the roller 77^a are supported upon a bifurcated frame 79^a which swings from a clevis 15^a supported by an overhead lever 16^a which is connected to automatic load-offsetting mechanism in all respects similar to that described in connection with the form of device shown in Figures I to III inclusive.

The material is wound upon the reel 78^a by means of a motor 80^a and imparts movement to the dipping drum 5^a, which is connected (by means of mechanism similar to that described as a part of the device shown in Figures I to III) to a pair of rigidly connected rotatable arms 52^a, the tips of which are so located as to precede and follow the hand 34^a. The hand 34^a is equipped with contacts adapted to be engaged by contacts on the arms 52^a. The pedestal 81^a which carries the squeezing rolls 75^a and 76^a also supports a reversible motor 82^a which is connected, by means of suitable gearing, to worms 83^a at each end of the upper roll 75^a by means of which the roll 75^a may be moved upwardly or downwardly to place the material passing between the rolls under more or less compression and thereby squeeze more or less of the saturating compound out of the material as it passes through the rolls. The compound thus squeezed out of the material runs back into the tank 7^a.

The reversible motor 82^a is controlled by switches 84^a and 85^a which are arranged, as diagrammatically shown in Figure IV, to direct the current from a source of energy G to one pole or the other of the reversible motor 82^a. The switches 84^a and 85^a are in turn controlled by magnets 86^a and 87^a, which are connected, as diagrammatically shown in Figure IV, to the contacts on the hand 34^a and the arms 52^a. When the speed of the hand 34^a is less than that of the arm 52^a, the contact on the rear arm 52^a engages the contact on the hand 34^a and the switches 84^a and 85^a are closed to cause the motor 82^a to turn in a direction to move the squeezing roll 75^a upwardly and thus permit more of the saturating compound to remain in the material which passes between the squeezing rolls. When the speed of the hand 34^a is greater than that of the arm, the contact on the front arm 52^a engages the contact on the hand 34^a and the switches 84^a and 85^a are closed to cause the motor 82^a to turn in the

opposite direction, so that the upper squeezing roll is forced downwardly toward the lower squeezing roll and more of the compound is wrung from the material as it passes between the rolls.

The controlling device may be set to maintain the product at any desired average weight by moving the slide 28^a along the beam 26^a.

If desired, the motor 82^a, which operates the squeezing rolls and its controlling switches and circuits, may be omitted and the weighing device used merely as an indicator, the squeezing rolls being operated by hand to diminish or increase the amount of saturating compound which the sheet material is permitted to retain.

The embodiments of my invention herein shown and described are to be regarded as illustrative only, and it is to be understood that the invention is susceptible to variation, modification and change within the spirit and scope of the subjoined claims.

Having described my invention, I claim:

1. In a device of the class described, in combination, means for delivering sheet material, means for applying liquid treating compound thereto, means for squeezing a portion of the compound so applied from said sheet material, to secure a definite degree of saturation, and means for indicating variations in the ratio of the rate of producing said saturated sheet material to the rate of accretion of weight of the product.

2. In a device of the class described, in combination, means for delivering sheet material, means for applying liquid treating compound thereto, a pair of squeezing rolls for expressing a part of the compound from said sheet material, and means controlled by the rate of accretion in weight of the product for regulating the squeezing effect of said squeezing rolls.

3. In a device of the class described, in combination, means for delivering sheet material, means for applying liquid treating compound thereto, a pair of squeezing rolls for expressing a part of the compound from said sheet material, means controlled by the rate of accretion in weight of the product for regulating the squeezing effect of said squeezing rolls, and means whereby said regulating means may be selectively set for a plurality of rates of accretion.

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