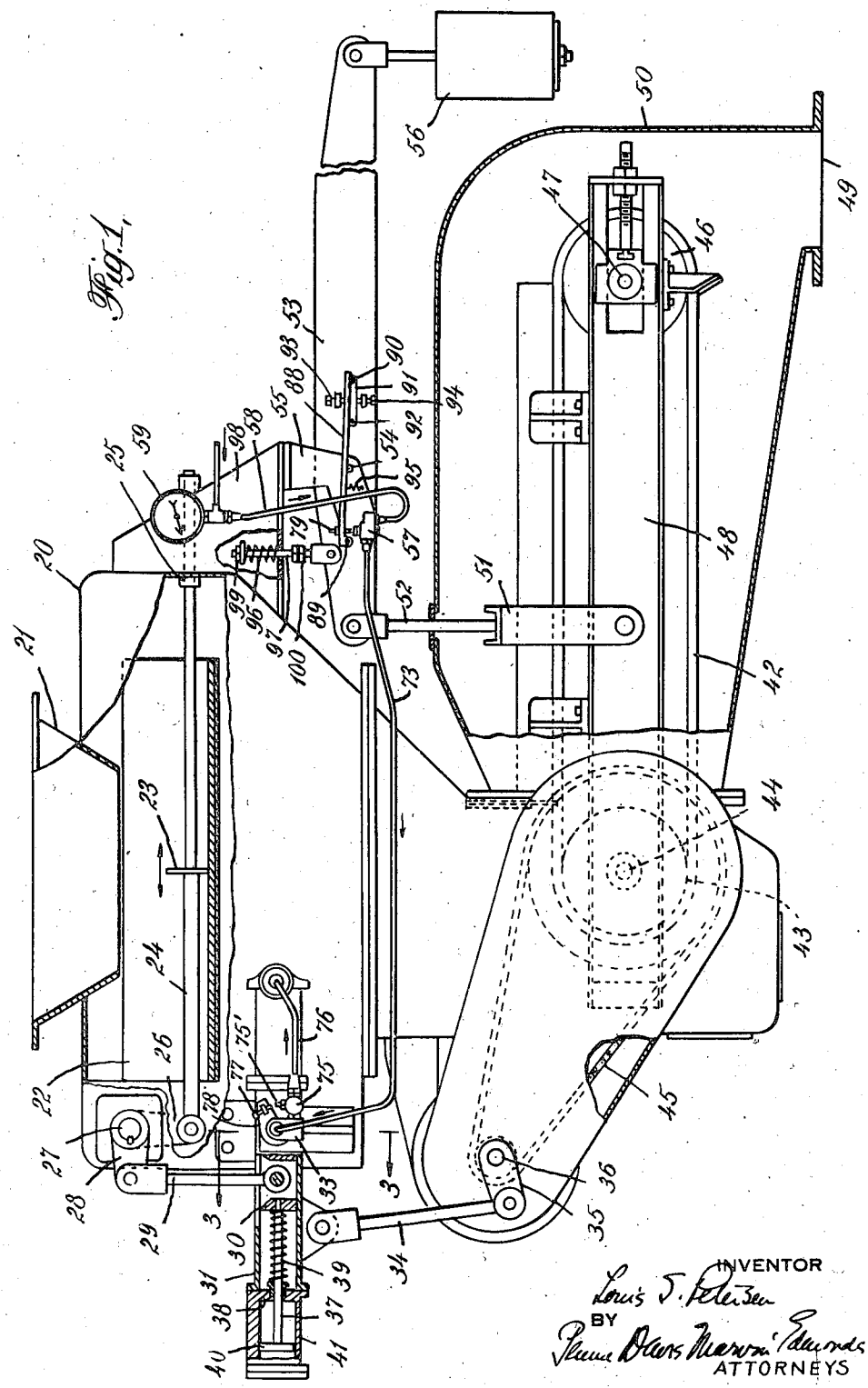
Aug. 24, 1948. L. S. PETERSEN 2,447,594

FEEDING AND WEIGHING APPARATUS

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Fig. 1.



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FEEDING AND WEIGHING APPARATUS

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Fig. 2.

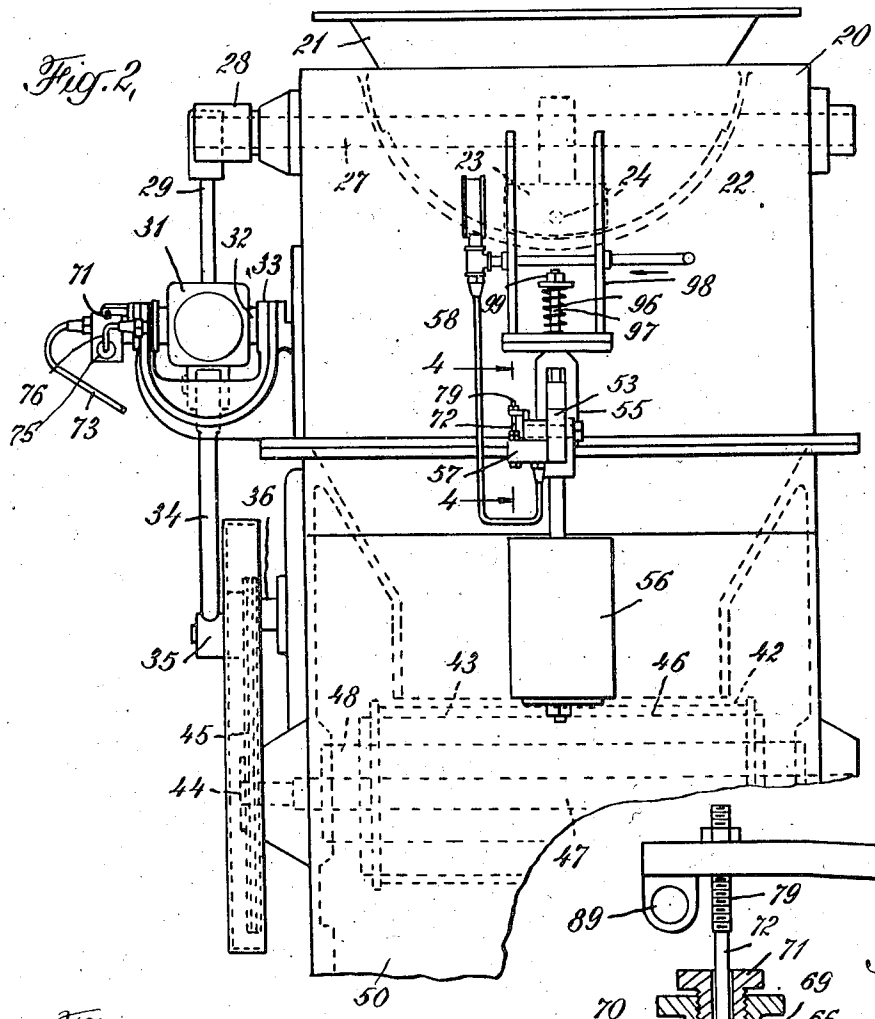


Fig. 3.

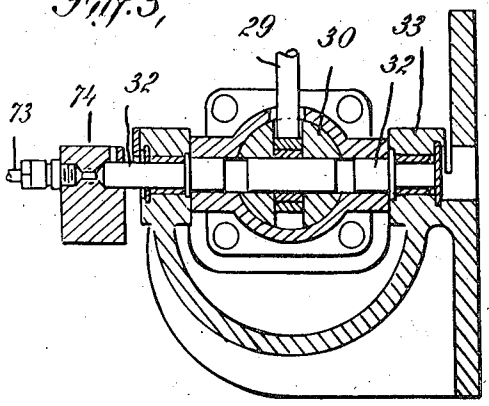
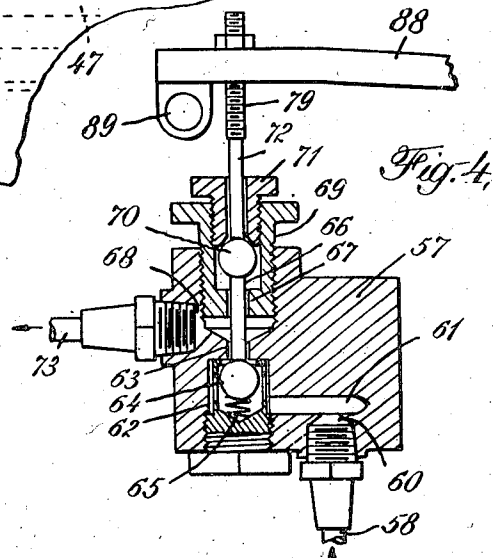


Fig. 4.



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Fig. 6,

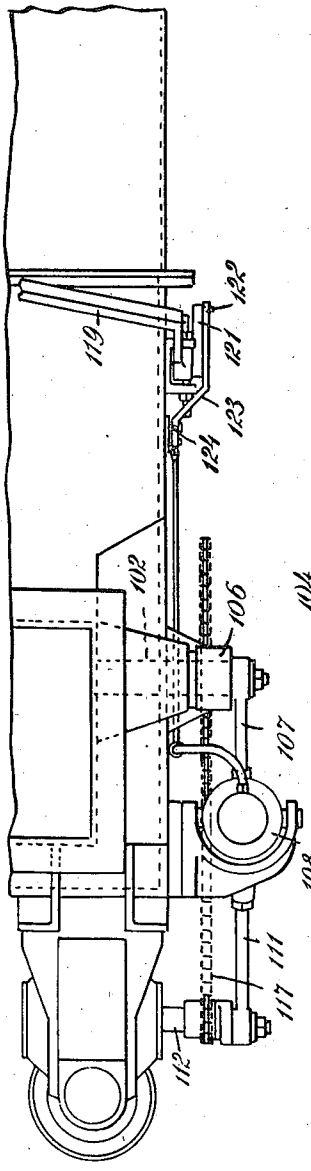
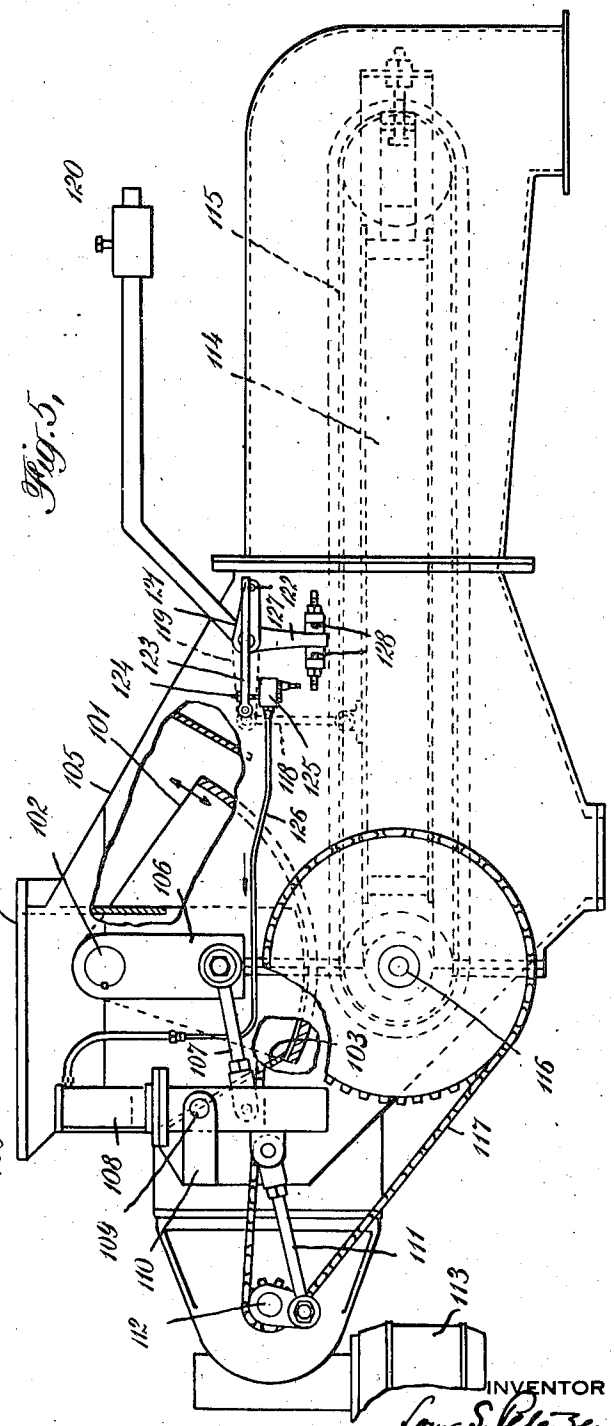


Fig. 5,



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Fig. 7,

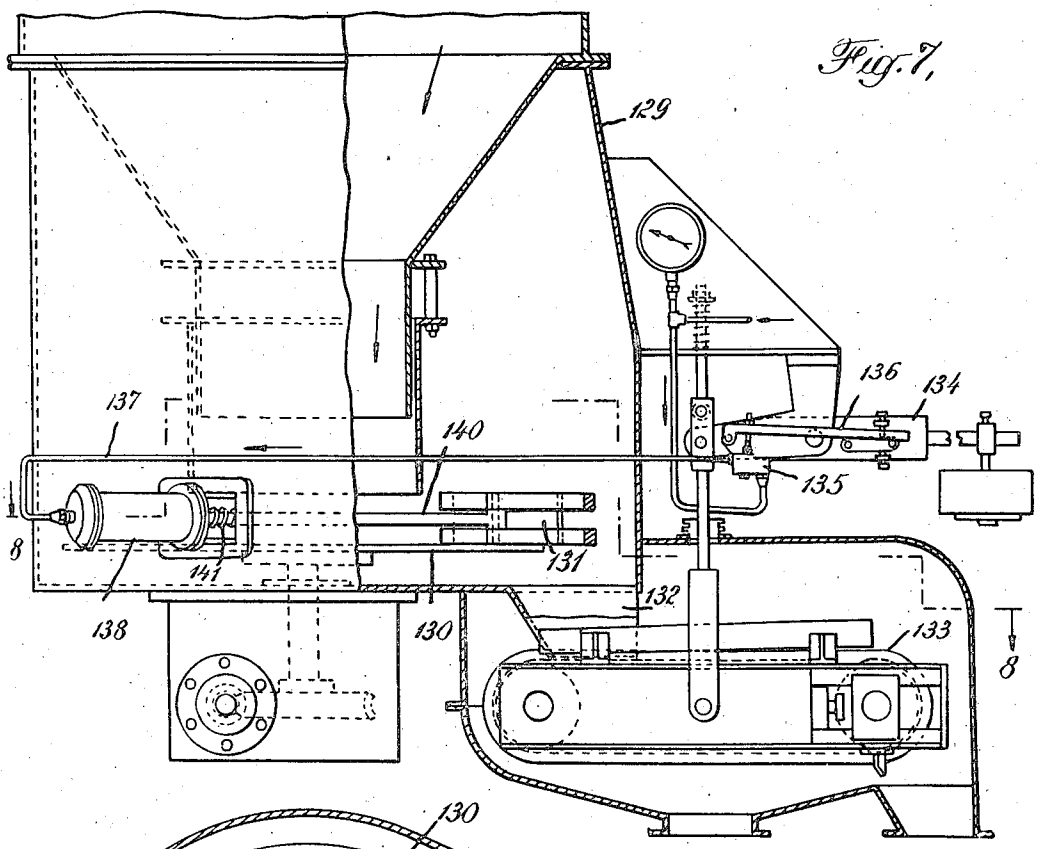
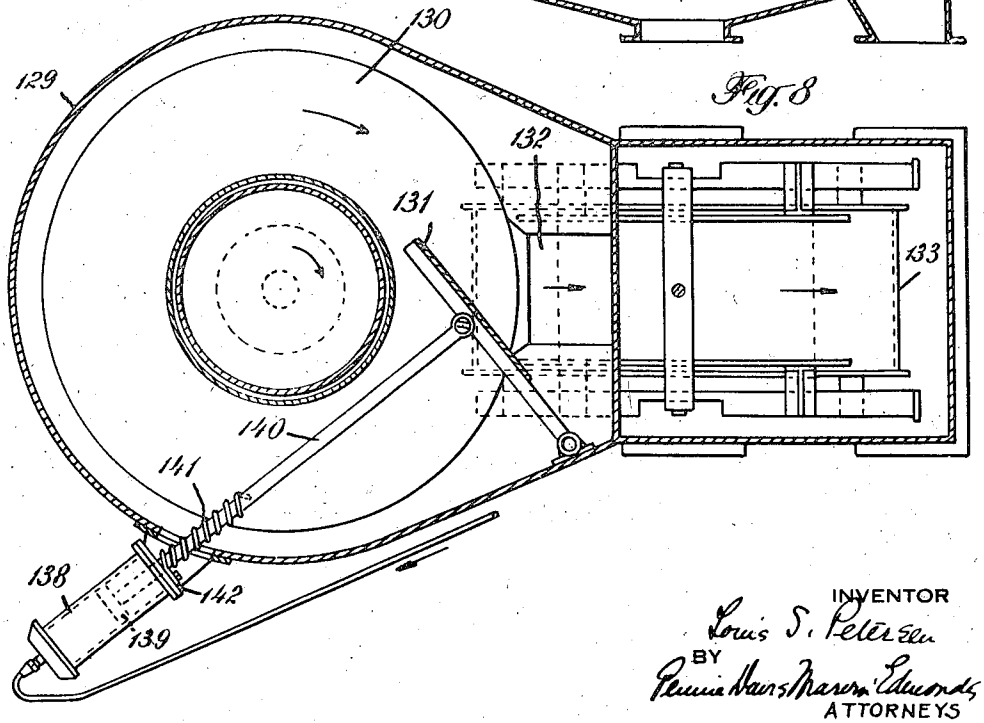


Fig. 8



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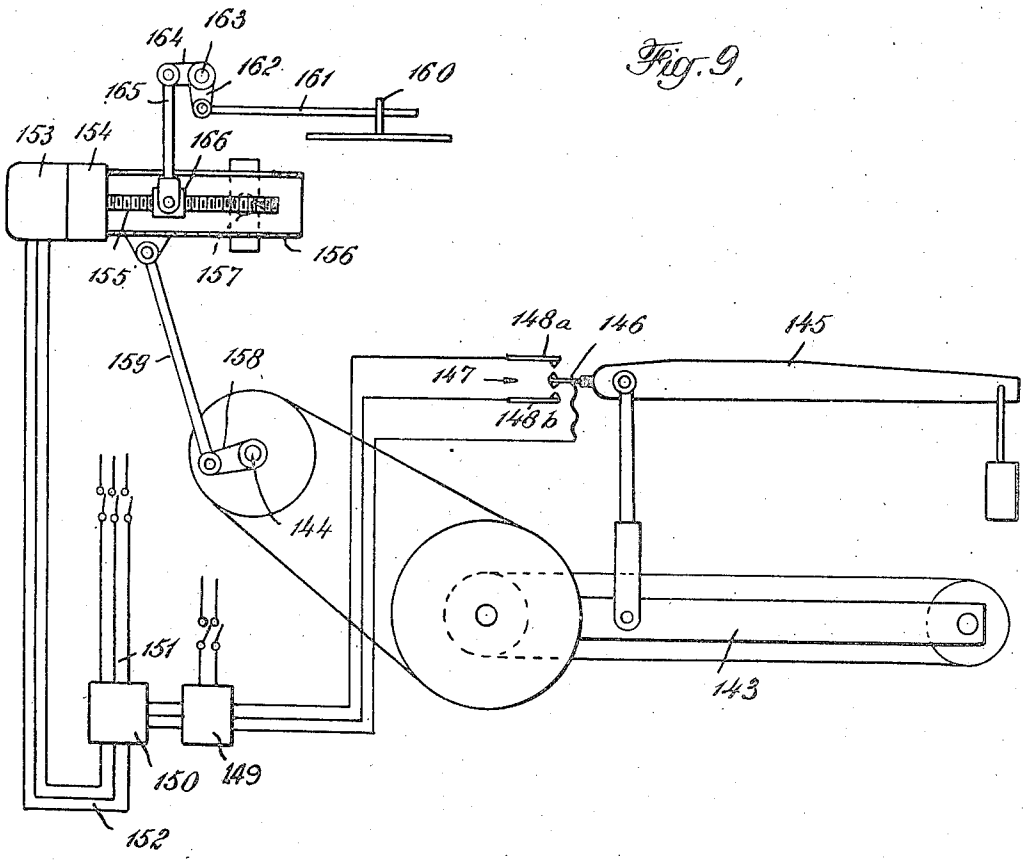


Fig. 9.

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2,447,594

FEEDING AND WEIGHING APPARATUS

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Application April 1, 1944, Serial No. 529,216

10 Claims. (Cl. 222—55)

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This invention relates to apparatus for feeding material at a constant rate and is concerned more particularly with a novel apparatus for the purpose which provides close control of the feeding rate and is of relatively simple construction.

The new feeding apparatus includes a feeding means which receives material from a supply and includes a pair of elements, one of which is fixed and the other movable. These elements cooperate to feed the material and their action is controllable so that the material may be fed at different rates within a range. The material discharged from the feeding means is deposited upon a conveyor, which is connected to a counter-balanced weigh beam and is movable from an initial position as the load upon it varies. The weigh beam operates to hold the conveyor in its initial position when it is carrying a selected load and the weigh beam and its associated parts may be adjusted to vary the load which the conveyor is to carry without displacement. The action of the feeding means is controlled by mechanism brought into action as the conveyor departs from its initial position, because of feeding under or over the desired rate, and the control mechanism varies the action of the feeding means to make the necessary correction and cause the conveyor to be restored to its initial position.

The feeding means employed in the apparatus may be of various types and may include a fixed trough containing a pusher, the stroke of which is varied to control the rate of feed. Another suitable feeder is of the cradle type, in which the material is deposited upon a swinging cradle from which the material is discharged by a fixed blade, the rate of discharge depending upon the length of the swing of the cradle. Still another feeder that may be used includes a rotating table upon which the material is deposited from a supply, the material being discharged from the table by a blade which can be moved to different positions to vary the feeding rate.

The action of the feeding means may be controlled by electric or pneumatic means actuated by movements of the conveyor and, preferably, operated by means associated with the weigh beam connected to the conveyor and movable thereby. In one satisfactory form, the control includes a cylinder and piston, the latter connected to a slide which is movable to different positions, dependent upon the pressure of air admitted into the cylinder. The slide is then connected to an appropriate part of the feeding means for varying the action of the latter.

For a better understanding of the application,

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reference may be had to the accompanying drawings, in which

Figure 1 is a view of one form of the apparatus in elevation with parts broken away and other parts shown in vertical section;

Figure 2 is an end view of the apparatus shown in Figure 1 seen from the right;

Figure 3 is a sectional view on the line 3—3 of Figure 1;

Figure 4 is a sectional view on the line 4—4 of Figure 2;

Figure 5 is a view similar to Figure 1 of a modified form of the apparatus;

Figure 6 is a fragmentary plan view of the construction shown in Figure 5;

Figure 7 is a view partly in elevation and partly in vertical section of another modified form of the apparatus;

Figure 8 is a sectional view on the line 8—8 of Figure 7; and

Figure 9 is a diagrammatic view showing the apparatus equipped with an electrical control mechanism.

The apparatus shown in Figure 1 includes a casing 20 having an inlet hopper 21 at the top, through which material from any suitable source of supply is discharged into a trough 22. Within the trough is a pusher 23 mounted on a rod 24 which extends through the trough from end to end and has one end projecting through a guide 25 in the wall of the housing. The other end of the rod is connected to an arm 26 on a shaft 27 mounted in suitable bearings and provided with an arm 28 connected by a rod 29 to a slide 30 within a cylinder 31. The cylinder 31 is provided with trunnions 32 mounted in bearings in a bracket 33 attached to a suitable part of the apparatus and, in the operation of the device, the cylinder is rocked by an arm 34 attached to a crank 35 on a shaft 36 driven by any suitable means, such as a motor and reduction gear.

Within the cylinder 31 is a rod 37 attached to one end of the slide 30 and extending through an end wall 38 of the cylinder. The rod is encircled by a spring 39 bearing at one end against the slide and at the other end against end wall 38. Beyond the end wall, the rod carries a disk 40 within an oil dashpot 41. The other end of slide 30 is connected to a piston (not shown) within the cylinder and by admission of air into the cylinder beyond the piston, the slide can be moved to various positions against the action of spring 39. The distance between the axis around which the cylinder 31 swings and the point at which rod 29 is connected to slide 30 determines the arc through

which shaft 27 will be rocked as the cylinder is rocked. The arc of movement of shaft 27 determines the length of the stroke of pusher 23 and thus determines the rate at which material will be pushed from trough 22 by the pusher.

The material discharged from trough 22 by pusher 23 falls through the casing to be deposited upon a conveyor belt 42 which is trained about a pulley 43 on shaft 44 mounted in fixed bearings and driven by chain 45 from shaft 36. Belt 42 is also trained about pulley 46 mounted on a shaft 47 running in bearings mounted adjustably in a frame 48 which is free to swing about shaft 44 as an axis. The material deposited upon the upper stretch of the belt is discharged therefrom to fall through an opening 49 in casing 50 which encloses the conveyor.

The conveyor is normally supported in generally horizontal position by a stirrup 51 attached to the frame 48 and connected by a rod 52 to the end of the short arm of a weigh beam 53 pivoted at 54 in a bracket 55 attached to a suitable part of the structure. The weigh beam carries a counter-balancing weight 56 at the end of its long arm and the weight may be varied so that the beam will support the conveyor in horizontal position under different loads. If a change in the load on the conveyor occurs as the result in a change in the specific gravity of the material or for any other reason, the conveyor will either swing downward or upward, as the case may be. This movement of the conveyor is utilized to control the action of the feeding mechanism.

The control mechanism illustrated is of the pneumatic type and it includes an air valve 57 mounted on bracket 55. This valve receives air under pressure through a line 58 connected to a source, the connection including a gauge 59 for indicating the pressure. The valve includes an inlet 60 leading to a passage 61 in the body of the valve and the passage leads to a chamber 62 from which there is an outlet passage 63. A ball 64 within chamber 62 is normally forced upwardly by a spring 65 to close the outlet passage. A rod 66 fitting loosely within passage 63 rests on top of the ball. The rod extends through an outlet chamber 67 from which the air can escape through an outlet 68. The top of the outlet chamber 67 is closed by a hollow plug 69 into the interior of which the rod 66 projects. A ball 70 rests on the top of rod 66 within the outlet chamber 67 and closes a passage through a plug 71 threaded into the end of plug 69. A rod 72 rests on top of ball 70 and by depression of rod 72, the balls can be unseated. In that condition, air under pressure enters through the inlet 60 and flows past ball 64 into the outlet chamber 67 from which it issues through outlet 68. Some of the air may also escape around rod 66 and flow past ball 70 to escape around rod 72 through the passage in plug 71. The amount of air so allowed to escape around ball 70 is a small proportion of the air admitted into chamber 67.

The outlet fitting 68 is connected by a line 73 to a passage within a block 74, which is mounted on one of the trunnions 32 attached to cylinder 31, and air entering the passage in block 74 passes to an air valve 75 mounted on the block. A line 76 leads from the air valve to an inlet at the end of cylinder 31. Valve 75 is provided with an operating stem 75' which can be engaged by an adjustment screw 77 on a bracket 78 fast on bracket 33. Each time the cylinder 31 is rocked counterclockwise, valve 75 moves upwardly until its stem 75' engages the screw 77. This causes the valve stem to be depressed and the valve opened to admit air into the cylinder.

The valve 57 is actuated by an adjustment screw 79 threaded through a lever 88 pivoted at one end 89 on bracket 55. The free end of lever 88 coacts with a pin 90 of a lever 91 pivotally mounted at 92 on the weigh beam 53. The position of lever 91 on the beam is determined by upper and lower adjustment screws 93, 94 mounted in brackets on the beam. The lever 88 is kept in contact with pin 90 by a spring 95 attached at one end to lever 88 and at the other to bracket 55.

In addition to the counterweight 56, the weigh beam is acted on by a spring 96 encircling a rod 97 which is connected at one end to the weigh beam and extends through a web on a bracket 98 to which bracket 55 is attached. The spring acts on a nut 99 at the end of the rod and on the web and tends to move the weigh beam clockwise about its pivot. The movement of the weigh beam in this direction is limited by nuts 100 threaded on the rod and engageable with the undersurface of the web.

In the operation of the apparatus, the weigh beam is set to maintain the conveyor in generally horizontal position under a selected load of material deposited upon the conveyor belt by discharge from trough 22 by pusher 23. Initially, air will have been admitted through valve 57 into cylinder 31 to move slide 30 against the action of spring 39 to a position which will cause the pusher 23 to have the desired stroke. As the material is fed to the conveyor, it is moved along the latter to the discharge and so long as the load on the conveyor does not vary, the conveyor will stay in its initial position. Whenever there is a change in the load, for example, an overload, for any reason, such as an increase in the specific gravity of the material, the conveyor will tend to swing downwardly. This will cause lever 88 to swing counterclockwise so that it will permit the pin of valve 57 to rise and the valve will tend to close. As the shaft 36 rotates, the cylinder 31 will be rocked once per revolution of the shaft and on each upward movement of the right hand end of the cylinder, valve 75 will be opened. When the opening through valve 57 is reduced, the pressure in line 73 will fall and, whenever valve 75 is opened, air will escape from the end of the cylinder back through line 73 to valve 57, from which it will escape around rod 66. As the pressure behind the piston falls, spring 39 will move slide 30 to the right and this will decrease the distance between the axis about which cylinder 31 rocks and the point of connection of rod 29 to slide 30. Such a change in the position of the slide reduces the arc of movement of rod 29 and in turn reduces the stroke of the pusher 23 and the rate of feeding. With a reduction in the rate of feed to the conveyor, the load thereon will diminish until the conveyor will be raised by the action of the weigh beam. As the weigh beam swings clockwise about its pivot, the opening of valve 57 will be increased and air at greater pressure will enter the cylinder and cause slide 30 to be moved against the action of spring 39. This will result in the increase in the stroke of the pusher 23.

A decrease in the load on the conveyor produces actions of the parts which are the reverse of those described. Under a decreased load, the conveyor will move the weigh beam to cause an increase in the opening of the valve 57, air under greater

pressure will enter the cylinder, and the slide 30 will be moved to increase the stroke of the pusher.

The control mechanism, actuated by the movement of the conveyor from its initial position, may be operated directly or indirectly from the conveyor. Preferably, the control is actuated from the weigh beam, which is in turn moved by the conveyor as the latter departs from its initial position.

In the construction illustrated in Figures 5 and 6, the feeding mechanism includes a cradle 101 hung from a shaft 102 and adapted to be swung about the axis of the shaft. A fixed blade 103 cooperates with the cradle. The material enters the feeding means through inlet 104 into the casing 105 and the material is deposited upon the cradle. As the latter swings back and forth, a quantity of the material is discharged by the action of the fixed blade 103 and the rate of feed depends upon the arc through which the cradle is swung.

The cradle is actuated by an arm 106 fast on shaft 102 and connected by a rod 107 to a slide within a cylinder 108. The slide and cylinder are of the same construction as slide 30 and cylinder 31 and the cylinder is pivoted at 109 on a bracket 110. The cylinder is attached by a rod 111 to a crank on shaft 112 which is driven by a motor 113 through a worm drive.

The material discharged from the cradle 101 is deposited upon a conveyor 114, which is similar to the conveyor illustrated in Figure 1 and includes a conveyor belt 115 trained about a pulley on shaft 116 driven from shaft 112 by chain 117. The conveyor is connected by a rod 118 to one end of a weigh beam 119, the other end of the beam carrying a movable weight 120. Attached to the beam is an arm 121 carrying a pin 122 on which bears a lever 123 carrying an adjustment screw 124 in position to make contact with the stem of an air valve 125. As the weigh beam moves in response to a departure of the conveyor from its initial position as a result of a variation in the load the lever 123 varies the opening of the air valve 125 and thus controls the pressure of air in a line 126 leading to the top of cylinder 108. The movement of the weigh beam is restricted by an arm 127 which lies between adjustment screws 128 mounted in a suitable bracket.

In the operation of the device illustrated in Figures 5 and 6, the cradle is rocked back and forth by the swinging of the cylinder 108 on its pivot. Such movement of the cradle causes material to be discharged on the conveyor and the rate of feed depends on the stroke of the cradle. This stroke is determined by the distance between the slide within cylinder 108 and the point 109 about which the cylinder is rocked. When the rate of feed is too high and the load on the conveyor increases, the conveyor moves from its initial position and this causes a movement of the weigh beam which in turn causes a change in the opening of air valve 125. As the air supplied to cylinder 108 increases or decreases, the slide moves farther from or nearer to the pivot 109 and this changes the stroke of the cradle.

In the construction shown in Figures 7 and 8, the feeding device includes a casing 129 through which material is discharged upon a rotating table 130. The material is removed from the table by means of a scraper blade 131 and discharged thereby through a chute 132 upon the belt 133 of a conveyor. The conveyor is connected to a weigh beam 134 similar to the beam 53 (Figure 1) and when the conveyor falls or rises in response to an increase or a decrease in the load thereon, the weigh beam is correspondingly swung. An air valve 135 is actuated by a lever 136, as the weigh beam swings in one direction or the other, and the valve controls the pressure of air admitted through a line 137 into a cylinder 138. The piston 139 in the cylinder is connected to a rod 140 which is in turn connected to the blade 131. A tension spring 141 connected at one end to rod 140 and at the other end to the end 142 of the cylinder tends to pull on the rod 140. As the conveyor moves down under an increase in load, air under higher pressure is admitted to the cylinder 138 and moves the piston to cause blade 131 to swing clockwise. This decreases the rate at which material is fed upon the conveyor. When a decrease in the load upon the conveyor occurs, the air pressure within the cylinder decreases and spring 141 is then effective to swing blade 131 counterclockwise to increase the rate of feed.

The construction illustrated in Figure 9 includes an electrical control mechanism for controlling the operation of the feeding means in accordance with variations in the load on the conveyor, the feeding means shown being of the pusher type illustrated in Figure 1. The Figure 9 apparatus includes a conveyor 143 including a belt driven from a shaft 144, the conveyor being connected to a weigh beam 145 which may be counter-balanced to support the conveyor in generally horizontal position when it is carrying a selected load. A movable contact 146 forming part of a switch 147 is actuated by the weigh beam and is movable by the latter into engagement with one or the other of the contacts 148*a*, 148*b*. The contacts are connected through a motor-driven time delay device 149 of conventional construction to a reversing starter 150 which is connected to a source of power through lines 151 and is also connected through lines 152 to a motor 153.

The motor acts through a reducing device 154 to drive a screw 155 in a cylinder 156. The cylinder 156 is pivotally mounted at 157 and, during the operation of the device, is rocked by a crank 158 acting through a link 159. The pusher element 160 of the feeding means is connected through a rod 161 and crank 162 to a shaft 163 which carries a crank 164 connected by rod 165 to a nut 166 threaded on the screw 155 within the cylinder 156. The stroke of the pusher 160 depends on the position of the nut 166 with relation to the pivot 157 about which cylinder 156 is rocked.

In the operation of the device shown in Figure 9, the weigh beam is counter-balanced to support the conveyor under a selected load and when a variation in the load occurs, the conveyor moves up or down, as the case may be. Such movement of the conveyor is transmitted to the beam and causes contact 146 to engage one or the other of the contacts 148*a* and 148*b*. The engagement of the contacts establishes a circuit which, after an interval determined by the time delay device 149, causes the reversing starter 150 to start motor 153. The motor then operates through reducer 154 to rotate screw 155 and this causes the nut 166 to move lengthwise of the cylinder to alter the position of the nut relative to the point 157 about which the cylinder is rocked by crank 158. The movement of the nut thus increases or reduces the stroke of the pusher as may be required to alter the action of the feeding means to correct the rate of feed.

The electrical mechanism illustrated in Figure 9 is one advantageous arrangement for control-

ling the feeding means in response to variations in the load on the conveyor but it will be apparent that various other electrical expedients may be used for the purpose. The time delay device is desirable, because it prevents the control mechanism from responding to minor variations in the load and thus reduces the periods during which the motor 153 is in operation. A suitable time delay device will be used to cause the control mechanism to operate with the desired sensitivity and without undesirable hunting.

I claim:

1. Apparatus for supplying material at a constant rate, which comprises material feeding means including a pair of elements, one of which is stationary and the other of which reciprocates, and mechanical means for reciprocating the second element to effect feeding of the material, a conveyor receiving material from the feeding means and movable from an initial position as the load thereon varies, a weigh beam connected to the conveyor and operable to hold it in said initial position when it is carrying a selected load, said beam being movable by the conveyor as the latter changes position in response to varying loads, and means operated by the conveyor as the latter moves from its initial position for acting on the means for reciprocating the second element to vary the length of the stroke thereof.

2. Apparatus for supplying material at a constant rate, which comprises material feeding means including a pair of elements, one of which is stationary and the other of which reciprocates, and mechanical means for reciprocating the second element to effect feeding of the material, a conveyor receiving material from the feeding means and movable from an initial position as the load thereon varies, a weigh beam connected to the conveyor and operable to hold it in said initial positon when it is carrying a selected load, said beam being movable by the conveyor as the latter changes position in response to varying loads, and fluid control means operated by the conveyor as the latter moves from its initial position for acting on the means for reciprocating the second element to vary the length of the stroke thereof.

3. Apparatus for supplying material at a constant rate, which comprises material feeding means including a pair of elements, one of which is stationary and the other of which reciprocates, and mechanical means for reciprocating the second element to effect feeding of the material, a conveyor receiving material from the feeding means and movable from an initial position as the load thereon varies, a weigh beam connected to the conveyor and operable to hold it in said initial position when it is carrying a selected load, said beam being movable by the conveyor as the latter changes position in response to varying loads, means operable on the means for reciprocating the second element to vary the length of the stroke thereof, and means controlled by the conveyor as it moves from its initial position and controlling the action of the stroke varying means.

4. Apparatus for supplying material at a constant rate, which comprises material feeding means including a pair of elements, one of which is stationary and the other of which reciprocates, and means for reciprocating the second element, a conveyor receiving material from the feeding means and movable from an initial position as the load thereon varies, a weigh beam connected to the conveyor and operable to hold it in said

initial position when it is carrying a selected load, said beam being movable by the conveyor as the latter changes position in response to varying loads, fluid control means for varying the length of the stroke of the reciprocating element, a supply of fluid under pressure connected to the fluid means, and a valve controlling the flow of fluid to the fluid means and operated by the conveyor as the latter moves from its initial position.

5. Apparatus for supplying material at a constant rate, which comprises feeding means including a pair of elements, one of which is stationary and the other of which reciprocates, and means connected to the second element for reciprocating it, the connection including a cylinder mounted for rocking movement and a piston within the cylinder and connected to the reciprocating element, the position of the piston within the cylinder determining the stroke of the element, a conveyor receiving material from the feeding means and movable from an initial position as the load thereon varies, a weigh beam connected to the conveyor and operable to hold it in an initial position when it is carrying a selected load, the beam being movable by the conveyor as the latter changes position in response to varying loads, a supply of fluid under pressure connected to the cylinder, and a valve controlling the flow of fluid to the cylinder and operated by the conveyor as it moves from its initial position.

6. Apparatus for supplying material at a constant rate, which comprises feeding means including a pair of elements, one of which is stationary and the other of which reciprocates, and means connected to the second element for reciprocating it, said means including an arm, a slide connected to the arm, and means for rocking the slide about an axis, the slide being movable toward and away from the axis to vary the stroke of the reciprocating element, a conveyor receiving material from the feeding means and movable from an initial position as the load thereon varies, a weigh beam connected to the conveyor and operable to hold it in an initial position when it is carrying a selected load, and means controlled by the movements of the conveyor in response to changes in the load for moving the slide to vary the stroke of the reciprocating element.

7. In apparatus for supplying material at a constant rate, said apparatus including a conveyor movable from an initial position as the load thereon varies, means for feeding material to the conveyor including a stationary element, a reciprocating element, a slide connected to the reciprocating element, means for rocking the slide about an axis to reciprocate the reciprocating element, the slide being movable toward and away from the axis to vary the stroke of the reciprocating element, and means responsive to changes in position of the conveyor for moving the slide.

8. In apparatus for supplying material at a constant rate, said apparatus including a conveyor movable from an initial position as the load thereon varies, means for feeding material to the conveyor including a stationary element, a reciprocating element, a slide connected to the reciprocating element, means for rocking the slide about an axis to reciprocate the reciprocating element, the slide being movable toward and away from the axis to vary the stroke of the reciprocating element, and pneumatic means responsive to changes in position of the conveyor for moving the slide.

9. In apparatus for supplying material at a

constant rate, said apparatus including a conveyor movable from an initial position as the load thereon varies, means for feeding material to the conveyor including a stationary element, a reciprocating element, a slide connected to the reciprocating element, means for rocking the slide about an axis to reciprocate the reciprocating element, the slide being movable toward and away from the axis to vary the stroke of the reciprocating element, and pneumatic means responsive to changes in position of the conveyor for moving the slide, said means including a cylinder, a piston within the cylinder and connected to the slide, a supply of air under pressure, and a valve operated by the conveyor as it moves from its initial position for controlling the flow of air to the cylinder to act on the piston.

10. In apparatus for supplying material at a constant rate, said apparatus including a conveyor movable from an initial position as the load thereon varies, means for feeding material to the conveyor including a stationary element, a reciprocating element, a member rockable about an axis, means for rocking the member, means connected to the member transmitting the movements of the member to the reciprocating element to reciprocate the element, the connection of the transmitting means to the member being movable toward and away from said axis to vary the length of the stroke of the reciprocating element, and means responsive to changes in the position of the conveyor for moving said connection in relation to said axis.

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