June 5, 1934. F. PARDEE, JR 1,961,595

FLOW REGULATOR FOR LOWERING CHUTES

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Fig. 1.

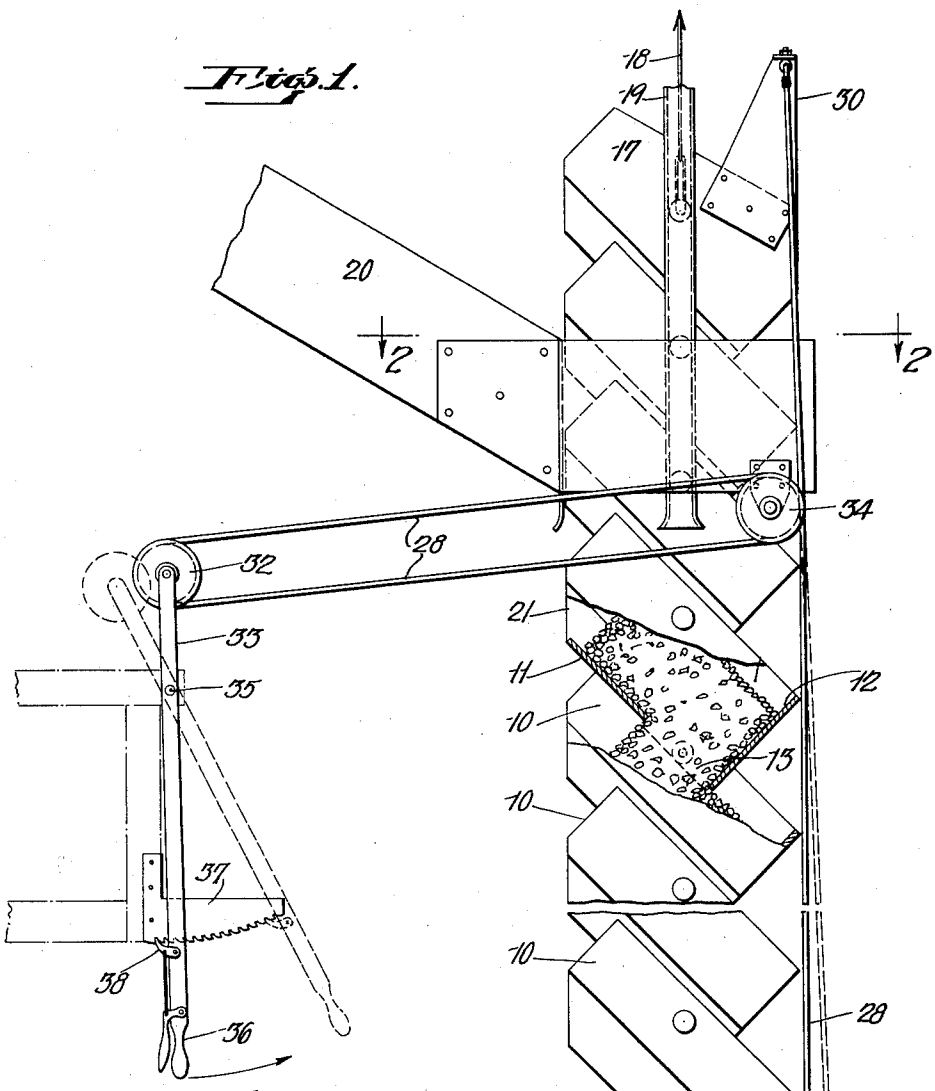
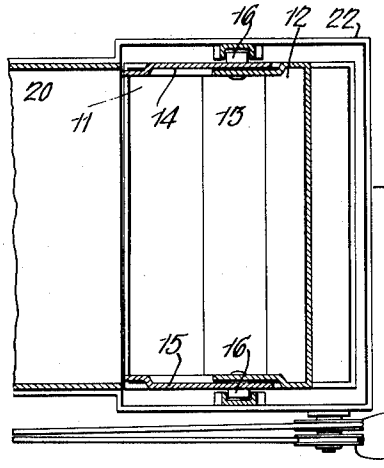


Fig. 2.



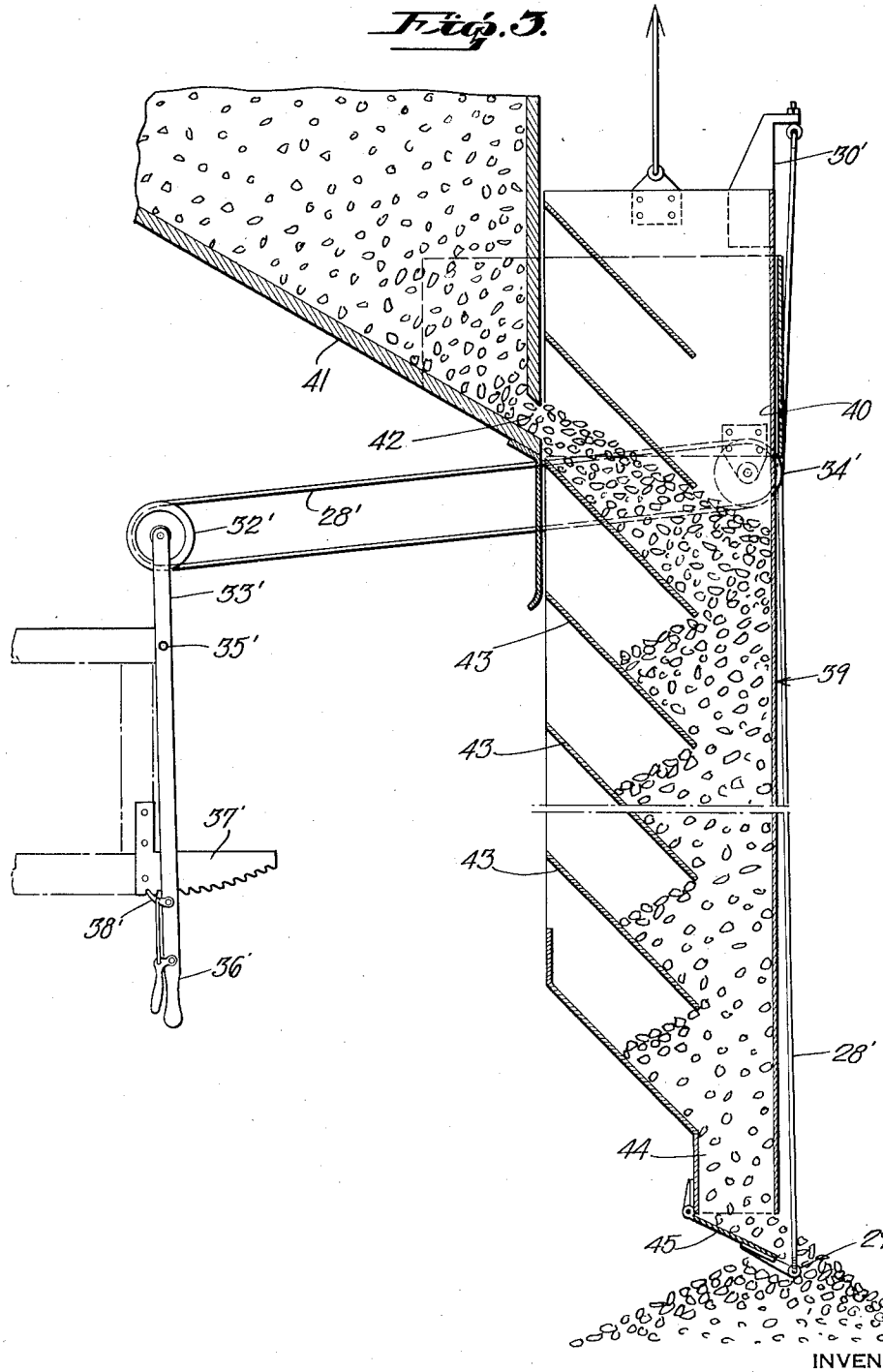
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Fig. 3.



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Fig. 4.

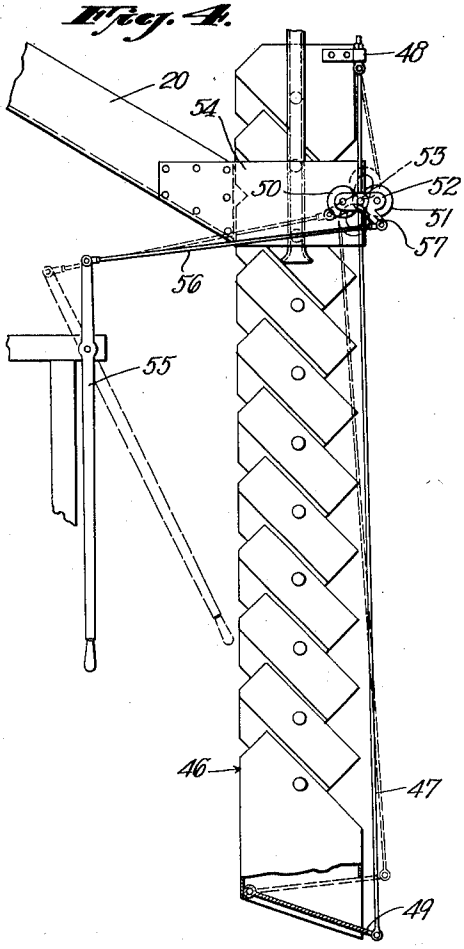


Fig. 6.

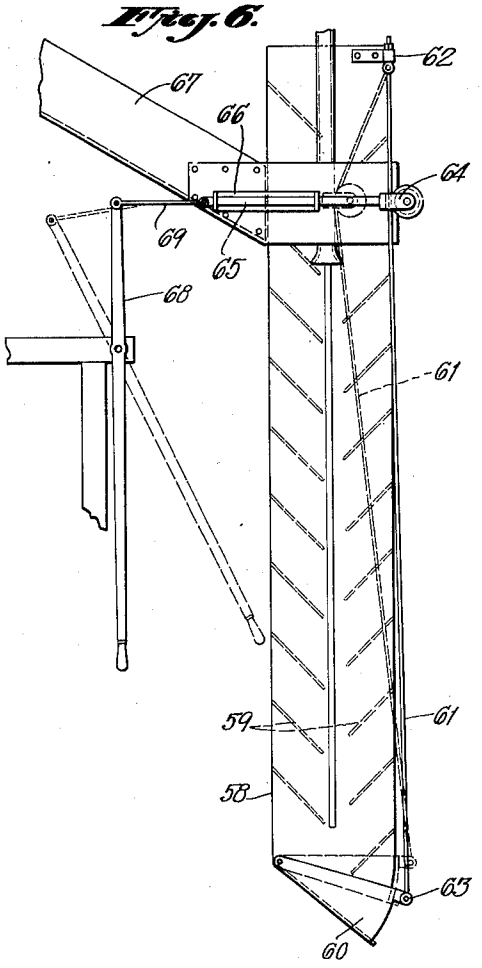


Fig. 5.

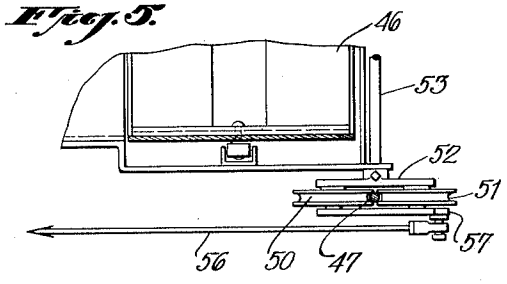
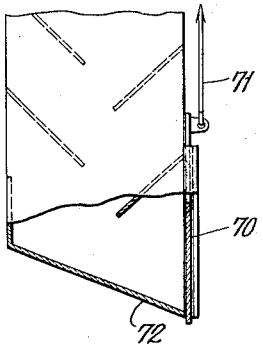


Fig. 7.



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FLOW REGULATOR FOR LOWERING CHUTES

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Application April 5, 1933, Serial No. 664,501

7 Claims. (Cl. 193—32)

My invention relates to a means for regulating the flow of granular or coarse particle material through lowering chutes, particularly chutes that may be moved or adjusted vertically.

In a lowering chute, it is desirable that the chute be filled to its full capacity so that the material will flow downwardly in a steady uniform stream. It sometimes happens, however, that the capacity of the conveyor or feeding mechanism does not equal that of the chute. The chute may, therefore, be only partly filled so that particles of coal or other material being fed will drop freely or will bounce about, thus causing breakage of the particles.

An object of my invention is to provide a means for regulating the flow of material through a lowering chute to correspond with varying feed rates, so that the chute may be maintained filled sufficiently for proper and efficient operation and moreover to provide such a control that may be operated from a position distant from the chute and one that will permit the chute to be raised or lowered without effecting the control mechanism.

The various features of the invention are illustrated in the accompanying drawings, in which—

Fig. 1 is a vertical side view of a lowering chute of the zig-zag type and a regulator therefor embodying my invention, a portion of the lowering chute being broken away to indicate its construction;

Fig. 2 is a horizontal section of the apparatus taken on line 2—2 of Fig. 1;

Fig. 3 is a vertical sectional view of another type of loader and a discharge regulator embodying the invention;

Fig. 4 is a vertical view partly in section of a modification of the invention, parts being broken away to show the construction of the discharge control element;

Fig. 5 is a horizontal section of a part of the apparatus shown in Fig. 4;

Fig. 6 is a vertical elevation of still another modification, and

Fig. 7 is an elevation, partly in section of the lower part of a chute and a discharge control means therefor.

The flow regulator of my invention may be applied to any suitable chute, in which the coal or other material flows downwardly with a retarded movement.

In Figs. 1 and 2 of the accompanying drawings, it is illustrated by way of example as applied to a flexible lowering chute of the type shown in my Patent No. 1,874,343, issued August 30, 1932. In this type of chute, a number of buckets 10 are secured together in vertical series, each bucket having an inclined floor or shelf 11 and an inclined end plate 12 at right angles to the floor 11 and spaced from the edge thereof to form a discharge opening 13, through which the coal, or other material sliding downwardly over the floor 11, will discharge to the next lower bucket, in which the progression of the material will be repeated. Each bucket is provided with a pair of side walls 14 and 15 to confine the material and complete the bucket. The side walls 14 and 15 are slightly offset in their upper and lower parts, so that the upper edge of one bucket overlaps the lower edge of the bucket immediately above it and the buckets are secured at their overlapping parts by means of bolts 16 to form a continuous chain. The uppermost bucket, indicated at 17 in Fig. 1, is secured to and supported by a pair of cables 18 on opposite sides and may be raised or lowered by means of the cables. Suitable guides 19, into which the projecting ends of the bolts 16 may pass are provided to help hold the upper buckets in proper position relative to a feed trough or chute 20.

The buckets are each cut to vertical edges 21, which align with the open end of the spout 20. The spout 20 is also provided with a frame 22, which encloses the chute at the level of the spout and holds it in place. In apparatus of this type, the coal or other material flows downwardly through the spout 20 and thence onto a floor 11 of a bucket which is brought into alignment or slightly below the floor of the spout. The coal then flows down the inclined floor 11 until it is stopped by the end wall 12 and caused to flow through the opening 13 to the next lower bucket. When the chute 20 supplies material as rapidly as the buckets 10 pass it downwardly, the buckets will remain filled, as indicated in the broken part of Fig. 1 and the coal will flow slowly and in a steady stream. If, however, the feed of the material through the spout should be less than the rate of flow through the vertical lowering chute, the buckets would become partly empty and the particles of coal would be free to roll and bounce. In my present invention, a flow regulator is provided which controls the discharge of material from the lowermost bucket so that this discharge may be made as small as the supply of material through the spout 20.

This flow regulator comprises a discharge bucket 23 pivoted by means of a bolt 24 at its

upper edge to the lowermost of the chute buckets 10 so that it may be tilted about a horizontal axis and the floor 25 of the bucket 23 may be given a greater or less inclination to increase or decrease the discharge of material. The bucket 23 is provided with an end wall 26 and suitable side walls 27. The tilting of the bucket 23 and its position about the axis of the bolt 24 is controlled by means of a cord 28 secured at its lower end to an eyelet 29 on the bucket 23 and at its upper end to a plate 30 mounted on the uppermost bucket 17.

The cable 28 may be secured directly to the bucket 17, if desired. The cable 28 extends upwardly from the eyelet 29 and then passes over a pulley 31 of a double sheave pulley and thence about a control pulley 32, mounted on a swinging lever 33. Thereafter, the cable passes below and about a second pulley 34 of the double sheaved pulley and upwardly to the plate 30. The lever 33 is pivoted on a pin 35 and may be rocked on the pin 35 by means of a handle 36 at its opposite end. When the lever 33 is moved counterclockwise, for example, from the position shown in full lines to that shown in dotted lines, the cable 28 will be drawn upwardly between the discharge bucket 25 and the pulley 31 to supply the additional length required between the pulley 32 and the pulleys 31 and 34 and this will cause a tilting of the discharge bucket 25 from the position shown in full lines in Fig. 1 to a position such as indicated in the broken lines of Fig. 1. The lever 33 may of course be swung to any position between those shown in full and dotted lines in Fig. 1 and may be held in position by means of a notched segment 37 and a pawl 38 on the lever 33.

It will be apparent that through the above mechanism the discharge of material from the lowering chute may be controlled and accordingly the rate of feed through the chute may be adjusted to the rate of supply through the spout 20. It will also be apparent that the lever 33 may be positioned at any distance from the lowering chute as convenience may require. The position of the discharge bucket 25 is also not altered by the raising or lowering of the chute because the relative distance between the top and bottom of the chute is always the same and the cable slides freely about the pulleys 31, 32 and 34. The chute may, therefore, be raised or adjusted while in operation without affecting the control of the discharge therefrom.

In the modification of the invention shown in Fig. 3, the chute 39 is formed on three sides with vertical enclosing walls 40, while the fourth side adjacent to the feeding hopper 41 is open to receive coal or other material from an opening 42 in the hopper 40. The coal is prevented from flowing out of the open side by means of inclined spaced steps 43. It will be apparent that in any position of vertical adjustment of the chute the coal may flow through the feed opening 42 between a pair of steps 43 and is thereafter retained therein inasmuch as there is no downwardly inclined path sidewise of the chute. Upon reaching the bottom of the chute, the coal enters a discharge spout 44, the outlet of which is controlled by a hinged bottom plate 45.

It will be apparent that if the coal discharges from the chute through the spout 44 more rapidly than it is fed thereto, the chute will empty and remain empty and the particles of coal will drop freely through the chute with danger of breaking and dusting. However, if the discharge of coal through the spout 44 is restricted by the bottom plate 45 the chute will remain filled and the coal will flow downwardly therethrough in a steady unbroken stream, as indicated in the drawings.

The position of the bottom plate 45 in my invention is controlled by a cable 28' secured at 29' as in Figs. 1 and 2 to the bottom plate 45 and at its upper end to a bracket 30' on the chute 39. The effective length of the cable between the bottom plate 45 and the bracket 30' is adjusted to control the position of the plate 45 by varying the loop formed in the cable as the latter passes about the fixed double sheaves 34' and the movable sheave 32' carried on the lever 33' in a manner similar to that of Figs. 1 and 2. It will be understood that the position of the lever 33' and sheave 32' may be controlled and fixed by the handle 36', notched segment 37' and pawl 38', as in the embodiment shown in Figs. 1 and 2.

In the preferred embodiment of the invention illustrated, the cable has been carried about pulleys 31, 32 and 34 as this is the preferred and most desirable arrangement. It will be understood, however, that other equivalent means might be employed, if desired.

In the modification shown in Fig. 4, the discharge from the bottom of a chute 46, which may be of the type shown in Fig. 1, or of other suitable types, is controlled by a cable 47 secured at its upper end to a bracket 48 fixed on the chute and at its lower end to a swinging plate 49, or other movable element of the discharge control mechanism. Coal, or other material, may be supplied to the chute from a spout 20, as in the modification shown in Fig. 1. The cable 47 passes between a pair of grooved sheaves 50 and 51, which are mounted on a block 52, pivotally supported on a pivot rod 53, carried on an extension 54 of the spout 20. The block 52 may be tilted or rocked about the supporting pivot rod 53, by means of a hand lever 55, connected by means of a rod or cable 56 to a depending arm 57 of the block 52. When the lever 55 is swung from the position shown in full lines in Fig. 4 to that shown in dotted lines, the sheave block 52 is swung from the position indicated in full lines to that in dotted lines. The cable 47 is thereby deflected and its effective length between the fixed point 48 and the movable discharge element 49 is shortened. The plate 49 is accordingly raised to a position such as that indicated in broken lines in Fig. 4. The lever 55 may be moved to and held in any position between those shown in full and dotted lines in Fig. 4 and the sheave block and the plate 49 will accordingly take the position intermediate those indicated.

In this manner, the position of the lever 55 controls the position of the discharge outlet plate 49. The sheaves 50 and 51 rotate freely so that the cable 47 may pass freely upwardly and downwardly with the chute 46 without affecting the effective length of cable between the fixed point 48 and the plate 49, as determined by the position of the sheave block 52.

In the modification shown in Fig. 6, the invention is illustrated, by way of example, as applied to a chute 58 having alternately spaced zig-zag plates 59, to control the downward movement of the material. In this case, the position of a discharge controlling plate or damper 60 is controlled by means of a cable 61, secured at its upper end to a bracket 62 to the chute and at its lower end to a bracket 63 on the discharge mechanism. The cable 61 runs through a deflecting mechanism comprising a sheave block 64 carried on a rod 65 and is slidably mounted on a bracket 66 on the feed spout 67. The rod 65 and sheave block 64

are movable by means of a lever 68 connected to the rod 65 by a connecting rod 69. When the lever is moved from the position shown in full lines in Fig. 6 to that shown in dotted lines and the sheave block 64 is drawn to the left, to the position indicated in broken lines, thereby deflecting the cable 61, as indicated, and shortening its effective length between the bracket 62 and 63 and thereby tilting the discharge control device 60 to reciprocate the discharge of material. In this case also the cable 61 is freely slidable through the sheave block 64 in all positions of the latter, so that the chute may be moved vertically without materially altering the position of the discharge control mechanism.

In the above examples, the invention has been shown as applied to a discharge control means having a tilting plate. It is, however, not limited to use with a plate of this type. A vertically sliding plate 70 may be employed and may be lifted to a determinable position by means of a cable 71, operated by any of the control devices of the preceding figures to control the opening formed by the plate 70 above an inclined bottom plate 72.

It will be understood that although the control mechanism and the method of control of the present invention have been illustrated in connection with a limited number of types of chutes, that it may be applied to any type of chute and to any type of discharge opening. It will also be understood that the examples given in the above figures are illustrative rather than limiting and that other methods and mechanisms for shortening or controlling the effective length of a cable, while permitting the cable to move freely lengthwise may be employed.

Having described the invention, what I claim is—

1. A zig-zag loader having a horizontally pivoted discharge bucket, a chute discharging into said loader above said discharge bucket, a double sheave mounted in fixed position relative to said chute, a sheave mounted for limited movement relative to said double sheave, and a cable secured to said discharge bucket to control its tilting movement and trained successively about said double sheave, said movable sheave to form a closed loop and secured at its opposite end to an upper bucket of said loader.

2. A loader of the type described which comprises means for feeding material thereto, a vertically movable lowering chute receiving material from said feeding means and having a discharge control member at the lower portion thereof, a cable secured at one end to said member and at the other end to an anchorage secured to the chute, said cable formed into a variable loop between said discharge control member and said anchorage, a normally fixed guiding means through which said cable is freely slidable into and out of said loop and movable guiding means over which said cable is freely slidable in said loop to increase or decrease the size of said loop and thereby to increase or decrease the effective length of said cable between said discharge control member and said anchorage.

3. A zig-zag loader having a horizontally pivoted discharge bucket, a chute discharging into said loader above said discharge bucket, a double sheave mounted in fixed position relative to said chute, a sheave mounted for limited movement relative to said double sheave, and a cable secured to said discharge bucket to control its tilting movement and trained successively about said double sheave, said movable sheave to form a closed loop and secured at its opposite end to an upper bucket of said loader, means to raise said zig-zag loader.

4. A downwardly feeding loader, means for feeding material to said loader, a discharge control means at the lower end of said loader, a cable secured to said discharge control means and to said loader above said feeding means and having a loop passing freely around guides at a fixed altitude, and means to vary the distance between said guides to alter the size of said loop to vary the effective length of cable between said discharge control means and said loader.

5. A downwardly feeding vertically movable loader, a tilting discharge control means for said loader, a control cable secured at one end to said discharge control means and to said loader above said discharge control means, a set of sheaves at a fixed position about which said cable is looped and means for varying the distance between said sheaves to vary the size of said loop.

6. A discharge control apparatus for a movable chute, which comprises a cable fixed at one end to move with said chute, a discharge control member attached to the opposite end of said cable and means for deflecting said cable between its attachment to said discharge control member and the end fixed to said chute while permitting it to move freely through said deflecting means.

7. The combination with a vertically adjustable discharge chute, of mechanism for controlling the discharge from said chute while permitting movement of said chute, which comprises a movable discharge control element, a cable attached to said element and secured to said chute at a distance from said control element and actuating means for taking up or paying out cable from a direct line between said discharge element and its point of attachment to the chute to vary the effective length of cable therebetween and guide means to permit said cable to run freely through said actuating means.

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