

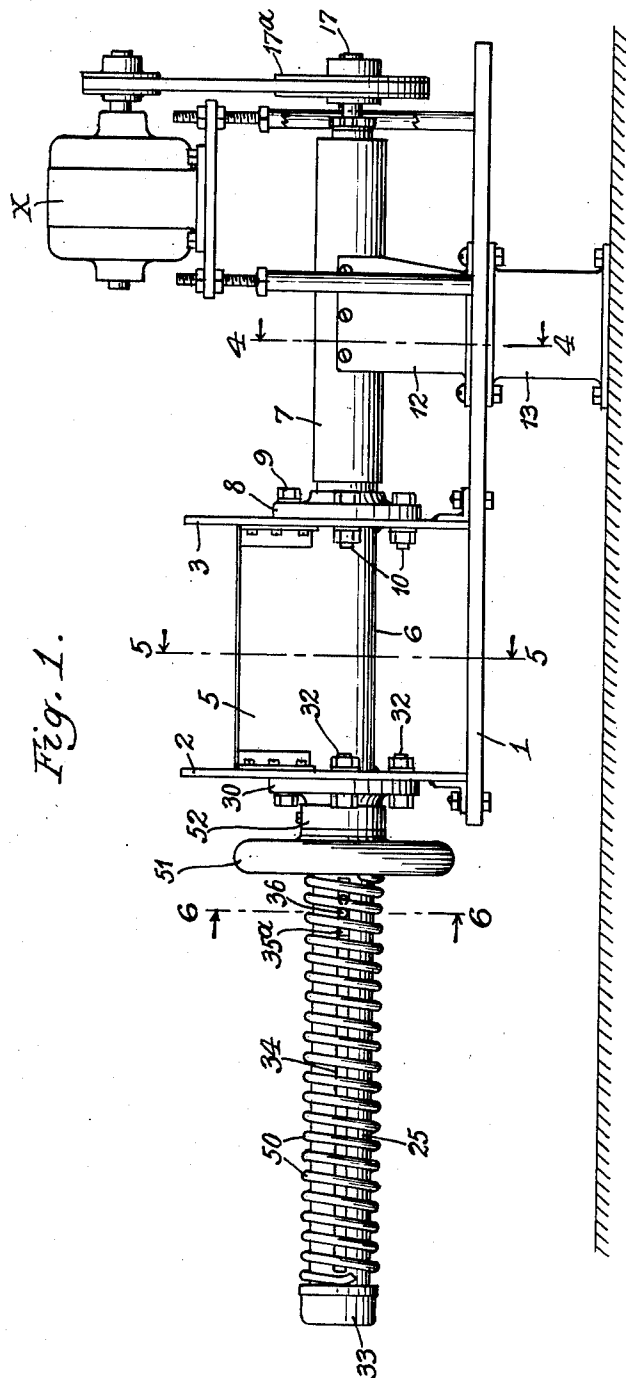
Sept. 22, 1953

L. J. NOWAK, JR
VARIABLE PITCH FEEDER

2,652,954

Filed Oct. 5, 1948

4 Sheets-Sheet 1



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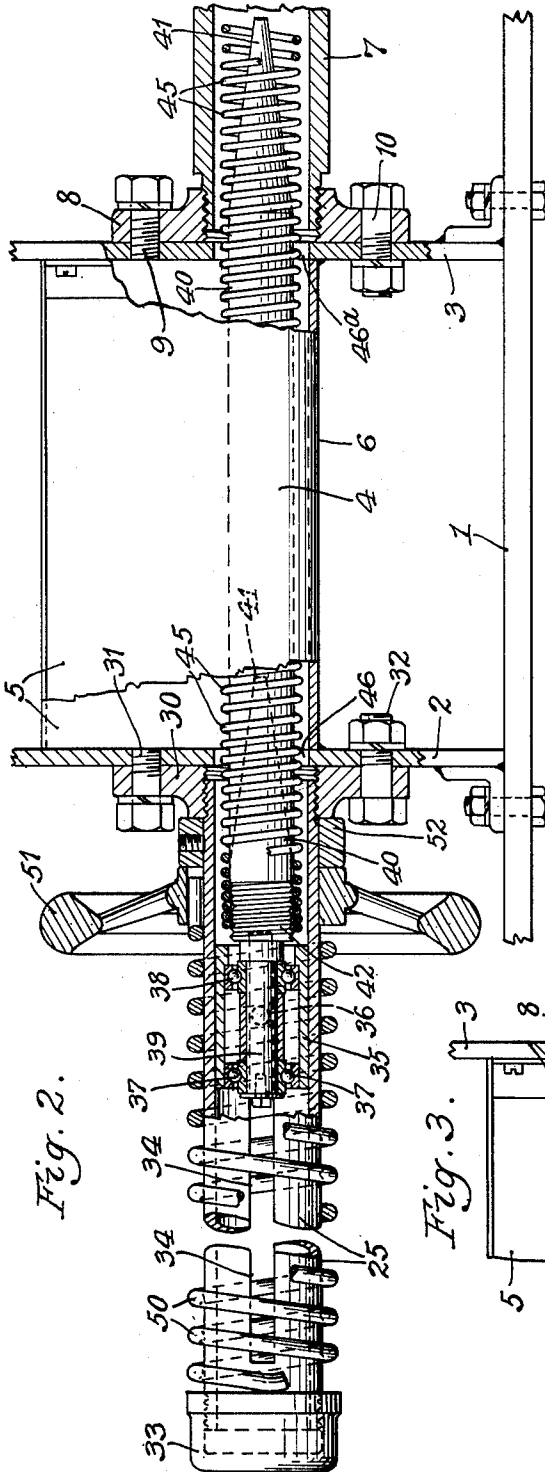
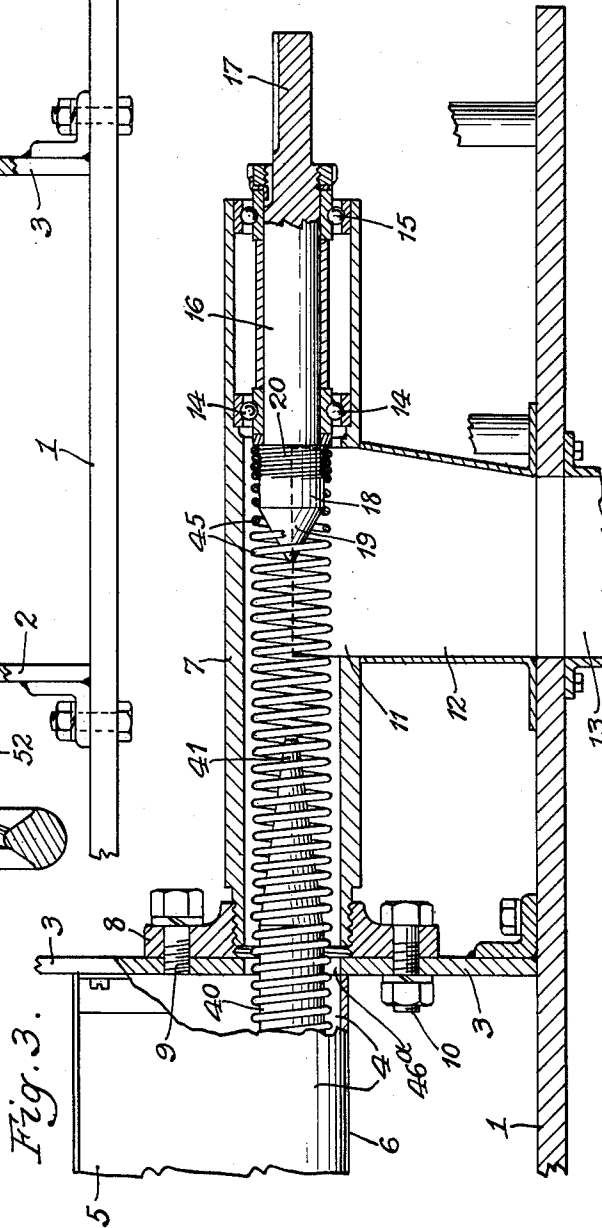
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Fig. 5.

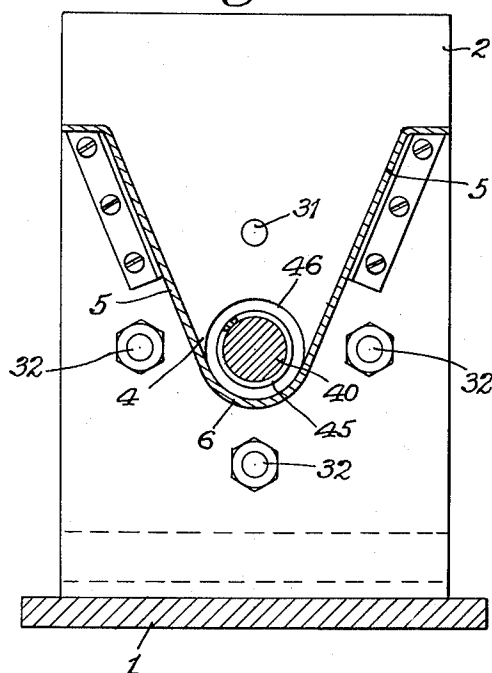


Fig. 4.

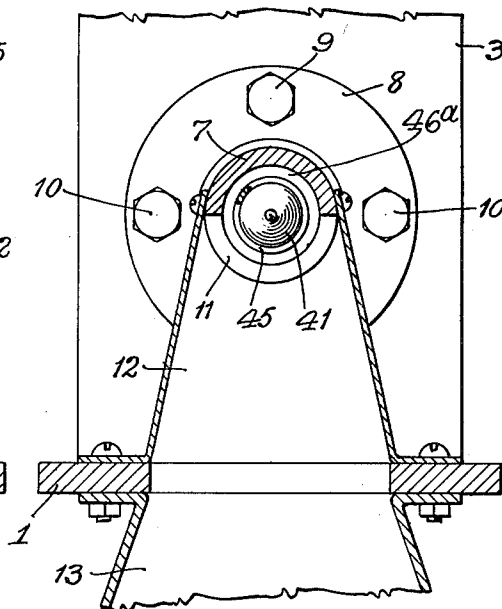


Fig. 6.

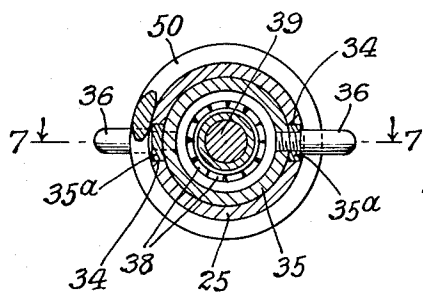
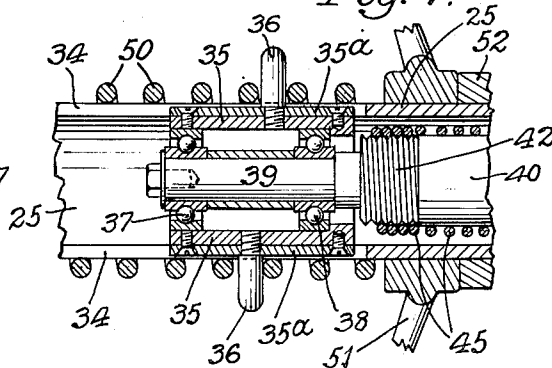


Fig. 7.



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UNITED STATES PATENT OFFICE

2,652,954

VARIABLE PITCH FEEDER

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Application October 5, 1948, Serial No. 52,923

13 Claims. (Cl. 222-282)

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My invention relates to an improvement in feeding devices and has for one purpose to provide a variable delivery feeder.

Another purpose is to provide a feeder for relatively finely divided substances such as grain or grain products.

Another purpose is to provide a variable pitch spring feeder.

Another purpose is to provide a variable pitch feeder which is readily adjustable.

Another purpose is to provide a variable pitch feeder with an adjustable inner core.

Other purposes will appear from time to time in the course of the specification and claims.

I illustrate the invention more or less diagrammatically in the accompanying drawings wherein:

Figure 1 is a side elevation of a device embodying my invention;

Figure 2 is a longitudinal axial section, on an enlarged scale, with parts omitted;

Figure 3 is a longitudinal axial section, on an enlarged scale, illustrating parts omitted from Figure 2;

Figure 4 is a section, on an enlarged scale, on line 4-4 of Figure 1;

Figure 5 is a section, on an enlarged scale, on line 5-5 of Figure 1;

Figure 6 is a section, on an enlarged scale, on line 6-6 of Figure 1;

Figure 7 is a section, on an enlarged scale, on line 7-7 of Figure 6; and

Figure 8 is a longitudinal section through another embodiment of the invention.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings, 1 generally indicates a base plate upon which the structure as a whole may be mounted. Upwardly extending from the base plate are a pair of hopper end plates 2, 3, which define the ends of a hopper. The hopper is completed by a trough member generally indicated as 4 and having upwardly and outwardly flared side wall members 5 connected by an arcuate bottom portion 6. Extended outwardly from the end plate 3 is a delivery tube 7 having an inner aperture aligned with the bottom of the hopper and conforming generally to the arcuate bottom portion 6. The tube 7 may be screw-threaded into or otherwise secured to a plate 8 which is screwed or otherwise secured to the hopper end wall 3 by screws 9 and bolts 10. The tube 7 has an outer discharge opening 11 which delivers to a discharge housing for the downspout 12 extending to and secured to the upper face

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of the base plate 1. The base plate 1 is appropriately apertured, the aperture being aligned with the bottom discharge or outlet member 13.

It will be understood, also, that the end wall 3 is apertured to put the interior of the hopper into communication with the interior of the discharge tube 7. At the outer end of the tube 7, I illustrate two ball-bearing assemblies 14, 15 within which is mounted a rotating member 16 having an outer end 17 to which the drive pulley 17a or other equivalent member may be secured.

The member 16 has an inner end 18 terminating in a conic portion 19, effective to divert fed material into the downspout 12. The member 18 is also provided with threads or spiral grooves as at 20, to receive an end of the below described spring 45.

Extending outwardly from the opposite hopper end-wall 2 is a second tube generally indicated as 25. It may be threaded into or otherwise secured to the apertured plate 30 which is secured to the end-wall 2 as by screws 31 and bolts 32. The tube 25 has its outer end closed by the pipe cap 33. It is provided with longitudinally extending slots 34 of which two are shown, diametrically opposed, and lying in a common horizontal plane.

Longitudinally slidable within the tube 25 is a bearing supporting collar 35 provided with outwardly extending pins 36 which pass outwardly through the slots 34 in the tube or pipe 25. It will thus be understood that while the sleeve 35 may be axially moved along and within the tube 25, it is held against rotation by the outwardly extending guide blocks 35a through which the pins 36 pass. Within the sleeve 25 are ball or roller bearing assemblies 37, 38 which support an inner rotating member 39 which has a longitudinal extension or core 40 terminating in a generally conic end portion 41. The core member 40 also has a threaded or spirally grooved portion 42. It will be noted that the members 18 and 40 are of approximately the same diameter and are axially aligned. Connecting the members 18 and 40 is a spiral conveying spring 45 which is shown as anchored or secured at one end to the member 16 by the threads or grooves 20 and as anchored at its other end to the member 40 by the grooves or threads 42. It will be understood that in response to the rotation of the member 18 by its outwardly extended portion 17 the spring 45 is rotated and, with it, the projecting core 40, which may extend into the bottom of the hopper through a suitable aperture 46 in the side plate 2, the aperture 46 being concentric with and prefer-

ably of the same diameter as the corresponding aperture 46a in the end plate 3.

In the use of the device material may be fed to the hopper by any suitable means and when the members 18 and 40 are rotated, for example by any suitable pulley 17a, the material is carried along the passage 7 to the discharge 11, the conic end 19 of the member 18 insuring that all of the material is deflected downwardly through the discharge aperture 11 and thus down the down-spout 12, 13.

I find it advantageous to control variably the pitch of the spring feeding element 45. I obtain this result, in the particular structure shown, by moving the member 40, to which one end of the spring 45 is secured, longitudinally along the tube or pipe 25. I may use any suitable means for this purpose but I illustrate the use of a normally fixed spring 50 which is coiled about the exterior of the tube 25 and which serves as a thread or worm for engaging the projecting pins 36 and for thus moving the sleeve 35 along the interior of the tube 25. I obtain this result by forming the spring 50 of rather stiff, heavy stock. I secure the spring to the hub of a hand wheel 51, which is rotatable about the exterior of the tube 25 and which is urged by the spring 50 against any suitable stop or collar 52 on the tube 25. The opposite end of the spring 50 thrusts against the pipe-cap 33 but is free to rotate in relation to it. Thus rotation of the hand wheel 51 in one direction moves the left end of the spring 45 to the left, referring to the position of the parts as shown in Figure 2, and its rotation in the opposite direction moves the spring end to the right.

It will be understood that the conveying effect of the spring 45, assuming a constant rate of rotation, can be varied by varying the pitch of the spring. This is done, as above described, by varying the effective length of the spring 45 by moving the bearing supporting sleeve 35 toward or away from the fixed member 18. It will be understood that the member 18 rotates but does not move axially along the tube or pipe 7.

As an additional varying or controlling factor, I may employ the plug or core member 40. While I illustrate it as moving unitarily with the member 39 and the bearing assembly 35, this is not necessary. However, when so used, it will be understood that as the pitch of the spring 45 is increased, the core 40 is withdrawn toward the left, referring to the position of the parts as shown in Figures 2 and 3. It may be entirely withdrawn into the tube 25, if desired, so that, at maximum pitch of the spring no core is employed at all. At the other extreme it may extend from end to end of the hopper, and into the tube 7, as shown in full line in Figures 2 and 3. When in that position the core largely fills the interior of the spring 25, leaving a relatively restricted space for the conveying movement of material along and within the space surrounded by or defined by the spring. Thus, as the pitch of the spring is reduced, the space within the spring is at the same time restricted.

Referring to Figure 8, I illustrate a structure similar to that shown in Figures 2 and 3, but in which the core 40 is omitted, and in which I rely solely on the spring. By varying the effective length of the spring, through rotation of the hand wheel 51, I vary the pitch, and thus the capacity of the spring. It will be noted that in place of the core 40 I illustrate a stub 40a, screw-threaded at 42a, to which the spring 45 is secured.

It will be realized that whereas I have de-

scribed and claimed a practical and operative device, nevertheless many changes may be made in size, shape, number and disposition of parts without departing from the spirit of my invention. I therefore wish my description and drawings to be taken as in a broad sense illustrative or diagrammatic, rather than as limiting me to my specific showing herein.

The use and operation of my invention are as follows:

I illustrate a variable feeder in which I may obtain a very accurate adjustment of feed by the separate or the conjoint use of several different adjusting or controlling means.

In the first place, I employ as my conveying member a variable pitch spring 45 which, during rotation, or previous to rotation, can be set at a wide pitch range. When set to a minimum pitch, there is a very slight feeding movement, a mere dribble, along the bottom of the hopper and downwardly and outwardly through the discharge aperture 11. As the pitch is increased the rate of feed is increased until, at half pitch, for example, with a two inch diameter of spring, I may get a feed of approximately 90 cubic feet or 112 bushels per hour. This factor of control involves merely varying the pitch of the spring by varying the effective length of the rotated spring.

Assuming that the spring is set at a predetermined pitch, I can also widely vary the feed by varying the speed of rotation of the spring. I do not illustrate specific means for this purpose, since they are well known, but it will be understood that I may employ a variable speed motor, diagrammatically illustrated at X to drive the pulley 17a. However, any suitable means for varying the rate of rotation of the spring may be employed.

Another factor of control is the core which I have illustrated as adjustable unitarily with the spring 45 but which, it will be understood, may, if desired, be independently adjustable. However, with reference to Figures 2 and 3, the plug or core 40 moves in and out as the pitch of the spring 45 is varied. When it is in the position in which it is shown in full line in Figure 2, it extends for the entire length of the hopper and cuts the feed or delivery down to a minimum. When it is withdrawn to the dotted line position of Figure 2, the pitch of the spring being at the same time increased, the rate of delivery of material from the hopper is at a maximum. The absolute maximum is reached when the core 40 is entirely withdrawn from the hopper.

While I find it in general advantageous to adjust the core and the spring in unison, it will be understood that this is not necessary. Under some circumstances, it may be advantageous to adjust the position of the core independently of the adjustment of the pitch of the spring 45. It will also be understood that if a spring of constant pitch is employed, the movement of the core 40, or its equivalent, into and out of the hopper, and its position at various points along the hopper, may provide an advantageous control of the feed. Under other circumstances I may employ a set of cores of different tapers or of different diameters which may selectively be positioned within the interior of the coil spring 45. It will be understood that the taper of the core 40 may be widely varied. However, I find it important that the cylindrical portion of the core be of sufficient length so that it can extend from end to end of the hopper bottom, as shown in full line in Figure 2, when the operator desires.

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In connection with the use of the core 40, it enormously increases the possible ratio or range of adjustment, as compared to using the spring 45 alone without a core. While, under some circumstances, I may prefer to omit the core altogether, in general I find its use highly advantageous. It will be understood that in the use of the device, when the core is omitted, the spring surrounds and conveys a substantially solid or continuous mass of material. With no core within the spring, the interior of the spring is filled with material and the minimum setting of the device in relation to its maximum is much higher than when the space surrounded by the spring is reduced in cross section by inserting a core within the spring surrounded space. By using a tapered core, I can control or vary the proportion of the space within the spring which is blocked out by insertion of the core.

It should be kept in mind that it is highly advantageous to employ an initially tightly wound spring which is under tension and which passes entirely through the hopper, both ends of the spring being outside of the hopper, an intermediate portion of the spring receiving the feed from the hopper and conveying it away from the hopper through the tubular passage 7 into which the discharge end of the spring extends. The bearings or supports for the ends of the spring are thus isolated from the entire path of movement of the material along the spring, and are protected from the material handled.

In connection with the various forms of the device herein shown it should be kept in mind that restricting the space in the spring does not restrict the opening from the supply hopper. Thus a uniform supply of material is always available for delivery to the outlet. Specifically, inserting a core within the spring does not change or limit the access opening through which the material flows to or reaches the spring for removal along the outlet.

I wish also to emphasize that whereas I have shown a coil spring, it is not, under all circumstances, necessary that spring stock be employed. Any flexible member, the coil or pitch of which can be varied, may be used.

In a broad sense, my invention includes employing a rotated coil to convey material from a receiving or storage zone, such as a hopper, through a conveying zone, which may be formed by a tube or duct, to a discharge outlet. The capacity of the feeder may be controlled by one or both of the above discussed factors, namely, by varying the coil pitch or by employing or adjusting a core or filler surrounded by the spring.

I claim:

1. In a variable volume feeder, a hopper, a discharge member extending from said hopper, a coil in said member, means for rotating said coil and for thereby moving material from said hopper and through said discharge member, said member having a discharge outlet, means for adjustably varying the pitch of the coil and for thereby varying the effective volume of delivery of the coil through the discharge member, and a core member surrounded by said coil and movable into and out of said discharge member.

2. The structure of claim 1 characterized in that the core member is adjustably mounted.

3. The structure of claim 1 characterized in that the core member is tapered and is adjustably mounted for movement into and out of the hopper.

4. In a variable volume feeder, a hopper, a coil

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passing through said hopper and having its opposite ends outside of said hopper, means for rotating said coil and for thereby withdrawing material from said hopper, a discharge tube surrounding one end of said coil, said tube having a discharge outlet, said coil being secured only at its ends, the interior of said coil being open and unimpeded, and means adapted adjustably to vary the volume of free space surrounded by the coil.

5. In a feeder a hopper having aligned tubes extending oppositely from a lower portion thereof, a coil passing through said hopper and having its opposite ends located outside of said hopper and in said tubes, said coil being initially tightly wound and being initially under tension, means for rotating said coil for thereby withdrawing material from said hopper, one of said tubes having a discharge outlet, means for adjustably varying the pitch of the coil and for thereby controlling its delivery rate, and a core adjustably insertable within said coil, into and through said hopper.

6. The structure of claim 5 characterized in that the core is adjustably mounted in one of the tubes and is extensible through the coil and through the hopper into the other tube.

7. In a feeder, a hopper, a discharge tube extending laterally from said hopper, a coil spring in said tube and extending into said hopper, means for rotating said spring and for thereby withdrawing material from said hopper and through said discharge tube, said tube having a discharge outlet, and a connection for variably retracting said spring into said tube, whereby to vary the effective length and the pitch of said spring, and a core positioned within said spring and extending into said hopper and a connection for controllably moving said core into and out of said hopper.

8. The structure of claim 7, characterized in that the connection for moving the core is formed and adapted to move the core into and out of the hopper in unison with the movement of the spring.

9. In a variable pitch feeder, a hopper, a discharge tube extending laterally from said hopper, a coil spring in said tube and extending into said hopper, means for rotating said spring and for thereby withdrawing material from said hopper through said discharge tube, said tube having a discharge outlet, connecting means for retracting the spring within the tube and for thereby reducing its effective length and increasing its pitch, a core mounted within said spring for endwise movement, and means for variably positioning it within the space surrounded by the coil spring, and for thereby varying the conveying capacity of the spring.

10. In a variable capacity feeder, a hopper having an upwardly open, laterally restricted bottom portion, an open coil positioned in and conforming generally to said bottom portion, the hopper having a discharge aperture aligned with said coil, adapted for the delivery of material from the hopper, means for rotating said coil and for thereby delivering material from the bottom portion of the hopper to and through said outlet aperture, a separate core positioned within and surrounded by said coil, and means for adjusting said core along the axis of the coil and for thereby varying the volume of material per revolution moved by said coil.

11. The structure of claim 10 characterized in that the core is tapered.

12. In a variable volume feeder, a hopper, a discharge passage member extending from said hopper and in lateral communication with the bottom portion of the interior of the hopper, a coil positioned in said discharge member, said coil extending into and being exposed within the bottom portion of the hopper and in unimpeded contact with material in the bottom portion of the hopper, the axis of said coil being generally horizontal, means for rotating said coil and for thereby moving material from said hopper and through said discharge member, and means for adjustably varying the pitch of the coil and for thereby varying the effective volume of delivery of the coil through the discharge member, and means for maintaining the coil under tension, the spring being biased toward a minimum pitch condition.

13. In a variable volume feeder, a hopper, a discharge member extending from the lower portion of the hopper, a coil in said discharge member, means for rotating said coil and for thereby moving material from the hopper and through said discharge member, said member having a discharge outlet, means for adjustably varying the pitch of the coil and for thereby varying the effective volume of the delivery of the coil

through the discharge member, the rotating means for the coil being secured to the discharge end of the coil at a point removed from the connection between the discharge member and the hopper but adjacent the discharge outlet of the hopper, whereby any clogging of the coil is adapted to cause an increase of pitch adjacent the discharge outlet.

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