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GRAIN DRYER

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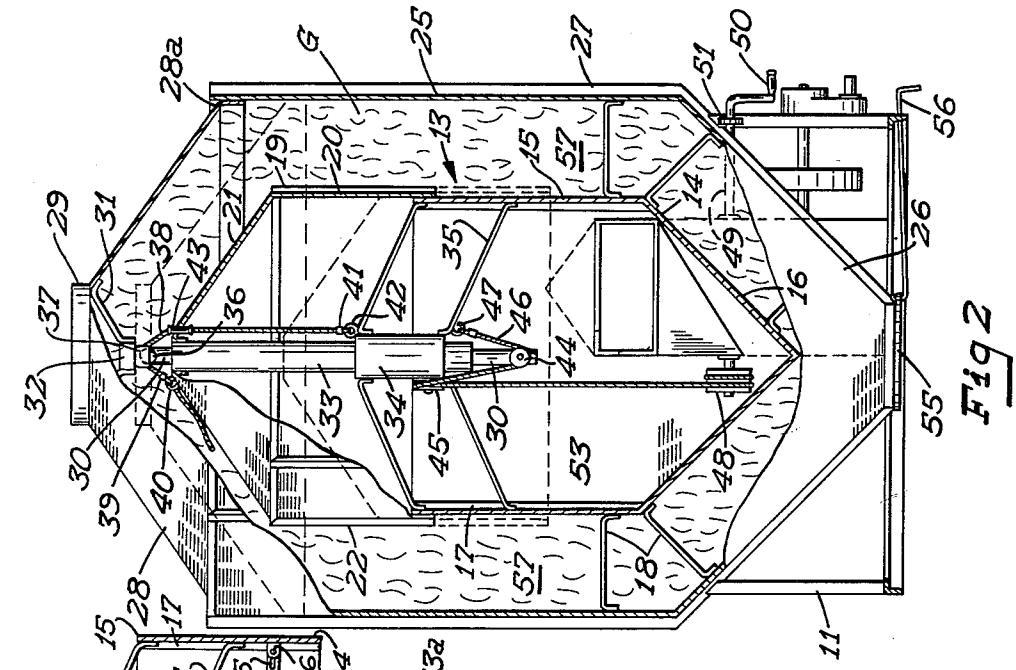


Fig 2

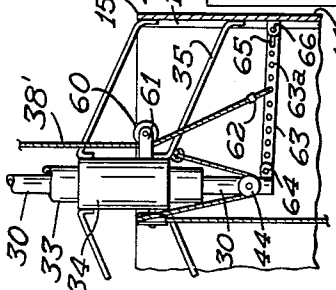


Fig 4



Fig 3

Fig 1

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GRAIN DRYER

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This invention relates to grain dryers.

Grain dryers have been known in the past and have been of the type wherein air under pressure is moved into a plenum chamber and the air is then allowed to move outwardly through a column of grain surrounding the plenum chamber. Because of shrinkage of the grain, many dryers in the past have had many disadvantages. One of the primary disadvantages is that due to the shrinkage of the grain, a portion of the plenum chamber is exposed to the exterior through the grain which has moved downwardly away from a portion of the plenum chamber wall. Under these conditions, most of the air under pressure which is moved into the plenum chamber escapes without passing through the grain to produce a drying effect. Consequently, there has been no particular advantage in using high air pressures in the plenum chamber. The lower pressures used do not cause the air to move rapidly enough through the grain as to permit the use of high air temperatures which are also advantageous to produce effective drying. It is to the elimination of these and other disadvantages to which the present invention is directed, along with the inclusion therein of other novel and desirable features.

An object of my invention is to provide a new and improved grain dryer of simple and inexpensive construction and operation.

Another object of my invention is to provide a new and improved grain dryer constructed to maintain the thickness of all portions of the column of grain substantially uniform throughout the drying operation so as to permit the maintenance of high air temperatures in the drying operation.

A further object of my invention is the provision of a novel and improved grain dryer which carefully controls the flow of air through the grain as to permit the use of drying air temperatures which would under other circumstances damage the grain being dried.

A still further object of my invention is the provision of a new and novel grain dryer which may be constructed with a substantially larger grain capacity than has heretofore been known, yet maintaining the thickness of the column of grain to conventional standards and to permit the dryer to be transported and shipped in assembled condition without violating any load height standards on highways and railroads.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings wherein like reference characters refer to the same or similar parts throughout the several views and in which:

FIG. 1 is a perspective view of the invention;

FIG. 2 is an elevation view, partly in section, the section being taken at approximately 2—2 in FIG. 1, and having the wheel structure removed from the view for clarity of detail; and

FIG. 3 is a detail elevation view in an enlarged schedule of a small portion of the perforate wall structures employed in the invention.

FIG. 4 is a detail elevational and section view showing a modified form of the invention.

One form of the invention is shown in the drawings and is described herein. The grain dryer is indicated in general by numeral 10 and has a frame 11 supported on

a mobile structure such as wheels 12. It will be understood that the grain dryer 10 could as well be a stationary installation without the wheels.

The grain dryer 10 includes an inner hollow telescoping structure 13 constructed of perforate sheet material similar to that shown in FIG. 3 wherein small openings 13*a* are produced by stamping small louvers 13*b* from the main portion 13*c* of the metallic sheet material. The openings 13*a* are of such size as to prevent grain from passing through, but facilitate ready and easy passage of air. The telescoping structure 13 has a lower end part 14 with a cylindrical sidewall 15 and a downwardly convergent substantially cone-shaped bottom 16. The lower part 14 of the telescoping structure is adequately braced by rigid supports 17, and the lower part 14 is supported from the frame 11 by means of brackets 18. The upper part 19 of the telescoping structure has a cylindrical and perforate sidewall 20 and upwardly convergent perforate upper end 21 secured to the sidewall. The upper part 19 of the telescoping structure 13 is adequately braced by external rigid elements 22 and the cylindrical sidewall 20 telescopically receives the cylindrical sidewall 15, and the upper part 19 freely moves in an upward and downward direction to move the cone-shaped end portion 21 downwardly as the grain shrinks.

The dryer 10 also includes an outer perforate wall 25 and a downwardly convergent bottom 26 secured to the wall 25 in concentric and enclosing relation with the telescoping structure 13. It will be seen that the wall 25 and bottom 26 is constructed of the same perforate material illustrated in FIG. 3. The sidewall 25 and bottom 26 are adequately braced and held in predetermined configuration by the angle iron structures 27. It will be seen that a uniform spacing is maintained between the sidewall 25 and the walls 15 and 20 of the telescoping structure 13 and between the bottom 26 and the bottom 16 so that the thickness of the quantity of grain G stored between the telescoping structure and the sidewall 25 and bottom 26 is substantially uniform throughout the entire grain dryer. The bottom 26 is affixed to the the frame 11 so as to maintain the wall 25 and the telescoping structure in concentric relation.

The grain dryer 10 is also provided with an upwardly and downwardly movable perforate lid 28 which is substantially cone-shaped and converges in an upward direction to a filling ring 29 which is normally open. The outer periphery 28*a* of the lid 28 fits loosely within the inner periphery of the sidewall 25 and is readily movable upwardly and downwardly within the cylindrical sidewall.

Normally, in operation, as shown in FIG. 2, the lid 28 is supported on the grain G.

Means are provided for maintaining the movable upper part 19, and the lid 28 in concentric relation with respect to each other and for suspending the upper part 19 from the lid such as to cause, as the lid 28 moves downwardly as the grain shrinks, the upper part 19 of the telescoping structure 13 to move downwardly at a faster rate of travel than the lid 28. In the form shown, such means includes an elongate rigid post 30 affixed by brackets 31 to the lid 28 and extending downwardly along the center line of the concentric enclosures. The post 30 is actually constructed of pipe which is provided with a cap 32 so as to prevent air flow upwardly through the post 31.

A tubular member 33 slidably receives the post 30 therethrough and the tubular member 33 opens upwardly through the upper conical end portion 21 of the upper telescoping part 19. The tubular member 33 is affixed at its upper end to the perforate sheet structure of the upper end portion 21. A rigid and upright stationary sleeve 34 slidably receives the tubular member

33 therethrough so as to maintain the upper part 19 of the telescoping structure and the lid 28 in concentric relation with each other. The sleeve 34 is supported by brackets 35 from the rigid bracing 17 of the telescoping structure 13 and is stationary with the frame 11 of the dryer.

A pulley 36 is journaled on the upper end of post 30 and is enclosed within a shielding structure 37 to be protected from the grain, and the pulley 36 has a cable 38 trained thereover with one end portion being releasably secured by a fixture 39 to an eye 40 on the upper part 19 of the telscoping structure. The fixture 39 is releasable in order to permit lengthening of the cable 38, for purposes hereinafter more fully described. The other end portion of cable 38 is affixed by a fixture 41 to an eye 42 which is affixed on the sleeve 34. It will be seen that the cable 38 extends through a tubular cable guide 43 which is affixed in and extends through the upper conical end portion 21 of the upper telescoping part 19.

The post 30 also has a pulley 44 mounted on its lower end and the sleeve 34 also has a pulley 45 mounted thereon. Another cable 46 is affixed at one end to an eye 47 on the sleeve 34 and is trained downwardly over the pulley 44 and thence upwardly over the pulley 45 and thence downwardly to a winding drum 48 which is affixed to a shaft 49 which extends through the bottom 16 and through the bottom 26 to the exterior of the grain dryer and has a crank handle 50 thereon for revolving the drum 48. A pawl and ratchet mechanism 51 is provided on the frame and shaft respectively to prevent unwanted rotation of the drum 48 but is releasable to permit desired rotation of the drum 48 as hereinafter more fully described.

A fan 52 is mounted on the frame 11 and the fan housing extends into and through the bottom 26 and into and through the bottom 16 into the interior plenum chamber 53 defined by the telescoping structure 13. The fan is provided with an attachment 54 adapted to receive power from a power takeoff of a conventional farm tractor and the fan structure is also provided with a gas burner 54*a* for heating the air being drawn into the fan. The fan housing occupies substantially a quarter or 90° segment of the bottoms 26 and 16 respectively.

The bottom 26 is also provided with a grain outlet gate 55 which is operated by a handle 56 in a conventional manner to permit ejection of the grain to be withdrawn from the grain chamber 57.

If the grain dryer 10 is to be shipped to its site of operation by rail or truck, it should be noted that the lid 28 may be lowered to occupy a position wherein the upper portion of ring 29 is disposed below the upper periphery of the wall 25. When the grain dryer 10 is at the site of its use, the lid 28 will be moved upwardly by winding the cable 46 on the drum 48 so as to urge the post 30 upwardly, whereupon after a short travel, the cable 38 will become taut and the lid 28 and upper part 19 of the telescoping structure will move upwardly simultaneously. It should be noted that because of the particular arrangement of the cable 38 and its support for the upper part 19, the upper part 19 will move upwardly as post 30 is moved upwardly at a rate twice the speed of the upward movement of lid 28. Likewise, as will hereinafter be more fully pointed out, when the lid 28 moves downwardly, due to such causes as shrinkage of the grain, the upper part 19 of the telescoping structure will move downwardly twice as fast as the movement of lid 28.

When the lid 28 has been moved to substantially the position shown in FIG. 2, the grain is directed into the grain chamber through the ring 29, whereupon the grain will be deflected off to the annular sides of the grain chamber and will fill upwardly substantially to the ring 29. At this time the thickness of grain all around the telescoping structure 13 and plenum chamber 53 is substantially uniform. The fan is then connected to the power takeoff of a tractor and started along with the gas burner so as to move heated air under pressure into the plenum chamber 53. It should be noted at this point that the air temperatures may be varied depending on the type of grain being handled and it has been found that air temperatures of 105 to 170 degrees F. and higher have been proven successful in this unit. The air pressure in the plenum chamber may be up to 8 inches static pressure and has been run successfully at even higher pressures. These temperatures and pressures have been used with the grain column having a thickness of approximately 18 inches in the grain chamber 57.

As the heated air is moved into the plenum chamber 53 under pressure, this air will move outwardly through all portions of the telescoping structure 13 and into the column of grain in all portions of the grain chamber 57 from bottom to top. It will be understood that because the air is the warmest as it first enters the grain from the plenum chamber 53 the inner portions of the grain in the chamber 57 are dried first and there will be some considerable shrinkage of the grain in the chamber. As the grain shrinks, the lid 28, which is being supported on the grain, will move downwardly within the wall 25 and the lid 28 moves downwardly, of course the post 30 and pulley 36 move downwardly and this allows the upper part 19 of the telescoping structure 13 to move downwardly at a rate twice as fast as the rate of downward movement of the lid 28. This differential in the downward speed of the upper part 19 allows portions of the grain at the upper end of the cylindrical sidewall 20 to fall inwardly onto the upper conical end portion 21 and as a result there will be no material decrease in the thickness of the grain between the upper end portion 21 and the conical lid 28 and, in fact, the spacing between the portion 21 and the lid 28 will actually increase to increase the thickness of the grain at this point. Because the upper part 19 of the telescoping structure moves downwardly at a rate faster than the lid 28 the peak portion of the conical end 21 will never be exposed through the grain in the chamber 57. The result is that the high pressures which are initially provided by the fan 52 may be maintained all during the drying operations and these higher pressures are effective for moving air all through the grain in the chamber 57.

When the grain has been dried to the desired degree, the gate 55 may be opened and the grain chamber 57 will be emptied.

It will be understood that during the initial stages of the drying operation, substantial slack will be provided in the cable 46 in order to cause the lid 28 to be supported directly on the grain and to permit the lid 28 and post 30 to move downwardly as the drying continues.

In the modified form of the invention shown in FIG. 4 the construction is substantially identical to that shown in FIGS. 1–3 and substantially of the parts carry identical identifying numerals.

In this modified version the cable 38′ which has a function and is arranged at its upper portion similar to cable 38 in the other form of the invention, is extended downwardly along the side of sleeve 34 and is trained around an additional idler puller 60 which is journaled on suitable brackets 61 affixed to the sleeve 34. The lower terminal end of cable 38′ is releasably secured by a suitable fastener 62 to a bar or swingable link 63, one end of which is projected at 64 to the bottom end of post 30, and the other end of which is slotted at 65 and is pivoted at 66 in the slot and to the framework 17 of the lower stationary part 14 of the telescoping structure 13. The bar 63 has a number of apertures 63*a* therein which facilitate atachment of the end of cable 38′ at any of a plurality of positions along the length thereof. It will be noted that as the end of cable 38′ is attached immediately adjacent the post 30, the upper part 19 of the telescoping structure 13 will have a motion substantially identical and at substantially the same rate as the lid 28.

If the lower end of cable 38' is attached immediately adjacent the wall 15, the upper part 19 of the telescoping structure 13 will move at a rate nearly approximating twice the rate of travel of the lid 28. Obviously as the lower end of cable 38' is attached intermediate the ends of bar 63 the speed of travel of the upper part 19 will vary between the two limits expressed.

This adjustability of the rate of movement of the upper part 19 as compared to the lid 28 will be desirable in the drying of one grain or pelleted material as compared with other materials.

It should be mentioned that in the operation of either form of the invention, the pressure of the air may be maintained throughout the complete operating cycle including drying with either heated or unheated air and also the cooling cycle with unheated air because an adequate layer of grain or pelleted material is maintained around and above the telescoping structure at all times.

It will be understood that in certain instances it will be desirable to merely provide a conduit from the exterior into the interior of the telescoping structure in order that an external blower and/or air heater may be used.

It will, of course, be understood that various changes may be made in the form, detail arrangement and proportion of the parts without departing from the scope of my invention which consists of the matter described herein and set forth in the appended claims.

What is claimed is:

1. A grain dryer comprising a frame, a perforate telescoping structure defining a plenum chamber, said structure including an upper part and a lower part, said upper part telescopically receiving the lower part in slidable relation, the upper part having an upwardly converging, substantially conically shaped upper end, a perforate grain-confining sidewall and bottom means supporting said telescoping structure within and spaced from said sidewall and bottom to define a grain chamber, means mounting the sidewall and bottom on the frame and also supporting said lower part, a substantially cone-shaped upwardly convergent perforate lid slidable downwardly within said sidewall and normally supported on the grain in spaced relation above the upper end of said upper part of the telescoping structure, motion amplifying transmission and control means connected with said lower part and lid and in supporting relation with the upper part and permitting said upper part to slide downwardly with an amplified motion in relation with the downsliding motion of the lid, and means for heating and moving air under pressure into the plenum chamber.

2. A grain dryer comprising a frame, a perforate telescoping structure defining a plenum chamber, said structure including an upper part and a lower part, said upper part telescoping receiving the lower part, the upper part having an upwardly converging conical upper end, a perforate grain-confining sidewall and bottom means supporting said telescoping structure within and spaced from said sidewall and bottom to define a grain chamber, means mounting the sidewall and bottom on the frame and also supporting the lower part, a substantially cone-shaped upwardly convergent perforate lid slidable downwardly within said sidewall and normally supported on the grain in spaced relation upon the upper end of said upper part of the telescoping structure, motion amplifying transmission and control means connected with said lower part and lid and in supporting relation with the upper part and permitting said upper part to slide downwardly with an amplified motion in relation to the downsliding motion of the lid, means for moving the lid of the telescoping structure upwardly to permit filling of the grain chamber, and means for heating and moving air under pressure into the plenum chamber.

3. A grain dryer comprising a frame, a perforate telescoping structure defining a plenum chamber, said structure including an upper part and a lower part, said upper part telescoping receiving the lower part, the upper part

having an upwardly converging conical upper end, a perforate grain-confining sidewall and bottom, means supporting said telescoping structure within and spaced from said sidewall and bottom to define a grain chamber, means mounting the sidewall and bottom on the frame and also supporting the lower part, a substantially cone-shaped upwardly convergent perforate lid slidable downwardly within said sidewall and normally supported upon the grain in spaced relation above the upper part of the telescoping structure, a pulley secured to the lid, a cable trained over the pulley and having a first depending end secured to the upper part of the telescoping structure and also having a second end, means connected with said lower part and anchoring said second end whereby the cable runs over the pulley under influence of said upper part when the lid and pulley are lowered due to grain shrinkage during drying and thereby cause downward movement of said upper part at a rate in excess of the rate of downward movement of the lid, and means moving the lid and upper telescoping part upwardly to permit filling of the grain chamber, and means for heating and moving air under pressure into the plenum chamber.

4. A grain dryer comprising a frame, a perforate telescoping structure defining a plenum chamber, said structure including an upper part and a lower part, said upper part telescopically receiving the lower part, the upper part having an upwardly converging conical upper end, a perforate grain-confining sidewall and bottom, means supporting said telescoping structure within and spaced from said sidewall and bottom to define a grain chamber, means mounting the sidewall and bottom on the frame and also supporting the lower part, a substantially cone-shaped upwardly convergent perforate lid slidable downwardly within said sidewall and normally supported on the grain in spaced relation above the upper part of the telescoping structure, an upright stationary guide sleeve within the plenum chamber, means rigidly supporting said sleeve from said lower part, a tubular member slidably mounted in the sleeve and opening through and secured to the upper end of the conical top of the upper telescoping part, an elongate rigid post secured to and depending from the lid and extending through the tubular member, a pulley mounted on the post beneath the lid, a tubular cable guide affixed to and extending through the upper end of said upper part of the telescoping structure in spaced relation with said tubular member, a cable trained over said pulley and having a first depending end portion secured to said upper part of said telescoping structure and having a second depending end portion extending through said cable guide and being connected to said last-mentioned means, and means for lifting said part whereby to lift the lid to permit filling the grain chamber, and means for heating and moving air under pressure into the plenum chamber.

5. The invention set forth in claim 3 and including means for adjusting the length of said cable to permit the spacing between said lid and said upper part of the telescoping structure to be varied with different types of grain.

6. A grain dryer comprising a frame, a perforate telescoping structure defining a plenum chamber and said structure including an upper part and a lower part, said upper part telescopically receiving the lower part, the upper part having an upwardly converging substantial conical upper end, a perforate grain-confining sidewall and bottom means supporting said telescoping structure within and spaced from said side wall and bottom to define a grain chamber, means mounting the sidewall and bottom on the frame and also supporting said lower part, a substantially cone-shaped, upwardly convergent perforate cover slidable downwardly within said sidewall and normally supported on the grain in spaced relation above the upper part of the telescoping structure, an upright stationary guide sleeve within the plenum chamber, means rigidly supporting said sleeve from said lower part, a

tubular member slidably mounted in the sleeve and opening through and secured to the upper conical end of the upper telescoping part, an elongate rigid post secured to and depending from the lid and extending through the tubular member and protruding downwardly below the tubular member and sleeve, a pulley on the upper portion of the post, the upper conical end of said upper part of the telescoping structure having a cable-receiving opening therethrough, a first cable trained over said pulley and having a first depending end portion affixed to the upper part of said telescoping structure and also having a depending second end portion extending through said opening and being affixed to said sleeve, a second pulley on the lower end of said post, a third pulley on the sleeve, a second cable having one end affixed to said sleeve and being trained downwardly over said second pulley and thence upwardly over said third pulley, and means for pulling said second cable over said second and third pullies for raising said post and the upper part of the telescoping structure and means for heating and moving air under pressure into the plenum chamber.

7. The invention set forth in claim 6 and including a drum within the plenum and having the other end of said second cable wound thereon, and means for revolving said drum to effect raising and lowering of the lid and upper part of the telescoping structure.

8. A grain dryer comprising a frame, a perforate telescoping structure defining a plenum chamber, said structure including an upper part and a lower part, said upper part telescopically receiving the lower part in slidable relation, the upper part having an upwardly converging, substantially conical upper end, a perforate grain-confining sidewall and bottom, means supporting said telescoping structure within and spaced from said sidewall and bottom to define a grain chamber, means mounting the sidewall and bottom on the frame and also supporting said lower part, a substantially cone-shaped upwardly convergent perforate lid slidable downwardly within said sidewall and normally supported on the grain in spaced relation above the upper part of the telescoping structure, an upright and stationary guiding sleeve within the plenum chamber, means rigidly supporting said sleeve from said lower part, a tubular member slidably mounted in the sleeve and opening through and secured to the upper conical end of said upper telescoping part, an elongate rigid post secured to and depending from the lid and extending through the tubular member, said sleeve, tubular member and post maintaining the upper part of the telescoping structure and said lid in predetermined orientation with respect to each other and permitting upward and downward movement with respect to each other, motion amplifying transmission and control means connected with said lower part and lid and in supporting relation with the upper part and permitting said upper part to slide downwardly with an amplified motion in relation to the downsliding motion of the lid, and means for heating and moving air under pressure into the plenum chamber.

9. A grain dryer comprising a frame, a perforate telescoping structure defining a plenum chamber, said structure including a cylindrical upper part having an upwardly convergent conical upper end, and also including a cylindrical lower part having a downwardly convergent lower end, said upper part telescopically receiving said lower part in slidable relation, a perforate grain-confining cylindrical sidewalls and downwardly convergent conical bottom means supporting said telescoping structure within and uniformly spaced from said sidewall and bottom to define a grain chamber, means mounting the sidewall and bottom on the frame and also supporting said lower part, a substantially cone-shaped upwardly convergent perforate lid slidable downwardly within said sidewall and normally supported on the grain in spaced relation above the upper part of the telescoping structure, motion amplifying transmission and control means connected with said lower part and lid and in supporting relation with the upper part and permitting said upper part to slide downwardly with an amplified motion in relation to the downsliding motion of the lid, and means for heating and moving air under pressure into the plenum chamber.

10. A grain dryer comprising a frame, a perforate telescoping structure defining a plenum chamber, said structure including an upper part and a lower part, said upper part telescopically receiving the lower part, said upper part having an upwardly converging substantially conical upper end, a perforate grain-confining sidewall and bottom, means supporting said telescoping structure within and spaced from said sidewall and bottom to define a grain chamber, means mounting the sidewall and bottom on the frame and also supporting the lower part, substantially cone-shaped upwardly convergent perforate lid slidable downwardly within said sidewall and normally supported on the grain in spaced relation above the upper end of said upper part of the telescoping structure, means connected to the lid supporting the upper part of the telescoping structure and permitting downward movement thereof at a predetermined rate related to the rate of downward movement of the lid as the grain shrinks during the drying operation and means for directing air under pressure into the plenum chamber.

11. The invention set forth in claim 10 and including a post affixed to the lid and extending downwardly into said plenum chamber in slidable relation with the upper part of the telescoping structure, a pulley on the upper end of said post adjacent the lid, the conical end of said upper part of the telescoping structure having a cable-guiding opening therein, a swingable, substantially horizontal link in the plenum chamber and pivoted at one end to the lower end of said post and having a pivot at its other end connected to said first mentioned means, a cable trained over said pulley and having a first depending end secured to the upper part of said telescoping structure and having a second depending end portion extending through said cable-guiding opening into the plenum chamber, releasable means securing said second depending end of the cable to said link and facilitating attachment to said link at any of a plurality of positions along the length of said link whereby to permit the upper part of said telescoping structure to be moved at a desired rate with respect to the rate of downward movement of the lid as the grain shrinks.

References Cited in the file of this patent

UNITED STATES PATENTS

2,627,670	Hurst et al.	Feb. 10, 1953
2,732,630	Markowich	Jan. 31, 1956

FOREIGN PATENTS

772,011	Great Britain	Apr. 10, 1957