Oct. 8, 1968 R. S. ALTMAN Re. 26,474

GRAIN AND BEAN COOKER

Original Filed April 7, 1961 2 Sheets-Sheet 1

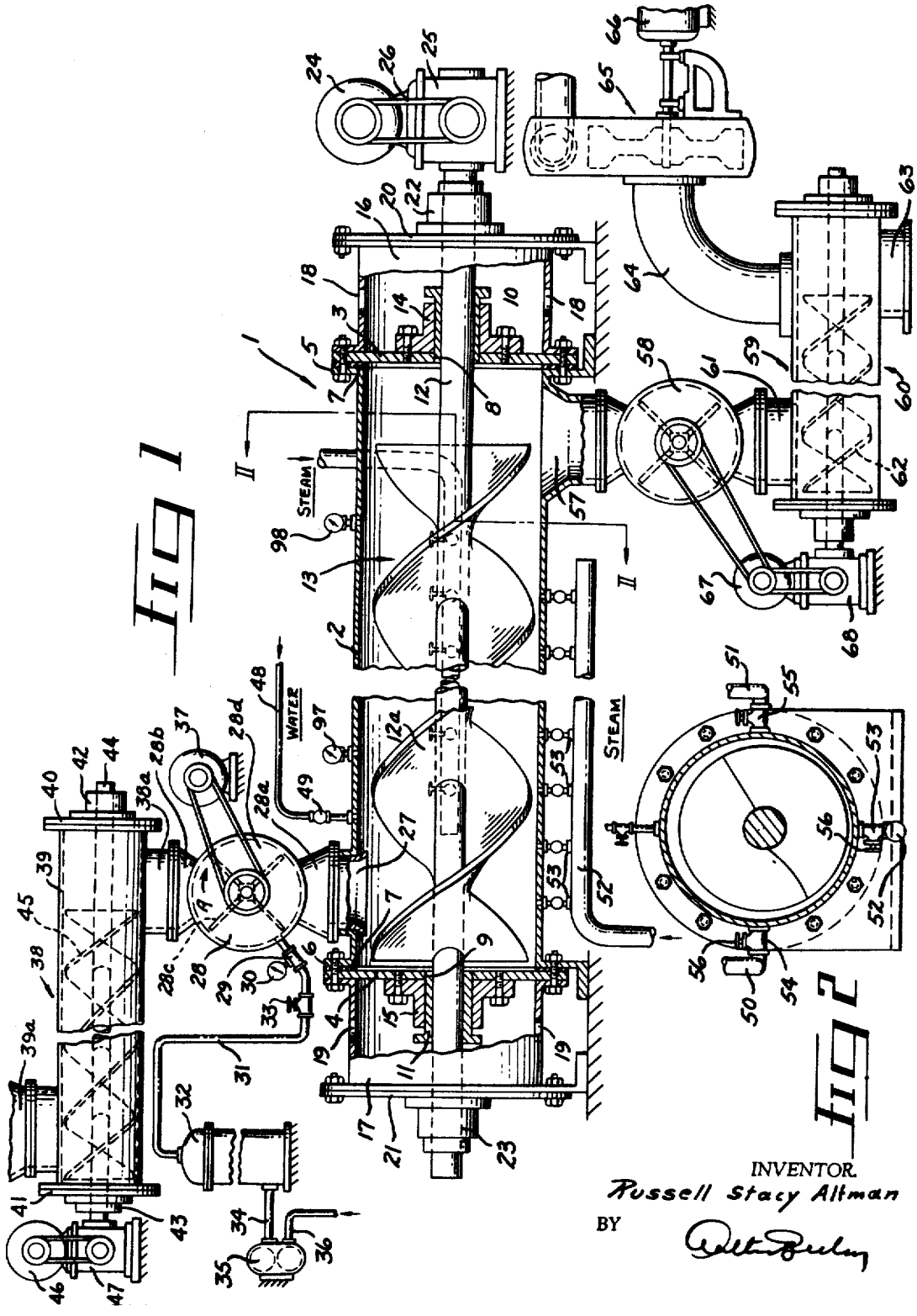


Fig 1

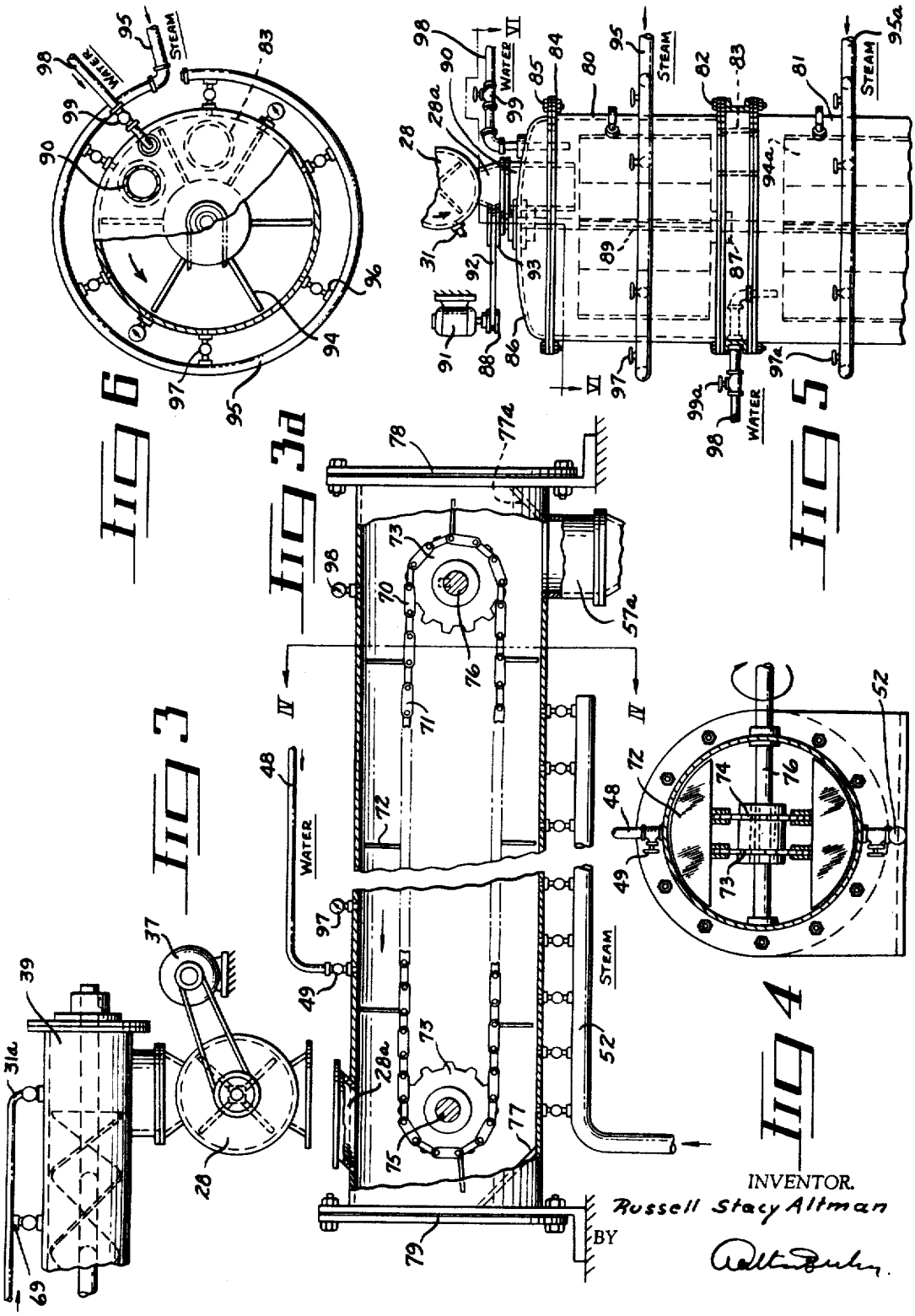
Fig 2

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GRAIN AND BEAN COOKER

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11 Claims. (Cl. 99—443)

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

ABSTRACT OF THE DISCLOSURE

An apparatus for cooking grains and beans has a cylindrical cooker in which a conveyor moves the grain from the inlet to outlet during cooking by steam introduced into the cooker. The grain is fed to the cooker by a conveyor in a chamber having an outlet leading to a passage to the inlet of the cooker. A rotary trap in the passage moves the grain to the inlet while retaining the steam in the cooker. Air under pressure is supplied to the feeder chamber or the region of the trap to increase the pressure at the inlet to the cooker and prevent escape of the steam from the cooker into the feeder chamber.

This is a continuation-in-part of my co-pending application Serial No. 822,765 filed June 25, 1959, now abandoned. The present invention relates to a grain cooker and, more particularly, to a grain cooker for use in milling plants for cooking, for example, soy beans and other types of grains.

Grain cookers of the above mentioned general type are known and consist primarily of a closed container which is charged with a certain batch. This batch is then first cooked and subsequently dried in one and the same apparatus, and after the batch has been sufficiently dried, the apparatus is stopped, discharged, and filled with a new load.

Cookers of this type have the serious drawback that they have only a relatively low capacity and are expensive in construction and operation, particularly due to the fact that they do not permit a continuous operation. Furthermore, considerable amounts of steam and heat are lost each time the apparatus is being emptied.

It is, therefore, an object of the present invention to provide a grain cooker which will overcome the above mentioned drawbacks.

It is another object of this invention to provide a grain cooker which can be operated on a continuous basis so that the grain can be loaded in a continuous manner at one end of the apparatus while the processed grain can be withdrawn in a continuous manner at the other end of the apparatus.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIG. 1 illustrates a grain cooker according to the invention partially in longitudinal section and partially in elevation.

FIG. 2 is a section along the line II—II of FIG. 1.

FIG. 3 shows a modified version of the feeding conveyor-trap arrangement and compressed air supply thereto.

FIG. 3a is a modified version of my grain cooker proper differing from that of FIG. 1 primarily in the conveyor type employed.

FIG. 4 is a section along the line IV—IV of FIG. 3a.

FIG. 5 shows in elevation a further modification of my grain cooker according to the invention which differs from the modifications of FIGS. 1 and 3 and primarily in that its longitudinal axis is vertical instead of horizontal.

FIG. 6 is a section along the line VI—VI of FIG. 5.

GENERAL ARRANGEMENT

The apparatus according to the present invention is characterized primarily by a relatively long pipe or tubular container provided with steam nozzles on at least one side thereof for feeding steam into said pipe or tubular container while grain to be processed is charged into said pipe or container through a trap at one end portion of said pipe or container. The grain to be processed is fed into said trap in a continuous way by continuously moving and feeding conveyor means. One of the most important features of the present invention consists in the provision of means which will make it possible to feed the grain to be processed through said trap into the cooker pipe or cooker container without running the risk that steam in the cooker, which steam is at a relatively high pressure, will escape into the feeding conveying means and humidify the oncoming grain before it has been charged into the cooker pipe or container. The grain charged through said trap into said pipe or container is by conveyor means in said pipe or container conveyed therethrough while being subjected to the action of steam under pressure as a result of which the grain will be cooked. Control means are provided for controlling and adjusting the pressure of the steam in said pipe or container to a desired value which will depend on the type of grain being cooked. The pressure itself may be ascertained from standard pressure gauges connected to said pipe or container. Said pipe or container may also have connected thereto a gauge indicating the degree of humidity therein. Furthermore, means are provided for preventing any material amount of steam from escaping from the pipe or container, while care is being taken to keep the amount of steam in said pipe substantially constant.

At the other end of the pipe, the cooked grain is passed through a further trap into a cooler which consists primarily of a pipe considerably smaller than the cooker pipe or container. The purpose of this cooler consists in withdrawing heat and steam from the cooked grain discharged from said cooker pipe or container at said other end thereof. The thus cooled material is then passed either through a drier of any desired design, or through rollers for making flakes. In either instance the treated material may then be ground.

STRUCTURAL ARRANGEMENT

Referring now to the drawings in detail and FIG. 1 thereof in particular, the cooker shown in FIG. 1 and generally designated **1** comprises a relatively long standard steel pipe **2** which may henceforth be called the cooker pipe. This cooker pipe **2** is closed at its ends by lids **3** and **4** bolted to flanges **5** and **6** respectively of the cooker pipe. Asbestos seals **7** or gaskets of any other convenient type are interposed between the respective lids **3**, **4** and flanges **5**, **6** so as to assure a good seal. The central portions of the lids **3** and **4** are each provided with an opening **8**, **9** through which extend sleeves **10**, **11** respectively for instance of bronze. Through these sleeves **10**, **11** extends a rotatable shaft **12** provided with helical blading **12a**. The said shaft **12** with its blading forms a worm conveyor generally designated **13**. The openings **8**, **9** around shaft **12** may be sealed in any convenient manner for instance by stuffing boxes diagramamtically illustrated in the drawings and designated **14** and **15**. Flanged to each of said lids **3** and **4** are tubular sections **16**, **17** respectively provided with openings **18** and **19**. The outer

ends of said tubular sections **16, 17** have bolted thereto lids **20, 21** carrying antifriction bearings **22, 23**. The openings **18, 19** allow access to the parts **9, 10, 14, 15** and also permit a venting and thus a cooling of the interior of the tubular sections **16, 17**. Due to the fact that the antifriction bearings **22, 23** are spaced from the lids **3, 4** and are arranged on the outside of the lids **20, 21,** they are not affected by the heat in the cooker pipe **2**. Shaft **12** is drivingly connected to an electric motor **24** through the intervention of a gear box **25** and a belt **26**.

The cooker pipe **2** is near lid **4** provided with an inlet connection **27** to which is flanged the outlet **28a** of a rotary trap **28** of any standard design. The rotary trap has an inlet **28b**. Between the inlet **28b** and the outlet **28a** the said trap has a rotary bladed wheel **28c** which is fitted with slight play into a cylinder **28d** sufficient to allow rotation of the bladed wheel in said cylinder and to carry grain received through the inlet **28b** from the latter to and into the outlet **28a**. This rotary trap **28** has furthermore connected thereto a T-piece **29** carrying a pressure gauge **30** and being connected to a conduit **31** leading to a compressed air reservoir **32**. Interposed in said conduit **31** is a shut-off valve **33**. The compressed air reservoir **32** has in its turn connected thereto a pipe **34** leading to the pressure side of an air pump **35** the suction side of which has connected thereto an intake pipe **36**. The rotary trap is adapted to be driven by a motor **37** of any desired type, preferably an electric motor, e.g. in the direction of the arrow A.

Connected to the inlet **28b** of the rotary trap **28** is the outlet **38a** of a feeding conveyor generally designated **38**. The feeding conveyor **38** comprises substantially a pipe **39** closed at its ends by lids **40, 41** which have connected thereto bearings **42, 43** in which is rotatably journalled a shaft **44** with helical blades **45** connected thereto so that shaft **44** with the blades **45** forms a worm conveyor. The blades of the worm conveyor may extend throughout the length of pipe **39** but it is sufficient if they extend slightly into the range of the connection **38a** as shown in the drawing. The worm conveyor may be driven in any convenient manner for instance by means of an electric motor **46** through the intervention of a gear box **47**.

The arrangement **29** to **36** is of foremost importance for the present invention and constitutes the very means which will prevent steam from passing from the cooker pipe into the feeding conveyor, thereby for the first time in the grain cooker art making possible a continuous cooking operation.

More specifically, the air under pressure delivered through the air conduit **31** has a manifold purpose, namely

(a) It not only counteracts the steam pressure on the cooker side of the trap but effectively keeps the steam in the cooker and prevents any substantial amount of the steam from entering the trap and the feeding conveyor.

(b) It exerts a pressure on the grain being fed into the trap and always sweeps the blades of the rotary trap clean.

(c) By keeping the steam from passing through the trap into the feeding conveyor, the grain in the feeding conveyor will not absorb any material amount of moisture while it passes through the feeding conveyor, thereby preventing the grain from sticking to the feeding conveyor, and thus making possible a continuous feeding operation. It will be appreciated that even if relatively small amounts of steam from the cooker would enter the feeding conveyor, the moisture of the steam would be absorbed by the grain which would then swell between the blading of the worm conveyor to such an extent that the worm conveyor would be unable to rotate whereby the feeding would stop.

The pressure of the air conveyed from the compressed air reservoir **32** through conduit **31** into trap **28** may vary in conformity with the type of grain being processed. As an example, the air pressure may vary, for instance, from 5 to 10 pounds, in which instance the steam pressure in the cooker may for instance vary from 5 to 9 pounds. At any rate, the air pressure must at least be as high as the steam pressure. As a mere example, soy beans have been cooked at a steam pressure of 5 pounds and an air pressure of 5 pounds, where as when cooking corn at a steam pressure of 9 pounds, an air pressure of 10 pounds was necessary. The air will thus maintain the trap at a pressure sufficient to prevent the steam from entering the feeding conveyor so that the grain therein would become sticky. While air will pass through the trap into the cooker, this will not interfere wtih the cooking operation. It will, of course, be understood that the feeding conveyor end adjacent the trap **28** and also its connection with said trap are properly sealed. The grain in the feeding conveyor will itself provide a sufficient seal with regard to the hopper **39a** against any material loss of air which would interfere with the proper operation of the cooker. The length of the pipe **39** of the feeding conveyor may vary in conformity with the location of the cooker and charging facilities and may, for instance, have a length of 5 feet. The degree of closure of valve **33** will allow any desired adjustment of the air in trap **28**.

Near the inlet connection **27** through which the grain passes from trap **28** into cooker pipe **2** there is arranged a water feeding line **48** leading from a water supply source (not shown in the drawings) into the interior of the cooker pipe **2** to feed water into the cooker pipe in conformity with the respective requirements. The water from the water line **48** is necessary to add moisture to the moisture of the steam in the cooker pipe. The steam moisture alone is not sufficient in most instances for a proper cooking of the grain. The amount of water which is to be added will be charged according to the condition of the grain as it comes out of the cooker. More specifically, if the cooked grain does not contain sufficient moisture, a valve **49** in the water line **48** may be adjusted so as to allow more water to flow into the cooker. If there is too much moisture in the cooked grain, the amount of water will, of course, be reduced. Once the water flow from line **48** has been adjusted by valve **49**, it will normally stay in its respective adjustment during the cooking operation, and the water will flow continuously in conformity with the adjustment of valve **49**.

The cooker pipe **2** according to FIG. 1 communicates with a plurality of steam feeding lines **50, 51,** and **52** preferably arranged as shown in FIGS. 1 and 2, although a different circumferential distribution and also a different distribution over the length of the cooker pipe **2** may be selected. As will be seen from FIG. 1, the steam feeding lines extend along the cooker pipe **2** over at least the major length thereof and will along their length be provided with nozzle-like branch tubes **53, 54, 55** leading into the cooker pipe **2**. Each or a number of these branch tubes **53, 54, 55** may be provided with a valve **56** so that the inflow of steam along the cooker pipe can be controlled in conformity with the most efficient operation of the cooker. By arranging the branch pipes **54, 55** opposite to each other, an additional and effective agitation of the grain on the conveyor **12, 12a** will be obtained.

Near the other end of the cooker pipe **2** there is provided a discharge connection **57** through which the cooked grain is discharged from cooker **2**. The discharge from cooker **2** is passed into a trap **58** connected to the discharge connection **57**. From the trap **58** the cooked grain is discharged into a cooler generally designated **59**. The cooler **59** comprises a pipe **60** with an inlet connection **61** which is connected to and communicates with the discharge trap **58**. The cooler pipe **60** has rotatably mounted therein a conveyor worm **62** which feeds the cooked grain received from the discharge trap **58** to a discharge connection **63** which latter may be connected either to rolls by means of which the material is flaked, or to driers for drying the cooked grain. Such rolls and driers are well known in the art and since they do not form a part of

the present invention, they have not been shown in the drawings. The cooler pipe **60** communicates through a pipe **64** with a blower generally designated **65** of any standard type which is drivingly connected to an electric motor **66** and withdraws the hot air and steam from pipe **60** in order to cool the cooked grain in the cooler, while simultaneously, by drawing off the steam, promoting drying of the grain. The conveyor worm **62** is connected to a prime mover such as an electric motor **67** through a gear box **68**.

The cooker system of the above described type has proved extremely successful and has made it possible for the first time to cook grain and process the same in a continuous manner. A cooker according to the present invention is easily able to be loaded every minute with from 100 to 400 pounds of grain. A device of this type has been successfully operated with a steam pressure for instance of from 3 to 9 pounds in the cooker pipe and a temperature in the cooker pipe of from 150 to 230° F. Naturally, the steam pressure and temperature may be varied in conformity with the special requirements and type of grains involved. Also the temperature will vary along the cooker by for instance 20 to 30° with the higher temperature near the discharge of the cooker.

While the dimensions of the cooker pipe and cooler pipe may, of course, vary in conformity with the size of the plant, a cooker pipe of an inner diameter of 18 inches and a length of 36 feet with a cooler pipe with a diameter of 9 inches and a length of 12 feet have been sucessfully employed.

Referring now to FIG. 3, the feeding conveyor-trap arrangment and compressed air supply therefore differs from the corresponding construction shown in FIG. 1 merely in that instead of supplying the compressed air from the reservoir **32** into the trap **28**, the compressed air supply line **31**a which, similar to line **31** receives its compressed air from a compressed air reservoir (not shown in FIG. 3), leads into the feeding conveyor pipe **39** near the front end thereof and has a branch line **69** leading into the conveyor pipe **39** at a greater axial distance from the front end of pipe **39**. In all other respects the feeding conveyor-trap arrangement of FIG. 3 corresponds to that of FIG. 1, and therefore similar parts have been designated with the same reference numerals as in FIG. 1. For instance the distance between the front end of line **31**a and branch line **69** may be 18 inches.

With regard to the cooker shown in FIG. 3*a*, this cooker is basically the same as that of FIG. 1 and, therefore, similar parts have been designated with the same reference numerals as in FIG. 1. The arrangement of FIG. 3a differs from that of FIG. 1 primarily in that the worm conveyor **12**, **12**a of FIG. 1 has been replaced by a drag chain conveyor **70**. The drag chain conveyor **70** consists mainly of chain means **71** having connected thereto paddles **72** arranged in spaced relationship to each other. The chain means **71** is supported by pairs of chain sprockets **73**, **74** supported by shafts **75** and **76**. The shaft **76** having one pair of chain sprockets **73**, **74** keyed thereto may be driven by a prime mover (not shown in the drawings) as indicated by the arrow in FIG. 4 so as to actuate the chain conveyor to move in the direction indicated by the arrow in FIG. 3a.

The grain charged through a trap of the type designated **28** in FIG. 1 and through the outlet **28**a into the cooker pipe **2** drops on an inclined steel board **77** and is then by means of the paddles **72** dragged along the bottom portion of cooker pipe **2**. It will be noticed that the inlet **28**a is somewhat inclined so as to cause the grain being charged into pipe **2** to pass around the left-hand sprocket wheels (with regard to FIG. 3a). The arrangement according to FIG. 3a is provided with one steam line **52** only, although, of course, additional steam lines may be provided if so desired. All other parts and also the operation of the cooker of FIG. 3a will be obvious from the description of FIG. 1 so that a further description of FIG. 3a will not be necessary. It may, however, be added that inasmuch as the conveyor means in the cooker of FIG. 3a does not have a shaft extending longitudinally through the cooker and being journalled at the ends thereof, the cooker pipe of FIG. 3a can be closed at its ends by lids **78** and **79**. To avoid a dead corner near lid **78**, an inclined steel board **77**a similar to the steel board **77** may be provided and arranged near the discharge **57**a, as shown in FIG. 3.

Referring now to the modified cooker shown in elevation in FIG. 5, this cooker differs from those of FIGS. 1 and 3a primarily in that its longitudinal axis is vertical instead of horizontal. The cooker according to FIG. 5 is preferably built up of a plurality of pipe sections of which only the sections 80 and 81 are shown. Each pipe section forms by itself a cooker. To this end, the pipe section 80 is provided with a bottom 82 having provided therein an outlet 83. Furthermore, the pipe section 80 has a top 84 to which is connected in any convenient manner, for instance by bolts 85, a head 86. Mounted in the bottom 82 and in the head 86 are bearings 87 and 88 for journalling a vertical shaft 89. The head 86 has connected thereto a chute 90 the lower end of which extends into the pipe section 80 while the upper end is connected in any convenient manner to an outlet 28a of a rotary trap 28 having connected thereto a compressed air supply line 31. The trap 28 of FIG. 5 corresponds to the trap 28 of FIG. 1, and the connection of the air supply line 31 in FIG. 5 likewise corresponds to that of FIG. 1. It is to be understood that the trap 28 of FIG. 5 is connected to a feeding conveyor corresponding to the feeding conveyor 38 of FIG. 1 through a corresponding connection 38a as likewise shown in FIG. 1. In other words, the construction shown in FIG. 1 above the inlet connection 27 is to be employed in connection with the cooker of FIG. 5. The arrangement of FIG. 5 furthermore comprises an electric motor 91 which through a belt 92 and pulley 93 drives the shaft 89. Keyed to shaft 89 are vanes or blades 94 (see FIG. 6). The pipe section 80 is surrounded by a steam line 95 from which radially branch off nozzles 96 communicating with the interior of tube section 80. Each of said nozzles has a valve 97 associated therewith for controlling the quantity of steam passing through said nozzles per time unit into the interior of the cooker section 80. Similar to the arrangement of FIGS. 1 and 3a, also the cooker of FIG. 5 is provided with a water supply line 98 for controlling the humidity in the cooker. Also the water line 98 has a control valve 99 interposed therein.

The cooker section 81 substantially corresponds to the cooker section 80 with the parts pertaining thereto, and, accordingly, corresponding parts of the cooker section 81 have been designated with the same reference numerals as those of the cooker section 80 but with the additional reference a.

The operation of the cooker of FIG. 5 corresponds substantially to that of FIGS. 1 and 3. More specifically, the grain to be processed is fed by a feeding conveyor corresponding to the feeding conveyor of FIG. 1 or FIG. 3, into the trap 28 of FIG. 5 and from there through chute 90 into the cooker section 80. Here the vanes or blades 94 keyed to the shaft 89, which latter is rotated by motor 91, pass the received grain in the direction of the arrow of FIG. 6 from a place below chute 90 around the axis of shaft 89 to and through the outlet 83. Steam under pressure is supplied to the interior of the cooker through a steam line 95 similar to the operation of FIGS. 1 and 3 while the humidity is controlled by water passing through the water line 98 into the cooker section 80.

The processed grain passing through the outlet 83 then passes into the cooker section 81 where it undergoes a further processing operation similar to the one encountered in tube section 80. These cycles may be repeated through all cooker sections of which the cooker of FIG. 5 may be made up. From the last outlet of the last cooker section, which outlet corresponds to the outlet 83, through a trap the processed grain passes into a drier which may

correspond to a drier system corresponding to that shown in FIG. 1 below the discharge connection 57.

It will be appreciated that if a relatively small capacity cooker only for continuous operation is desired, the cooker section 81 may be omitted, in which instance the processed grain passing through outlet 83 is directly discharged through a trap (corresponding for instance to trap 58) into the drier. On the other hand, if a large capacity vertical cooker is desired, the cooker may be built up by as many cooker sections 80, 81 as will be necessary. It will be appreciated that the vertical cooker according to FIG. 5 has the advantage that it requires relatively little bottom space and may, therefore, be particularly advantageous where limited bottom space only is available. It will also be appreciated that while in FIG. 5 the motor drives the shaft 89 directly through a pulley, if desired a stepdown transmission may be interposed between the motor and the pulley 93.

It will furthermore be appreciated that while according to FIG. 5 the compressed air supply pipe 31 is arranged in conformity with the arrangement of FIG. 1, it could, of course, also be arranged for instance in conformity with the arrangement of FIG. 3.

The cooker of the present invention may, of course, be provided with any desired gauges such as the gauges 97, 98 for indicating the pressure and degree of humidity inside the cooker pipe or pipes.

It is, of course, to be understood that the present invention is, by no means, limited to the particular constructions shown in the drawings but also comprises any modifications within the scope of the appended claims. Thus, while the compressed air feeding pipe **31** leads into the lower left-hand side of trap **28** according to a preferred embodiment of the invention, the cooker system according to the invention would also operate satisfactorily if said compressed air feeding pipe would lead into the left-hand central or upper portion of the trap if the rotor in said trap rotates in the direction of the arrow A.

Furthermore, while according to the arrangement shown in FIG. 1 the compressed air is blown into the grain while the latter is being moved through the trap, as evident from the arrow A, the arrangement would also operate if the direction of rotation of the rotary blades in trap **28** were reversed. Furthermore, instead of compressed air feeding pipe **31** leading into the left-hand side (with regard to FIGS. 1 and 5) of trap **28**, it could also lead into the opposite side of trap **28** either into a grain filled compartment between the trap blades or into an empty compartment between the trap blades.

What I claim is:

1. In a grain cooker system: a tubular cooker having an inlet and an outlet and also having conveying means therein extending substantially the length of the cooker and including means to convey continuously to said outlet grain to be cooked and received through said inlet, conduit means adapted to be connected to a source of steam under pressure and leading into said tubular cooker for conveying steam under pressure into said tubular cooker, grain feeding means including a tube having a grain inlet and a grain outlet and a conveyor therein to convey grain from said grain inlet to said grain outlet, said feeding means including trap means connected to said grain outlet and to said cooker inlet for feeding grain to be cooked in a continuous manner into said tubular cooker, said trap means comprising a housing sealed to said tube and to said cooker and having a bladed rotary trap member therein preventing direct communication between said grain outlet and said cooker inlet, and air supply means connected to said feeding means in the region of said trap means to establish in said feeding means between said conveyor and said cooker inlet an air pressure at least as high as said steam pressure in said tubular cooker to thereby inhibit the escape of steam from said cooker through said trap means into said feeding means.

2. In a grain cooker system: grain feeder means comprising a tube having an inlet opening at one end portion and a discharge opening at the other end portion and also having a screw conveyor therein extending substantially the length of said tube and rotatable for conveying grain to be cooked from said inlet opening to and through said discharge opening, a tubular cooker having an inlet substantially below said discharge opening and in vertically spaced relationship thereto, said grain feeder means also including a rotary trap interposed between and connected to said discharge opening and said inlet of said tubular cooker for conveying grain to be cooked from said discharge opening to said inlet of said tubular cooker, said trap having a housing sealed to said tube and to said cooker and a bladed rotary member in said housing preventing direct communication between said outlet opening and said cooker inlet, said cooker also having an outlet for discharging cooked grain and furthermore comprising a conveyor extending substantially the length thereof and including means for conveying grain continuously from said inlet of said cooker to the outlet thereof, steam supply means leading into said tubular cooker for feeding steam under pressure into said cooker, and means connected to said feeder means at a point between the inlet of said cooker and a point of said other end portion of said tube which other end portion is adjacent said discharge opening for supplying compressed air into said feeder means for maintaining in said feeder means at said other end portion an air pressure at least as high as the steam pressure in said cooker to thereby inhibit the escape of steam from said cooker through said rotary trap to said screw conveyor.

3. In a grain cooker system: a tubular cooker having an inlet to receive grain to be cooked and also having an outlet for discharging grain cooked in said cooker, conveyor means in said cooker extending substantially the length thereof to convey continuously grain to be cooked from an area near said inlet to an area near said outlet, feeding means comprising a tube having an inlet opening for receiving grain to be cooked and also having an outlet opening, said feeding means comprising continuously operating means including rotary trap means for feeding grain in a continuous manner from said outlet opening into said cooker inlet, said trap comprising a housing sealed to said tube and to said cooker and having a bladed rotary trap member therein preventing direct communication between said outlet opening and said cooker inlet, steam supply means adapted to be connected with a source of steam under pressure and leading into said cooker at different peripheral points thereof for feeding steam under pressure into said cooker, water supply means leading into said cooker and including valve means for controlling the humidity in said cooker, and compressed air supply means leading into said feeding means near said trap means to maintain a certain air pressure in said feeding means near said inlet at least as high as the steam pressure in said cooker to thereby prevent steam from said cooker from entering said feeding means and humidifying grain in said feeding means prior to said grain in said feeding means reachng said cooker.

4. A grain cooker system according to claim **1**, in which said tubular cooker is substantially horizontal and said conveying means therein is a screw conveyor, and in which said conduit means terminates in steam conveying inlets arranged circumferentially and longitudinally of said cooker tube.

5. A grain cooker system according to claim **1**, in which said tubular cooker is substantially horizontal and said conveying means therein is a drag chain with paddles connected thereto, said paddles being movable close to the bottom portion of said tubular cooker, and in which said conduit means terminates in steam conveying inlets arranged circumferentially and longitudinally of said cooker tube.

6. In a grain cooker system: a tubular cooker having an

inlet and an outlet and also having continuously operating conveying means extending substantially the full length thereof to convey to said outlet grain to be cooked and received through said inlet, conduit means adapted to be connected to a source of steam under pressure and leading into said tubular cooker at circumferentially spaced points for conveying steam under pressure into said tubular cooker, a grain feeder including a tubular housing and a conveyor therein and also having a grain inlet and a grain outlet, said feeding means including a rotary trap having a housing sealed to said tubular housing around said grain outlet and sealed to said tubular cooker around the said inlet therein and having a rotary bladed member therein preventing direct communication between said grain outlet and said cooker inlet, said rotary member being rotatable to feed grain from said grain outlet to said cooker inlet, a compressed air supply source under a certain pressure at least as high as the stream pressure in said cooker, and conduit means leading from said compressed air supply source into the housing of said trap in a region thereof through which the blades of said member move after having discharged the grain between adjacent blades into said cooker inlet to thereby maintain in said section an air pressure higher than the steam pressure in said cooker.

7. In a grain cooker system: a tubular cooker having an inlet and an outlet and also having conveying means therein extending substantially the length of the cooker and including means to convey continuously to said outlet grain to be cooked and received through said inlet, conduit means adapted to be connected to a source of steam under pressure and leading into said tubular cooker for conveying steam under pressure into said tubular cooker, grain feeding means including a tube having a grain inlet and a grain outlet and a conveyor therein to convey grain from said grain inlet to said grain outlet, said feeding means including passage means leading from said grain outlet to said cooker inlet and forming a feeding path extending substantially in axial direction of said tubular cooker and trap means in said passage means connected to said grain outlet and to said cooker inlet for feeding grain to be cooked in a continuous manner into said tubular cooker, said trap means comprising a housing sealed to said tube and to said cooker and having a bladed rotary trap member therein preventing direct communication between said grain outlet and said cooker inlet, and air supply means connected to said feed means in the region of said trap means to establish in said feeding means between said conveyor and said cooker inlet an air pressure at least as high as said steam pressure in said tubular cooker to thereby inhibit the escape of steam from said cooker through said trap means into said feeding means.

8. In a grain cooker system: grain feeder means comprising a tube having an inlet opening at one end portion and a discharge opening at the other end portion and also having a screw conveyor therein extending substantially the length of said tube and rotatable for conveying grain to be cooked from said inlet opening to and through said discharge opening, a tubular cooker having an inlet substantially below said discharge opening and in vertically spaced relationship thereto, said grain feeder means also including a rotary trap interposed between and connected to said discharge opening and said inlet of said tubular cooker for conveying grain to be cooked from said discharge opening to said inlet of said tubular cooker, said trap having a housing sealed to said tube and to said cooker and forming a feeding path extending substantially in axial direction of said tubular cooker and a bladed rotary member in said housing preventing direct communication between said outlet opening and said cooker inlet, said cooker also having an outlet for discharging cooked grain and furthermore comprising a conveyor extending substantially the length thereof and including means for conveying grain continuously from said inlet of said cooker to the outlet thereof, steam supply means leading into said tubular cooker for feeding steam under pressure into said cooker, and means connected to said feeder means at a point between the inlet of said cooker and a point of said other end portion of said tube which other end portion is adjacent said discharge opening for supplying compressed air into said feeder means for maintaining in said feeder means at said other end portion an air pressure at least as high as the steam pressure in said cooker to thereby inhibit the escape of steam from said cooker through said rotary trap to said screw conveyor.

9. In a grain cooker system: grain feeder means comprising a tube having an inlet opening at one end portion and a discharge opening at the other end portion and also having a screw conveyor therein extending substantially the length of said tube and rotatable for conveying grain to be cooked from said inlet opening to and through said discharge opening, a substantially vertically arranged tubular cooker having an inlet substantially below said discharge opening and in vertically spaced relationship thereto, said grain feeder means also including a rotary trap interposed between and connected to said discharge opening and said inlet of said tubular cooker for conveying grain to be cooked from said discharge opening to said inlet of said tubular cooker, said trap having a housing sealed to said tube and to said cooker and a bladed rotary member in said housing preventing direct communication between said outlet opening and said cooker inlet, said cooker also having an outlet for discharging cooked grain and furthermore comprising a conveyor movable about the vertical axis of said cooker and extending substantially the length thereof and including means for conveying grain continuously from said inlet of said cooker to the outlet thereof, steam supply means leading into said tubular cooker for feeding steam under pressure into said cooker, and means connected to said feeder means at a point between the inlet of said cooker and a point of said other end portion of said tube which other end portion is adjacent said discharge opening for supplying compressed air into said feeder means for maintaining in said feeder means at said other end portion an air pressure at least as high as the steam pressure in said cooker to thereby inhibit the escape of steam from said cooker through said rotary trap to said screw conveyor.

10. In a grain cooker system: grain feeder means comprising a tube having an inlet opening at one end portion and a discharge opening at the other end portion and also having a screw conveyor therein extending substantially the length of said tube and rotatable for conveying grain to be cooked from said inlet opening to and through said discharge opening, a tubular cooker comprising a plurality of vertically superimposed tubular containers, each of said tubular containers having an inlet and an outlet, the arrangement being such that the outlet of an upper container is connected to the inlet of the next adjacent lower container, the uppermost container having an inlet substantially below said discharge opening and in vertically spaced relationship thereto, said grain feeder means also including a rotary trap interposed between and connected to said discharge opening and said inlet of said tubular cooker for conveying grain to be cooked from said discharge opening to said inlet of said tubular cooker, said trap having a housing sealed to said tube and to said cooker and a bladed rotary member in said housing preventing direct communication between said outlet and said cooker uppermost inlet, said cooker also having an outlet for discharging cooked grain and vertical shaft means common to and extending into all of said containers and furthermore comprising a conveyor in each of said containers connected to said vertical shaft means and extending substantially the length thereof and including means for conveying grain continuously from said inlet of said cooker to the outlet thereof, steam supply means leading into said containers of said tubular cooker for

feeding steam under pressure into said cooker, and means connected to said feeder means at a point between the inlet of said cooker and a point of said other end portion of said tube which other end portion is adjacent said discharge opening for supplying compressed air into said feeder means for maintaining in said feeder means at said other end portion an air pressure at least as high as the steam pressure in said cooker to thereby inhibit the escape of steam from said cooker through said rotary trap to said screw conveyor.

11. In a grain cooker system as claimed in claim 3, in which said tube of said feeding means forms a feeding path extending substantially in axial direction of said tubular cooker.

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