

E. H. REYNOLDS.
GRAIN PURIFYING APPARATUS AND PROCESS.
APPLICATION FILED JAN. 11, 1910.

1,067,342.

Patented July 15, 1913.

3 SHEETS-SHEET 1.

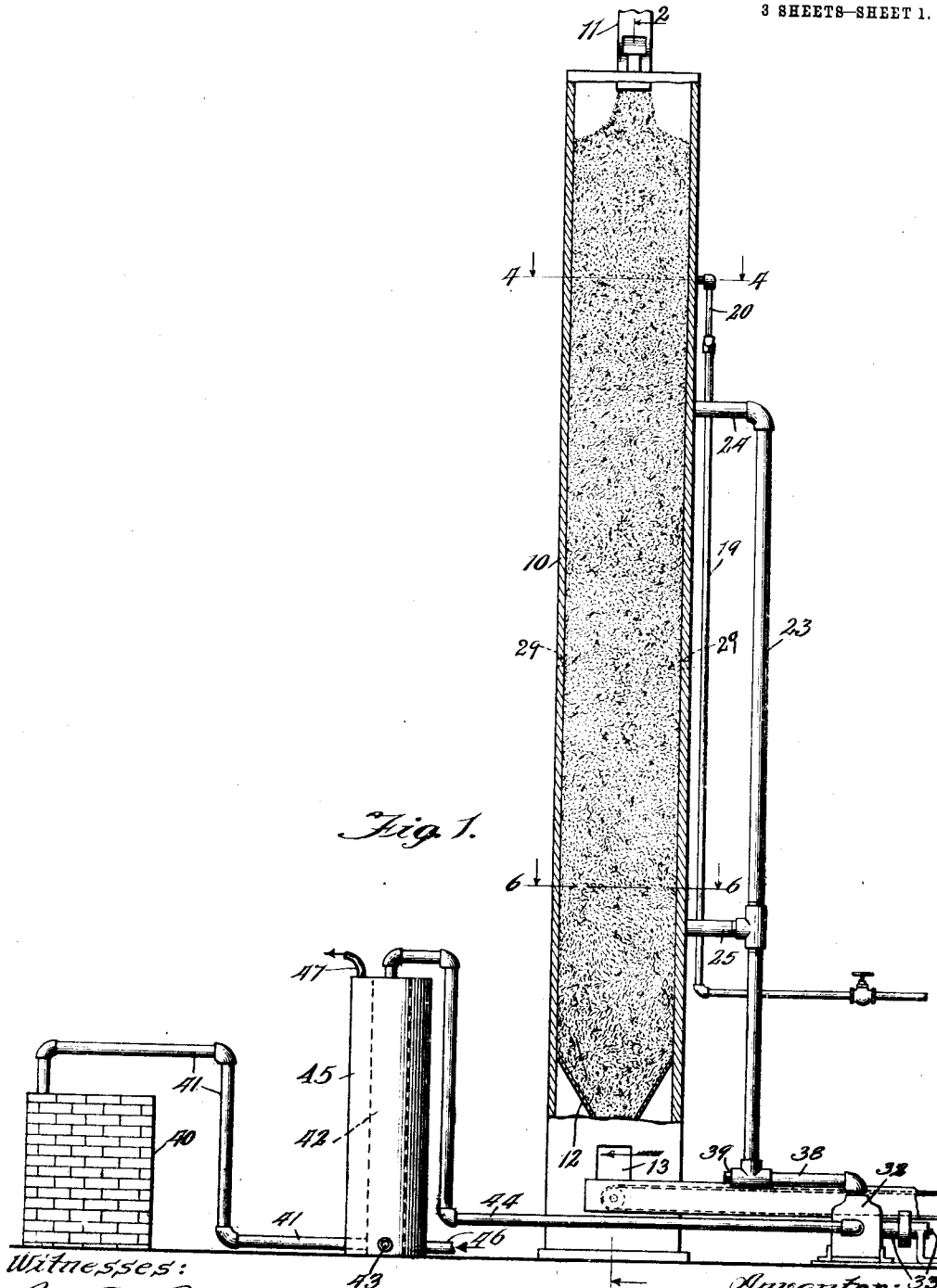


Fig. 1.

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Alfred J. Lancel.

Inventor: E. H. Reynolds
By Munday, Evans, Adcock & Clarke

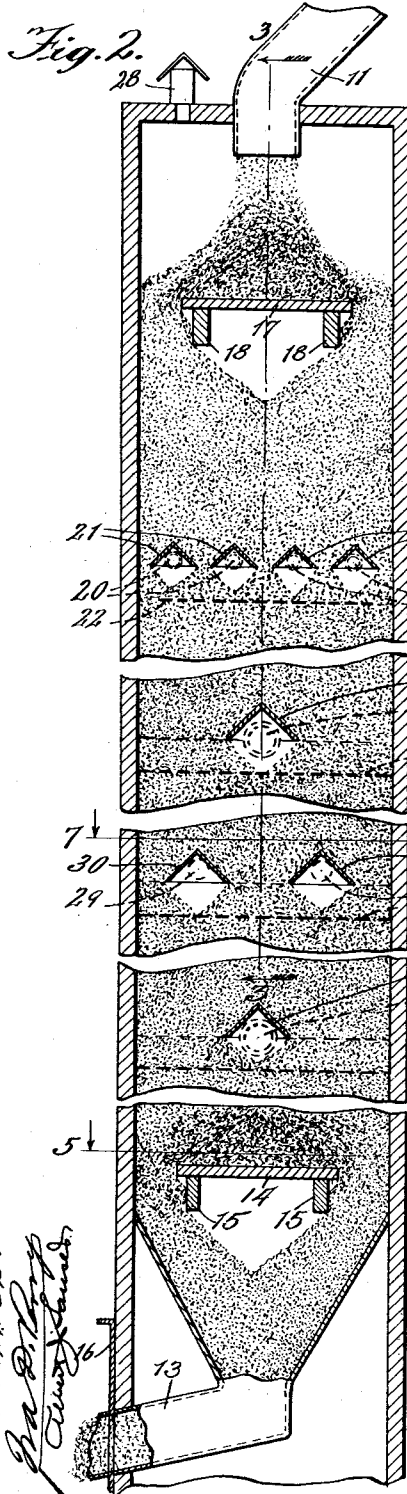
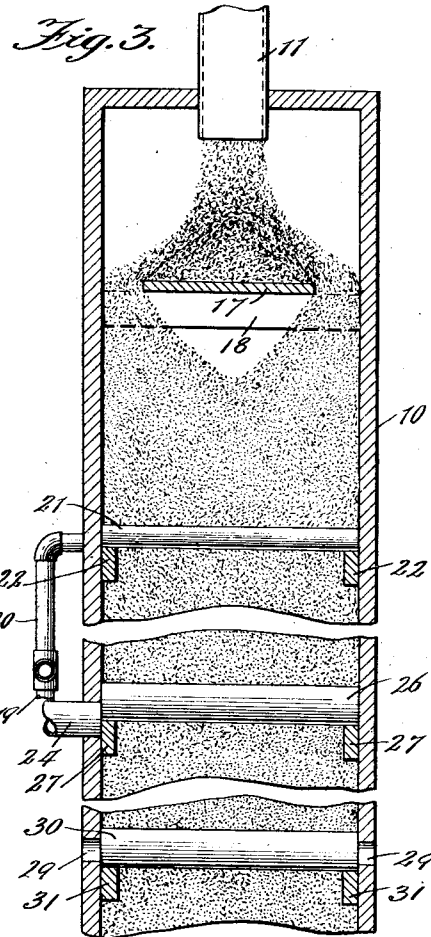
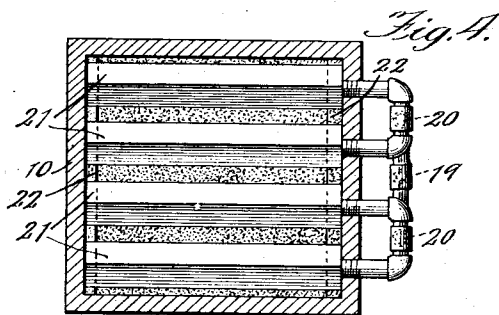
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 6.

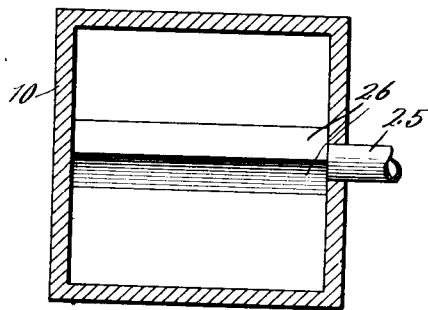


Fig. 5.

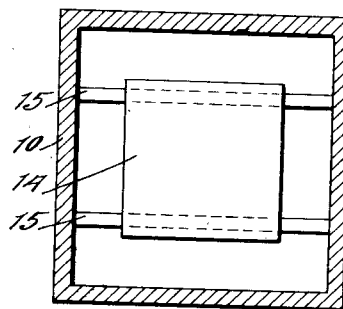


Fig. 7.

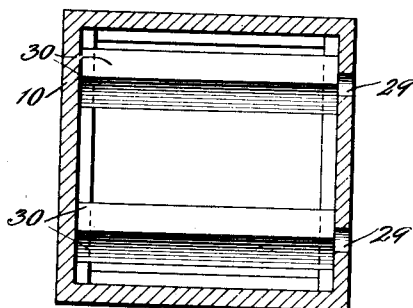
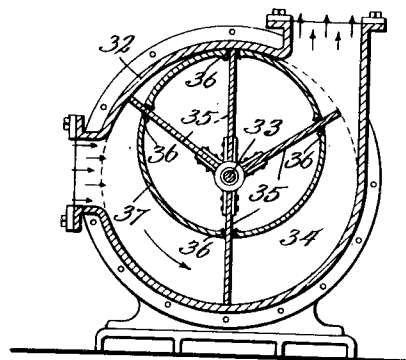


Fig. 8.



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UNITED STATES PATENT OFFICE.

EARL H. REYNOLDS, OF CHICAGO, ILLINOIS.

GRAIN-PURIFYING APPARATUS AND PROCESS.

1,067,342.

Specification of Letters Patent.

Patented July 15, 1913.

Application filed January 11, 1910. Serial No. 537,491.

To all whom it may concern:

Be it known that I, EARL H. REYNOLDS, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Grain-Purifying Apparatus and Processes, of which the following is a specification.

My invention relates to a grain purifying apparatus and process in which oats, barley, or other grains are treated with fumes, such as those of sulfur, for the purpose of purifying and whitening the grain and destroying any rust or other infection by which it may have been discolored, or otherwise superficially impaired. And the invention has for an object the providing of an apparatus and process that shall effect the required purification of the grain with the greatest possible uniformity and thoroughness and at the same time permit the grain to be treated in the largest possible quantities and at the lowest possible cost; and the invention has for further objects such other improvements in structure or function as may be found to obtain in the device or process hereinafter described or claimed.

In the accompanying drawings, forming a part of this specification, and in which like reference numerals indicate like parts in all of the figures, Figure 1 is an elevational view showing the complete apparatus exteriorly and with a side wall of the reservoir broken away to show the descending columnar mass of grain indicated within the grain reservoir; Fig. 2 is a vertical sectional view on the line 2—2 of Fig. 1, but with considerable portions of the columnar grain-reservoir broken away between the fumes inlets and the vent apertures, to accommodate such enlarged sectional view to the limits of the sheet; Fig. 3 is a partial vertical sectional view taken on a plane perpendicular to that of Fig. 2; Fig. 4 is a section on the line 4—4 of Fig. 1, to show the vapor inlet through which steam is forced into the upper part of the columnar mass; Fig. 5 is a section on line 5—5 of Fig. 2, to show the deflector-plate at the top of the hopper bottom of the reservoir, around which the grain flows out; Fig. 6 is a sectional view on the line 6—6 of Fig. 1 to show the fumes inlet through which sulfur fumes, under pressure, are forced into the body of the descending columnar grain-

mass; Fig. 7 is a sectional view on the line 7—7 of Fig. 2, to show the vent aperturing through which residual fumes are permitted to pass off from the body of the descending columnar grain-mass; and Fig. 8 is a vertical sectional view of the power driven compressor by which the sulfur fumes from the fumes generator are compressed and positively forced into the descending columnar grain-mass.

10 is a square vertical columnar grain-reservoir built of masonry and having a free internal cross area that is large in proportion to its height, as indicated in Fig. 1. The particular reservoir indicated in the drawing is about forty-five feet high and about five feet square. This reservoir is provided at its top with an inlet chute 11 through which the grain from the grain elevator flows constantly, keeping the reservoir filled with a close-packed columnar grain-mass that constantly settles toward and is discharged through the four-sided hopper outlet 12 at the bottom of the reservoir, said hopper outlet being provided with a laterally extended chute 13 through which the discharged grain passes to the bin or conveyer that is arranged to receive it. The hopper bottom of the grain-reservoir is also provided with the deflector plate 14, supported on horizontal cross beams 15 at the upper part of the hopper, whereby the outflowing grain is caused to be drawn off from the peripheral part of the descending grain column, so as to maintain a constant uniform outflow of the entire bottom portion of said grain column, precluding the tendency there would otherwise be for the grain to be drawn out from the central core of the column much more rapidly than from its peripheral part. To control the discharge outflow through the chute 13, and to entirely stop such outflow when the fumes treatment is stopped, the chute 13 is provided with a gate valve 16, arranged far enough from the bottom of the hopper to prevent any possibility that the partial closing of such a gate might interfere with the uniform drawing off of the grain from all four sides of the said hopper bottom of the grain-reservoir. Just under the mouth of the inlet chute 11 there is provided another deflector plate 17, supported on the horizontal cross beams 18, to cause the inflowing grain to be immediately distributed as uni-

formly as possible over the top of the descending columnar grain-mass within the reservoir.

Somewhat below the top of the descending columnar grain-mass within the reservoir, steam is introduced, from the steam pipe 19, through the steam inlets 20 that open into one end of the transverse steam ducts 21 that are of inverted-V shape and are supported at either end on the cross-beams 22. The descending grain-mass passes around these steam ducts, as indicated in Fig. 2, and the steam is forced out from under said ducts into the upper portion of said grain-mass, the steam supply being regulated to furnish just the limited amount of steam requisite to slightly moisten the grain before it comes into contact with the sulfur fumes that are forced into said grain-mass some distance below such steam inlet. At two points within the height of the reservoir, one considerably below and the other considerably above its middle, the sulfur fumes are forced into the descending columnar grain-mass from the fumes pipe 23 having the two lateral branches 24 and 25, respectively let into the lower part and the upper part of the masonry wall of one side of the reservoir. To permit the fumes to be immediately forced into the whole transverse area of the descending grain-column, each of these fumes inlets is provided, inside the reservoir, with a transverse fumes duct 26 that is of inverted-V shape and supported at either end by the cross-beams 27. The descending columnar grain-mass passes around each of these fumes ducts, as indicated in Fig. 2, and the compressed fumes, entering under positive pressure from the fumes pipe, are positively forced into and permeate throughout the entire close-packed mass of the said descending grain column within the reservoir. The uniform distribution of the said fumes is insured by the homogeneous character of the directly incased and closely confined and compacted grain-mass itself, and by the absence of any air-spaces or cavities into which the fumes may be drawn off or collected away from the grain, and by the constant and uniform settling of the grain as its columnar mass descends in the reservoir. By reason of this forcing of the fumes into the solid and uniformly settling grain-mass, with an absence of any air-spaces or cavities into which such fumes may draw off and collect, it also becomes possible to gage the fumes-supply to an amount just about sufficient to properly impregnate the grain-mass without there being any considerable residuum of waste fumes and only a restricted vent-aperturing is required. To draw off whatever residual fumes there may be, however, and also to prevent an injurious excess of fumes from being forced into

the grain-mass, there is provided a hooded vent aperture 28 at the top of the grain reservoir and also the vent aperturing 29 located at about the middle of two of the vertical sides of the reservoir, the latter aperturing opening into the ends of the transverse vent ducts 30 that are of inverted-V shape and supported on the cross-beams 31 inside the reservoir. The descending grain-mass passes around these vent ducts, as indicated in Fig. 2, and residual fumes from the surrounding grain-mass draw off into these vent ducts and are discharged into the outer air. The fumes forced under positive pressure into the descending columnar grain-mass will both ascend and descend from each fumes inlet, because of the uniform resistance that the homogeneous grain-mass offers to such fumes, and because such resistance of the constantly settling close-packed grain-mass is only overcome by a fumes pressure of such amount that mere warmth of the fumes will not determine the direction of the fumes; and the fumes ascending from each fumes inlet may not be greater in quantity than the fumes forced downward from each inlet. Thus in actual operation there may also be some venting of residual fumes through the hopper bottom of the reservoir, such fumes having been forced or carried downward, through or with the constantly settling grain-mass, from the lower of the two fumes inlets. The forcing of the fumes through the fumes pipe that leads to the fumes inlets of the reservoir, is effected by the positive rotary force-pump 32, located to one side of the base of the reservoir. This compressor is of the rotary type shown in Fig. 8 and is entirely positive in its action, permitting a considerable compression of the fumes. In this type of pump, the power-driven shaft 33 rotates in the axis of the cylindrical chamber 34 and has pivotally connected with it four radial vanes 35 that project out through the slots 36 in the hollow cylinder 37 that is eccentric to the said shaft 33 and that rotates on its own axis simultaneously with the rotation of said shaft 33. These vanes swing on the shaft and are drawn in and thrust out through the said slots in the eccentrically positioned cylinder 37 as the latter rotates, in a manner that is apparent from Fig. 8 of the drawings and that is well known in this type of rotary pump. As the fumes are positively trapped between the successively passing vanes of this pump, as said vanes are swung across the inlet of the pump 34, and are positively expelled as the vanes pass the outlet port of said chamber, rapid rotation of the pump shaft effects a positive and considerable compression of the fumes in the outlet pipe that lead to the grain reservoir. Furthermore, the several moving parts in the pump chamber are ob-

viously so related to, and make such contact with, each other that they constantly tend to clear each other of any corrosion or deposit that the sulfur fumes cause to occur within the pump chamber, and all such matter scraped from or otherwise present in the pump chamber is positively expelled from the outlet port and so prevented from accumulating and causing sticking or undue wear of the working parts within said chamber, thus overcoming an important difficulty that would otherwise be presented in attempting to effect positive compression of sulfur fumes. Any corrosion products or other deposits so expelled from the pump are precipitated in the short horizontal length 38 of the fumes pipe that leads to the grain reservoir, such short length of pipe, as well as the base of the upright length of the fumes pipe, being cleared occasionally by removing the accumulation through the plugged orifice 39 at the base of the upright length of the fumes pipe.

The fumes are generated in the sulfur furnace 40 and are carried first, through the pipe 41, into the cooling and precipitation chamber 42, where their temperature is lowered and most of the flower of sulfur carried over from the furnace is precipitated, such precipitation being occasionally cleared out through the vent-gate 43 at the base of the cooling chamber. From said chamber the fumes pass over through the pipe 44 into the chamber of the rotary pump. The chamber 42 is cooled by the surrounding water-jacket 45, in which a circulation of water is maintained by means of the water-inlet 46 and water-outlet 47.

The preferred embodiment of my invention is hereinabove set forth, but it may be otherwise embodied within the scope of the claims hereinafter made.

I claim:—

1. In a grain-purifier, in combination: a columnar grain-reservoir having a grain inlet and a grain outlet and adapted to directly incase the grain and to have the grain pass through it in a continuously settling and closely confined and compacted columnar mass; mechanism adapted to compress fumes and positively force them into and through said columnar grain-mass; and restricted vent-aperturing for discharging from said reservoir the residual fumes from such fumes-permeated grain-mass; the vent-aperturing and the intake of the fumes being widely separated longitudinally of the grain column; substantially as specified.

2. A process of purifying grain, consisting in positively forcing compressed fumes into and through a directly incased and continuously settling and closely confined and compacted columnar mass of grain that has been moistened, and at the same time restrictedly venting the residual fumes from

such fumes-permeated grain-mass, the venting and the fumes inflowing being performed at positions widely separated longitudinally of the columnar grain-mass, substantially as specified.

3. In a grain-purifier, in combination: a columnar grain-reservoir having a grain inlet and a grain outlet and adapted to directly incase the grain and to have the grain pass through it in a continuously settling and closely confined and compacted columnar mass; mechanism adapted to compress fumes and positively force them into and longitudinally through said columnar grain-mass; and restricted vent-aperturing for discharging from said reservoir the residual fumes from such fumes-permeated grain-mass; substantially as specified.

4. In a grain-purifier, in combination: a columnar grain-reservoir having a grain inlet and a grain outlet and adapted to directly incase the grain and to have the grain pass through it in a continuously settling and closely confined and compacted columnar mass; a vapor-supply device for injecting into said mass the vapor to moisten it; mechanism adapted to compress fumes and positively force them into and longitudinally through said columnar grain-mass; and restricted vent-aperturing for discharging from said reservoir the residual fumes from such fumes-permeated grain mass; substantially as specified.

5. A process of purifying grain, consisting in positively forcing compressed fumes into and longitudinally through a directly incased and continuously settling and closely confined and compacted columnar mass of grain that has been moistened, and at the same time restrictedly venting the residual fumes from such fumes-permeated grain-mass; substantially as specified.

6. In a grain-purifier, in combination: a columnar grain-reservoir having a grain inlet and a grain outlet and adapted to directly incase the grain and to have the grain pass through it in a continuously settling and closely confined and compacted columnar mass, said outlet being hopper-formed and provided with a deflector arranged to cause the grain to be drawn off from the peripheral part of said columnar mass; mechanism adapted to compress fumes and positively force them into and longitudinally through said columnar grain-mass; and restricted vent-aperturing for discharging from said reservoir the residual fumes from such fumes-permeated grain-mass; substantially as specified.

7. In a grain-purifier, in combination: a columnar grain-reservoir having a grain inlet and a grain outlet and adapted to directly incase the grain and to have the grain pass through it in a continuously settling and closely confined and compacted col-

ummar mass; mechanism adapted to compress fumes and positively force them into and longitudinally through said columnar grain-mass, said mechanism being provided with downwardly open ducts arranged transversely inside the reservoir and adapted to distribute the compressed fumes within the said grain-mass; and restricted vent-aperturing for discharging from said reservoir the residual fumes from such fumes-permeated grain-mass; substantially as specified.

8. In a grain-purifier, in combination: a columnar grain-reservoir having a grain inlet and a grain outlet and adapted to directly incase the grain and to have the grain pass through it in a continuously settling and closely confined and compacted columnar mass; mechanism adapted to compress fumes and positively force them into and longitudinally through said columnar grain-mass; and restricted vent-aperturing for discharging from said reservoir the residual fumes from such fumes-permeated grain-mass, said aperturing being provided with downwardly open ducts arranged transversely inside the reservoir and adapted to collect and discharge such residual fumes from within said grain-mass; substantially as specified.

9. In a grain-purifier, in combination: a columnar grain-reservoir having a grain inlet and a grain outlet and adapted to directly incase the grain and to have the grain pass through it in a continuously settling and closely confined and compacted columnar mass; a vapor-supply device for injecting into said grain-mass the vapor to moisten it, said device being provided with ducts arranged inside the reservoir and adapted to distribute such moistening vapor

within the grain-mass; mechanism adapted to compress fumes and positively force them into and through said columnar grain-mass; and restricted vent-aperturing for discharging from said reservoir the residual fumes from such fumes-permeated grain-mass; substantially as specified.

10. In a grain-purifier, in combination, a columnar grain-reservoir having a grain inlet and a grain outlet and adapted to directly incase the grain and to have the grain pass through it in a continuously settling and closely confined and compacted columnar mass; a fumes-inlet; mechanism adapted to force fumes longitudinally through said columnar grain-mass; and restricted aperturing, longitudinally remote from said fumes-inlet, for the egress from said reservoir of the residual fumes from such fumes-permeated grain-mass; substantially as specified.

11. A process of purifying grain, consisting in admitting fumes to and forcing them longitudinally through a directly incased and continuously settling and closely confined and compacted columnar mass of grain that has been moistened, and at the same time restricting the outflow of the residual fumes from such fumes-permeated grain-mass so that such outflow shall be longitudinally remote from the inflow of the fumes into said columnar grain-mass; substantially as specified.

In testimony whereof I hereunto set my hand in the presence of two subscribing witnesses.

EARL H. REYNOLDS.

Witnesses:

PEARL ABRAMS,
HENRY LOVE CLARKE.