Oct. 3, 1933. O. STRUB 1,929,084

VENTILATING SILO

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Fig. 1

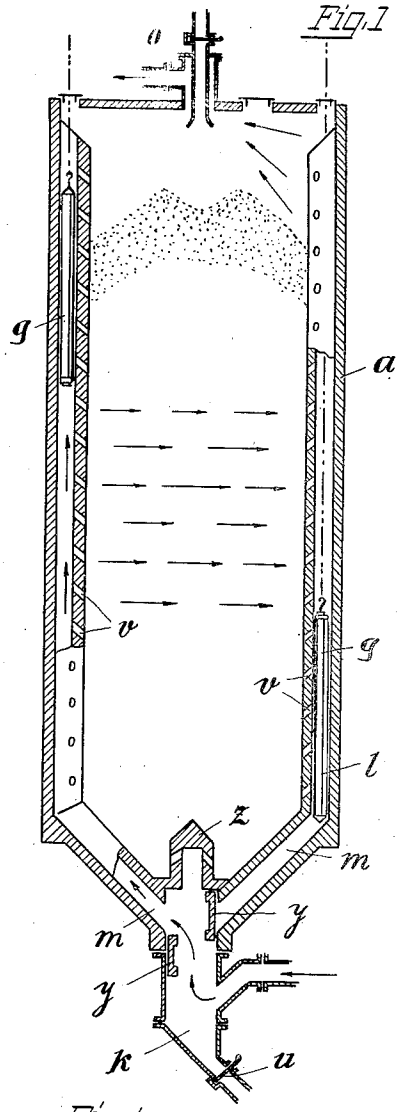


Fig. 2

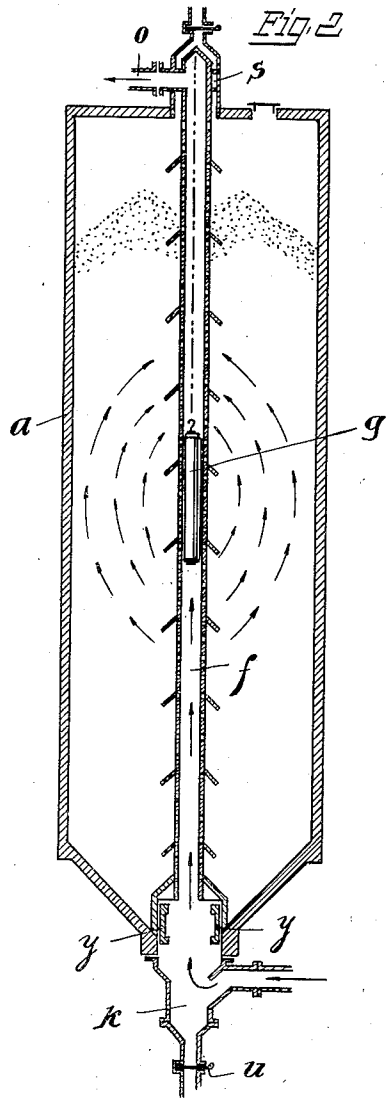


Fig. 4

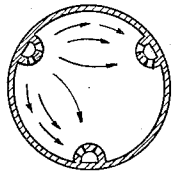


Fig. 5

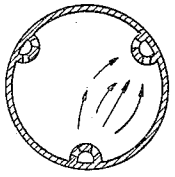
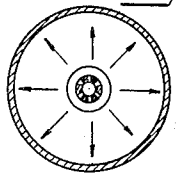


Fig. 9



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Fig. 3

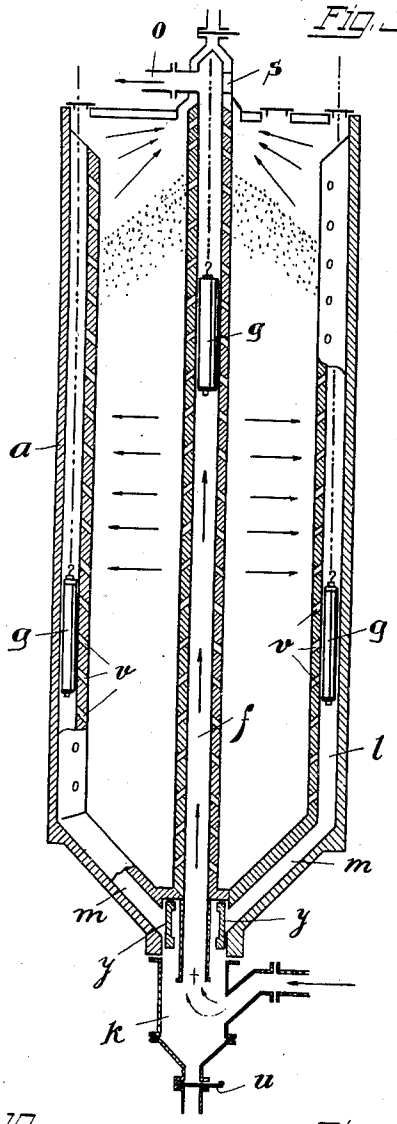


Fig. 8

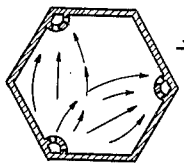


Fig. 7

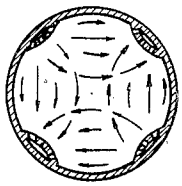


Fig. 6



Fig. 13

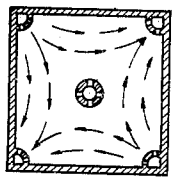


Fig. 10

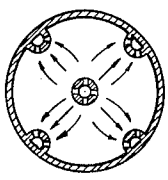


Fig. 11

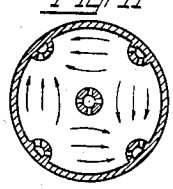
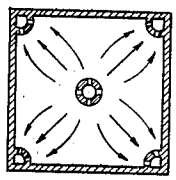


Fig. 12



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UNITED STATES PATENT OFFICE

1,929,084

VENTILATING SILO

Othello Strub, Munich, Germany, assignor of one-half to Leo Littmann, Munich, Germany

Application July 15, 1929, Serial No. 378,386, and in Germany July 23, 1928

10 Claims. (Cl. 98—55)

My invention relates to an improved method of and apparatus for ventilating grain silos and similar structures.

Numerous methods of ventilating silos are known to the art and so far as I am aware all such methods effect the desired ventilation by conducting at one time, a current of air through the entire silo. The method of my invention distinguishes from prior art methods by the fact that I ventilate vertical sections of the silo in periodical alternation and by a succession of a proper number of such ventilations the entire silo or selected parts thereof or grain stratums may be effectively ventilated.

The vertical sections to be ventilated may be the entire height of the silo or sections of less vertical extent and if successive parts of a vertical section are ventilated, the ventilating action would be more thorough and intense than if the entire vertical section were ventilated at one time.

In the practical application of my improved method I provide silo with one or more conduits having air openings therein, each conduit being controllably connected to a source of air under pressure and each conduit also having means for controlling the outflow of air from and the inflow of air to the conduit. Where the silo contains a plurality of such vertical conduits, the latter are connected preferably to a common air supply source but the admission of air to each conduit is independently controlled.

The improved apparatus of my invention is illustrated in the accompanying drawings in which Figure 1 is a vertical sectional view of a silo having a plurality of air conduits therein; Figure 2 is a similar view of a modified form containing a single, central air conduit; Figure 3 is a similar view of another modified form containing a central air conduit and additional wall conduits; and Figures 4 to 13 are horizontal sectional views illustrative of the various paths which the air may take in the silo for ventilation purposes.

The silo of Figure 1 may be of round, square or polygonal cross-section with smooth full walls *a* and has three or more (as a rule 3 or 4) vertical conduits such as pipes or chimneys *l* adjacent the silo walls. These pipes can either be iron, in which case they are perforated and provided at intervals with protecting shelves, as shown in Figure 2 or else they are of concrete or stone with smooth sides having, in the same way as the chimneys which may be substituted for the pipes, ports *v*, which incline down towards the interior of the silo. All these conduits are inter-connected at the foot of the silo by converging conduits *m* or by connecting tubes joining them, all leading to a common air supply conduit *k*, to supply the air at will to all but one simultaneously or to individual pipes or chimney *l* from a single source of supply. In this way each of the converging conduits or connecting tubes *m* can be opened or closed independently by means of simple slides or other cut-off mechanism *y*. With this arrangement the supply of air to the interior of the silo may be regulated at will by means of the slides, so that either one pipe or chimney *l* alone is provided with air, or several simultaneously. The flow of air out of the conduits *l* may be so regulated that any desired vertical section of the interior of the silo is ventilated, and the periodic alternation above referred to may be effected.

In addition to providing each conduit from the common supply conduit *k* with a slide control, permitting the supply of air to the interior of the silo to be determined at will, further control of the air is allowed for in the interior of the silo itself, by means of adjustable long-plungers *g* arranged in the vertical pipes or chimneys which plungers control by their relative position the upper and lower limit of the grain column ventilated.

These long-plungers are of a length corresponding to the longest horizontal distance traversed by the air as it issues within the silo from one of the conduits *l*. If these plungers are suitably adjusted in two or more pipes or chimneys *l*, an example of which may be seen in Fig. 1, a part only of the vertical section is subjected to the flow of air and the ventilation of the interior of the silo only takes place in the horizontal section each time desired, which may of course be the lower, middle or upper section, or also the full height of the contents of the silo.

The cut-offs or valves *y* constitute lower air control means and the plungers *g* constitute upper air control means for the conduits *l*.

The silo as a whole as well as desired individual vertical parts thereof limited by arbitrarily selected upper and lower horizontal boundaries may, by the proper adjustment of the air control members, be subjected to periodically alternating ventilation in any desired sequence, these several ventilating phases complementing one another until the ventilation of the silo is completed. A complete ventilation is thus effected in two or more successive ventilating phases, which are illustrated in Figures 4 to 13. Figures 4 and 5 illustrate two complementary ventilating phases of a silo round in cross-section and provided with three conduits *l*. Figure 6 illustrates a square silo having four vertical conduits, the air passing diagonally through the silo. This diagonal passage of the air may be considered an initial ventilating phase which may be complemented by a second phase in which the air passes along the wall of the silo, somewhat as shown in Figure 13. Figure 7 illustrates a round silo with four vertical conduits, in which the air is directed along the silo walls and this ventilating phase may be complemented by a succeeding diagonal phase

analogous to the diagonal phase illustrated in Figure 6. Figure 8 shows a hexagonal cell and the ventilating phase here illustrated may be complemented by one analogous to the phase illustrated in Figure 5. The ventilation of a silo may be effected in only two phases or, dependent upon the adjustment of the air control members, three or more phases may be employed.

The silo according to Fig. 1 may have a ventilation projection *z* in the centre of the conic base of the silo interior for the purpose of aerating the grain present in the conic base and is in direct, controllable connection with the common air supply *k*. The drawing also shows the converging of two conduits *l* at the foot of the silo, one slide *y* being closed and the other open.

From the compressed air supply inlet *k* the branches *m* extend to the various conduits *l*.

The silo roof is provided with an air exit projection *o* and the loading pipe for the grain, which pipe may be closed with a slide.

The modification of Figure 2 is a simplified form well adapted for small silos and has but a single vertical conduit *f* in the center of the silo. The air may be admitted to the top or bottom of the conduit *f*, the latter being provided with the adjustable plunger *g*. As the length of the piston or plunger *g* corresponds to the longest horizontal air path or the distance from the conduit *f* to the silo wall, the flow of the air will be in a natural curve to the silo wall as indicated by the arrows. By moving the plunger to different positions, the successive parts of the silo considered vertically as well as horizontally may be ventilated in periodic sequence, until the entire silo contents, including the base cone, have been aerated. Figure 9 is a section of the modified form of Figure 2, the silo being shown round.

The modified form illustrated in Figure 3 is particularly designed for large capacity silos and includes a central vertical conduit *f* as well as a number of such conduits *l* adjacent the silo walls. All of these conduits are provided with plungers or pistons *g* of the specified length and each conduit communicates at the base of the silo with the common air supply *k*. Each conduit also has a lower air inlet control member. Figures 10, 11, 12 and 13 illustrate the paths of the air flow in ventilating a silo such as that shown in Figure 3.

The decided advance over the art which is achieved by the several forms of the invention herein described is that by the use of very simple means, such as the vertical conduits associated with the air control members, a most comprehensive ventilating action of all parts of the silo can be effected by periodically successive ventilation. The ventilation may concentrate at any part of the silo so that the intensity of ventilation at any desired part of the silo may be regulated. All of these features are combined with economy and simplicity of construction as well as ease of operation.

I claim:

1. A grain silo having perforated conduits extending lengthwise within the silo adjacent the silo walls, means common to the conduits for admitting air thereto at one end of the silo, air cut-off means for each conduit and plungers of a length at least equal to the distance between conduits for controlling the flow of air into and out of selected perforations in each conduit.

2. A grain silo having a perforated conduit extending lengthwise within the silo, means for supplying air to one end of the conduit, air cut-off means at said end of the conduit and a plunger adjustable within the conduit to close selected groups of perforations.

3. A grain silo having a perforated conduit extending lengthwise within the silo, means for supplying air to one end of the conduit, air cut-off means at said end of the conduit and a plunger adjustable within the conduit, said plunger being of a length equal to the longest transverse path of the air in the silo.

4. A grain storage chamber comprising a plurality of perforated air induction and eduction pipes longitudinally disposed in said chamber and adapted for interchangeable use, an air inlet common to all pipes, an air supply connected to said inlet, controlling means associated with said inlet to cut off selected pipes from the air supply, all said pipes communicating with the outside, plungers movably disposed in all said pipes, the plungers of the air induction pipes forming with their lower ends the upper ends and limits for the induction pipes and being adapted to force the air admitted through said inlet out of the perforations of the pipes, the plungers of said air eduction pipes always forming with their upper ends the bottoms of the air eduction pipes, the air stream from pipes to pipes being controlled as to shape and height by the said plungers.

5. A grain storage chamber as claimed in claim 4, in which said pipes are disposed adjacent the chamber walls and one pipe substantially centrally of the chamber.

6. A grain storage chamber comprising a substantially centrally positioned perforated pipe connected to a compressed air supply, the upper end of the pipe communicating with the outside, a plunger movable in said pipe dividing the same into two portions, the lower end of the said plunger forming the upper end and limit of the air induction portion of the pipe and the upper end of said plunger forming the bottom of the air eduction portion of the pipe, said plunger adapted to force the air radially into the grain, the air eduction portion of the said pipe receiving the air seeking to escape through the outlet offering the least resistance, whereby the grain portion situated along the said plunger is ventilated.

7. A storage chamber, as claimed in claim 4, in which said plungers have a length at least equal to the distance from one pipe to another pipe.

8. A grain storage chamber, as claimed in claim 4, in which said pipes are disposed adjacent the chamber walls and one pipe is arranged substantially centrally of the chamber, the plungers in said pipes having a length at least equal to the distance from one pipe to another pipe.

9. A storage chamber, as claimed in claim 6, in which said plunger has a length at least equal to the distance from the pipe to the chamber walls.

10. A grain silo having therein a plurality of perforated pipes usable interchangeably as air induction and air eduction conduits, plungers movable to predetermined positions in said pipes to form the upper and lower limits, respectively, for the flow of air out of one pipe into another and means for selectively controlling the supply of compressed air to said pipes.

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