

No. 731,682.

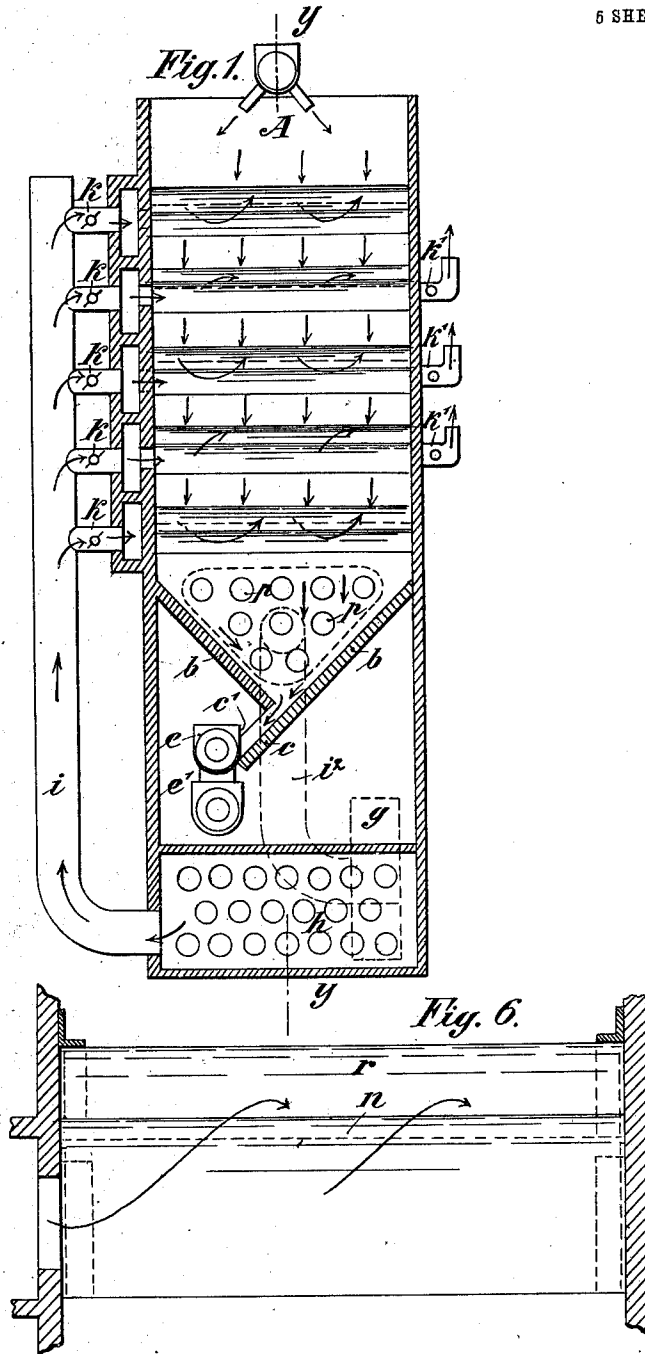
PATENTED JUNE 23, 1903.

O. M. HILLIG.
DRYING OR COOLING APPARATUS.

APPLICATION FILED SEPT. 28, 1901.

NO MODEL.

5 SHEETS—SHEET 1.



Witnesses
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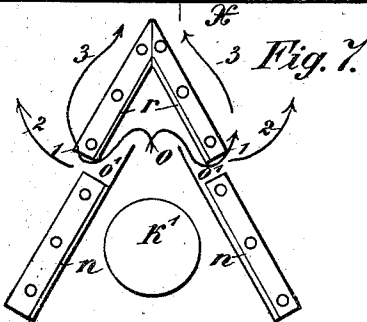
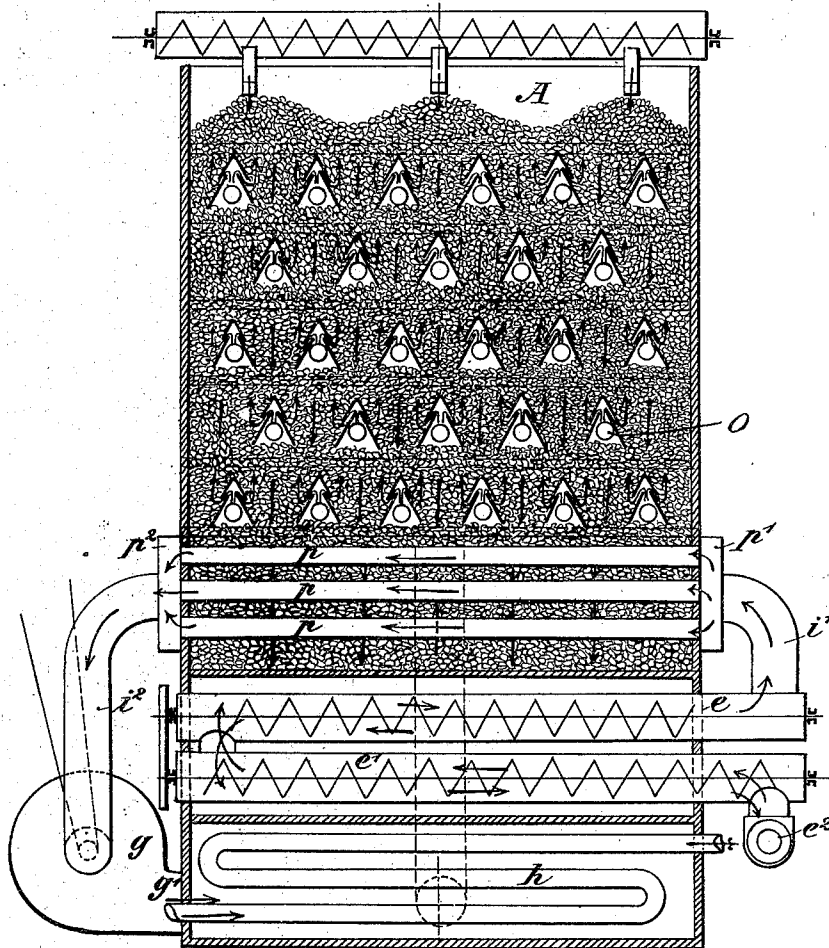
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5 SHEETS—SHEET 2.

Fig. 2. $\mathcal{H}$



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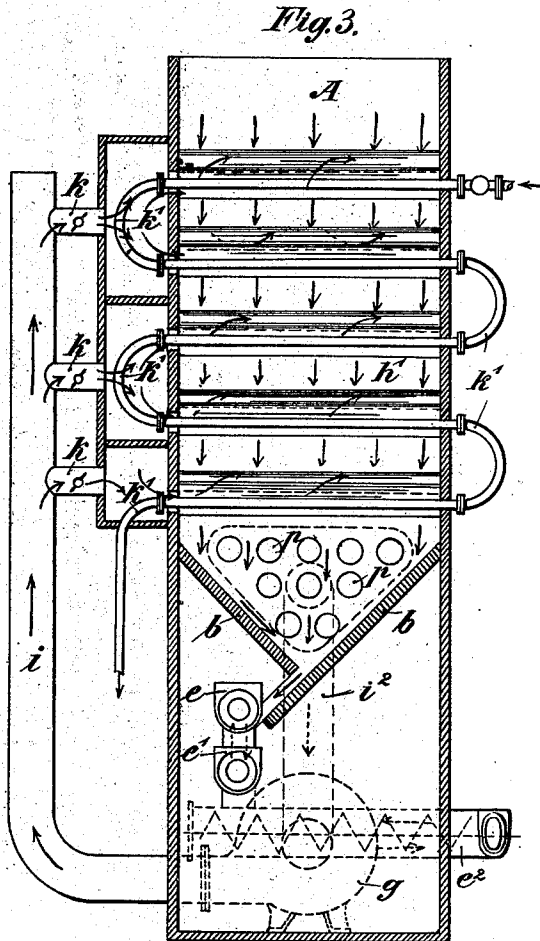
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5 SHEETS—SHEET 3.



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5 SHEETS—SHEET 5.

Fig. 5.

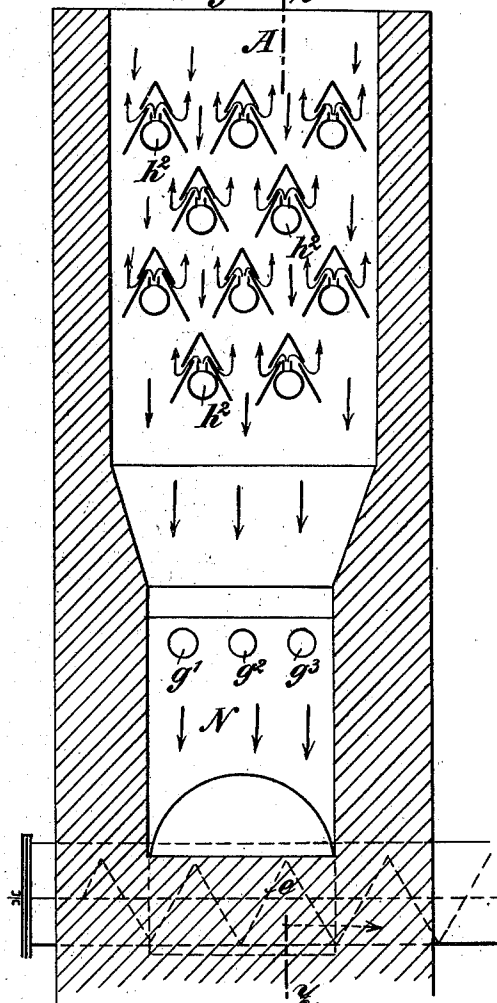
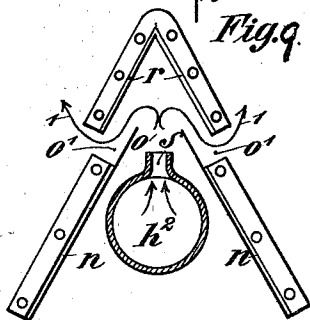


Fig. 9.



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UNITED STATES PATENT OFFICE.

OTTO MORITZ HILLIG, OF BERLIN, GERMANY.

DRYING OR COOLING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 731,682, dated June 23, 1903.

Application filed September 28, 1901. Serial No. 76,895. (No model.)

To all whom it may concern:

Be it known that I, OTTO MORITZ HILLIG, engineer, a subject of the King of Prussia, Emperor of Germany, residing at Haidestrasse 20, Berlin, in the Kingdom of Prussia and Empire of Germany, have invented certain new and useful Improvements in Improved Drying or Cooling Apparatus, of which the following is a full, clear, and exact description.

The object of this invention is to cause substances in granular or piece form which are conveyed through a silo-like vessel at a greater or lesser degree of speed to be permeated by gases for the purpose of drying or cooling them in such a manner that all the strata or layers of the said substances may as far as possible be simultaneously brought into contact with the cooling or drying gas and the last-named pass readily between the grains or pieces of the material to be dried or cooled and the drying or cooling effect of the apparatus be accelerated and increased without the drying or cooling medium being applied at an excessively high or low temperature or in excessively large quantity or at an increased rate of speed, whereby the drying or cooling process would be carried out at greater cost than usual. In the invention hereinafter described the purpose indicated is effected by a new kind of heating or cooling elements, which are introduced under a certain proper arrangement into the vessel through which the material to be treated passes and enable the drying or cooling medium to be very easily and thoroughly conveyed to the material through slots arranged in the sides of such elements and over which the material moving downward, chiefly through its own weight, slides along. In connection herewith of course the motion of the drying or cooling material is effected in the opposite direction to that of the material to be treated, besides which an arrangement can be contrived whereby the drying or cooling medium by being drawn up through the material already fully treated can be preliminarily heated or cooled and the said material deprived simultaneously of heat or cold, which can then be utilized in the whole process, whereas in the ordinary drying or cooling process it is lost.

The invention is illustrated in the accompanying drawings, Figure 1 being a vertical

section along the line X X in Fig. 2 and representing a form of the drying or cooling apparatus in which the new distributing elements are arranged in the silo-like receptacle without the heating organs that run through them, a special chamber being provided, on the other hand, which is furnished with heating or refrigerating coils. Fig. 2 is a section along the line Y Y in Fig. 1; Fig. 3, a central vertical section showing an apparatus in an altered form, in which the new distributing elements have pipes running direct through them, in which a heating or cooling fluid circulates, and in which therefore a heating or cooling chamber for the said fluid is not necessary. Fig. 4 is a section along the line Z Z in Fig. 5, representing an apparatus in a varied form, in which combustion-gas produced in a fireplace is introduced direct into the distributing elements for the purpose of drying substances in grains or pieces. Fig. 5 is a section along the line U U in Fig. 4; Fig. 6, a front view, on an enlarged scale, showing a distributing element as applied in the apparatus illustrated in Figs. 1 and 2, together with the sides of the receptacle belonging thereto. Fig. 7 is an end view of Fig. 6. Figs. 8 and 9 are views corresponding to those in Figs. 6 and 7 and intended for more precise illustration of the distributing elements employed in the apparatus shown in Figs. 3 to 5.

The construction and working of the apparatus are described below with reference to the drawings and with the limitations that the apparatus is only regarded as employed for drying and not for cooling and that atmospheric air is assumed to be the drying medium for the apparatus, as shown in Figs. 1 to 3.

Considering first Figs. 1 and 2, the new drying apparatus consists of a silo-like receptacle A, to which the material to be dried is conveyed from above, the lower portion of the receptacle being limited by oblique walls *b*, an opening *c* being left through which the material can pass out of the receptacle A in order to be conveyed by conveyers *e* *e'* *e''* or any other conveying organs. Between the oblique walls *b* *b* are a number of pipes *p*, with their ends secured in the walls of the receptacle A. Conveyers *e*, *e'*, and *e''* are suitably positioned to receive and carry the dried grain as it

emerges from the opening between the oblique walls *b b*. The conveyer *e* is in communication with one end of the pipes *p* through the elbow *i*, as shown in Fig. 2. The opposite ends of the pipe *p* communicate with a pipe *i*², leading to a fan *g*, said fan discharging into a chamber at the bottom of the casing which is heated by the coil *h*. The arrow *g'* indicates the direction of the current from the fan. The receptacle is provided with a series of pipes *O*, lying at right angles to the pipes *p*, the said pipes being arranged in rows, the pipes of one row being intermediate of those of the rows above and below it. The pipes are protected in order that the grain may not contact with them that a free circulation of the drying agent may be afforded, and to this end each pipe is provided with a shield comprising two obliquely-set walls *n n*, which are secured to the walls of the receptacle in any suitable manner. The opening between the walls *n* and *n* is guarded by an inverted-V-shaped plate *r*, extending on a plane above the plane of the walls *n n* and terminating a suitable distance therefrom in order to produce the openings *o'*, through which the heating agent may escape in the direction of the arrows 1, 2, and 3. As shown in Fig. 2, the grain descending through the receptacle is directed in alternate courses, so as to be sufficiently agitated to permit the heating agent to act on all of the grain. The pipes *O* receive the heated air through the pipe *i*, which is in communication with the chamber in the bottom of the receptacle. Valves *k* control the circulation from the pipe *i* to the pipes *O*, and the valves *k'* control the passages from the pipes *O* to the atmosphere.

In operation the air at its normal temperature is carried through the casings of the conveyers and through the pipes *p* to the fan *g*, whereby its temperature is increased, said air being heated through the action of the heated grain, which has passed through the receptacle *A* into the conveyers. The temperature of the air is further heightened in passing through the chamber in the bottom of the receptacle from whence it escapes to the pipe *i* and is circulated through the pipes *O*.

In Figs. 4 and 5 I have shown a slightly-modified construction in which pipe *h*², corresponding with the pipes *O*, as heretofore described, is opened and discharges to the interior of the receptacle instead of passing through the receptacle incased, as in Figs. 1 and 2.

In Fig. 3 the heating agent is carried continuously through a coil passing through the receptacle in which the grain descends while being dried. In the latter application the

furnace *K* has grate-bars *R* and ducts leading upward to the end of the pipe *h*², and the heat rising in the passage *K* enters the pipe *h*² and then passes out, as indicated by the arrow, Figs. 4, 5, and 9. In this form the conveyer *e*² is at the bottom of the inclined floor of the silo.

Having fully described the invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a device of the character described, a receptacle, pipes extending therethrough, walls set obliquely partially embracing the pipes, roof-shaped walls over the opening between the walls partially embracing each pipe, pipes near the bottom of the receptacle, conveyers for carrying the dried grain from the receptacle, means for drawing air through the conveyers and pipes in the bottom of the receptacle, a heating-chamber through which the air is directed and means for carrying the heated air from the chamber to the first-named pipes, as and for the purpose described.

2. In a device of the character described, a receptacle, pipes therein, walls for protecting said pipes, an inverted-V-shaped covering for the space between the walls, the plane of said covering being above the plane of the walls, the parts being so positioned as to provide an opening between the lower edges of the cover and the upper edges of the walls, pipes extending through the receptacle near its bottom, conveyers for carrying the heated grain from the receptacle, an elbow connecting one of the conveyers with the pipes in the bottom of the receptacle, a heating-chamber in the receptacle, means for drawing air from the conveyer and forcing it through the heating-chamber to the first-named pipes, substantially as described.

3. In a device of the character described, a receptacle for drying grain, means for furnishing heat to the receptacle, a conveyer for carrying the grain from the receptacle, air-pipes near the bottom of the receptacle over which the heated grain descends, means for drawing the air through the conveyers and the last-named pipes whereby, owing to the heated condition of the grain, the said air becomes heated, a heating-chamber and means for directing the air drawn from the conveyer, to the heating-chamber, and for utilizing it in heating the grain, as and for the purpose described.

In witness whereof I subscribe my signature in presence of two witnesses.

OTTO MORITZ HILLIG.

Witnesses:

WOLDEMAR HAUPT,
HENRY HASPER.