No. 676,140. Patented June 11, 1901.

M. KÖNIG.

DUST REMOVING DEVICE FOR DRYING APPARATUS.

(Application filed Mar. 14, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 2.

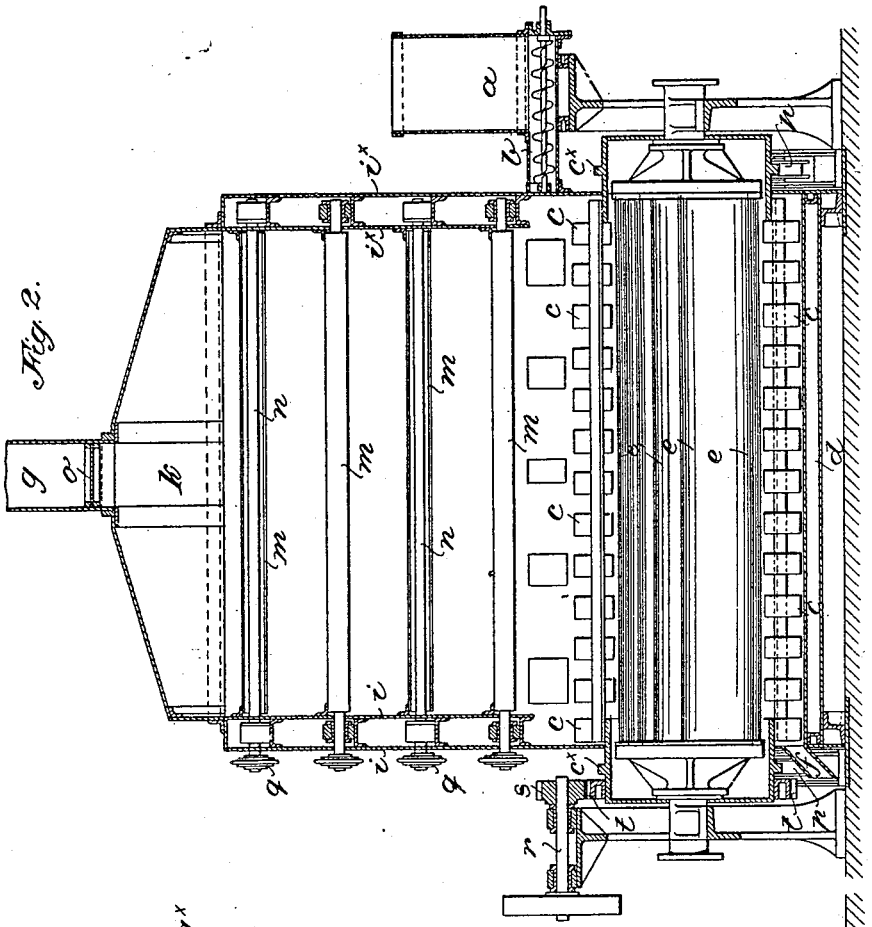

Fig. 1.

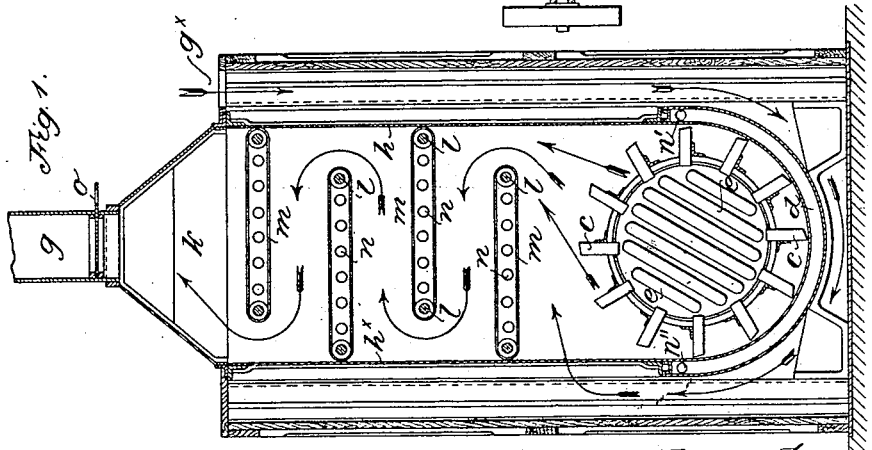

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Fig. 3.

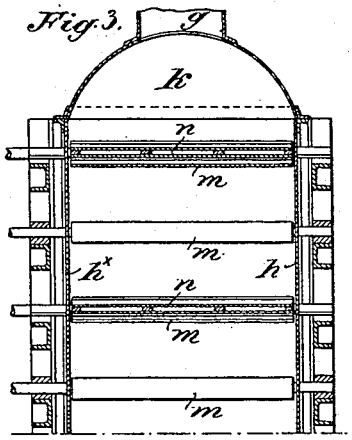


Fig. 4.

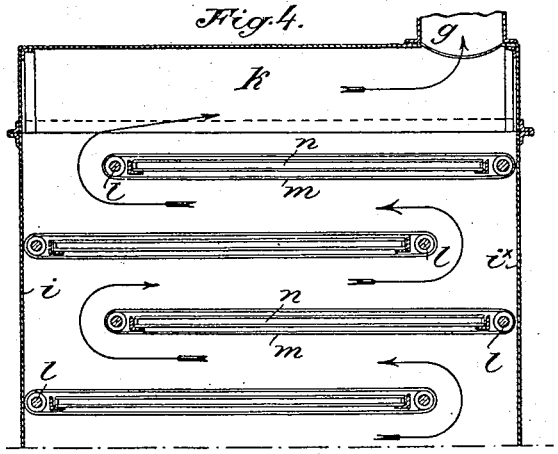


Fig. 5.

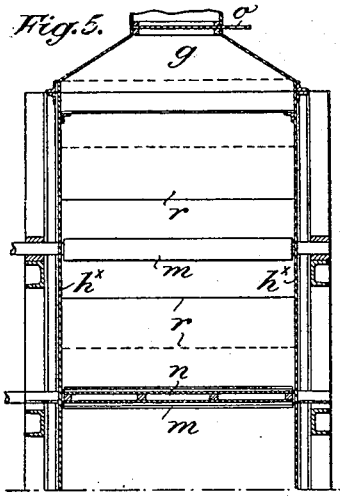


Fig. 6.

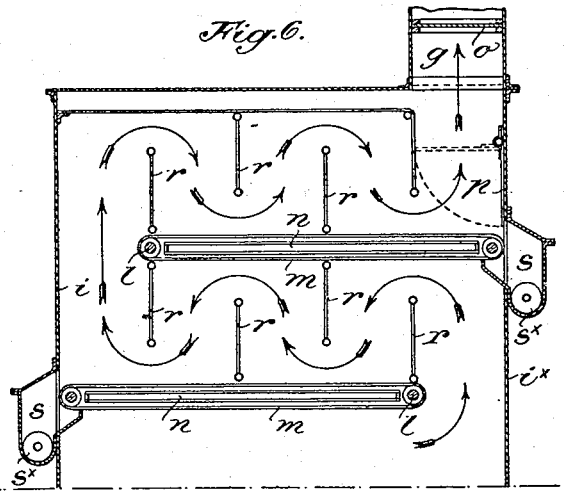


Fig. 7.

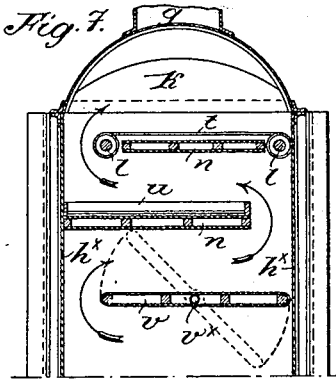
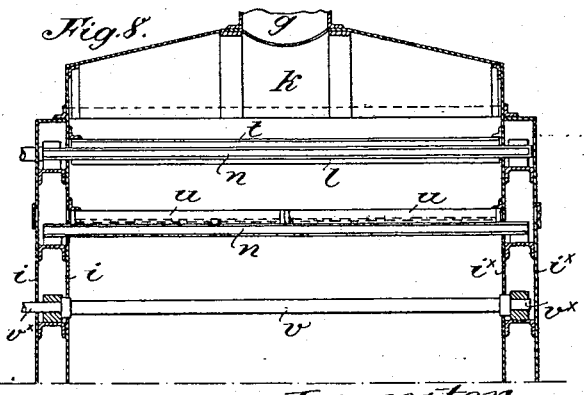


Fig. 8.



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UNITED STATES PATENT OFFICE.

MAX KÖNIG, OF GROSSLICHTERFELDE, GERMANY.

DUST-REMOVING DEVICE FOR DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 676,140, dated June 11, 1901.

Application filed March 14, 1900. Serial No. 8,626. (No model.)

To all whom it may concern:

Be it known that I, MAX KÖNIG, residing at 109[b] Chausseestrasse, Grosslichterfelde, near Berlin, Kingdom of Prussia, German Empire, have invented a new and useful Dust-Removing Device for Drying Apparatus, of which the following is a specification.

The mechanical appliances for drying starch, dyes, and the like hitherto constructed have been more or less defective for the reason that a portion of the material to be dried is carried away with the vapor through the ventilating-flue, owing to which, apart from other disadvantages, a considerable loss of the substance to be dried takes place. Various means have been employed to obviate this defect or to recover the substance so carried off in the form of powder. For example, over the drying apparatus a so-called "dust-chamber" has been arranged—that is to say, a large and tightly-closed chamber—through which the vapor passes, its velocity being by this means diminished to such an extent that the dust by reason of its greater specific gravity falls to the floor of the chamber, whence it can be removed from time to time. In cases in which the available space is small partitions have been provided in the dust-chamber, either horizontal or vertical, a small free space being left above and below or upon two opposite sides alternately, thereby forcing the vapor to traverse a path of as great a length as possible in a zigzag direction. In this manner also the dust may be separated, and by increasing the number of variations in the direction of the draft for the vapor this separation may be still further promoted. In cases in which no space whatever has been available for a dust-chamber a box formed of wood or sheet metal has been arranged in the vapor-chamber, and in this box the direction of the draft for the vapor is caused by the partitions to undergo numerous variations, while the velocity of the vapor decreases, owing to the larger cross-section, so that a separation of the dust is effected. These devices, however, all present the defect that the dust must be removed therefrom by hand, which is a laborious and protracted operation and one which, moreover, necessitates the previous opening of the apparatus. When the opening takes place, it almost always happens that the vapors produced by the drying operation and which are not at a high temperature become condensed in the dust-retainer and are deposited in the form of water upon the dust. In this manner a portion or even the whole of the pulverulent material in the dust-retainer is spoiled. In the case of starch, for example, gelatinous and value-less masses are formed. In accordance with the present invention all these defects are obviated in the following manner, viz: The pulverulent material is collected upon the displaceable depositing-surface and there dried or kept dry by means of special heating devices. It is then mechanically removed from the apparatus without its being necessary to open this latter. Owing to the heating devices the vapors are not able to condense, and even if by reason of special circumstances a portion of the vapor should become deposited it would immediately be reconverted into vapor. A dried material of full value is therefore invariably obtained without any loss whatever.

In the accompanying drawings several constructional forms of the apparatus which constitutes the subject of this invention are illustrated in Figures 1 to 8.

Figs. 1 and 2 are vertical sections, taken at right angles to each other, of an apparatus constructed in accordance with the invention in which the dust-removing device is directly connected to the drying apparatus. Figs. 3 and 4 are similar vertical sections of a modification of the dust-removing device in which the intermediate spaces for the passage of the vapors are adjacent to the front and rear walls. Figs. 5 and 6 are similar vertical sections of another modification of the dust-removing device in which there is provided a number of partitions or deflectors for changing the direction of movement of the vapors, and means for conveying the dust from the collectors to the outside of the apparatus. Figs. 7 and 8 are similar vertical sections of a modification in which the endless cloths or aprons are not employed.

In the form represented in Figs. 1 and 2 by two vertical sections taken at right angles one to the other the novel dust-removing device is directly connected with the drying apparatus, as is generally the case in practice.

The device may, however, be erected separately from drying appliances in any desired manner.

As shown in Figs. 1 and 2, the drying apparatus consists of a trough *d*, adapted to be heated, an agitating and shoveling device *c*, capable of rotation therein, and of a heating-body *e*, fixed within this latter. The material to be dried is conducted into the apparatus from the charging-hopper *a* by means of the conveyer-screw *b*. It is then removed from the trough *d* by means of the scoops of the agitating device *c* and distributed over the heating-body *e*. The material falls over the obliquely-arranged elements of the latter back into the trough *d*. The material is then conveyed farther into the apparatus by means of the scoops *c* and leaves the same in a dried condition through the discharge box or spout *f*. The drum $c^{\times}$ of the agitating mechanism rests upon rollers *p* and is driven from the shaft *r*. Upon the latter is fixed a toothed wheel *s*, which gears with the toothed ring *t* of the drum $c^{\times}$. Above the drying apparatus which has been described is formed by means of the walls *h* $h^{\times}$ and *i* $i^{\times}$ and the cover *k* a chamber in which the dust-removing apparatus is erected. The latter consists of several endless cloths or aprons *m*, arranged one above the other and conducted over rollers *l*, which are capable of rotation. By means of these cloths or aprons *m* the chamber above the drying apparatus is divided into a number of compartments in such a manner that at the lateral walls *h* and $h^{\times}$, alternately, there remains free a small space for the passage of the vapor and of the pulverulent material which is carried with it. The vapor resulting from the drying operation is carried off through a flue *g*, which is arranged upon the cover *k*, fresh air being drawn in at $g^{\times}$. This air becomes heated upon the outer walls of the trough *d*, which may be heated by admission of steam into the space between the inner and outer walls of the trough, *n'* being the steam-inlet and *n''* the outlet, and passes through the drying apparatus in the direction indicated by the arrows, thereby carrying up the vapor and conducting it outside the apparatus. Inside the endless aprons *m* and between the rollers *l* are arranged heating-bodies *n*, which in the present case consist of smooth tubes which radiate their heat upon the aprons *m*.

The operation of the dust-removing device is as follows: Owing to the considerable cross-section or area which is left between the aprons *m* in proportion to that of the draft-chimneys *g* the vapor will traverse that part of the apparatus in which these aprons are situated at a small velocity. The specifically heavier dust will fall and become deposited upon the aprons *m*. The dust is here exposed to the heat radiated from the heated bodies *n* and is thus completely dried. The deposit of the dust upon the aprons *m* continues in layers, which gradually become thicker, but yet are composed of separate particles, so that the dust will be readily dried by means of the heated bodies *n*. The surplus heat from these heated bodies serves to maintain the vapor in a heated condition and also prevents condensation. When the vapor has passed through the whole of the compartments formed by the cloths or aprons *m*, all dust will have been separated from such vapor and the vapor only is conducted outside the apparatus through the chimney *g*. When such a quantity of dust has been deposited upon the cloths that it is deemed advisable to remove it, the chimney *g* is closed by means of the damper *o*, thus causing the air in the apparatus to become stagnant. Thereupon the endless cloths *m* are displaced, by means of transmission-chains and chain-wheels *q*, either simultaneously or in succession in such a manner that the dust upon the topmost cloth falls upon that which is next below it, from this latter upon the next lower cloth, &c., until it falls from the lowest cloth into the drying apparatus and is removed therefrom, together with the remainder of the material which has been dried. During the removal of the dust from the cloth, as above, the drying apparatus is preferably brought to rest in order that the generation of vapor may be reduced to a minimum during such time as the chimney remains closed. After the dust has been removed from all the cloths, which occupies a short time only, the chimney *g* is allowed to remain closed for some little time longer in order that the dust which has been raised while the contents of the cloth has been falling from one to the other may again settle. Then the drying operation is resumed.

In Figs. 3 and 4 a constructional form of the dust-removing apparatus is illustrated by means of two vertical sections taken at right angles one to the other, in which, as above described, a number of compartments are formed by means of endless cloths *m*, which are adapted to run over rotatable rollers *l*. The intermediate spaces for the passage of the vapor are in this case situated upon the front and rear walls *i* and $i^{\times}$ alternately, and the chimney *g* arranged upon the cover *k*. The heating devices *n*, arranged between the cloths *m*, consist of smooth double-walled plates, in which the heating-vapor circulates.

According to the constructional form represented in Figs. 5 and 6 there are arranged over the endless cloths *m* and the heating devices *n* a number of partitions *r*, which serve to cause the vapor passing through to frequently change its direction, thus facilitating the separation of the dust from the vapor, as above specified. Moreover, there is shown in Fig. 6 a device by means of which the dust may be conveyed directly from the cloths outside the dust-removing apparatus. This device consists of a channel *s*, excluded from the atmosphere by a suitable cover. This channel is fixed upon the front and rear

walls i and $i^{\times}$, and into it the dust from the endless cloth falls and is conveyed by means of a conveyer-screw $s^{\times}$ into a sack or other receptacle attached to the channel. There is also provided a door or flap p, which is raised into the position indicated by the dotted lines while the clearing of the cloths is taking place in order to prevent dust from collecting in the lower part of the chimney g.

Figs. 7 and 8 illustrate other constructional forms of the depositing-surfaces for the dust in cross-sectional views at right angles one to the other. Instead of the endless cloths m a simple cloth t is provided, which may be rolled upon and unrolled from the rollers l. In this case the heating-bodies are free beneath the cloth. The collecting-surfaces may consist of one or more boxes u, arranged above the heating-bodies n. In these boxes the dust settles. For the purpose of removing the dust the boxes are withdrawn from the apparatus, emptied, and again placed in position.

Finally, the heating-bodies themselves may serve as the collecting-surfaces for the dust. In Figs. 7 and 8 such a heating-body v is shown mounted on pivots $v^{\times}$, so that it may be caused to occupy either an inclined or a vertical position for the purpose of removing the dust from its upper surface.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In drying apparatus for starch, dyes and the like the combination with the drying apparatus of a series of dust-collectors arranged one above the other in the space between the drier and the chimney, such dust-collectors consisting of a displaceable dust-collecting surface combined with a heater, and means for mechanically displacing said surface, essentially as and for the purpose described.

2. In drying apparatus for starch, dyes and the like, the combination with the drying apparatus, of a series of dust-collectors arranged one above the other, such dust-collectors consisting each of an apron conducted over rollers rotated from the outside combined with a heater, essentially as and for the purpose described.

3. In drying apparatus for starch, dyes and the like, the combination with the drying apparatus, of a series of dust-collectors arranged one above the other and consisting each of a displaceable collecting-surface combined with a heater, and means for displacing the superposed surfaces alternately to opposite sides, essentially as and for the purpose described.

4. In drying apparatus for starch, dyes and the like the combination with the drying apparatus, of a series of superposed heated dust-collectors having displaceable surfaces, and of a conveyer for each collector, such conveyers being located in a closed casing outside of the apparatus, essentially as and for the purpose described.

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

MAX KÖNIG.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.