No. 728,859. PATENTED MAY 26, 1903.

H. J. CALDWELL & J. R. BARR.

GRAIN TREATING AND DRYING APPARATUS.

APPLICATION FILED SEPT. 18, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 4.

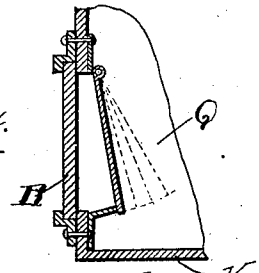


Fig. 3.

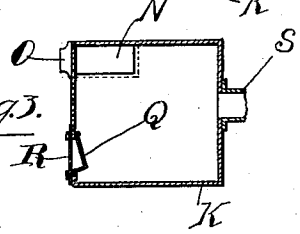
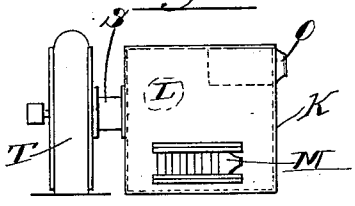
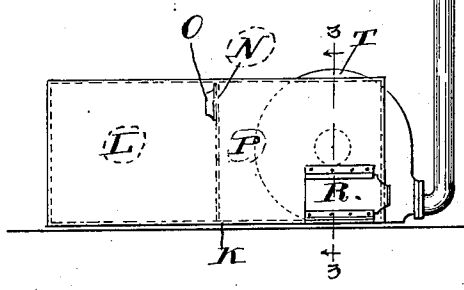


Fig. 2.





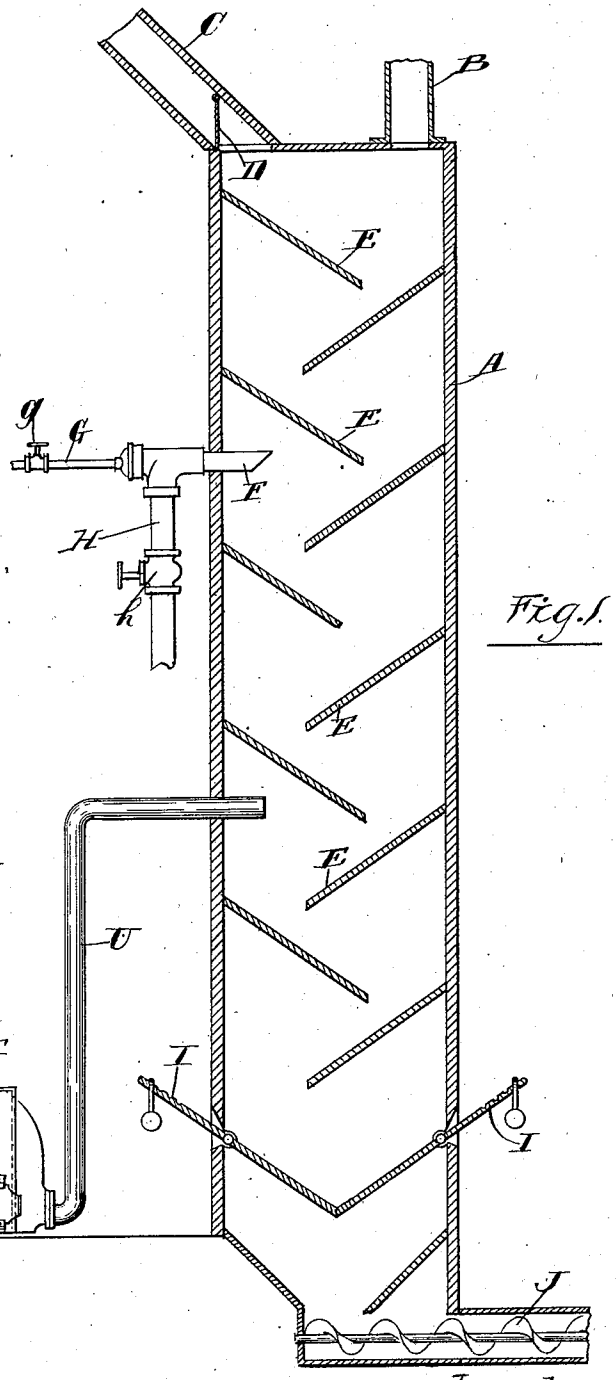


Fig. 1.

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 5.

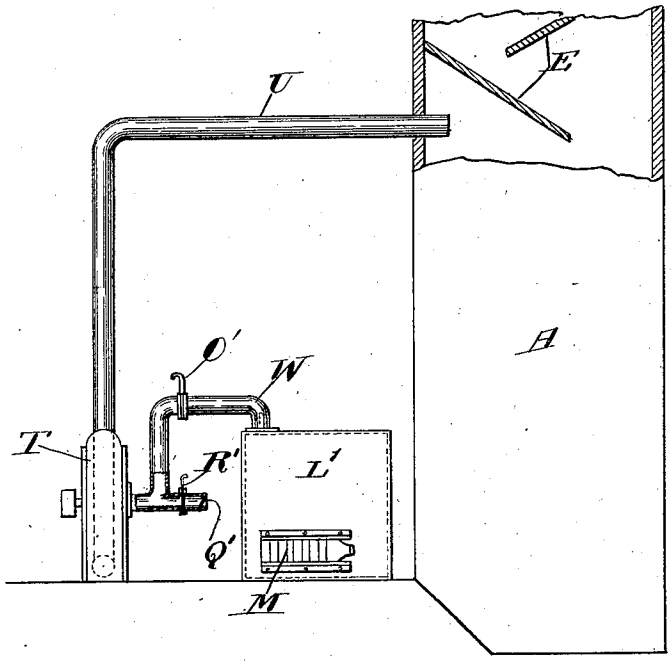
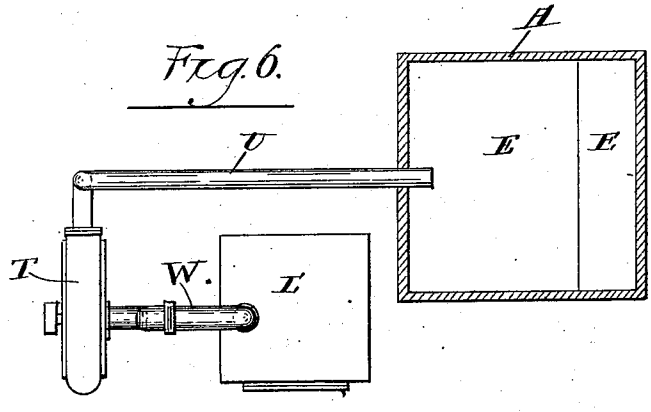


Fig. 6.



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No. 728,859. Patented May 26, 1903.

UNITED STATES PATENT OFFICE.

HARRY J. CALDWELL AND JAMES R. BARR, OF EARLPARK, INDIANA.

GRAIN TREATING AND DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 728,859, dated May 26, 1903.

Application filed September 18, 1902. Serial No. 123,895. (No model.)

To all whom it may concern:

Be it known that we, HARRY J. CALDWELL and JAMES R. BARR, citizens of the United States, residing at Earlpark, in the county of Benton and State of Indiana, have invented certain new and useful Improvements in Grain Treating and Drying Apparatus, of which the following is a specification.

Our invention relates particularly to apparatus for employing sulfur or other chemical fumes for the bleaching or other treatment of grains.

The primary object of our invention is to provide means for controlling the temperature of the fumes at the point where they come in contact with the grain and to also control the proportion of fumes in the column of air which is blown through the grain while the same is being treated.

Another object of our invention is to provide means for properly moistening the grain to facilitate the treatment thereof and to provide means for so controlling the temperature of the moistening fluid as to prevent the undue heating of the grain thereby.

A further object of our invention is to provide grain-treating apparatus which may be readily used in connection with a familiar form of grain-drying stack, so that the stack may be readily used either for bleaching grain or for drying, cooling, or otherwise treating the same.

These and such other objects as may hereinafter appear are attained by the devices illustrated in the accompanying drawings, in which—

Figure 1 is a sectional view of a familiar form of grain-drying stack provided with our improved apparatus. Fig. 2 is an end elevation of the furnace and fan. Fig. 3 is a sectional view on the line 3 3 of Fig. 1 looking in the direction indicated by the arrows. Fig. 4 is an enlarged detail of a portion of Fig. 3. Fig. 5 is an elevation of a modification of our device with a part of the apparatus broken away, and Fig. 6 is a plan view of Fig. 5.

Like letters of reference indicate the same parts in the several figures of the drawings.

Referring by letter to the accompanying drawings, A indicates a vertical stack provided with an exhaust-pipe B and with a grain-inlet pipe C, opening in the stack at the upper end thereof and provided with a swinging valve or door D, arranged to be automatically opened inwardly by the pressure of grain within the inlet-pipe C. Arranged within the stack are deflecting-shelves E, set in staggered relation to each other, so that the grain in falling through the stack will be deflected alternately from one shelf to the other. Opening into the stack at a convenient point is a nozzle F, which connects with a steam-pipe G and is also provided with a connection H at a point outside of the stack for the entrance of a steam-condensing medium. This nozzle may be constructed and operated as an injector, if so desired, in which event the steam-jet entering through the pipe G will draw water through the connection H and discharge a mixed jet of water and steam through the nozzle F. It may be preferred, however, to leave the connection H open to the atmosphere, in which event the steam-jet will draw a current of air through the connection H, which air-current will to a greater or less extent condense and cool the steam, so that a fine spray will be discharged through the nozzle F into the stack A. Adjacent to the bottom of the stack are pivoted and counterweighted gates I, while leading from the bottom of the stack is a conveyer J.

The above construction of stack is merely suggestive of one form of stack with which our improved form of apparatus may be readily used; but the stack *per se* does not constitute any part of this application.

Arranged adjacent to the stack is the furnace K, consisting of a closed chamber L and provided with any suitable damper or air-inlet, as M. Opening from this chamber is a passage N, controlled by a valve O, which passage leads into a mixing-chamber P, which is provided with a double air-valve consisting of an automatic pivoted valve Q and a manually-operated valve R. Leading from the mixing-chamber is a pipe S, which leads to a fan T, from which the pipe U communicates with the interior of the stack A.

With the apparatus so constructed the operation is as follows: Sulfur, for example, is ignited in the combustion-chamber L of the furnace K, and the fan T being set in motion the sulfur fumes are drawn through the opening N into the mixing-chamber P, where they

are mixed with air which enters through the compound valve Q R, and the combination of air and sulfur fumes is drawn into the fan T and forced by it through the pipe U into the stack A, whence the mixture of air and sulfur is driven upwardly and out at the exhaust B. It will thus be seen that when so constructed the mixing-chamber and connecting-pipes form a conduit carrying the fumes from the combustion-chamber into the stack. At the same time steam is admitted to the pipe G, and a spray is discharged into the stack A through the nozzle F. The grain to be bleached or otherwise treated is now admitted to the stack A through the feed-pipe C, the valve D opening to admit grain to the stack, but closing whenever the pipe C is empty, thereby preventing the entrance of the fumes to the source of grain-supply. With the apparatus so in operation there will be a thin sheet of grain falling through the stack, which grain is thoroughly agitated first by being thrown backward and forward by the shelves E and also by the upward draft of air and sulfur fumes mixed. A thermometer being now inserted in the stack, the temperature of the sulfur fumes may be regulated by adjusting the valves Q and R, whereby the amount of hot sulfur fumes and of cool air forced into the stack by the fan may be adjusted to any desired extent, the valve Q automatically adjusting the amount of air admitted to the mixing-chamber to any variation in the speed of the fan.

With the apparatus so constructed we are enabled, by means of the steam-valve *g* within the pipe G and the valve *h* within the connection H, to control the temperature of the moistening fluid while still using steam-pressure to drive the jet of moistening fluid through the falling grain, and at the same time we are enabled to control the temperature of the sulfur fumes within the stack A and to thus keep the grain in a cool condition, whereas with other devices the grain is moistened by live steam or by vapor at a high temperature, and so is subjected to a high degree of heat and moisture, necessitating an extensive manipulation of the grain after treatment in order both to sufficiently dry and to sufficiently cool the grain for commercial purposes. Indeed, it not infrequently happens that the grain becomes so heated that it continues heating during subsequent storage or shipment. With our device, however, we are enabled to first moisten the grain without unduly heating the same and to then force through the falling column of grain a column of comparatively cool and dry air and sulfur fumes mixed, which not only sufficiently bleach the grain, but also simultaneously dry it to such an extent that after the grain has passed through the stack and been efficiently bleached by our apparatus the grain is in most cases sufficiently cooled and dried for all commercial purposes, while in extreme cases but little further manipulation is needed to bring it to that condition. We thus effectively bleach or otherwise treat the grain, prevent overheating the same, and discharge the same from the bleaching apparatus in a cool and dry condition.

In Figs. 5 and 6 we have shown a modification of our device in which the furnace consists of but one chamber L′, within which the sulfur is burned and from which communication is had with the fan by means of the pipe W, air being admitted directly to the pipe W and controlled, as before, by means of the valve Q′ R′ and the proportion of fumes being controlled by means of the valve O′.

Obviously other arrangements may be made whereby the temperature of the fumes may be controlled by mixing the fumes with air, so as to prevent the heating of the grain by the heated fumes, without departing from the spirit of our invention. So, also, the exact location of the fan is not material to the broad idea of our invention. For instance, the current from the fume-chamber through the exhaust-pipe B might well be entirely an induced current by connecting the fan with the exhaust-pipe B, or the fan might be located and connected in any other convenient manner, whereby the desired fume-laden current shall be caused to pass through the stack A in such a manner as to bring the fumes in contact with the falling grain.

It will be understood that the invention shown, described, and claimed in this application is an improvement upon the apparatus shown in our copending application, Serial No. 121,816, filed September 2, 1902, in which we have claimed the broad features of our invention which are herein shown but not claimed.

We claim—

1. In a grain-treating apparatus, the combination with means for generating fumes, of means for conveying the same to a point of delivery, and means interposed in said apparatus between the device for generating the fumes and the point of delivery for mixing air with said fumes in controllable quantities, said means comprising an automatic air-valve and a manually-operated fume-valve, substantially as described.

2. In an apparatus for treating grain, the combination with a closed chamber for the combustion of a chemical, of a stack, a conduit for conveying fumes from said chamber to said stack, and means arranged between said chamber and said stack for admitting air to said conduit, said means comprising an automatic valve and a manually-operated valve, regulating the amount of air passing through said automatic valve, substantially as described.

3. In a grain-treating apparatus, the combination with a closed chamber for the combustion of chemicals, of a conduit connecting said chamber with a fan arranged to draw fumes from said chamber and through the induction-port of said fan, and means arranged

between said chamber and said fan for mixing air with said fumes, substantially as described.

4. In an apparatus for treating grain, the combination with a combustion-chamber provided with an air-inlet, of a mixing-chamber arranged to communicate with said combustion-chamber, said mixing-chamber being also provided with an air-inlet, means for controlling said air-inlet, and means for inducing a current through both of said chambers and out of said mixing-chamber, substantially as described.

5. In a device of the class described, the combination with a mixing-chamber and means for generating fumes, of means for mixing air with said fumes in controllable quantities in said mixing-chamber, said means comprising an automatic valve and a manually-operated valve controlling the admission of air to said automatic valve, substantially as described.

6. In a device of the class described, the combination with a casing, of means for generating fumes and conducting the same within said casing, of means for spraying grain as it falls through said casing, said means comprising a nozzle projecting within said casing, said nozzle communicating with a steam-pipe and being also provided with a port for the admission of a steam-condensing medium, substantially as described.

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