No. 825,378.

PATENTED JULY 10, 1906.

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

PROCESS OF CONDITIONING GRAIN.

APPLICATION FILED NOV. 10, 1902.

2 SHEETS—SHEET 1.

Fig. 1½.

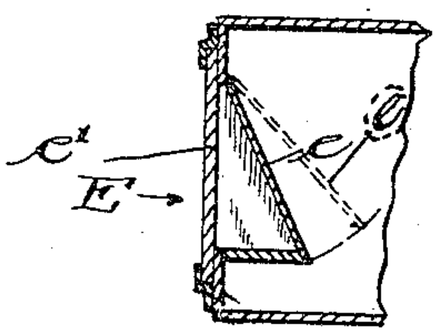

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 3

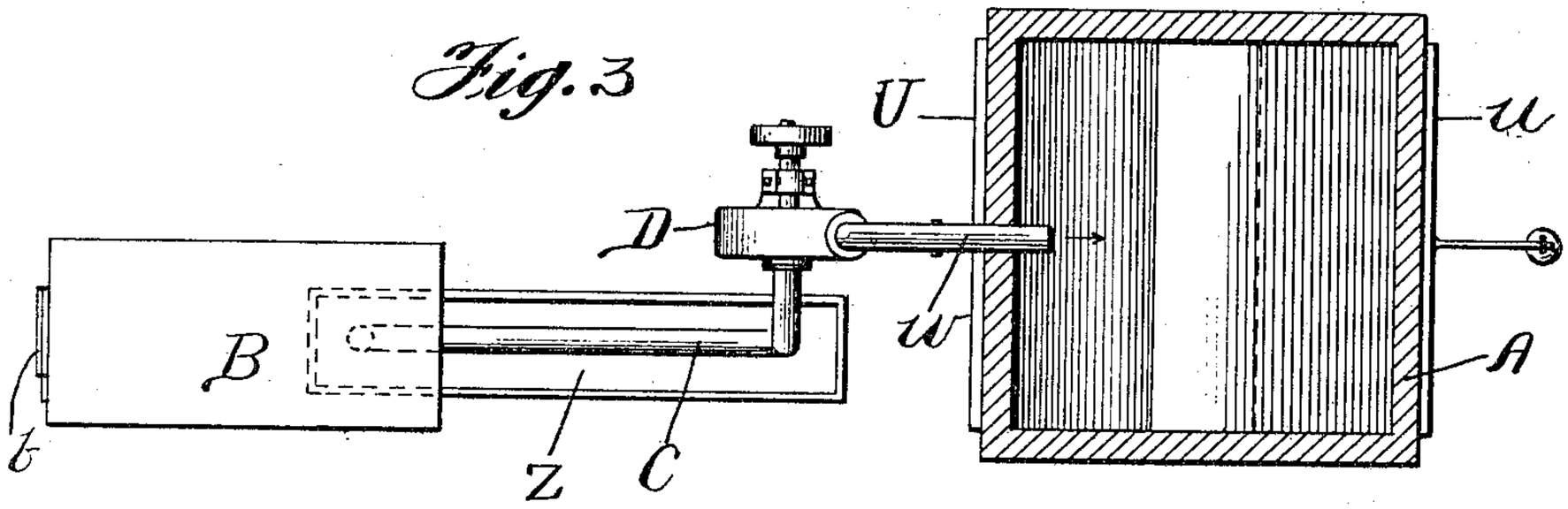
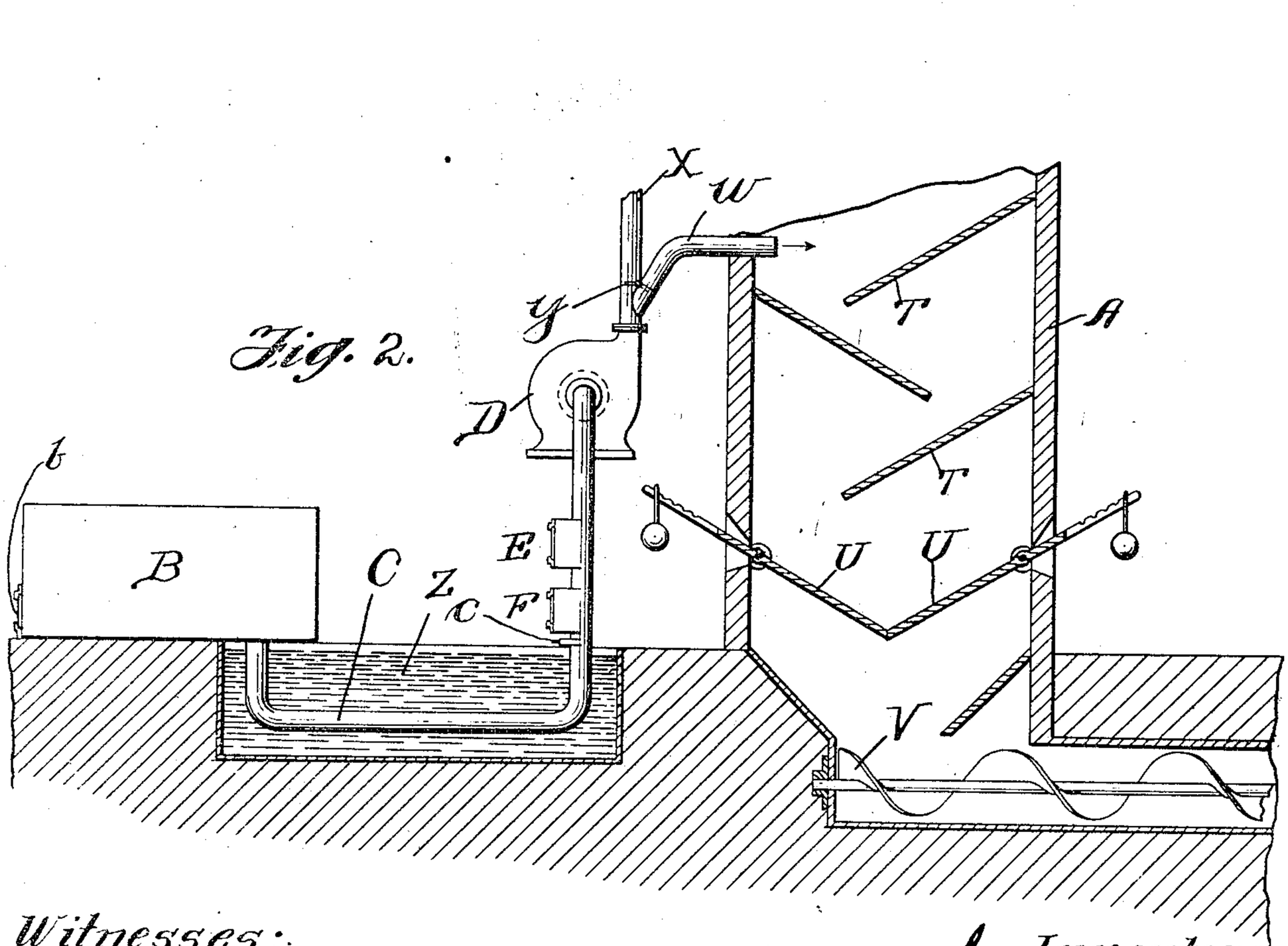


Fig. 2.



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UNITED STATES PATENT OFFICE.

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PROCESS OF CONDITIONING GRAIN.

No. 825,378. Specification of Letters Patent. Patented July 10, 1906.

Application filed November 10, 1902. Serial No. 130,768.

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 Earl Park, in the county of Benton and State of Indiana, have invented certain new and useful Improvements in Processes of Conditioning Grain, of which the following is a specification.

Our invention relates to improvements in a process of purifying and conditioning grain by subjecting the same to moisture, chemical fumes, and air.

Our apparatus and process are particularly adapted for removing foreign growths—such as smut, must, rust, and the like—and weather-stains, mildew, and the like, which when present seriously affect the grade and commercial value of the grain. When the grain is so affected, it presents a dirty and unattractive appearance, has an unnatural musty odor, and many products made therefrom will also be discolored and all be affected by an undesirable odor. We have found, however, that such conditions are largely superficial and do not affect the real quality of the grain, the natural color of the grain being in most instances concealed and not destroyed by the discoloration, the natural aroma of the grain also being present, but concealed by the heavier odor of fungus growths and the like, and the natural quality of the grain-kernel remaining unimpaired.

It is therefore the object of our invention to improve the grade and commercial value of the grain by removing the objectionable foreign growths, substances, odors, and stains, and thus restore the grain to its original condition. In a sense, therefore, we merely remove impurities and the like, and thus we term our process a "purifying" or "conditioning" process.

At the same time it is the object of our invention to purify and condition the grain as above set forth and leave the grain free from chemical odors and in a cool, dry, and sweet condition regardless of whether or not it was heated or moist before being subjected to our process, and at the same time to accomplish all these results while avoiding danger of fire to the apparatus or grain-treating plant or buildings.

These and such other objects as hereinafter appear are attained by the devices shown in the accompanying drawings and by the process hereinafter described.

In the drawings, Figure 1 indicates a view, partly in section and partly in elevation, of one form of apparatus suitable for practicing our process. Fig. 1½ is a sectional view of the valve-box E. Fig. 2 indicates a modification thereof; and Fig. 3 indicates a view, partly in plan and partly in horizontal section, of Fig. 2.

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 grain-treating stack of familiar form; B, a furnace for developing chemical fumes; C, a fume-conduit leading from the furnace to the stack; D, a fan for forcing the fumes into the stack.

E and F are inlet-valves; *c*, a control-valve in the fume-pipe; G, a water-pipe provided with a sprinkler H and a valve I; J, a branch water-pipe having a sprinkler K and valve L; M, a steam-pipe provided with a branch N, having a valve O, and a branch P, having a valve Q.

R is an exhaust-opening leading out of the stack A.

S is a conveyer for conducting grain into the stack A.

T represents deflecting-shelves for agitating the grain as it falls through the stack A.

U represents counterweighted shelves or gates adjacent to the bottom of the stack A.

V is a conveyer for conveying grain from the bottom of the stack.

W and X are pipes leading from the fan D into the stack, and Y is a valve for controlling communication between the fan D and the pipes W and X.

It is well known that by moistening the surface of grain and then subjecting the same to sulfurous gas formed by the combustion of sulfur or otherwise a bleaching process will ensue. As commonly practiced prior to our invention it was supposed that this process must be conducted at a high temperature and that the grain must be subjected to the action of pure or undiluted fumes. The result of treating grain in this manner is highly objectionable for several reasons.

First. The grain is literally bleached, thereby giving it an unnatural whiteness. In other words, not only is the undesirable stain removed from the grain, but the natural color of the grain is also removed and the treated grain is given an unnatural, undesirable, and uniformly bleached appearance,

and in removing the unnatural odors the natural aroma of the grain is destroyed.

Second. As a result of subjecting the grain to the action of fumes at their full strength the chemical seemingly enters the fiber of the grain, and the sulfurous gas so adheres to the surface of the grain that it is practically impossible to eliminate the chemical odor, which is objectionably apparent for a long period, and in some instances for many months after treatment and is rarely ever wholly removed.

Third. In the treatment of the grain at a high temperature there is grave danger of impairing and even destroying the germ of the grain, so that it cannot be used as seed-grain.

Fourth. This excessive heating of the grain may actually injure the quality of the grain and certainly so heats it that further extensive manipulation is required after the bleaching process in order to cool the grain sufficiently for shipping, storage, or commercial purposes, and this condition is promoted by the fact that with the old process in order to treat the grain at a high temperature it has almost invariably been moistened with steam, as well as subjected to the fumes at a temperature of between 200° and 300° Fahrenheit. With our process, however, we pursue a diametrically opposite course—that is, we seek at all times to keep the grain as cool as possible—and to attain this result we cool the sulfurous gas and preferably moisten the grain with cold water or with steam mixed with large volumes of cold air, so that the grain is treated at a low temperature. In fact, we have successfully treated grain by our process at a temperature of about 65° Fahrenheit. We thus avoid any impairment of the germ of the grain and other injury to the quality of the grain. We also avoid heating the grain, so as to render necessary any extensive subsequent treatment to cool the same, while at the same time we remove the otherwise ever-present danger of fire arising from the overheated fumes and fume-pipe. Furthermore, we depart from the previous process of treatment by diluting the fumes with several times their volume of air, and also throwing large quantities of air in contact with the grain simultaneously with steam when steam is used for moistening. By so doing we accomplish the following new and valuable results: first, we have found that the fumes so diluted are entirely effective for removing superficial stains, must, smut, rust, mildew, odors, and the like from the grain without affecting the natural color of the grain; second, we thereby successfully treat the grain without causing the chemical to any material extent, if at all, to enter the grain fiber, chemical tests having demonstrated the fact that immediately after treatment the treating chemical remains with the grain in such infinitesimal quantities that it can barely be detected by most careful chemical analysis; third, immediately after treatment the grain is almost entirely free from any chemical odor and within a day or so after treatment it is found that not only can no chemical odor be detected, but it is also found that the grain has been restored to its sweet natural nutty aroma, or, rather, that the foreign odors which before treatment disguised the natural aroma have been entirely removed, while the natual aroma remains; fourth, by diluting the fumes we introduce into the stack a column of fresh air which carries the chemical fumes away from the grain and out of the stack, so that the fumes are in contact with the grain only to such an extent and for such a time as is necessary to accomplish the result desired by us; fifth, the volume of air introduced into the stack serves also to carry away the surplus moisture, as well as heat, so that by our process the grain is simultaneously treated and also cooled; sixth, the addition to the chemical fumes of the volume of air serves of itself to assist in the cooling of the fumes to the desired extent.

Our improved process may be practiced with the apparatus shown in the accompanying drawings in the following manner: Fumes may be generated by burning sulfur within the chamber B, air to promote combustion being admitted to the combustion-chamber to any desired extent by means of the slide-damper *b* of any familiar form. The fumes so generated are drawn from the chamber B through the conduit C, which is, in effect, the induction-pipe of the fan D. The fumes leave the chamber B at a temperature not far from 300° and are preferably first cooled by conducting the pipe C underground for some distance, as shown in Fig. 1, or through a water-jacket Z, as shown in Fig. 2. The volume of the fumes drawn through the fume-pipe C is also regulated by means of the fume-valve *c*, and the volume of air added thereto is controlled by manipulation of air-valves E and F, through which air is admitted in any desired quantity directly to the pipe C. The fumes or fumes and air so mixed are forced by the fan D into the stack A through pipe X or pipe W, as the case may be, according to the position of the valve Y. In practice when using our process for purifying grain we prefer to discharge the fumes into the stack A through the pipe X at a point considerably above the bottom of the stack A, thereby lessening the possibility of the escape of the fumes through the bottom of the stack A and into the grain storage or shipping department; but when our apparatus is used merely for cooling or drying grain then we prefer to discharge pure air, either cool or heated, as the case may be, into the stack A through the pipe W, which is located

near the bottom of the stack, so that the grain may be subjected for a longer period to the drying action of the current of air. Ordinarily in order to obtain the surface-moisture which is necessary for the effective treatment of the grain the grain to be treated will be moistened by means of the nozzle H as it passes through the conveyer S and into the stack A; but as it may be at times desirable to moisten the grain with water shortly after it enters the stack or to moisten it with steam near the upper end of the stack or to moisten it with steam at a point adjacent to the inlet of the treating-fumes we also provide the water-sprinkler K and the steam-nozzles N and P, any one or all of which can be used at will by manipulation of their respective control-valves. When using steam as a moistening medium, we find it desirable and effective to keep the temperature within the stack at a low point by providing an air-inlet pipe or jacket *n*, surrounding the steam-nozzle, so that the steam-jet when discharged into the stack will draw into the stack through the air pipe or jacket a large volume of air at a much lower temperature than that of the steam. When it is desired to use our apparatus merely for a cooling or drying device, the valves I, L, O, and Q are closed, and if heated air is desired the chamber B is merely used as an air-heating chamber, or if cool air only is desired the slide-damper *b* and the air-valves E F are left open to any desired extent, so that the fan D will force a cooling and drying current of air through the stack A and out of the exhaust R.

It will of course be understood that our process is suitable for use in any treatment of grain out of condition for whatever cause where its condition will be improved by treatment by the process described.

We claim—

1. The process of treating grain which comprises subjecting superficially-moistened grain to the action of cooled bleaching chemical fumes.

2. The process of treating grain which comprises subjecting superficially-moistened grain to the action of cooled fumes of sulfurous gas.

3. The process of treating grain which comprises subjecting superficially-moistened grain to the action of sulfurous fumes cooled and diluted with several times their own volume of air.

4. The process of treating grain which comprises generating sulfurous fumes by the combustion of sulfur within a closed compartment, conducting the fumes from a generating-compartment to a grain-treating compartment, rapidly cooling the fumes during such passage, diluting the fumes and then discharging the fumes, so cooled and diluted, against superficially-moistened grain.

5. The process of treating grain which comprises sprinkling the grain with water and subjecting it to the action of diluted sulfur fumes cooled to a temperature of less than 100°.

6. The process of treating grain, which consists in supplying free moisture to a treating zone, supplying cooled and diluted sulfurous fumes to said treating zone, and passing the grain to be treated through the said treating zone and in the presence of said moisture and said fumes.

7. The process of treating grain, which comprises supplying free moisture to a treating zone, also supplying cooled sulfurous fumes to said treating zone, and passing the grain to be treated through said treating zone and in the presence of said moisture and said fumes.

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