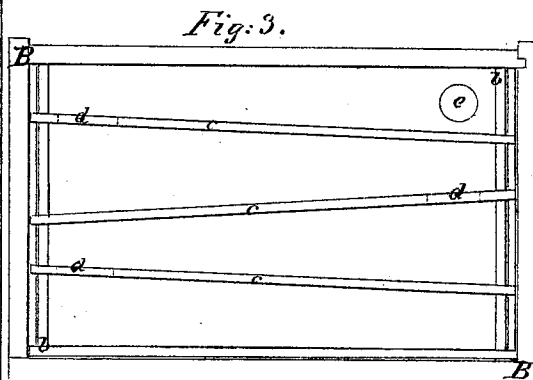
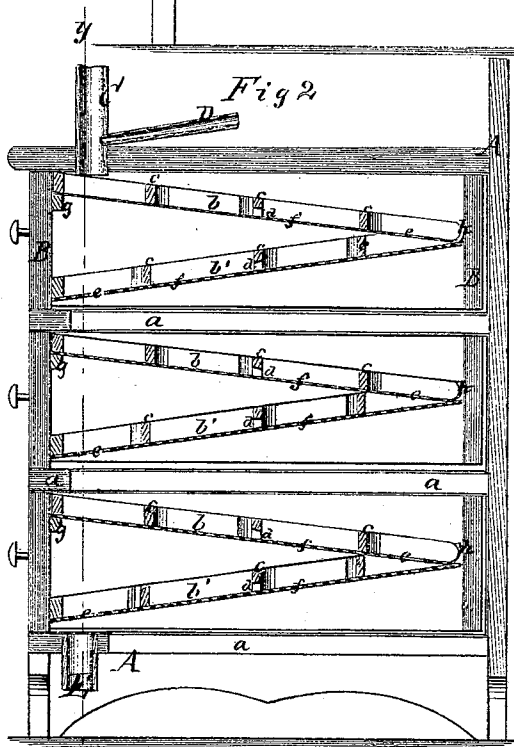
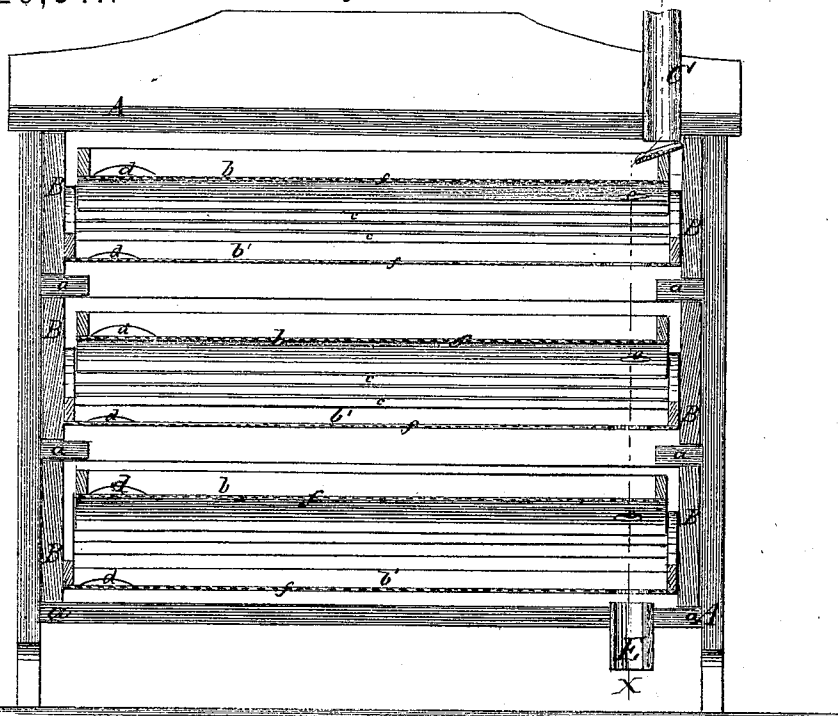
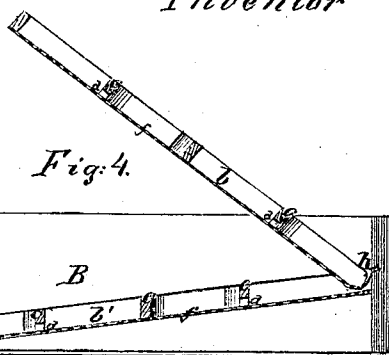


**B. R. HAWLEY.**  
**Improvement in Bleaching Cane-Juices and other**  
**Liquids with Sulphurous Acid.**  
 No. 129,341. *Fig:1.* Patented July 16, 1872.



*B. R. Hawley*  
 Inventor



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# UNITED STATES PATENT OFFICE.

BENJAMIN R. HAWLEY, OF NORMAL, ILLINOIS.

IMPROVEMENT IN BLEACHING CANE-JUICE AND OTHER LIQUIDS WITH SULPHUROUS ACIDS.

Specification forming part of Letters Patent No. 129,341, dated July 16, 1872.

Specification describing certain new and useful Improvements in Bleaching Cane-Juice and other Liquids, invented by BENJ. R. HAWLEY, of Normal, McLean county and State of Illinois.

My invention consists of apparatus for bleaching and defecating cane-juice, also applicable for the making of vinegars, which is designed to economize materially in the space occupied and in the cost of construction, by an arrangement of a series of shelves or planes one above another in a case, from one to another of which the juice flows in succession, the shelves being slightly descending in reverse directions, and provided with several ribs on the upper surface to cause the juice to flow several times forward and back on each shelf before descending to the next. The invention is also designed to economize considerably in the labor of cleaning the apparatus by having the case constructed in the form of drawers, and one or more of the shelves arranged in each section, to be taken out from time to time and its place supplied with a spare one without stopping the operation, the removed section to be cleaned at leisure. The invention is also designed to economize considerably in heat and the defecating vapors, and also to utilize the heat imparted to the juices in the bleaching process, or that remaining when the bleaching is completed in the boiling process, by having the heated sulphurous gas act upon the juice in a continuous current or stream moving in the opposite direction to that of the juice, in direct contact with it, and having the hot juice flow directly from the apparatus to the boiling-kettles in process of operation, so that it will be evaporated with less heat than if delivered to the boilers cold. The invention is also designed to economize expense by utilizing the gravity of the juice to produce, in connection with successive descending shelves, the necessary agitation to bring the gas into intimate contact with the juice, and thus dispense with the expensive agitating machinery commonly used for the purpose.

Figure 1 is a longitudinal sectional elevation of my improved bleaching apparatus taken on the line *yy* of Fig. 2. Fig. 2 is a transverse section taken on the line *xx* of Fig. 1. Fig. 3 is a plan view of one of the sections

and a shelf; and Fig. 4 is a transverse section of Fig. 3, the upper shelf being turned upward on its hinges.

A is a rectangular case, of wood or other suitable substance, with several bottomless sections or drawers, B, fitted to slide into and out of the case at one or it may be two sides, on cleats or supports, *a*, which said drawers contain shelves, of which there are preferably two—one above another, as shown—the upper one, *b*, descending from side to side in one direction, and the lower one similarly descending in the other direction, and either one or both being hinged to one side of the drawer B, preferably by tacking the cloth part *f* thereto, as shown at *h*, so that they can be raised or lowered to change the angle of inclination, and to facilitate the cleaning of them, particularly the parts between the two shelves. Said shelves may be otherwise connected or removable altogether. This arrangement affords a series of shelves which may be in any required number, onto the uppermost of which the juice is delivered through pipes C D; and caused to flow forward and back from end to end at right angles to the descending direction of said shelves by ribs *e*, escaping through a passage, *d*, at each end alternately, and finally passing through the bottom of the shelf at *e* to the next one, and so throughout the whole series to the outlet-pipe F, when sufficiently bleached, to any receptacle, but preferably, as before stated, directly into the boiling or evaporating apparatus, to utilize in the boiling process the heat imparted in the bleaching process and remaining in the juice, which remaining heat is lost with the bleaching apparatus now used. I propose to introduce the sulphurous gas at the outlet-pipe E, and cause it to pass through the apparatus in the contrary direction to the course of the juice, up through the holes *e*, and out at the pipe C; and I make the parts *f* of said shelves of canvas or other equivalent woven substance, which will hold or shed the juice or most of it, but will allow the gas to pass through—which I find in practice canvas will—from the under side and act upon the lower surface of the stream of juice, so that practically I greatly increase if not nearly double the capacity of the apparatus by this device. If some of the juice does drip

through no harm will be done, for it will thus be brought into contact with the gas very effectually; but it is believed that the leakage will not be considerable. The shelves being capable of adjustment to vary the descent, adds very much to the efficiency of the apparatus, in that the movements of the juice may be retarded or accelerated, as circumstances or different conditions of the juice or sulphurous gas may require.

By my system of removable shelves I am enabled to largely economize both labor and time in cleaning the apparatus, which it is necessary to do frequently in order to keep it sweet and prevent fermentation, because by having one or more spare sections I can remove one section at a time and put a spare one in its place without stopping the work, and then clean the removed section at leisure, to be ready to be put in the place of another one, and so on; whereas in the common bleaching apparatus the process must be stopped and some of the heavy parts of the apparatus removed to allow of the cleaning.

As this apparatus affords a very efficient means of heating the juice by reason of the direct and thorough mingling of hot air or gas with it in passing through, as above described, I propose to heat the juice also, at the same time that I am bleaching it, by hot air or by the same and the products of combustion, using such fuel as will not injure the juice, and thus raise it nearly to the boiling point before delivering it to the kettles, and thus save the difference in cost of heating in this way and in the kettles. The economy in space, also in cost, effected by this arrangement of apparatus as compared with those in which large tanks with revolving or otherwise moving agitators, requiring motive power, are used, will manifestly be large; for the arrangement of shelves and return passages on them, and the employment of canvas shelves to allow the gas to act on the under surface also give a very large surface in the aggregate for the action of the gas, and the exposure to the gas is maintained for a long time within a case of comparatively small size, which requires but little material for its construction and but little and inexpensive labor to construct it.

To make vinegar with this apparatus the juice or other liquid of which it is to be made will be passed through in precisely the same way, and warm air of the right temperature to facilitate oxygenation will be introduced and passed through in the same manner as the sulphurous gas is here used.

I claim as my invention—

1. The mode of applying the sulphurous gas to the juice to be bleached by causing it to move continuously along and in contact with the stream of juice moving in an opposite direction, as the said stream traverses descending shelves and falls from one to another, substantially as specified.
2. The arrangement of the shelves in removable sections of the case, and the said sections adapted to be removed and replaced without interrupting the bleaching process, substantially as specified.
3. The said shelves hinged or connected to the said sections in such manner as to be removed and raised or lowered to change the inclination and for other purposes, substantially as specified.
4. The cloth shelves in a bleaching apparatus, substantially as specified.
5. The hinging of the shelves to the sections by nailing the cloth thereto at the margin, substantially as specified.
6. The heating of the juice preparatory to the boiling or evaporating process by the sulphurous gas and hot air, also with other products of combustion or not, the same being directly applied to the juice in a bleaching apparatus, substantially such as herein described.
7. The introducing of the sulphurous gas to the bleaching apparatus through the outlet-pipe for the juice, and the introducing of the juice through the outlet for the gas, substantially as specified.
8. The combination of the case A, sections B, and adjustable shelves *b b'*, substantially as specified.

B. R. HAWLEY.

Witnesses:

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