No. 725,427. PATENTED APR. 14, 1903.

O. H. ELIEL.

APPARATUS FOR THE MANUFACTURE OF SULFURIC ACID.

APPLICATION FILED SEPT. 24, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

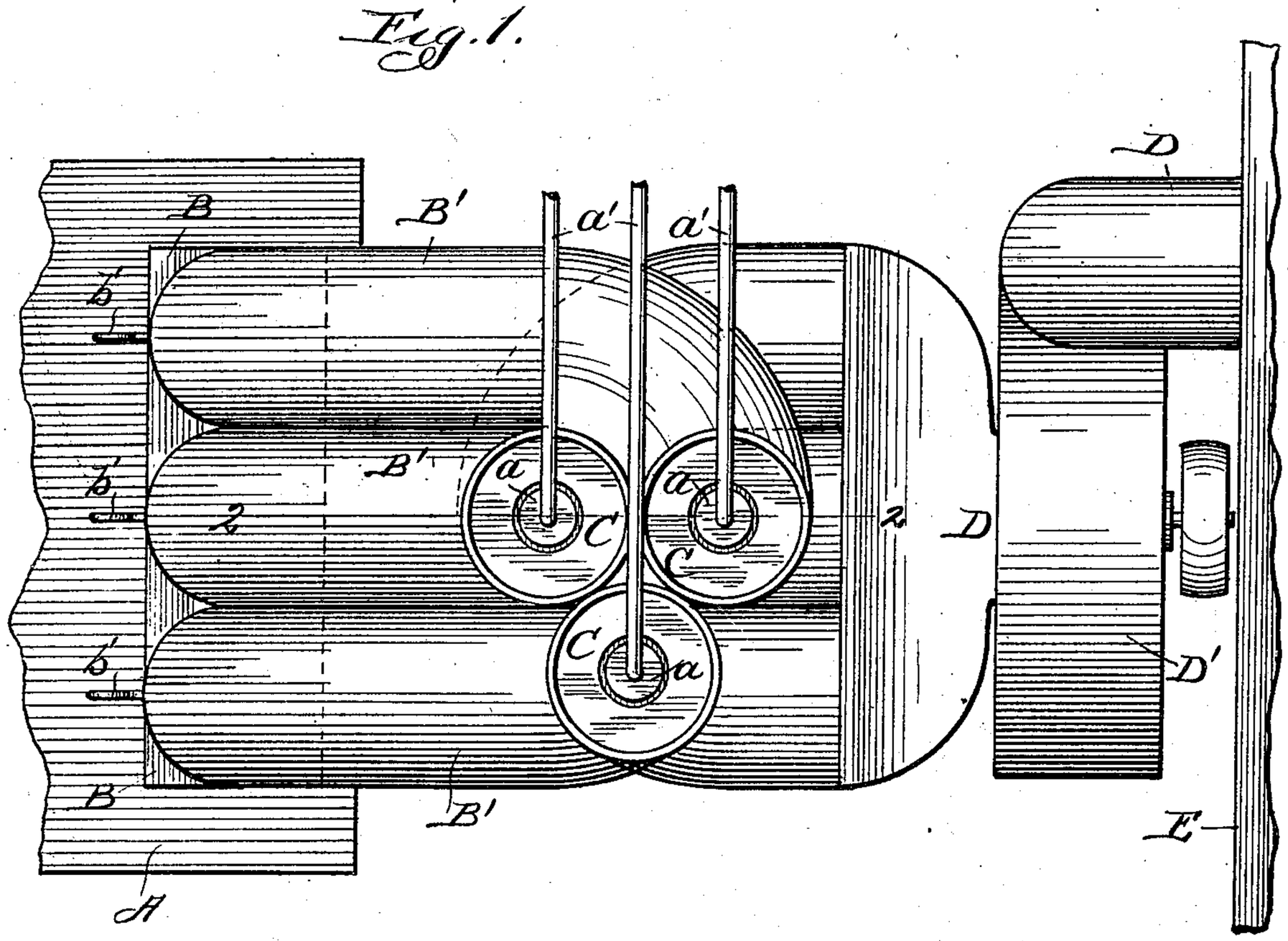


Fig. 3.

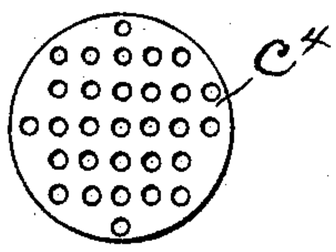
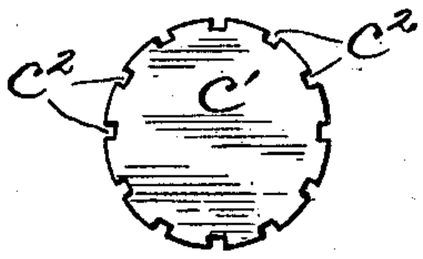


Fig. 4.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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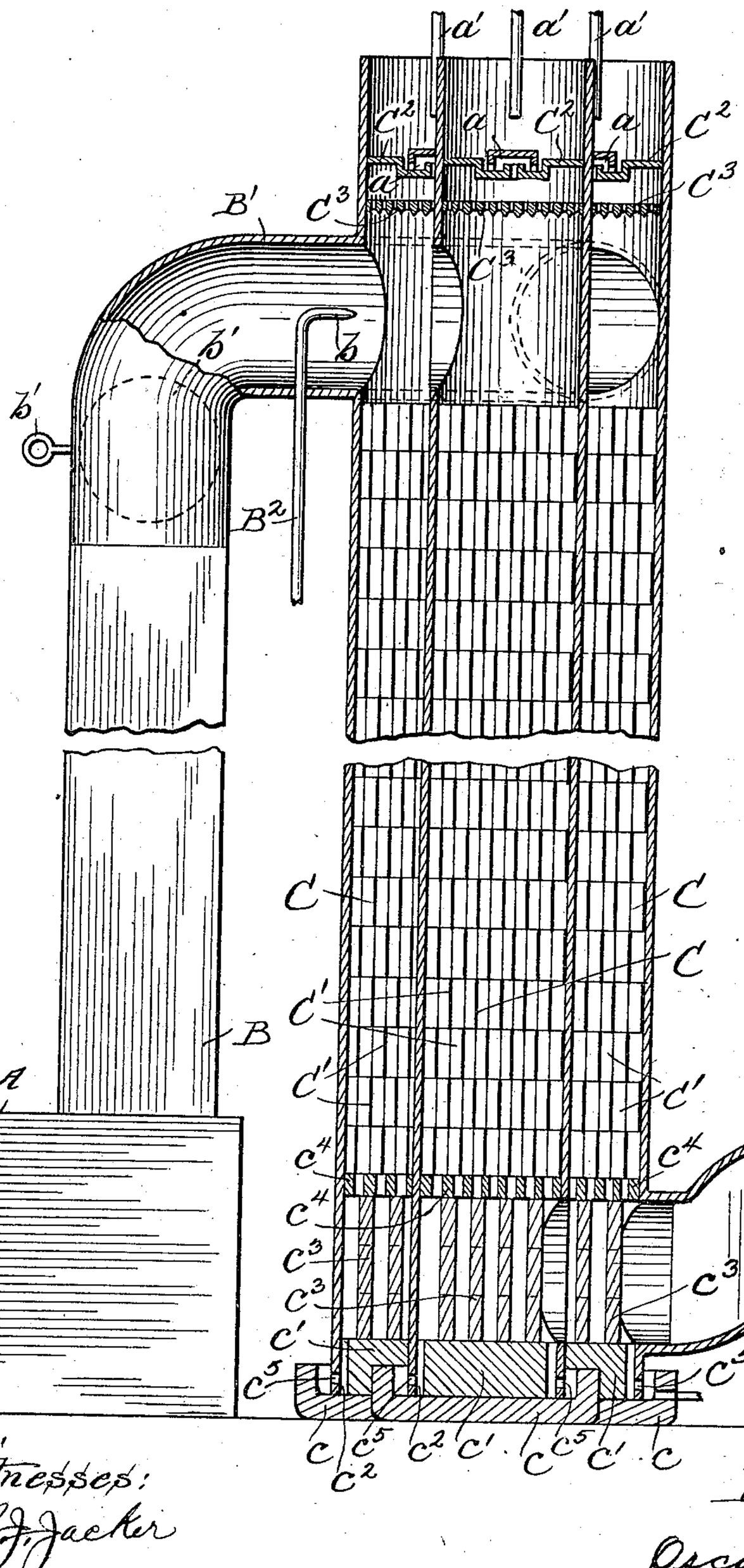

Fig. 2.

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UNITED STATES PATENT OFFICE.

OSCAR H. ELIEL, OF LASALLE, ILLINOIS.

APPARATUS FOR THE MANUFACTURE OF SULFURIC ACID.

SPECIFICATION forming part of Letters Patent No. 725,427, dated April 14, 1903.

Application filed September 24, 1902. Serial No. 124,622. (No model.)

To all whom it may concern:

Be it known that I, OSCAR H. ELIEL, of Lasalle, in the State of Illinois, have invented certain new and useful Improvements in Apparatus for the Manufacture of Sulfuric Acid, of which the following is a specification.

The invention relates to the construction of a concentrating and denitrating tower and to the application of the same to the sulfur-burners and acid-chamber.

As now constructed the denitrating-tower comprises a single large flue with glazed tile or other acid-proof material with interstices through which the acids trickle and the gases ascend. The sulfur-burner is connected with the bottom of the tower and the acid-chamber with the top, and the acids to be denitrated are introduced at the top. Thus constructed and arranged the tower cannot work to the best advantage. When the amount of sulfur burned is less than enough to utilize the normal capacity of the tower, the ascending gases do not meet with the required resistance therein and denitration is correspondingly reduced and the temperature in the tower decreased. The ascending gases being lighter than air meet with proportionately greater aerial resistance in the finer than in the coarser interstices of the filling, and consequently are diverted to the coarser ones, thus leaving large portions of the filling-surfaces unused when the tower is running at full capacity. The SO_2 unites with oxidizing compounds, and the heat of the ascending gases is so great that all of the nitrogen compounds or oxidizing agents are taken up in the upper portion of the tower and carried up and out to the acid-chamber, so that no denitration of acid can take place in the lower portion.

The object of my improvements is to provide a construction and arrangement of the denitrating-tower which will obviate these defects in the operation. To obviate the first difficulty, I propose to provide a sectional tower comprising a plurality of independent tower-flues having separate connection with the burner and acid-chamber, so that when less than the normal amount of sulfur is burned one or more of the tower-flues can be shut off, leaving others to run at their normal capacity. For the second and third of the above-mentioned difficulties I reverse the connections of the tower with the burner and chamber or connect the burner with the top of the tower and force the sulfurous gases down through the tower instead of up and connect the bottom of the tower with the acid-chamber. By this means the proportionately greater aerial resistance in the finest interstices of the tower-filling is materially reduced and the entire filling-surface is more perfectly utilized. The nitrogen compounds and the oxidizing agents are introduced at the top of the tower and carried down through the tower with the sulfurous gases, so as to be present therewith for oxidizing, denitrating, and concentrating purposes throughout the entire length of the tower.

I propose, further, to provide means for spraying instead of showering the acids to be denitrated and concentrated into the top of the tower.

I have attained these objects by the tower constructed and arranged as illustrated in the accompanying drawings, in which—

Figure 1 is a top or plan view of that portion of the apparatus containing my invention. Fig. 2 is a fragment of an enlarged vertical section, taken on a plane at the line 2 2 of Fig. 1. Fig. 3 is a detail showing a detached part in plan view. Fig. 4 is a detail showing a like view of another detached part.

In the drawings, A is the sulfur-burner; B, a branched flue leading from the burner to the sectional tower C, a branch B′ of the flue running to each tower-section, and D a flue having a branch leading from each of the tower-sections and connecting with the acid-chamber E. It is contemplated that the chamber shall have the usual connection with a Gay-Lussac tower, which is not illustrated, as the invention relates entirely to the construction, relative arrangement, and manner of connection of the denitrating and concentrating tower with the burners and acid-chamber.

As shown in the present instance, the tower C is made in three independent sections arranged in a triangle at the base, although any plurality greater or less can be used to suit each individual case. These sections may be made of thirty-six-inch glazed sewer-tiling or any suitable material to withstand the action of the acid, having a filling of glazed brick or other common filling material laid in

the usual fashion. Each tower-section rests in a basin *c* for collecting and draining off the acid therefrom. In the bottom of each section is first laid a disk, brick, or plate *c'*, having recesses c^2 in its edges. On this supporting-bricks c^3 are set up on end with intervening spaces, and upon the bricks a perforated clay plate or disk c^4 is placed to support the tile-filling C'. Near the bottom the tower is provided with holes c^5 below the acid-line and corresponding with the recesses c^2 for allowing the acid to pass out of the tower-section into the basin *c*.

The top of each section of the tower is provided with a cover C^2, which fits in gas-tight, and is provided with a liquid seal *a* at the center, which will overflow inside and allow the nitrated acids poured in through a pipe *a'* to pass into the towers, but prevent the escape of gas from the same. Below the cover is an acid-separator C^3 in each section of the tower, comprising a perforated plate set with numerous tubes, having nozzles at their lower end for dividing the ingoing acid into numerous small streams. The separators are placed just above the entrance of the flues B' from the sulfur-burner, so that the ingoing acids are showered into the sulfurous gases coming from the burners.

Another way of introducing the acids to be denitrated and concentrated is provided by a pipe B^2, which connects with the acid-supply (not shown) and enters through the flue B', wherein it is bent forward to the entrance-aperture of the tower-section, and is provided with a spray-nozzle *b*, by which the ingoing acids forced in under suitable pressure are divided into very fine particles, and thereby brought in better contact with the gases, causing quicker action. The acids will also be better carried along with the gases passing down through the tower. The downdraft through the tower may be produced by suction at the bottom effected by any well-known means. D' is a fan or blower in the flue D, whereby the downdraft through the tower is produced in this instance and the regular draft through the system is maintained. The several branches B' of the flue B are provided at each tower with a valve *b'*, whereby any one or more of the tower-sections may be shut off or cut out of the system when less than the full amount of sulfur is being burned or for repairing the tower section by section without stopping the entire plant.

Each separate section of the tower individually attains the results of more perfectly utilizing all the filling-surfaces and of denitrating and concentrating the acid throughout the entire height of the tower by reason of the downward movement of all the reacting gases, compounds, or elements involved.

What I claim is—

1. In an apparatus of the class described a denitrating and concentrating tower comprising a plurality of independent filled sections, in combination with the sulfur-burner and acid-chamber, valved flues severally connecting the top of the tower with the sulfur-burner, and valved flues severally connecting the bottom of the tower with the acid-chamber substantially as specified.

2. In an apparatus of the class described a denitrating and concentrating tower, in combination with the sulfur-burner, a flue from the burner connected with the top of the denitrating and concentrating tower whereby the sulfurous gases are introduced into the tower at the top, and means for producing a downdraft through the tower as specified.

3. In an apparatus of the class described a denitrating and concentrating tower, in combination with the sulfur-burner, a flue from the burner communicating with the denitrating and concentrating tower above the filling therein, a flue from the tower connected below the filling and communicating with the acid-chamber, and means for producing a downdraft through the tower as specified.

4. In an apparatus of the class described a denitrating and concentrating tower provided with a closed top in combination with the sulfur-burner, a flue from the burner communicating with the tower above the filling, and a pipe entering the denitrating and concentrating tower over the filling and provided with a spray-nozzle as specified.

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