

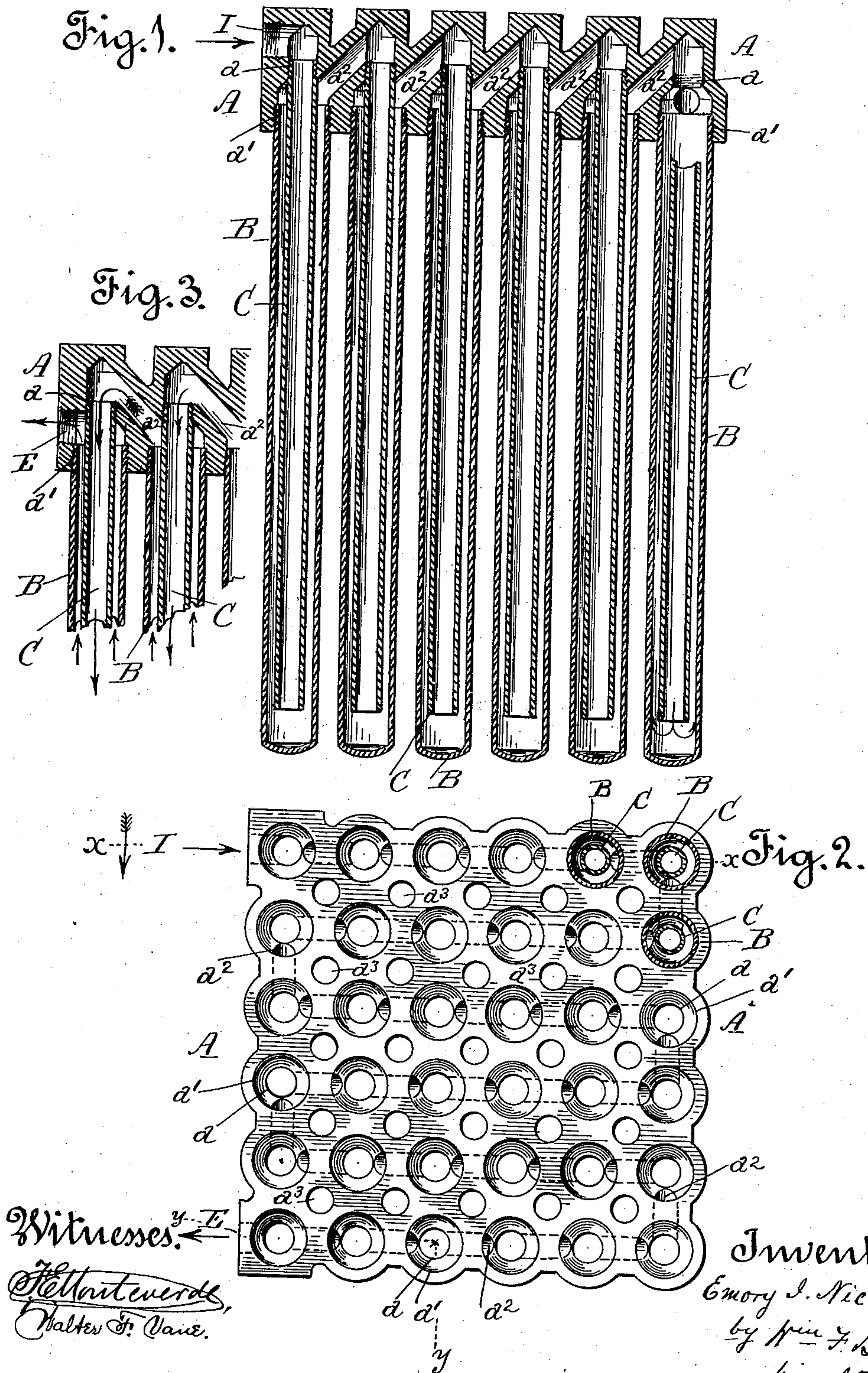
No. 742,480.

PATENTED OCT. 27, 1903.

E. I. NICHOLS.  
STEAM GENERATOR.

APPLICATION FILED NOV. 4, 1902.

NO MODEL.





# UNITED STATES PATENT OFFICE.

EMORY I. NICHOLS, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR OF ONE-HALF TO FRANK A. HUNTINGTON, OF SAN FRANCISCO, CALIFORNIA.

## STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 742,480, dated October 27, 1903.

Application filed November 4, 1902. Serial No. 130,084. (No model.)

*To all whom it may concern:*

Be it known that I, EMORY I. NICHOLS, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Steam or Gas Generators; and I do hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to the class of steam or gas generators. Its object is to provide a simple, effective, compact, and light generator for use in boats, automobiles, or other places in which economy of space or fuel is required or in any case where steam is required to be made economically or in a short time or where water is to be heated rapidly for use as such.

It consists in the novel construction, relative arrangement, and connection of the several parts constituting the fluid course, which I shall hereinafter fully describe by reference to the accompanying drawings, in which—

Figure 1 is a vertical section through one line of tubes and the head, taken on line  $x x$  of Fig. 2, looking in the direction of the arrow. Fig. 2 is a plan of the under side of the head, several of the tubes being shown in cross-section. Fig. 3 is a vertical section on the line  $y y$  of Fig. 2.

A is a plate which forms the generator-head. This plate may be made in any desired shape in contour. It is for illustration here shown as rectangular. To this head are connected the generating-tubes in concentric pairs.

B represents the outer tubes, and C represents the inner tubes. The connection of these tubes with the head may be of any suitable character. I deem the construction here shown both practical and simple. It consists of sockets in the head made in two diameters, the deeper part  $a$  being of smaller diameter than the shallower part  $a'$ . Into the smaller diameter is fitted the inner tube C, and into the larger diameter is fitted the outer tube B. The two tubes are of such diameters that an annular space is left between them, which space has a capacity equal to that of the inner tube. The outer or free end of the inner tube is open directly into the closed end

of the outer tube, and thus communicates with the annular space between the tubes. The inner end of each tube is open, and in the head A are made passages of any suitable character designed to connect the inner open end of one tube of each pair with the inner open end of the other tube of the succeeding pair, thus connecting the tubes successively or in "series," as it may be termed, to form a continuous fluid-passage throughout the entire series from the inlet to the exit. These connecting-passages I consider are best constructed as I have here shown—to wit, the passage  $a^2$  bored in on a slope from the inner end of the larger-diameter socket  $a'$  to the inner end of the smaller diameter  $a$  of an adjacent socket. Thus these passages  $a^2$  connect the inner open end of the inner tube of one pair of tubes with the inner open end of the outer tube of a succeeding pair, and so on throughout the whole series from beginning to end. There may be as many of these concentric pairs of tubes as may be desired arranged in such rows and lines as economy in space may require, and in case an increase in capacity be desired several independent series may be coupled together in one generator.

The inlet of the water to the first inner tube is indicated at I by a hole made in the head A, and the exit from the last outer tube is at the hole E in head A.

Any suitable fire-box or casing may be used, and the generator may be supported therein in any suitable manner. I have here shown holes  $a^3$  made in the head A for the passage of the products of combustion.

The operation is as follows: If steam is to be made, the tubes and head having been exposed to the heat of the fire-box until they are hot enough water is fed in proper quantities at the inlet I. It enters the first inner tube C and passing down therein is practically instantaneously converted into steam. Thence the steam enters and passes up through the outer tube B of the same pair. Thence from the open upper end of said outer tube it passes through passage  $a^2$  into the upper end of the inner tube of the succeeding pair of tubes and down in said tube and up in the outer tube of said pair, and so on, down the inner tubes and up the outer tubes



throughout the series until as superheated steam it finds exit at E. According to the amount of water fed at I the steam will be generated in more advanced parts of the course  
5 and will be more or less superheated, and on the same principle if a sufficient stream of water be supplied the device may be used to obtain hot water at E. If gas is to be generated, the operation is the same, the proper fuel  
10 oil being supplied. As a steam or gas generator its action is substantially instantaneous, and the course being continuous the flow is so rapid and strong that the tubes are kept clean and free from sediment.

15 Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

In a generator of the class described, the combination of a plurality of rows of pairs of  
20 concentric tubes, the outer tube of each pair being spaced from the inner tube, said inner

and outer tubes communicating directly at one end, a head with which said tubes are connected at the other end, said head having passages arranged to effect the communication  
25 of one member of each pair with the other member of a succeeding pair in sequence from the first pair of the first row, through successive rows to the last pair of the last row, whereby a single continuous fluid course is  
30 had to and fro in successive rows, an inlet in the head to admit the fluid to a tube of the first pair of the first row, and an outlet in the head from a tube of the last pair of the last row.

35 In witness whereof I have hereunto set my hand.

EMORY I. NICHOLS.

Witnesses:

WALTER F. VANE,  
D. B. RICHARDS.