

S. E. BABCOCK.  
Smoke Stack.

No. 230,217.

Patented July 20, 1880.

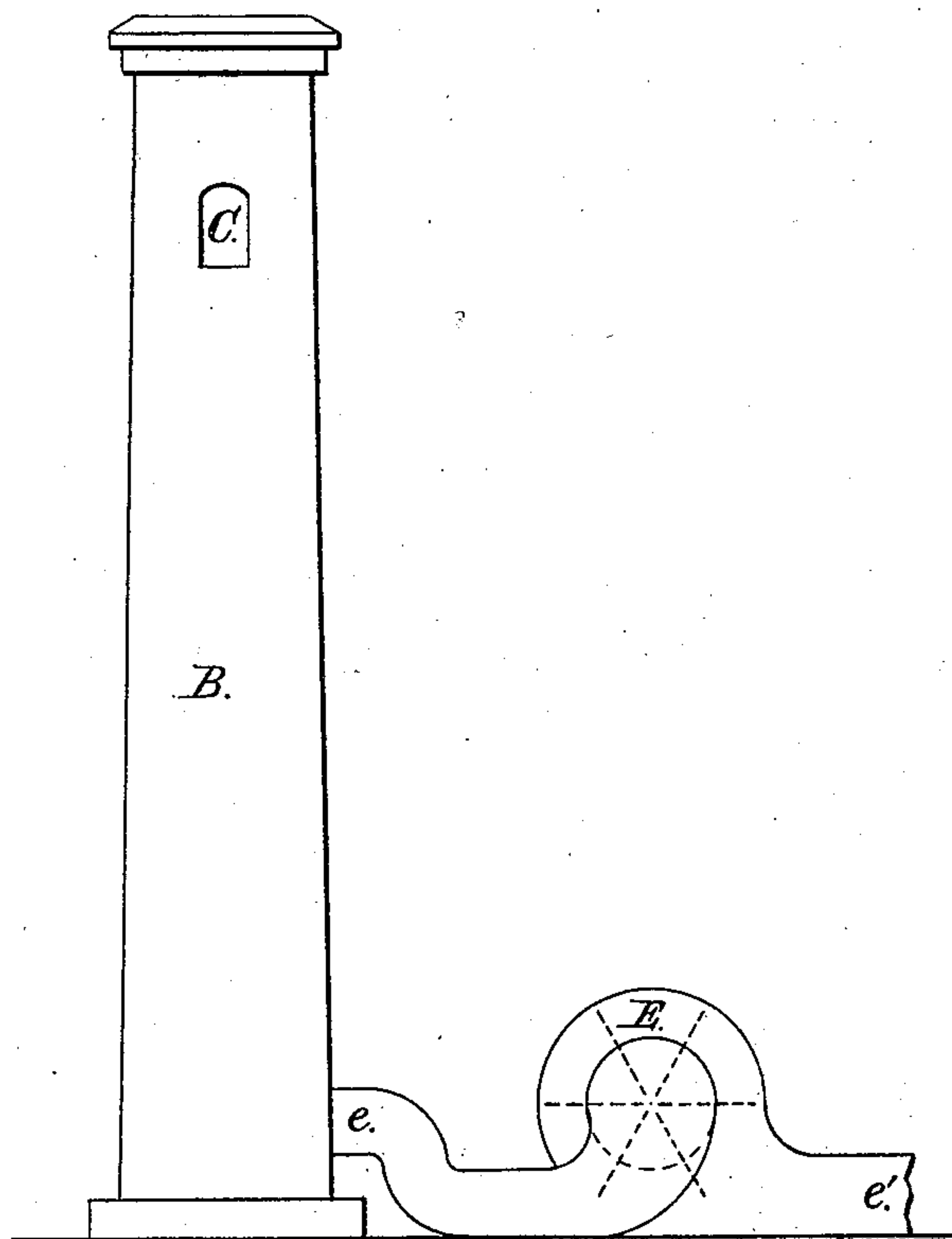


FIG. 2.

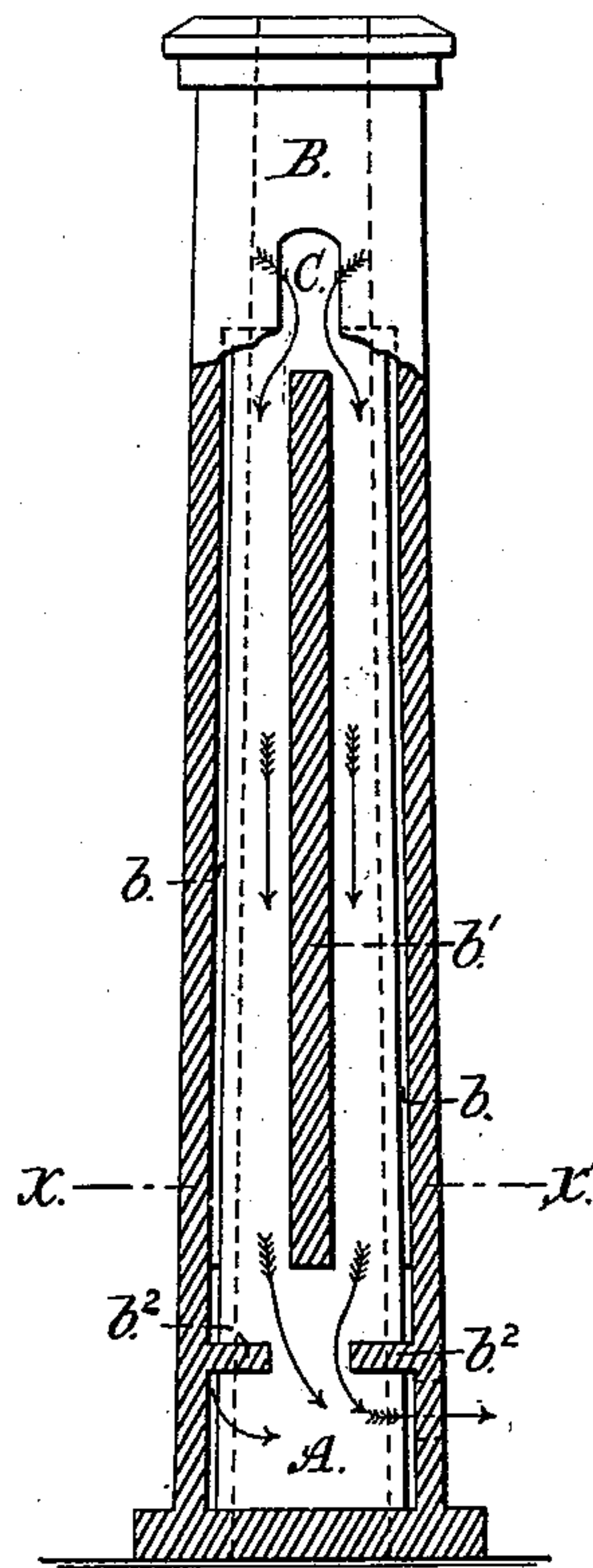


FIG. 1.

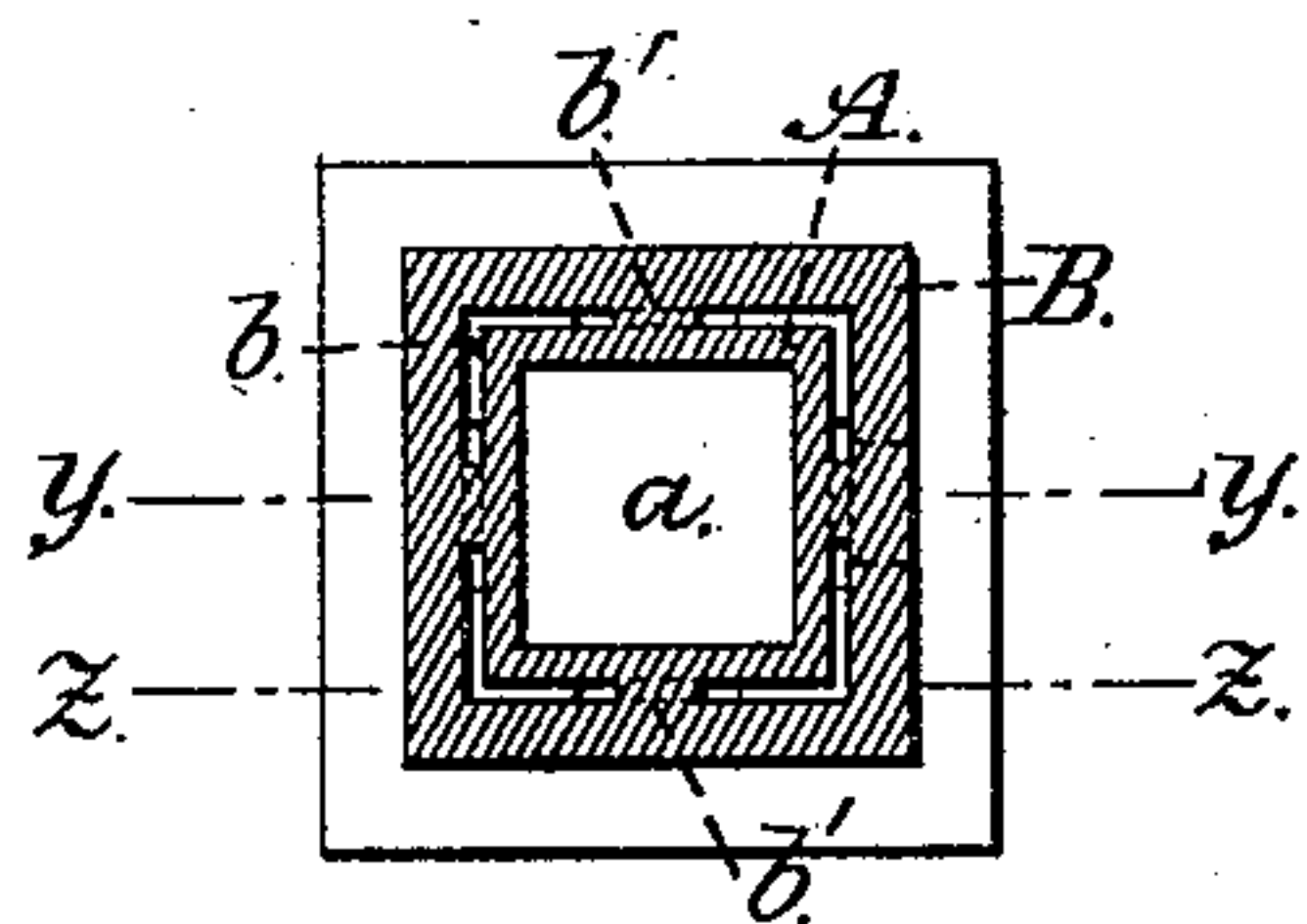


FIG. 3.

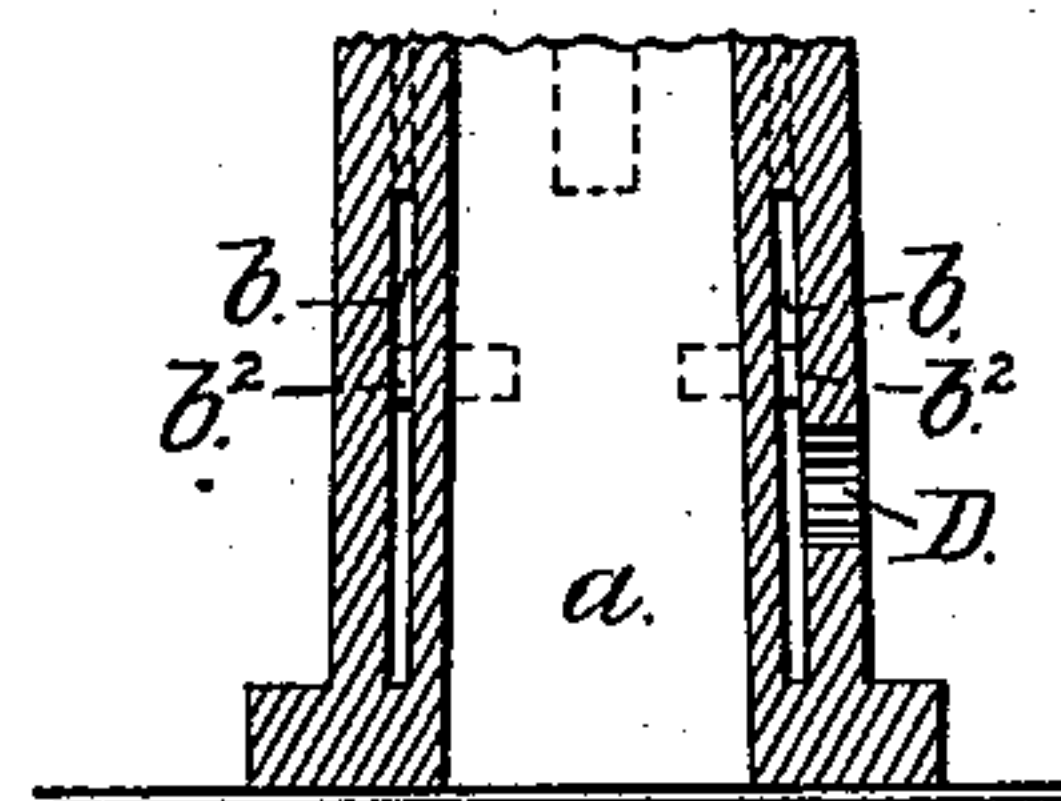


FIG. 4.

Witnesses,

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# UNITED STATES PATENT OFFICE.

STEPHEN E. BABCOCK, OF TROY, NEW YORK, ASSIGNOR OF SEVENTEEN TWENTY-FOURTHS OF HIS RIGHT TO D. STEWART DENNISON, JESSE B. ANTHONY, AND THEODORE E. HASLEHURST, OF SAME PLACE.

## SMOKE-STACK.

SPECIFICATION forming part of Letters Patent No. 230,217, dated July 20, 1880.

Application filed November 21, 1879.

*To all whom it may concern:*

Be it known that I, STEPHEN E. BABCOCK, of Troy, in the county of Rensselaer and State of New York, have invented certain new and useful Improvements in Smoke-Stacks, of which the following is a full and exact description, reference being made to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a side elevation, showing a portion of the outer wall removed at the line  $z z$ ; Fig. 2, a side elevation; Fig. 3, a horizontal section at the line  $x x$ , and Fig. 4 a vertical section through the base of the stack at the line  $y y$ .

The object of my invention is to recover the heat derived from the wasted products of combustion and absorbed by the brick-work of the chimney, and to utilize it for heating the air that is supplied to the furnaces for the purpose of supporting combustion; and to this end my invention consists of a smoke-stack constructed with a central or principal flue, for the escape of the volatile waste products of combustion, surrounded by double walls containing air-flues, into which flues suitable inlet-openings for the admission of air are made near the top of the stack, and an outlet opening or openings near the base of the stack, from which the heated air may be drawn by any suitable artificial means, and then forced beneath the fires in the furnaces.

As shown in the drawings, A is the central shaft, containing the principal or smoke flue  $a$ . Said shaft may be made of any required size or form, and connected with the furnace for which it is intended in any suitable manner. An outer wall, B, entirely surrounds the shaft A, and is placed at sufficient distance therefrom to form the air-flues  $b$ , which inclose the central shaft. Said air-flues I preferably divide by means of the vertical partitions  $b'$  and horizontal partitions  $b''$ , for the purpose of preventing the air in said flues from reaching the exit by the shortest course thereto.

Inlet-openings C are made through the wall B at each side of the chimney, near the top thereof. Said openings communicate directly with the air-flues  $b$ , and through these open-

ings the said flues are furnished with a supply of air from the surrounding atmosphere.

An outlet-opening, D, is made near the base of the chimney through the outer wall, B. All of the air-flues  $b$ , at their lower ends, have a direct communication with the said outlet-opening, to which an exhausting apparatus must be attached for the purpose of drawing downward the heated air from out the air-flues in opposition to its natural tendency to rise.

The exhausting apparatus (shown in Fig. 1) consists of a fan-blower, E, whose induction-pipe  $e$  is connected directly to the outlet-opening D of the chimney, and forms a communication between said opening and the center of the fan. The eduction-pipe  $e'$  of the fan-blower conveys the heated air drawn out of the air-flues by the fan-blower beneath the furnace-fires in the usual manner.

In smoke stacks of the ordinary construction the heat absorbed by the brick-work is not only entirely lost for any useful purpose, but it is also very destructive in its effect on the masonry.

The central shaft, A, of my chimney becomes heated by absorbing the waste heat from the furnaces; and if this heat can be utilized in the manner hereinbefore described I derive the benefit of the well-known fact in calorifics that every unit of heat imparted to the air supplied for supporting combustion produces a corresponding saving in the amount of fuel required in the furnaces, and it follows that if the heat absorbed by the chimney can be taken up and recovered by the air for supplying the furnaces a saving of fuel will be effected that will equal the amount required for increasing the temperature of the atmosphere to that of the air so heated. To produce this effect the air is drawn from the lower end of the air-flues  $b$  by the exhausting apparatus connected to the outlet-opening D, and a partial vacuum is thereby created in the air-flues, which are instantly refilled by the air entering the inlet-openings C. In this manner a constant flow of descending currents of air, as indicated by the arrows in Fig. 1, is established in the air-flues, and these currents take up the heat radiated from the



masonry, and the air is thereby reduced to a highly-heated condition before it is discharged from the eduction-pipe of the exhausting apparatus, by which it is conveyed beneath the  
5 fires in the furnaces.

By taking the cold air in at the top of the chimney it is brought into contact, while in its coldest condition, with the coolest part of the central shaft, and as the air descends it progressively comes in contact with the parts of  
10 the shaft where the heat is constantly increasing, until it reaches the hottest part at the base, where the air is drawn out, as before described, in its most favorable condition for  
15 supplying the furnaces.

By means of the partitions  $b'$  and  $b^2$  the air-currents are prevented from pursuing the shortest course to the outlet-opening D, and are therefore kept longer in contact with the  
20 heated masonry, and the central shaft and outer wall of the chimney are by these partitions "bonded" together to produce greater strength in the structure.

I am aware that smoke-stacks have heretofore been constructed with an inner and outer  
25 shell arranged to leave an annular space between them, the air being admitted into said annular space near the top of the stack and drawn out by means of a fan through exit-  
30 openings near its bottom; but such a construction fails to utilize but a small portion of the waste heat, for the reason that the annular space being undivided by vertical partitions into separate air-flues, the air entering the inlet-  
35 openings at the top of the stack will be drawn by the fan in the most direct line to the exit-

openings, and by passing obliquely from the inlet to the outlet openings will only be brought into contact with a small portion of the heated  
inside flue.

Smoke-stacks have also been constructed with inside and outside shells, and having the intermediate space divided into cold and hot air flues, the air being admitted, near the  
bottom of the stack, into the cold-air flues, through which it passes upward to the top of  
45 the stack, and from thence downward through the hot-air flues to the exit-openings at the bottom of the stack; but in that construction the action is so sluggish that provision is made  
50 for stimulating it by forcing the air upward through the cold-air flues by means of the exhausting-fan.

I claim as my invention—

1. As an improved smoke-stack, the construction herein described, consisting of the central  
shaft, A, outer wall, B, and air-flues  $b$ , said  
55 flues being formed by the partitions  $b'$  and  $b^2$ , and having inlet air-openings C near the top of the stack, and outlet-opening D near the  
60 base thereof, as and for the purpose herein specified.

2. The central shaft, A, outer wall, B, and partitions  $b'$   $b^2$ , arranged, as herein described, to form the air-flues  $b$ , the inlet-openings C, and  
65 outlet-opening D, constructed, arranged, and combined with an exhausting apparatus, as and for the purpose herein specified.

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Witnesses:

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