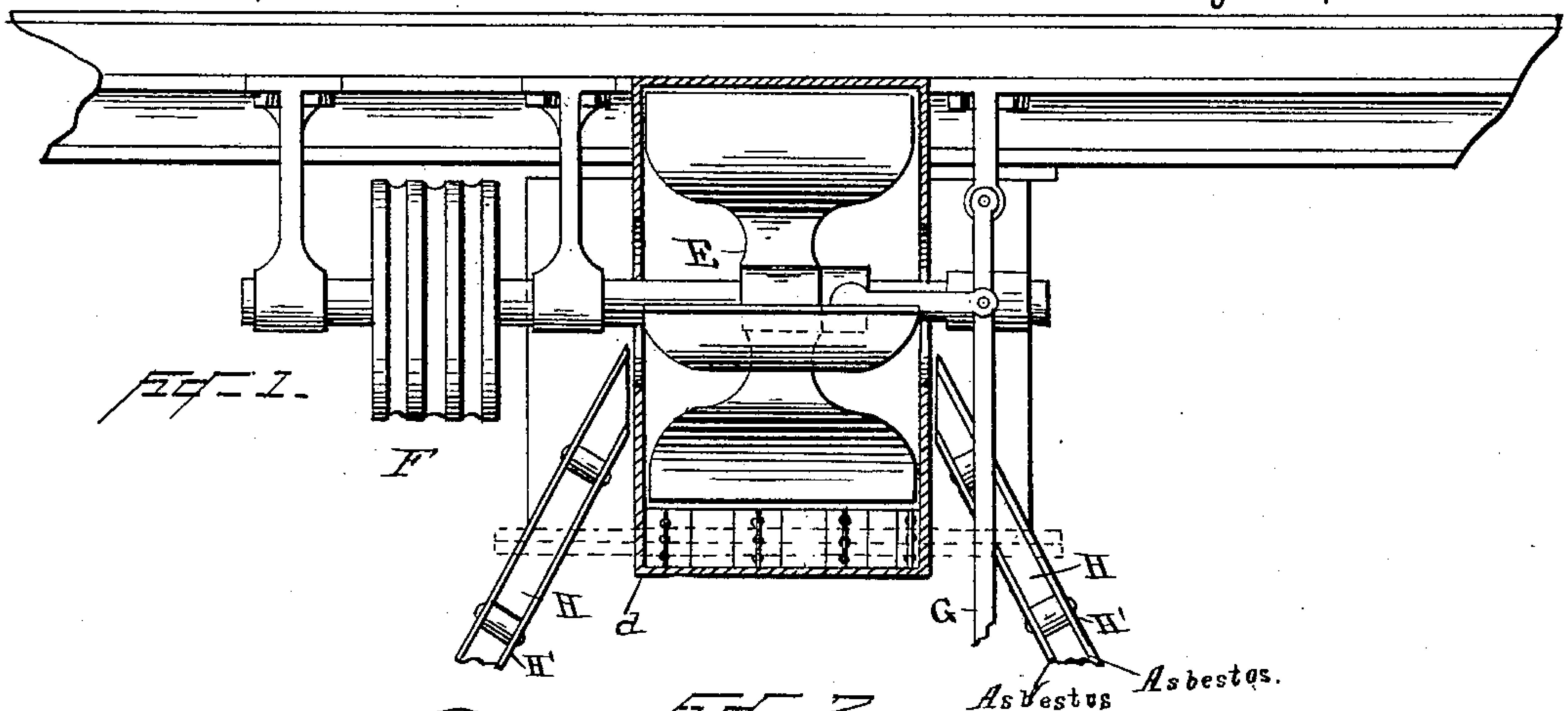
(No Model.)

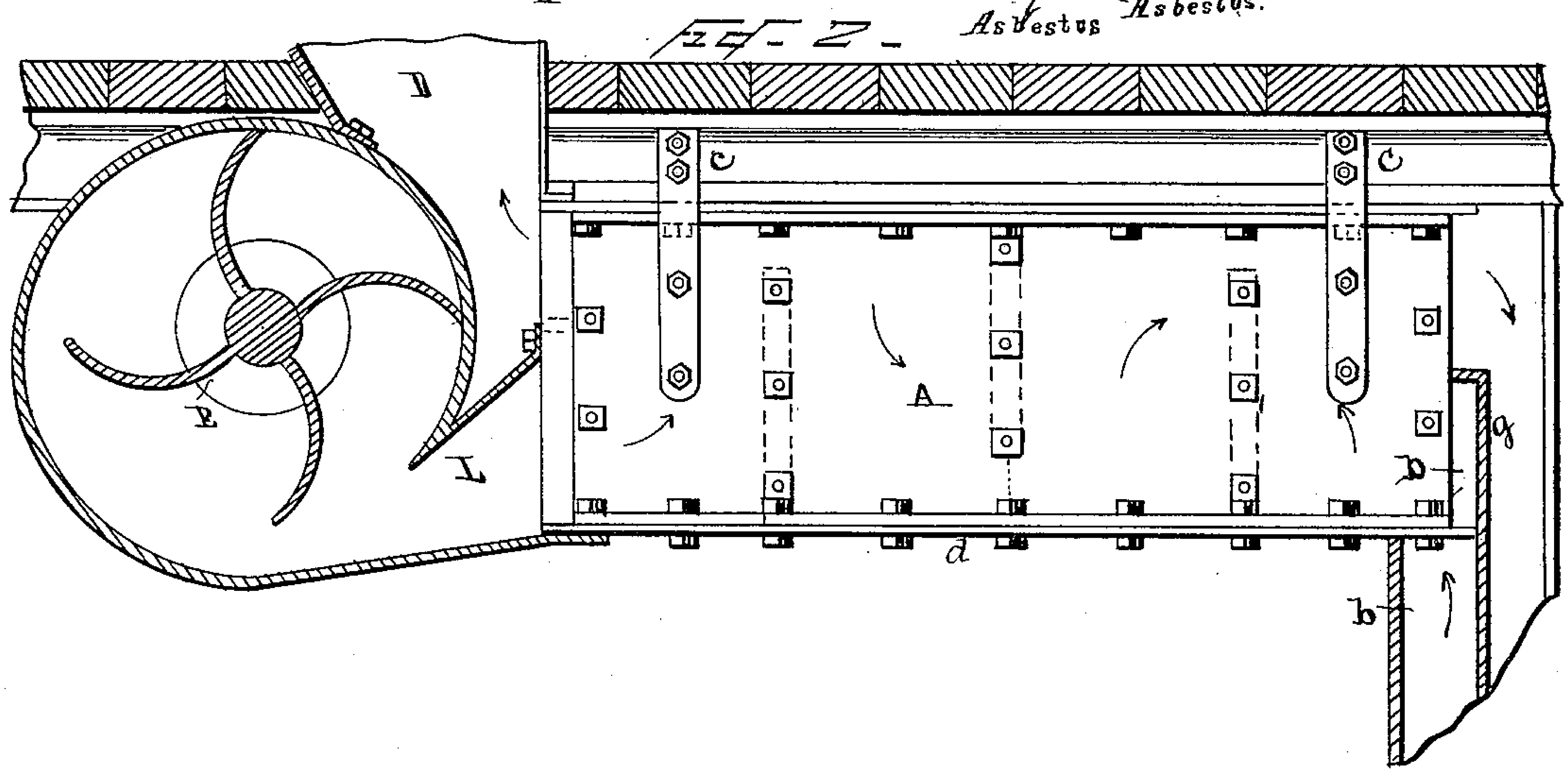
2 Sheets—Sheet 1.

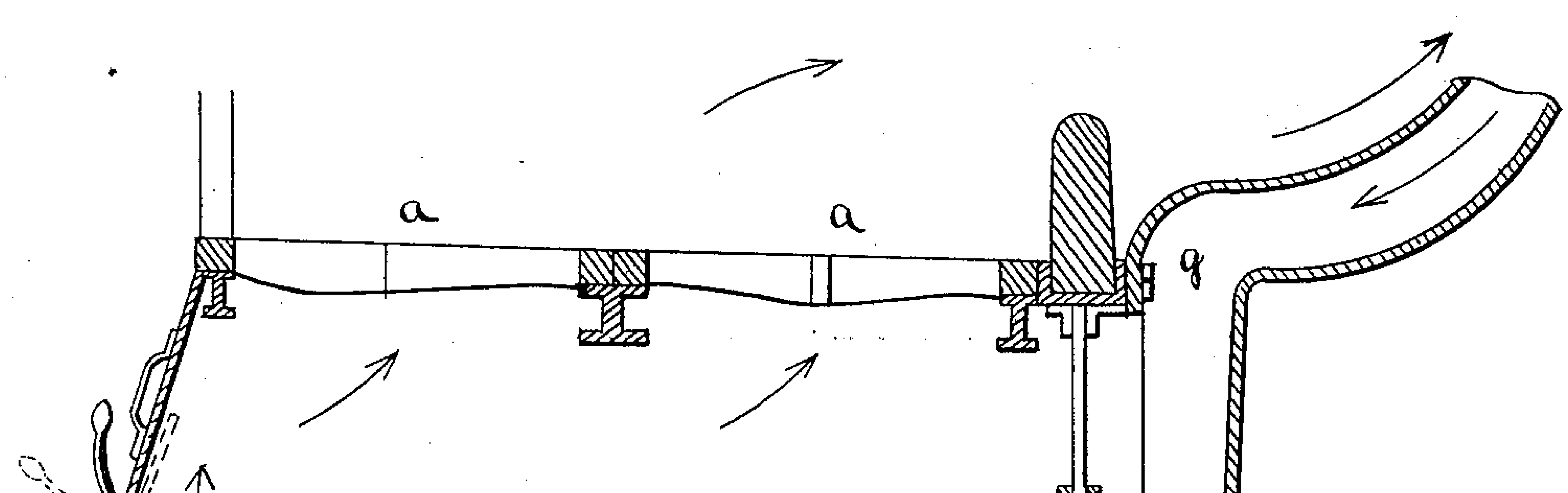
N. B. CLARK & F. B. KING.

HOT AIR FEEDER.

No. 386,527. Patented July 24, 1888.







WITNESSES.

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(No Model.) 2 Sheets—Sheet 2.

N. B. CLARK & F. B. KING.

HOT AIR FEEDER.

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Fig. 3.

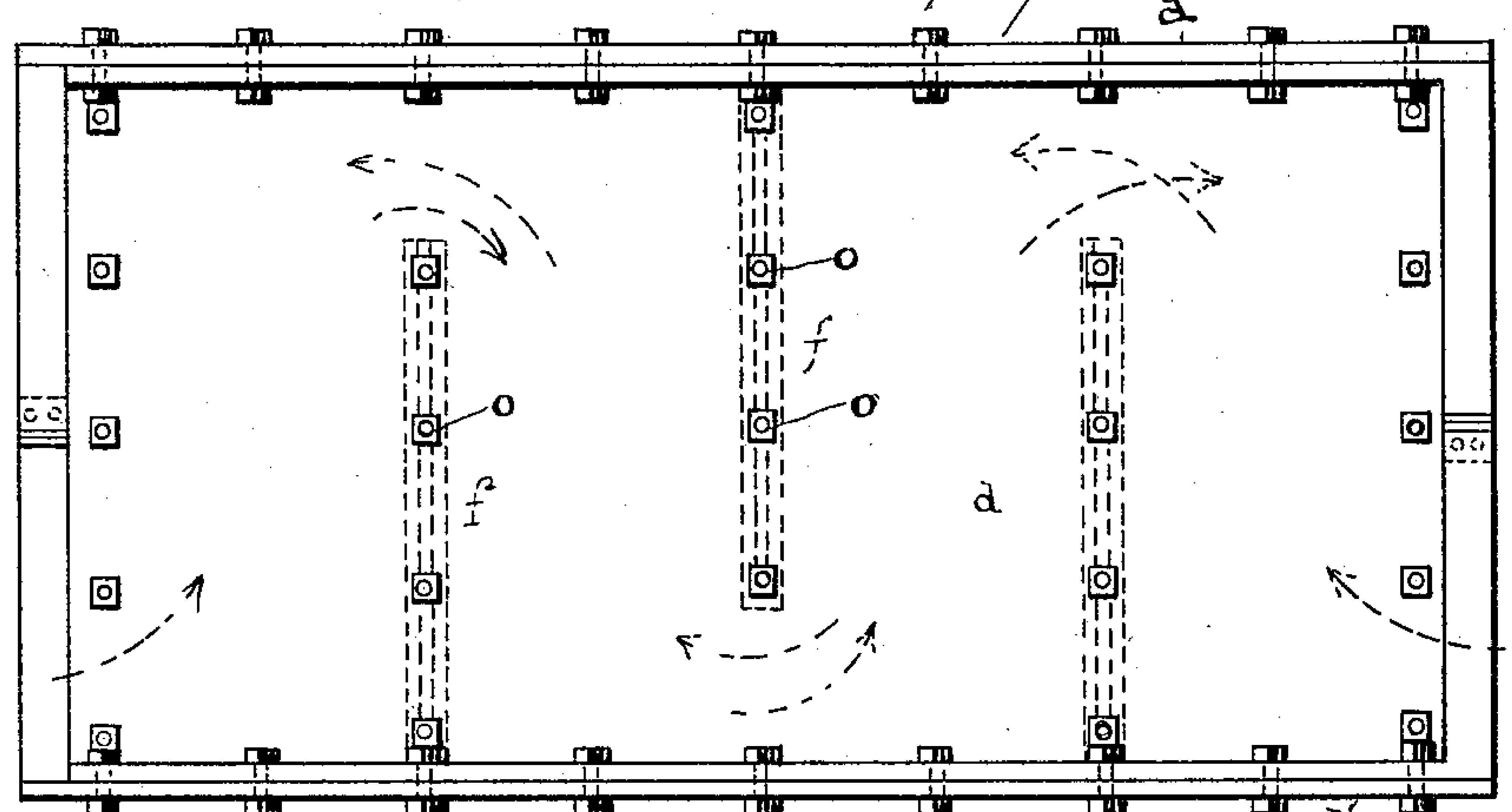


Fig. 4.

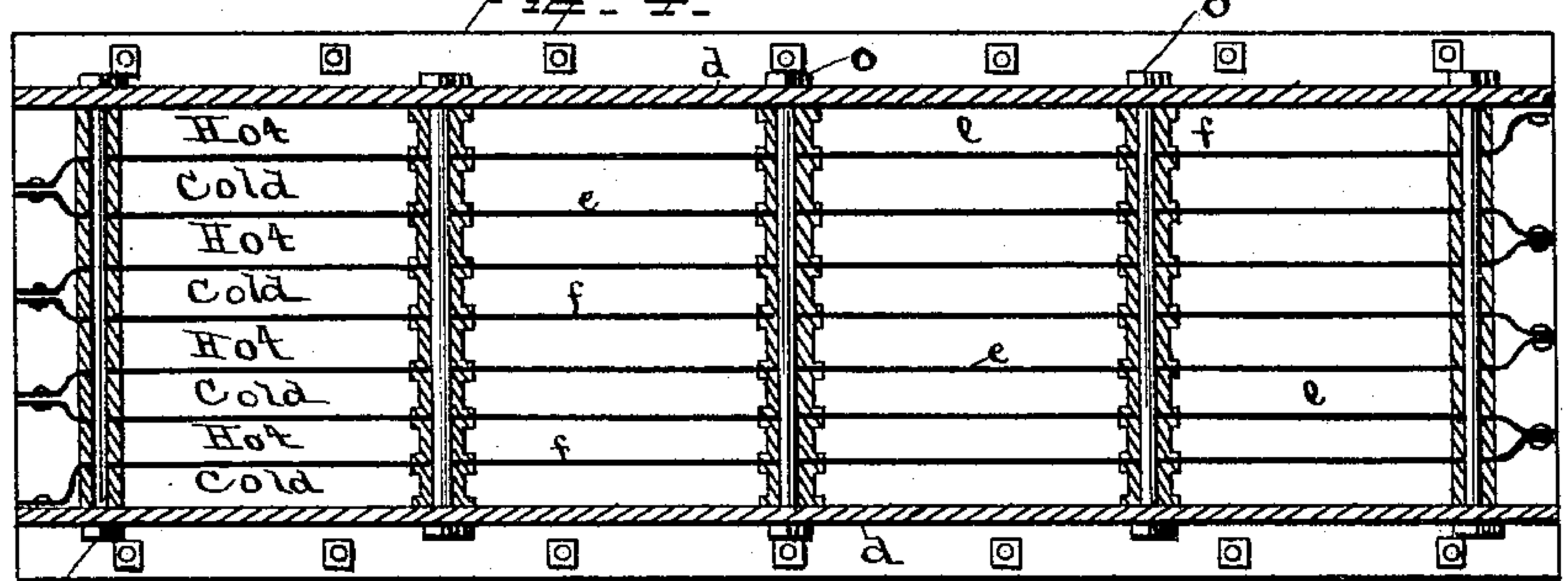


Fig. 6.

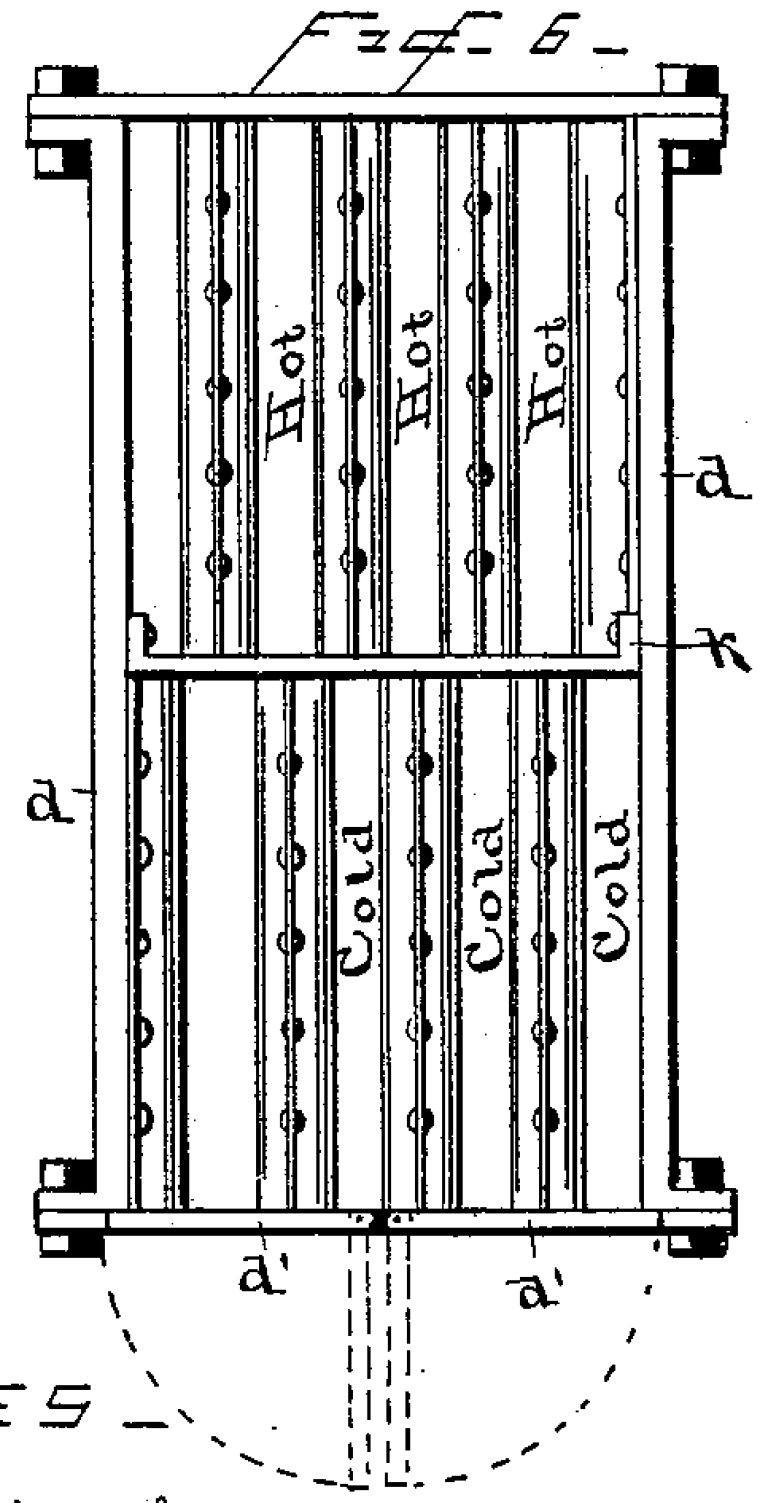
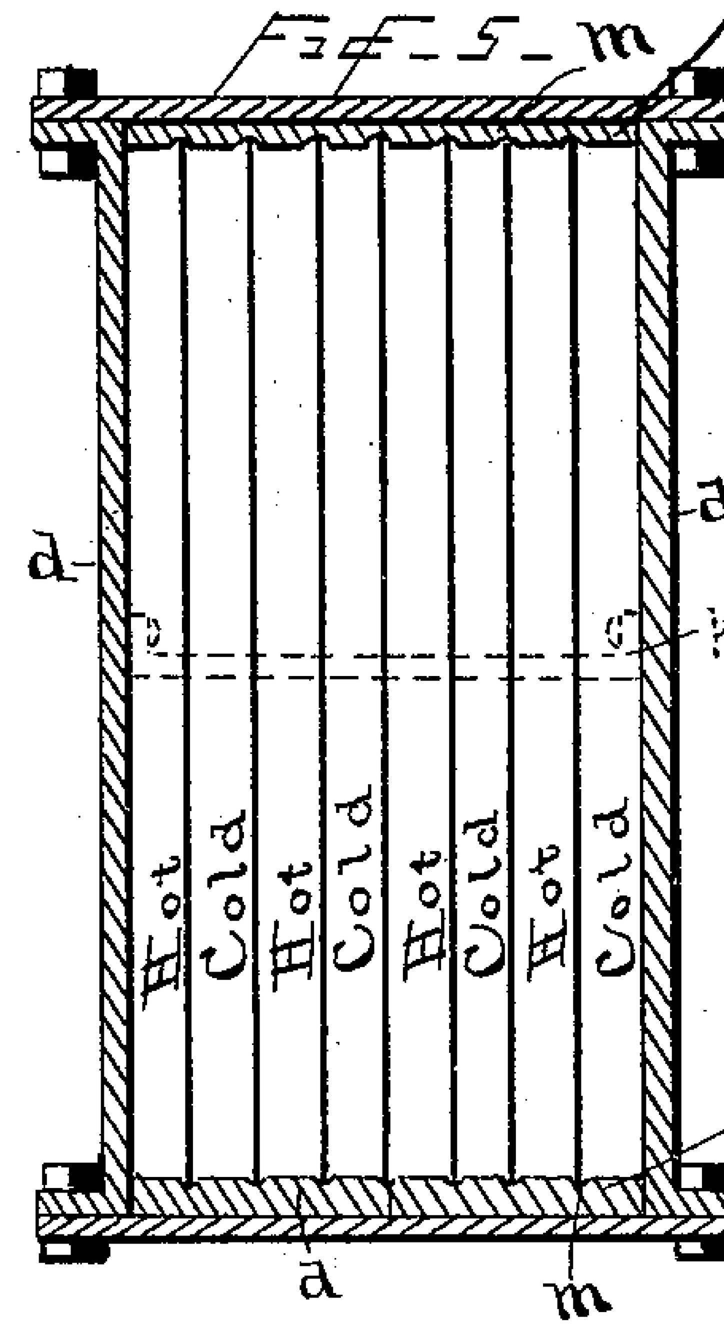


Fig. 5.



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UNITED STATES PATENT OFFICE.

NATHAN B. CLARK, OF WASHINGTON, DISTRICT OF COLUMBIA, AND FRANK B. KING, OF BALTIMORE, MARYLAND.

HOT-AIR FEEDER.

SPECIFICATION forming part of Letters Patent No. 386,527, dated July 24, 1888.

Original application filed March 21, 1888, Serial No. 267,991. Divided and this application filed May 10, 1888. Serial No. 273,449. (No model.)

To all whom it may concern:

Be it known that we, NATHAN B. CLARK, Chief Engineer United States Navy, retired, of Washington, District of Columbia, and FRANK B. KING, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Hot-Air Feeders, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to mechanism for heating the air preparatory to feeding it to the furnace of a steam-boiler, and to utilizing the otherwise waste products of combustion.

The invention consists in the novel features of construction and combination of parts constituting the device.

The object of the invention is to so utilize the products of combustion that the waste gases will escape from the smoke-pipe practically deprived of caloric, and to heat the air fed to the furnace to such an extent that a ready combustion of fuel is effected.

This application is a division of our application Serial No. 267,991, filed March 21, 1888.

In the drawings, Figure 1 is a front view, partly in elevation and partly in section, of a blower and the entrance to the heat-interchanger. Fig. 2 is a section and elevation at a right angle to Fig. 1, partly broken away, showing in general the relative arrangement of the interchanger with the boiler-furnace, the boiler itself being omitted. Fig. 3 is a side elevation of the interchanger proper, the deflecting partitions being shown in dotted lines. Fig. 4 is a horizontal section about midway of Fig. 3. Fig. 5 is a vertical cross section of Fig. 4 on a plane midway of two partitions. Fig. 6 is a rear end view of the interchanger.

The letter *a* indicates the grate-bars of a boiler-furnace. The boiler is placed above the furnace at a proper distance to permit combustion. The products of combustion, after passing the boiler, enter the interchanger by passages *b*.

The interchanger A consists of a box, preferably rectangular in form and suspended above the boiler. As shown in Figs. 1 and 2, the interchanger is suspended from the deck-beams of a ship above the boiler-casing by hangers *c*, bolted to the casing of the interchanger and the deck-beams. The outer shell or casing, *d*, of the interchanger may be of metal plates, of suitable strength and thickness. The casing is divided longitudinally by a large number of thin metal plates, *e e*, which are held apart at suitable distances by spreaders or spacing-pieces *f f*. These pieces *f f* extend alternately from the bottom to near the top of the plates *e*, and from the top to near the bottom, as indicated in dotted lines, Fig. 3. Bolts or rods *o*, passing through the casing, and plates *e* and spacing-pieces *f* hold all in place. The plates *e e* are cut horizontally at the ends for a little way and a cross bar or brace, *k*, inserted. Adjacent plates are brought together at their ends above this cut and riveted or otherwise closed, while below the cut the plates are bent in reverse direction and the ends closed, as shown. Thus the plates *e e* form very narrow passages, open at the ends alternately above and below the medial line, and these channels are partially closed by the spacing-pieces to form zigzig passages. It will be understood that the alternation of plates may be varied. The passages extend from top to bottom of the interchanger, but are partially closed at the ends by the closing together of the plates, and are also partially divided by the partitions. Each hot-air passage extends from top to bottom and from end to end of the casing, and has a cold air passage on each side thereof. A blower, E, communicates with the open ends of alternate passages, as in Figs. 1 and 2. This blower will force thin films of air through the passages which open toward the blower, the air being then comparatively cold. These currents of air will be deflected up and down by the spacing-plates *f*, and will pass out to the channel *g*, and so to the furnace, which the air will enter at any desirable place or places. The hot air, smoke, and gases from the furnace will at the same time pass in reverse direction through the alternate channels, and will escape to the smoke-pipe through passage D. The hot air and gases from the furnace will thus be divided into thin films, or strata, and will be separated from the thin films of cold air moving toward the furnace by the thin metal plates *e*. The effect will be that the cold air moving toward the furnace becomes heated while the gases from the furnace are cooled, and will escape from the passage D, deprived of nearly all the caloric evolved in the furnace, while the cold air going to support combustion is highly heated before it reaches the fire.

Any suitable air-forcer may be used to give forced draft. We illustrate a rotary blower at E, in front of the interchanger. This blower is driven from pulley F, and may be thrown into or out of operation by clutch-lever G. The air-forcer will drive cold air into the alternate passages of the interchanger through channel L, and the continued blast will accelerate the passage of the gases of combustion from the furnace, the doors of the furnace of course being closed while the blower is in operation.

The plates *e* may be held at the edges in grooved sheets *m*, of asbestus or similar material, the grooves receiving the edges of plates *e*. The plates *e* may generally be pressed into the asbestus.

The bottom plate, *d'*, of the interchanger may be hinged to the other parts of the casing, so as to be readily dropped to take out soot and ashes which accumulate in the interchanger. The boiler-casing may be made hollow, as described in the application referred to, and lead by passages H to the vicinity of the blower, so that the escape of heat from the boiler is prevented. The plates H' may be lined with asbestus or similar material. The passages H will of course be open at the bottom, so that ashes, soot, &c., will drop out when the bottom plate is removed.

It will be observed that the end of the interchanger next to the furnace will be subjected to a much more intense heat than the other end, from which the cool gases of combustion are discharged. In other words, in a well-proportioned interchanger the end next the furnace may be intensely hot, while the end next the air-forcer would be comparatively cool. In designing an interchanger for a furnace from which the gases of combustion are discharged at too high a temperature for metallic plates to resist, it is proposed to divide it into two sections, the section next the furnace being constructed of thin plates of soapstone, densely-compacted asbestus-millboard, or any other refractory material that will best serve the purpose.

This air-heater or interchanger can be applied to other furnaces than those of steam-boilers.

What we claim is—

1. The combination, with a furnace, of an interchanger consisting of a casing divided into narrow passages by thin plates, alternate passages communicating with and receiving air from the outer atmosphere and conveying it toward the furnace, and alternate passages receiving the products of combustion from the furnace and conveying them in reverse direction from that of the moving air-currents and in proximity thereto, all substantially as set forth.

2. The combination, with a furnace, of an interchanger consisting of a number of passages separated by thin plates, alternate passages communicating with an air-forcer, and alternate passages leading to the smoke-pipe, the inflow-passages leading toward and the outflow-passages away from said furnace, substantially as described.

3. The interchanger, substantially as described, consisting of a casing and a number of thin metallic plates within the casing separated by suitable spacing-pieces, adjacent plates at the ends being turned toward each other and riveted, substantially as described, all in combination.

4. The interchanger described, consisting, essentially, of a casing, a number of thin plates dividing said casing into narrow passages from end to end, a number of spacing-pieces between the plates extending inward from the casing between the plates, arranged as described, so as to partially close the passages alternately at one side and at the other, and tie-rods for holding all in place, the combination being and operating substantially as described.

5. The interchanger described, consisting, essentially, of a casing and a number of thin vertical plates dividing the same into narrow channels, and a movable bottom piece to said casing, as set forth.

6. The combination, with the casing of the interchanger, of asbestus sheets inside the same, and thin partition-plates resting in grooves in said sheets, as set forth.

7. The combination, with a boiler-furnace, of an air-forcer, an air-interchanger of substantially the character described, and a double boiler-casing having an air-passage between the walls open to the air at one end and leading to said air-forcer at the other end, all substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

NATHAN B. CLARK.
FRANK B. KING.

Witnesses:
JOHN R. FARNUM,
W. A. BARTLETT.